



DISASTER RISKS AND RESILIENCE IN INDIA

- An Analytical Study



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- An Analytical Study

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FOREWORD

Disaster risks are increasing exponentially due to rapid urbanisation, high population density and extreme climate-related events. Recent disasters viz. Tropical Cyclone Fani (Odisha), 2019, Floods (Kerala), 2018 and Landslides (Odisha), 2019 are the strong reminders of the suddenness and unpredictable nature of disasters.

Disaster Management System in India presents holistic management of disasters that include pre-disaster prevention, mitigation and preparedness as well as post-disaster response, recovery and reconstruction. Enactment of Disaster Management Act, 2005, National Policy, 2009, National Disaster Management Plan, 2016 and DM plans at state and district levels have institutionalized the key role of Central Ministries, State/UT Governments and Departments in the field of Disaster Management.

The positive impacts of these initiatives are visible through the development of advanced early warning systems, improved coordination among various agencies, drastic reduction in human deaths during disasters and enhanced general awareness & preparedness about disasters at various levels. Understanding risk for achieving disaster resilience is an important pillar of Sendai Framework for Disaster Risk Reduction (2015-2030). It requires detailed scientific analysis of risk and vulnerabilities of different areas. Such studies will be helpful in developing realistic strategies for disaster prevention and mitigation in the country. Honorable Prime Minister's Ten-point agenda on Disaster Management specifically highlighted the need for investing in disaster risk mapping globally.

The present study titled "Disaster Risks and Resilience in States and Union Territories - An Analytical Study" has been prepared under the Gol-UNDP Project on "Enhancing Institutional and Community Resilience to Disasters and Climate Change". The overall objective of the study is to analyze the disaster risks and the level of disaster resilience achieved by the State/UTs in the country. The process of measuring risk and resilience of a large, diverse and multi-hazard prone country like India is a very complex task. The non-uniformity of hazards, differences in socio-economic conditions and geographic uniqueness causes challenges for developing a universally acceptable methodology. The study has attempted to address all of these challenges suitably.

This study is perhaps a first and unique step towards analyzing disaster risks and resilience in the country. The study would be useful to the State/UTs, Central Ministries & Departments and other Stakeholders for enhancing disaster resilience in the country.

(Sanjeev Kumar Jindal)

New Delhi
18th December 2019

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The study has been a collaborative effort of a number of Ministries and Departments of Government of India, State Governments, Union Territory Administrations, various scientific and technical organisations of Government of India, academic institutions and experts.

Special thanks are accorded to the concerned divisions of Ministry of Agriculture & Farmers' Welfare, Ministry of Earth Sciences, Ministry of Environment, Forests & Climate Change, Ministry of Statistics & Programme Implementation, Department of Science & Technology, and Department of Land Resources of Ministry of Rural Development for facilitating collection of data on various indicators of Disaster Risk Index.

Various scientific and technical organisations of Government of India, such as India Meteorological Department, Central Water Commission, Geological Survey of India, National Remote Sensing Centre, Indian Institute of Tropical Meteorology, Indian National Centre for Oceanic Information Services, Forest Research Institute, Snow and Avalanche Study Establishment, National Centre for Seismology, Building Materials and Technology Promotion Council, Central Research Institute for Dryland Agriculture, Central Ground Water Board, Central Pollution Control Board, Central Statistical Organisation, NITI Ayog, and National Crime Record Bureau have contributed to the study by making available their data and reports and providing valuable inputs and comments on different indices of disaster risks and resilience.

The Principal Secretaries in charge of Department of Disaster Management, State Disaster Management Authorities and Relief Commissioners of 29 States and 7 Union Territories supported the study by responding to the comprehensive set of questionnaires for collection of primary information and data on various indicators of Disaster Resilience Index.

The State Governments of Assam, Maharashtra, Tamil Nadu and West Bengal hosted the regional consultation workshops which saw active participation from States and experts. These were useful for developing a consensus on the methodology adopted for the study.

Members of Expert Working Groups representing various specialised institutions and organisations enriched the study through their valuable comments, advice and inputs. Special mention may be made about professionals of the National Disaster Management Authority and National Institute of Disaster Management who participated actively in the deliberations of these groups.

The study was supported with the continuous support of the Indian Statistical Institute Kolkata. Finally, the role of Dr. P.G. Dhar Chakrabarti, as the Lead Consultant who finalized the methodology, collected data and compiled this report is gratefully acknowledged.

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List of Abbreviations

ADB	Asian Development Bank,	EM-DAT	Emergency Events Database,	km	kilometer,	RIMES	Regional Integrated Multi-Hazard Early Warning System,
ADSIR	Ahmedabad-Dholera Special Investment Region,	EMEx	Emergency Management Exercises,	KSEOC	Kerala State Emergency Operations Centre,	RRI	Risk Reduction Index,
AMCDRR	Asian Ministerial Conference on Disaster Risk Reduction,	ERC	Emergency Response Centre,	KSNDMC	Karnataka State Natural Disaster Monitoring Centre,	RRRI	Rescue Recovery Return Integration,
APSDMS	AP State Disaster Mitigation Society,	ESF	Emergency Support Functions,	L	Low,	Rs	Rupees,
ASDMA	Assam State Disaster Management Authority,	ETRP	Emergency Tsunami Reconstruction Project,	LLE	Lessons Learnt Exercises,	RVS	Rapid Visual Screening,
AWS	Automated Weather Station,	EWDS	Early Warning Dissemination Systems,	M	Medium,	SCHR	Standing Committee for Humanitarian Response,
BBB	Build Back Better,	FLEWS	Flood Early Warning System,	MAH	Maximum Accident Hazard,	SDMA	State Disaster Management Authority,
BBMP	Bruhat Bengaluru Mahanagar Palike,	FREMAA	Flood and River Erosion Management Agency,	MCGM	Municipal Corporation of Greater Mumbai	SDMA s	State Disaster Management Authorities,
BIS	Bureau of Indian Standards,	FSI	Forest Survey of India,	MHI	Maximum Hazard Industries,	SDMF	State Disaster Mitigation Fund,
BMTPC	Building Materials and Technology Promotion Council,	FVI	Flood Vulnerability Index,	MIS	Management Information System,	SDRF	State Disaster Response Fund,
BNPB	Badan Nasional Penanggulangan Bencana,	GAR	Global Assessment Report,	MMR	maternal mortality rate,	SDRT	State Disaster Response Fund,
BPL	Below Poverty Line,	GDP	Gross Domestic Product,	MNREGA	Mahatama Gandhi National Rural Employment Gurantee Act,	SEC	State Executive Committee,
BRIC	Baseline Resilience Indicators for Communities,	GEM	Global Network of Civil Society Organizations for Disaster Reduction,	MOEFCC	Ministry of Environment, Forests and Climate Change,	SEOC	State Emergency Operations Centre,
CAGs	Comptroller and Auditor General,	GFM	Global Focus Model,	MPI	Maximum Polluting Industries,	SEZ	Special Economic Zones,
CAPRA	Central American Probabilistic Risk Assessment Platform,	GIDM	Gujarat Institute of Disaster Management,	MSME	Micro, Small and Medium Enterprises,	SOPs	Standard Operating Procedures,
CBDP	Community Based Disaster Preparedness,	GIS	Geographic Information system,	NABARD	National Bank for Agriculture & Rural Development,	SW	South West,
CDMP	City Disaster Management Plan,	GLOF	Glacial Lake Outburst Flood,	NBC	National Building Codes,	TEAP	Tsunami Emergency Assistance Project,
CDRRP	Coastal Disaster Risk Reduction Project,	GNDR	Global Network of Civil Society Organizations for Disaster Reduction,	NCMRWF	National Centre for Medium Range Weather Forecasting,	TERI	The energy and Resources Institute,
CEPI	Comprehensive Environmental Pollution Index,	GOI	Government of India,	NCR	National Capital Region,	TN-SMART	Tamil Nadu System for Multi-hazard potential impact assessment, alert, emergency response planning and tracking,
CIF	Childline India Foundation,	GPRS	General Packet Radio Service,	NCRB	National Crime Records Bureau,	TRG	Telemetric Rain Gauges,
CIRG	Central Implementation Review Group,	GSDMA	Gujarat State Disaster Management Authority,	NCRMP	National Cyclone Risk Mitigation Project,	UDRP	Uttarakhand Disaster Recovery Project,
CoBRA	Community Based Resilience Analysis,	GSI	Geological Survey of India,	NDEM	National Database for Emergency Management,	UHS	Universal Health Insurance Scheme,
CoR	xxxx,	H	High,	NDMA	National Disaster Management Authority,	UK	United Kingdom,
CPCB	Central Pollution Control Board,	HPC	High-Powered Committee,	NDMP	National Plan on Disaster Management,	ULBs	Urban Local Bodies,
CPCs	Child Protection Committees,	HPI	Heavily Polluting Industries,	NDRF	National Disaster Response Force,	UN	United Nations,
CRF	xxx,	HRVA	Hazard Vulnerability Risk Assessment,	NE	North East,	UNDP	United Nations Development Program
CSO	Central Statistical Organization,	HVRA	Hazard Vulnerability Risk Assessment,	NEC	xxxx,	UNDRR	United Nations Office for Disaster Risk Reduction,
CWC	Central Water Commission,	ICRC	xxxx,	NESAC	North Eastern Space Application Centre, 2	UNICEF	United Nations International Children's Emergency Fund,
DALA	Damage and Loss Assessment,	ICT	Information and Communication Technology	NGOs	Non Government Organisations,	UNISDR	United Nations Office for Disaster Risk Reduction,
DDMA	District Disaster Management Authority,	IDNDR	International Decade for Natural Disaster Reduction,	NIDM	National institute of Disaster Management,	UNOCHA	United Nations Office for Coordination for Humanitarian Assistance,
DDMF	District Disaster Mitigation Fund,	IDRN	xxx,	NOAA	National Oceanic and Atmospheric Administration,	UNU-EHS	United Nations University Institute for Environment and Human Security,
DM	Disaster Management,	IEC	Information Education and Communication,	NRSC	National Remote Sensing Centre,	USA	United States of America,
DMA	Directorate of Municipal Administration,	IFRC	International Federation of Red Cross,	NSDI	National Spatial Data Infrastructure,	UT	Union Territory
DMC	Drought Monitoring Cell,	IMD	India Meteorological Department,	OSDMA	Odisha State Disaster Management Authority,	UTs	Union Territories,
DMMC	Disaster Mitigation & Management Centre,	IMR	Infant Mortality Rate,	PDNA	Post Disaster Need Assessment,	VH	Very High,
DPI	Disaster Preparedness Index,	INCOIS	Indian National Centre for Ocean Information Services,	PML	Probable Maximum Loss,	VL	Very Low,
DPI	Disaster Preparedness Index,	INFORM	Index for Risk Management,	PMU	Project Management Unit,	VLMCC	Village Land Management and Conservation Committee,
DRDB	Digital Risk Data Base,	INSARAG	International Search and Rescue Advisory Group,	PRF	PEOPLES Resilience Framework,	WFP	World Food Programme,
DRDO	Defence Research and Development Organisation,	IRDR	Integrated Research on Disaster Risks,	PTSD	Post Traumatic Stress Disorder,	WHO	World Health Organization,
DResI	Disaster Resilience Index,	IRS	Incident Response System,	PWD	Public Works Department,	WRD	Water Resource Department,
DRIsI	Disaster Risk Index,	JFPR	Japan Fund for Poverty Reduction,	RCI	Resilience Capacity Index,	WRIS	Water Resource Information System,
DRR	Disaster Risk Reduction,	JICA	Japan International Cooperation agency,	RGRP	Rajiv Gandhi Rehabilitation Package,		
ECLAC	Economic Commission for Latin America and the Caribbean,						

Executive Summary

The disaster management system of India has undergone a paradigm shift from relief and rehabilitation to holistic management of disasters. This shift was ushered through the Disaster Management Act 2005, institutionalized with the disaster management authorities at national, state and district levels, guided by the National Policy on Disaster Management 2009, and operationalised through a series of guidelines, plans, procedures, programmes and projects at national, state and local levels.

The cumulative effects of these initiatives are clearly visible in advanced early warning systems, coordinated response to disasters and impending disasters, drastic reduction in disaster mortalities, and general increase in awareness about disasters at all levels. The effects are not so visible in disaster risk assessment at various levels, risk prevention and mitigation, and mainstreaming disaster risk reduction across different sectors of development.

The progress achieved has also not been uniform throughout the country. A few States that encountered mega disasters have learnt from the catastrophes and developed systems and processes to deal with the disasters, but a few States that faced major disasters have not been so proactive in transforming the challenges into opportunities. Many States are in the process of improving their systems of disaster management, but the majority of States have remained largely complacent. Even the States that have done relatively better have not done so uniformly in every aspect of disaster risk management - performance has been typically better in post-disaster response-relief-reconstruction than in pre-disaster prevention-mitigation-preparedness.

Therefore, in order to assist the State governments and Union Territory administration to measure various types of risks of disasters and benchmark the performance on different aspects of disaster

risk management, the Ministry of Home Affairs, with support from the United Nations Development Programme and in consultation with the State governments has undertaken this analytical study of measuring disaster risks and resilience in the States and Union Territories of India.

The study is divided into two parts. The first part quantifies risks of various types of natural and manmade disasters in the States and Union Territories, and the second part measures the progress achieved for holistic management of these risks, covering both pre-disaster risk assessment, risk prevention & mitigation and risk governance, and post-disaster preparedness, response, relief & rehabilitation, and reconstruction.

Measuring Risks

The methodology adopted for measuring risks and resilience was developed through extensive survey of literature, and consultations with experts of various scientific and technical agencies, State governments and UT administration. Risks are measured with the equation of $R = \{(h \times v) \times e\} \div c$, when, 'R' denotes risks of disasters; 'h' represents hazards or the potentials of a physical event that may cause loss of life or property; 'v' symbolises vulnerabilities - physical, social, economic, and environmental - which increase susceptibility of an area or a community to impact of hazards; 'e' means exposures of vulnerable population and assets to hazards; and 'c' is capacities or resources that can reduce the level of risk, or the effects of disasters.

12 indicators of natural hazards (earthquake, landslide, flood, drought, cyclone, tsunami, avalanche, heat wave, cold wave, coastal erosion, lightening, forest fire) and 2 manmade hazards (fire and industrial hazards), 14 indicators of vulnerabilities (unsafe buildings, physical infrastructure, social infrastructure, agriculture, livestock, industries,

vulnerable women, children, disabled, elderly, poor, water stress, depleting forests and mangroves), and 2 indicators of exposures (population and economy) were selected for the study. Each of these hazards, vulnerabilities and exposures has multiple parameters with varying importance, such as the hazard of cyclone has the parameters of wind speed, storm surge and rainfall besides the pattern of previous cyclone. These parameters and their relative weights were identified through consultation with experts in the respective fields.

District wise data on each of the parameters of 14 hazards, 14 vulnerabilities and 2 exposures were collected from various primary and secondary sources in consultation with scientific, technical and research institutions of the country. In the absence of any uniformly available pan Indian data on capacity, disaster resilience index of States/ UTs was taken as the proxy indicator of capacity. In order to avoid any bias in favour of States/ UTs with larger area or population, data has been normalised for each State/ UT with reference to area and/or population.

Based on these parameters and weights on parameters, hazard index, vulnerability index and exposure index has been worked out for each of the 14 hazards, 14 vulnerabilities, and 2 exposures for each of 640 census districts, 29 States and 7 Union Territories of the country. Since every indicator of vulnerability is not relevant for every hazard, a hazard specific vulnerability matrix has been developed for measuring risks of each hazard.

Every hazard and every indicator on vulnerability do not create the same magnitude of risks. In the absence of any robust time series data on disasters and its impacts, existing datasets of disaster damage and losses have been used to develop relative weights on hazards and vulnerabilities for measuring composite risks of disasters. These have been further refined based on the feedback received during the process of consultations. Equal weights on hazards,

vulnerabilities and exposures may magnify the level of risks of districts with higher density of population and/or higher GDP. Since hazards are the primary triggers of risks, relative weights of h, v and e are given in the ratio of 4:2:1.

Based on hazard, vulnerability and exposure indexes, hazard specific vulnerabilities, and relative weights on indicators, a Composite Disaster Risk Index has been developed for each of 640 census districts, 29 States and 7 Union Territories of the country.

Measuring Resilience

Measuring disaster resilience is difficult and complicated as there is hardly any consensus on what constitutes resilience and what could be the commonly accepted indicators of resilience. Broadly, there are three layers of resilience: the societal layer which include capacities of individuals, families, neighbourhood, communities; the governance layer which consists of institutions, systems, regulations, processes, programmes, and activities which support and strengthen societal layer; and the layer of external support system from national government and international agencies when the societal and governance capacity are overwhelmed by the magnitude of the disasters. In the context of a large federal country like India the external support system is very crucial for the resilience of the constituent States and UTs. This study is essentially looking at resilience at the second layer - the systems, institutions, processes, programmes and activities of the State Governments and UT Administration in building resilience as per the national and global standards of disaster risk management. The study does not examine resilience either at the level of society or of the support system of central government.

The systems, institutions, processes, programmes and activities expected to be taken up at the sub-national level have been compiled and catalogued from the global and national frameworks on building resilience to disasters. The global frameworks include

"Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole"

the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals, and the Paris Agreement on Climate Change, with specific reference to the activities expected to be taken up at the State and local level. A total of 72 activities were catalogued under these three global frameworks. The national frameworks include the activities proposed to be taken up at sub-national level under the Disaster Management Act 2005, National Policy on Disaster Management 2009, and the National Disaster Management Plan 2016. A total of 335 activities were catalogued under these three national frameworks.

Activities that are not relevant in Indian contexts and activities that have recurrence in different frameworks were removed and the residual activities were classified and clubbed together to identify 7 generic indicators on disaster resilience. These are: (a) Risk Assessment; (b) Risk Prevention and Mitigation; (c) Risk Governance; (d) Disaster Preparedness; (e) Disaster Response; (f) Disaster Relief and Rehabilitation; and (g) Disaster Reconstruction. Each of these 7 generic indicators was further disaggregated in 10 sub-indicators, making a total of 70 indicators on disaster risk resilience at the level of the States and UTs. As all the 7 aggregate indicators are not equally important for building resilience to disasters it was imperative that relative weights on these indicators are agreed through a consultative process.

The database on these 70 indicators was constructed on the basis of information collected from the State governments and UT administration through a comprehensive set of questionnaire on different aspects of disaster risk management. The questionnaire was carefully designed and structured to obtain maximum possible information in both qualitative and quantitative terms on the systems, institutions, processes, programmes and activities for reducing risks and building resilience to disasters. The first question on an indicator was usually in a binary format, followed by a more probing question on the details of activities undertaken, and finally a question on the means of verification, asking for documentary

evidence of the activities. Under each generic question an open-ended question was asked to cover activities and initiatives that are not captured under specific questions. Quantitative norms were developed for assessing the performance of the States and UTs against each question

Each of 29 States and 7 UTs submitted their response to the questionnaire supported by documentary evidences. These were carefully examined to assess the type and quality of action undertaken on each of 70 indicators and accordingly resilience scores were assigned following the quantitative norms of evaluation. The scores were aggregated to develop resilience index for each of the 7 generic indicators of resilience and these were further aggregated on the basis of weights to work out the composite Disaster Risk Resilience of States and UTs.

PART 1: Introduction

INTRODUCTION

During the past decade and a half (2002-2017), the disaster management system of India has undergone a paradigm shift: from humanitarian relief and rehabilitation of victims to holistic management of disasters which includes pre-disaster prevention, mitigation and preparedness as well as post-disaster response, recovery and reconstruction. This shift was ushered through the Disaster Management Act 2005, institutionalized through the establishment of disaster management authorities at national, state and district levels, guided by the National Policy on Disaster Management 2009, and operationalized through a series of guidelines, plans, procedures, programs and projects at national, state and local levels.

The cumulative impacts of all these initiatives are clearly visible in advanced early warning of hydro-meteorological disasters, coordinated responses to actual and impending disasters, a drastic reduction in human and animal mortalities in disasters, and a general increase in education and awareness about disasters at all levels. The impacts are not so visible in comprehensive assessment of hazards, vulnerabilities and risks of disasters at different levels, prevention of creation of new risks and mitigation of the existing risks of disasters, and mainstreaming disaster risk reduction across different sectors of development.

Progress has not been uniform throughout the country, additionally a few States that encountered mega disasters have learnt from catastrophes and developed systems and processes with which to deal with disasters, but a few States that faced major disasters have not been as proactive in transforming the challenges into opportunities. Many States are in the process of improving their systems of disaster management, but the majority of States have remained largely complacent, irrespective of whether they faced major or minor disasters. Even the States that have done relatively better have not done so uniformly in every aspect of disaster risk

management--performance has been typically better in post-disaster response-relief-reconstruction than in pre-disaster prevention-mitigation-preparedness.

At the national level, the Government of India was reviewing the biennial progress of the implementation of the Hyogo Framework for Action in the past, and will be performing a similar exercise for its successor, the Sendai Framework for Disaster Risk Reduction--but such reviews do not always address the national priorities of disaster management as enshrined in our national legislations, policies and programs, nor do these cover the relative progress achieved at the sub-national level. The Finance Commission has been reviewing the financial needs of the States for disaster response and relief on a five-yearly basis, but this does not involve performance review of the States. To a limited extent, the Comptroller and Auditor General conducted a performance audit of a few State governments, but typically these are limited to government expenditure. The Standing Committee in the Parliament has been reviewing the management of specific aspects and events of disasters, but these are not systematic reviews of progress taking the entire gamut of disaster risk management into consideration.

In the federal system of governance in India, the State governments have the primary responsibilities of disaster management while the Central government plays what is largely a supporting role. State governments, district administration and the local authorities have been dealing with disasters on a daily basis, but as yet no scientific system or tool is available to the State governments and their agencies either to benchmark the performance or to measure the progress achieved on different aspects and issues of disaster management on a scientific basis. At times, legislative scrutiny, financial audit, media analysis, and academic research have been helpful in identifying constraints and challenges, but such exercises have focused more on the management of

specific incidents or events than on the entire cycle of disaster risk management.

Background to this Study

Increasingly, the tools of benchmarking and indicators are being adopted for performance evaluation of public policies and programmes. There is no reason why similar tools should not be developed for a performance audit of disaster risk management in our country. Such tools would be useful to identify the strong and weak areas in the system and facilitate corrective action for improvement. This would be further useful to assess the relative performance of the States and encourage learning across States and sectors. Therefore, in order to assist the State governments with benchmarking the performance on different aspects of disaster risk management and to measure the progress achieved in building disaster resilience of rural and urban communities, the Ministry of Home Affairs, with support from the United Nations Development Programme and in consultation with State governments, has undertaken this study to measure risks and resilience in the States and Union Territories.

The study assumes significance in the context of the Sendai Framework for Disaster Risk Reduction that will drive the agenda of disaster risk management for the next decade and half. The Framework adopted a set of seven global targets for disaster risk reduction and stipulated that a set of indicators shall be developed for measuring the progress achieved on these targets as well as the priorities of action under the framework. The national governments have been asked to develop their country specific indicators for measuring progress achieved in building disaster resilience.

Rationale

The Study has three overarching objectives:

- a) To develop benchmarks for various activities to be taken up towards disaster risk management, namely risk assessment, risk prevention, risk mitigation and risk governance; and disaster preparedness,

disaster response, disaster recovery and disaster reconstruction;

- b) To quantify the risk of disasters in the States and Union Territories of India on the basis of uniform datasets on common, relevant set of indicators;

- c) To quantify the level of disaster resilience achieved by the States and Union Territories of India on the basis of uniform datasets on common, relevant set of indicators;

The scope of this study has been determined by the following four considerations:

- a) This study is not intended to be a mechanism to reward the performing States or to penalize the non-performing States. This is designed to be a facilitating tool to identify the strong and weak areas of disaster risk management in each State and Union Territory of the country. Therefore, the report would not be a consideration in the devolution of revenue or non-revenue funds or other resources from the Central government to State governments or local authorities.

- b) This study provides a framework of benchmarks and indicators on the basis of data that is presently available in a uniform format on a pan-India scale. Data inventory of hazards, vulnerabilities and exposures as well as various activities undertaken by the States as per the provisions of the disaster management act, policy, guidelines etc was mapped, and a final set of indicators have been selected through a consultative process. The scope of the benchmarks and indicators shall be enlarged as the database improves progressively.

- c) This study is a quantitative analysis of risks and resilience to the extent that the qualitative aspects of risk reduction are amenable to quantification through indicators. However, there will be many qualitative aspects of disaster risk reduction that may not be easily captured in data. Some of these qualitative aspects of disaster risks and resilience have been mentioned in accompanying narratives to supplement the quantitative analysis of risk and resilience.

Table 1: Population of States of India Compared to Countries of the World

Population and rank of Indian States			Countries and global ranks	
STATES	Population	India Rank	Countries	Global Rank
Uttar Pradesh	199,581,477	1	Brazil	5
Maharashtra	112,372,972	2	Mexico	10
Bihar	103,804,637	3	Philippines	13
West Bengal	91,347,736	4	Vietnam	15
Madhya Pradesh	72,597,565	5	Iran	18
Tamil Nadu	72,138,958	6	Turkey	19
Rajasthan	68,621,012	7	Thailand	20
Karnataka	61,130,704	8	France	22
Gujarat	60,383,628	9	Italy	23
Andhra Pradesh	52,410,653	10	Myanmar	26
Odisha	41,947,358	11	Argentina	31
Kerala	33,387,677	12	Canada	38
Jharkhand	32,966,238	13	Saudi Arabia	41
Telangana	32,255,880	14	Peru	42
Assam	31,169,272	15	Venezuela	43
Punjab	27,704,236	16	Malaysia	48
Chhattisgarh	25,540,196	17	Ghana	49
Haryana	25,353,081	18	Australia	53
Jammu & Kashmir	12,548,926	19	Guinea	75
Uttarakhand	10,116,752	20	Greece	82
Himachal Pradesh	6,684,602	21	Laos	106
Tripura	3,671,032	22	Singapore	115
Meghalaya	2,964,007	23	Mongolia	137
Manipur	2,721,756	24	Jamaica	140
Nagaland	1,980,602	25	Gabon	149
Goa	1,457,723	26	Bahrain	152
Arunachal Pradesh	1,382,611	27	Trinidad & Tobago	153
Mizoram	1,091,014	28	Cyprus	159
Sikkim	607,688	29	Macao	167
UNION TERRITORIES				
Delhi	16,787,941	1	Netherlands	67
Puducherry	1,244,464	2	Mauritius	158
Chandigarh	1,055,450	3	Djibouti	160
Andaman & Nicobar	379,944	4	Bahamas	177
Dadra & Nagar Haveli	342,853	5	Iceland	180
Daman & Diu	242,911	6	Vanuatu	185
Lakshadweep	64,429	7	Bermuda	193

“Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole”

Challenges

Measuring risks and resilience at the sub-national level in a large, diverse, multi-hazard country like India is a challenging task. First, the sheer size of the 29 States and 7 Union Territories and the numerous districts, cities, towns and villages is huge by any reckoning. The top 20 States and Union Territories of India are larger in population than the top 75 countries of the world. Uttar Pradesh, the largest Indian State, is larger than Brazil, ranking fifth globally. Delhi, the largest Union Territory of India, is larger than the Netherlands.

Some of the districts of India are larger than many countries. The district of Thane in the state of Maharashtra, for example, is the largest district of India, with a population of 11.06 million—which is larger than the entire country of Greece. Mumbai, the largest city of India, is larger than the South American country of Chile. Therefore, measuring the risks and resilience of sub-national India has continental dimensions.

The States and Union Territories of India present a wide range of diversities in terms of geography, topography, hydrology, temperature, climate, precipitation, vegetation and settlements, as no other country in the world does. Indian States/ UTs face almost every type of natural and manmade hazard known to mankind. The nuances of physical, social, economic and environmental vulnerabilities of the States/ UTs also differ widely. Some of the States have reached levels of human development that are comparable to some advanced countries in the West, while there are States that are worse off than sub-Saharan Africa.

In terms of the exposure of population and economy to the hazards of nature, the States/ UTs present a wide spectrum of differences. Maharashtra State has a GDP of Rs. 20, 01,223 crores compared to Rs. 15,339 crores in Mizoram. Per capita income in Goa is Rs. 372,117 versus Rs. 36,648 in Bihar. Density of population in Indian States varies from 17 per square kilometre in Arunachal Pradesh to 1106 per

square kilometre in Bihar, while some districts have population density as high as 25,000, observed in Kolkata.

Developing a common set of indicators for measuring risks and resilience of States/ UTs with such a wide range of differences poses serious methodological challenges. These are compounded by the lack of credible datasets on hazards, vulnerabilities and exposures in a common and uniform format for the country, and the absence of any data at all for measuring disaster resilience at sub-national levels.

Process

In order to overcome some of these challenges and enlist the cooperation of the State Governments, UT administration and various scientific and technological agencies, as well as to develop a common framework of methodology for the study of many elaborate processes, many consultations were held through out the country which involved various stakeholders. Such consultations have taken place at three levels: Advisory Committee, Working Groups and Regional Consultation Workshops.

An Advisory Committee was constituted under the chairmanship of Joint Secretary (DM) with representatives from National Disaster Management Authority (NDMA), five State Governments (Andhra Pradesh, Assam, Himachal Pradesh, Maharashtra and Odisha) and experts on the subject, which were nominated by the Committee, as and when required. The Emergency Analyst, UNDP was the Member Secretary of the Committee.

The Advisory Committee held two meetings, and considered the broad purpose and objectives of the study and the methodology to be adopted. A Lead Consultant was engaged for conducting the study.

An Expert Working Group comprising of representatives of NDMA, NIDM, various technical agencies of the Government of India, two academic institutions and a few State Governments/ UTs as well as four individual experts, was constituted to

consider various technical issues related to the study. The technical agencies include: Indian Meteorological Department, Geological Survey of India, Central Water Commission, Indian National Centre for Oceanic Information Services, Snow and Avalanche Study Establishment, Building Materials and Technology Promotion Council, Registrar General of India, Central Statistical Organization, National Informatics Centre, and National Sample Survey Organization. There were also two academic institutions present: Indian Statistical Institute and India Institute of Human Settlement.

The Working Group was constituted of four sub-committees, which held several sessions to discuss issues related to collection and compilation of data, adoption of methodology for development of the index, selection of indicators, and determination of weights on indicators.

Five Regional Consultation Workshops were organized in all the five regions of the country during February-March 2017 to explain the objectives, scope, approach and methodology for the development of the study, obtain comments and feedback thereon, and clarify queries and doubts on a set of questionnaires that was developed for collection of data from the States and Union Territories, mainly related to disaster risk resilience.

Inputs received through the prolonged period of consultations have shaped the various aspects of the

methodology adopted for the study, such as section of indicators and sub-indicators on disaster risks and resilience, collection of data on indicators, and determination of weights on indicators.

Survey of literature

Indicators and scorecards are important tools for measuring progress of any programme, project or activity. Indicators are also important to assess the relative progress of countries, provinces and cities on various specific as well as generic issues. There have been several initiatives to measure the performance of the States of India in different fields such as economic development,¹ human development,² health, education, infrastructure,³ ease of doing business,⁴ economic freedom,⁵ cleanliness⁶ etc. So far, there has not been any study to measure the risks of disasters in the States and Union Territories, and much less investigation to assess the relative progress achieved in building resilience to disasters.

Globally, there have been efforts by a few thinktanks and academic institutions to rank countries in terms of disaster risk and climate vulnerabilities,⁷ but there have not been any initiatives to develop any composite index that would factor both disaster risk and resilience.

For a vast and complex country like India, with many layers of hazards, vulnerabilities and risks, and a myriad web of initiatives for resilience at various levels, measuring risk and resilience is by no means

1 The Reserve Bank of India publishes an annual *Handbook of Statistics on Indian Economy*, which measures performance of States in terms of basic indicators of economic development, such as GDP, per capita income, rate of economic growth etc.

2 In a joint initiative of the Planning Commission and UNDP, Human Development Reports on several Indian States have been prepared. These have been compiled in *Human Development in India: Analysis to Action*, 2012. Relative performance of States on various indicators of human development has been studied. MH Suryanarayana, Ankush Agarwal and K Seeta Prabhu, *Inequality Adjusted Human Development Index for India's States*, UNDP, 2011.

3 The Planning Commission has been publishing data on various indicators of development such as health, education, and infrastructure, and comparing performance of States on the basis of these indicators. *Refining State Level Comparisons in India*, Planning Commission Working Paper Series 2012, *Data Book on Indicators of Development*, 2014

4 The World Bank has been publishing its annual report on *Doing Business in India*, which ranks major industrial and commercial cities of India in terms of their competitiveness in terms of doing business.

5 Bibek Debroy, Laveesh Bhandari and S Anklesaria Aiyar, *Economic Freedom of the States of India*, 2013

6 Ministry of Urban Development, Swachh Survekshan, http://www.swachhbharaturban.gov.in/writereaddata/Swachh_Survekshan_2017_Result.pdf

7 Some of these initiatives include *Global Climate Risk Index* of Germanwatch, *Climate Change Vulnerability Index* of

an easy and simple task. The States of India present a wide range of geographical variations in terms of climate, hydrology, topography, vegetation and settlement pattern, which make up a kaleidoscope of almost every possible hazard of nature. These are compounded by manmade hazards and layers of vulnerabilities at physical, social, economic and environmental levels. Like most countries around the world, India is yet to develop a sound and robust database of hazards, vulnerabilities, risks and resilience; therefore, 'ideal' theoretical framework on indicators is severely challenged by the lack of data at the State level for measuring progress on indicators.

Most of the growing volume of literature on disaster risk and resilience indicators is focused on communities as it is easier to collect data at the community level through participatory and ethnographic research.⁸ Based on community level studies and field testing of methodologies, various community-based risk and resilience frameworks have been developed.⁹

The call of *Hyogo Framework for Action 2005-2015* to develop 'generic, realistic and measurable indicators' to assess progress in implementation of the framework encouraged several organizations and think tanks to develop indicators on disaster risks and resilience at the national level. The Inter-American Development Bank was the first to develop composite indicators on disaster risks and risk management for 12 Latin American and Caribbean countries¹⁰. These include Disaster Deficit Index, Local Disaster Index, Prevalent

Vulnerability Index and Risk Management Index.

Disaster Deficit Index was designed to measure country risk from a macroeconomic and financial perspective according to potential catastrophic events. *Local Disaster Index* was meant to identify the social and environmental risks resulting from more recurrent disasters at sub-national levels. *Prevalent Vulnerability Index* was made up of a series of indicators that characterize prevalent conditions of vulnerability reflected in exposure in prone areas, socioeconomic weaknesses and lack of social resilience in general. *Risk Management Index* brings together a group of indicators that measure a country's risk management performance. These indexes remained largely theoretical constructs, and were not adopted by national governments.

The Fritz Institute of the Centre for Hazard Research and Policy Development, University of Louisville developed the Disaster Preparedness Index (DPI), based on various parameters such as risk zoning, early warning, response time for evacuation, equipment and training for search and rescue and pre-disaster recovery plan.¹¹ The Benfield Hazard Research Centre developed Indicators for Disaster Risk Reduction based on mainstreaming DRR in various aspects of development.¹² Both remained purely academic exercises..

After prolonged consultations at various levels, the United Nations Office for Disaster Risk Reduction (UNDRR) developed a set of 22 indicators on Five Priorities of

Action of the Hyogo Framework, upon which countries had to make a self-assessment of progress biennially on a scale of 1 to 5¹³. This quantitative measurement of a country's progress was supplemented by a qualitative analysis of achievements, challenges and constraints. While this provided a fairly good overview of the areas of strengths and weaknesses, this did not give a realistic idea of the actual progress as countries tended to overestimate progress that was not supported by the realities on the ground.¹⁴ This is acknowledged by the biennial UN Global Assessment Report (GAR) on disaster risk reduction, which goes beyond the official country progress reports to assess both risks and resilience.

Various risk modelling tools have been deployed to capture the dynamics of evolving situations and scenarios of possible development. These include GEM¹⁵, CAPRA¹⁶, GFM¹⁷, INFORM¹⁸ etc., but similar tools on disaster resilience on a global scale are yet to be developed. Spanish non-profit organisation DARA developed Risk Reduction Index (RRI) for seven Central American and Caribbean countries,¹⁹ but the methodology adopted for rating resilience through a set of questionnaires to 'key informants' may not be the ideal for replication.

Applying a mix of tools, indicators and proxy indicators on which a global database is available for a fairly large number of countries, various think tanks have been quantifying the risks and resilience of countries and ranking them globally. A few such initiatives include the works of UNU-EHS²⁰, Germanwatch²¹, Maplecroft²² and TERI²³.

While disaster risk and resilience indicators have been developed at global and national levels, similar initiatives are missing at the sub-national level. Badan Nasional Penanggulangan Bencana (BNPB), the Indonesian national authority on disaster management, is probably the only national disaster management agency that has indexed disaster risks of the provinces and districts by mapping hazards, vulnerabilities and exposures²⁴, but these are not very comprehensive as various aspects and dimensions of hazards and vulnerabilities are not included in the analysis.

In the backdrop of this global overview of literature on disaster risk and resilience indicators, this analytical study measures both risk and resilience.

Maplecroft, *World Risk Report* of Institute for Environment and Human Security, and the TERI study on *Climate Change and Sustainable Development*.

8 A systematic review of literature on community resilience is available in *Community Disaster Resilience: A Systematic Review on Assessment Models and Tools*, Abbas Ostadtaghizadeh et al, PLOS Currents: Disasters, April 2015.

9 These include *Resilience Capacity Index* (RCI) of the Network for Building Resilient Regions, University of California, Berkeley; *Baseline Resilience Indicators for Communities* (BRIC), developed by Hazards and Vulnerability Research Institute, University of South Carolina; *PEOPLES Resilience Framework* (PRF) developed by Multi-disciplinary Centre for Earthquake Engineering Research, University of Buffalo; *Community Based Resilience Analysis* (CoBRA) of UNDP Drylands Development Centre etc.

10 *Indicators of Disaster Risks and Disaster Risk Management*, Main Technical Report, Inter-American Development Bank, 2005.

11 *Indicator Issues and Proposed Framework for Disaster Preparedness Index* (DPi), The Fritz Institute, Centre for Hazard Research and Policy Development, University of Louisville, 2006

12 *An Operational Framework for Mainstreaming Disaster Risk Reduction*, Benfield Hazard Research Centre, University College of London, 2005.

13 *Indicators of Progress: Guidance on Measuring the Reduction of Disaster Risks and the Implementation of the Hyogo Framework for Action*, UNISDR, 2008.

14 Global Network of Civil Society Organizations for Disaster Reduction (GNDR) published its biennial *Views from the Frontline* that challenged claims of progress.

15 *Global Earthquake Model* (GEM) developed by the Global Science Forum of the OECD through a public-private partnership provides open source risk assessment software for calculating and communicating earthquake risks. Efforts are on to develop Global Flood Model and Global Tropical Cyclone Model.

16 *Central American Probabilistic Risk Assessment Platform* (CAPRA) was set up by the World Bank to consolidate hazard and risk assessment methodologies in Central American countries.

17 *Global Focus Model* (GFM) is a tool developed by the UNOCHA to produce an annual Humanitarian Risk Index based on hazards, vulnerabilities and capacities of every country.

18 *Index for Risk Management* (INFORM) is a composite indicator that identifies countries at risk of humanitarian crisis and disaster that would overwhelm national response capacity.

19 *Risk Reduction Index: Analysis of the Capacities and Conditions for Disaster Risk Reduction*, DARA, 2011.

20 The United Nations University: Institute for Environment and Human Security (UNU-EHS) in Bonn, Germany has been publishing its annual World Risk Report since 2011. The report ranks countries in a composite index factoring various climatic and non-climatic risks.

21 Germanwatch, a non-profit think tank based in Germany, has been publishing its annual global Climate Risk Index since 2006.

22 Maplecroft, a global risk and strategic consulting firm based in UK, has been ranking countries annually on Climate Change Vulnerability Index (CCVI) since 2010.

23 The Energy and Resources Institute (TERI) published its Global Sustainable Development Report 2015 on the theme of Climate Change and Sustainable Development, ranking countries on Climate Risks and Climate Adaptive Capacity.

24 BNPB, Disaster Risk Index of Indonesia, 2013.

Approach

In order to be both locally relevant and globally significant, the study is rooted in India's legal-institutional-policy framework on disaster

management, while simultaneously aligned with global frameworks. It factors the systems, policies, plans, guidelines and processes that the country has adopted for dealing with disasters. The indicators are carefully selected taking into consideration the mandates of Disaster Management Act 2005, the formulations of National Policy on Disaster Management,²⁵ the prescriptions of National Guidelines on Disaster Management²⁶ and the activities proposed under the National Plan on Disaster Management²⁷. A matrix of activities expected to be performed at State level under these national frameworks have been compiled, and the same is annexed-I.

The study is also aligned with the global framework on disaster risk reduction, as formalized in three international instruments adopted in 2015. These are: (a) Sendai Framework for Disaster Risk Reduction 2015-2030; (b) Transforming Our World: the 2030 Agenda for Sustainable Development; and (c) Paris Agreement on Climate Change.

India has not only endorsed and adopted these instruments, it has taken a prominent role in shaping them. India has further taken a leadership role in championing the implementation of the Sendai Framework in the Asia-Pacific region, by deciding to host the first Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR) in November 2016.

The Sendai Framework has enlarged the scope of disaster risk reduction in many respects. First, it has included man-made disasters related to environmental, technological and biological hazards

in the existing framework of disaster risk reduction, which covered mainly the natural hazards. This has brought international discourse on disaster management closer to India's Disaster Management Act, which covers both natural and manmade disasters. Second, it has adopted seven global targets of disaster reduction and resilience that can be achieved through appropriate national targets and indicators. Third, it has defined responsibilities at various levels for the implementation of its four Priorities for Actions: (a) understanding disaster risks; (b) strengthening disaster risk governance; (c) investing in disaster risk reduction for resilience; and (d) enhancing disaster preparedness and 'building back better'.

Under each of these priorities, several activities have been prescribed as necessary to take up at 'national and local' and 'global and regional' levels. The Sendai Framework mandated an open-ended, inter-governmental expert working group to develop indicators on the global targets as well as priorities of action of the framework. The working group has recommended a set of 38 indicators for measuring the progress achieved by countries in achieving the seven global targets. The indicators that are relevant for the States of India are factored in the study.

The 2030 Agenda for Sustainable Development²⁸ includes 17 Sustainable Development Goals and 169 targets. An Inter-Agency Expert Group on Sustainable Goals and Indicators has proposed a set of 222 indicators for measuring progress in achieving the targets. At least nine of these goals and the related targets have elements of disaster risk reduction embedded in them. These are detailed in Annexure-III. The study factors these goals, targets and indicators to the extent that this is feasible.

The Paris Agreement on Climate Change has called

for enhanced 'understanding, action and support' for 'averting, minimizing and addressing loss and damage' associated with climate related disasters. Eight specific action areas have been prescribed, which include: (a) early warning systems; (b) emergency preparedness; (c) slow onset events; (d) events that may involve irreversible and permanent loss and damage; (e) comprehensive risk assessment and management; (f) risk insurance facilities, climate risk pooling and other insurance solutions; (g) non-economic losses; (h) resilience of communities, livelihoods and ecosystems.²⁹ These action areas are also factored to the extent relevant in the contexts of Indian States.

Structure

The findings of the study are based on two different sets of indexes: Disaster Risk Index (DRisI) and Disaster Resilience Index (DResI). DRisI captures the risks of disasters at the level of 640 census districts of the country,³⁰ which has been further aggregated at the level of States and UTs. In the absence of any data on resilience at district level, DResI measures the level of resilience to disasters at the level of States and UTs. Hazard, vulnerability, exposure and risk indexes of the districts were completed in a separate three volume report, and do not form part of this study.

This study is structured in two main parts, Part I dealing with Disaster Risk Index and Part II focusing on Disaster Resilience Index--each part is further sub-divided into several chapters. Part I has six chapters: Methodology and Data, Hazards, Vulnerabilities, Exposures, Capacities and Disaster Risk Index. Part-II has nine chapters: Methodology and Data, Risk Assessment, Risk Prevention and Mitigation, Risk Governance, Disaster Preparedness, Disaster Response, Disaster Relief and Rehabilitation, Disaster

Reconstruction, and Disaster Resilience Index. The concluding chapter makes an overall assessment of achievements, challenges and opportunities.

25 National Policy on Disaster Management, NDMA, 2016.

26 National Disaster Management Guidelines: Action Points for Implementation by States/ UTS, NDMA, 2012

27 National Plan on Disaster Management, NDMA, 2016

28 'Transforming Our World: The 2030 Agenda for Sustainable Development', UN General Assembly Resolution NO A/RES/70/1.

29 Paris Agreement, Conference of the Parties Twenty-first Session, Paris, UN Framework Convention on Climate Change, FCCC/CP/2015/L.9/Rev.1 2015.

30 Census 2011 was conducted on 640 districts of the country. Thereafter, more than 60 districts have been created by way of bifurcation of one district or merger of parts of two more districts. A database on the newly created districts in terms of demographic and other data is not clear. Therefore, it has been decided to restrict the study to 640 census districts of the country. A Disaster Risk Index of districts has been submitted separately and does not form part of this report.

PART II: Measuring Risks of Disasters

Methodology and Data

Hazards

Vulnerabilities

Exposures

Capacities

Disaster Risk Index

METHODOLOGY AND DATA

Methodology

The methodology of the Disaster Risk Index has several components. These are explained in a sequential manner for better appreciation.

a) What constitutes risks of disasters

A general consensus has been developed on what constitutes risks of disasters. This is presented in the following equation: $R = \{(h \times v) \times e\} \div c$

when ‘R’ denotes risks of disasters; ‘h’ the hazards or the potentials of a physical event that may cause loss of life or property; ‘v’ the vulnerabilities or the factors or processes--physical, social, economic, and environmental--which increase the susceptibility of an area or a community to the impact of hazards; ‘e’ exposures of vulnerable population and assets to hazards; and ‘c’ the capacities or resources available within a community, society or organization that can reduce the level of risk or the effects of disasters.

This equation is aligned with globally accepted definitions of risks of disasters.

b) Selection of indicators on hazards, vulnerabilities and exposures

It was agreed that indicators on hazards, vulnerabilities and exposures shall be selected based on their importance as well as availability of data in uniform format throughout the country. Robust data sets on some of the indicators, such as lightning, coastal erosion, fire, industrial hazards etc are not available, but considering their importance these were selected and available datasets were used to the best possible extent.

The final list indicators selected for hazards, vulnerabilities and exposures are as follows:

Table 2: Indicators Selected for Disaster Risk Index

	Hazards	Vulnerabilities	Exposures
1.	Earthquake	Unsafe buildings	Population
2.	Cyclone	Social infrastructure	GDP
3.	Flood	Physical infrastructure	
4.	Drought	Net cropped area	
5.	Landslide	Livestock population	
6.	Tsunami	Industries	
7.	Avalanche	Vulnerable women	
8.	Heat Wave	Vulnerable children	
9.	Cold Wave	Disabled people	
10.	Coastal Erosion	Aged people	
11.	Coastal Erosion	Rural/Urban poor	
12.	Forest Fire	Deforestation	
13.	Fire	Depletion of mangroves	
14.	Industrial Hazards	Water stress	

c) Parameters on indicators and weights on parameters

Each of these fourteen hazards, fourteen vulnerabilities and two exposures have several parameters. Based on the availability of datasets throughout the country on uniform formats, the following parameters were selected for development of indexes on hazards, vulnerabilities and exposures.

Not all the parameters of hazards, vulnerabilities and exposures are equally important. Based on the importance of the parameters, as advised by experts and agreed on during consultation workshops, the following weights have been given to the parameters.



Table 3: Parameters and Weights on Hazards

	Hazards	Parameters on hazards	Weights on parameters
1.	Earthquake	Seismic hazard zonation: Zone-V, IV, III and II.	Zone-V: 10, Zone-IV: 6, Zone-III: 4, Zone-II: 2
2.	Landslide	Landslide hazard zonation: Zone- IV, III, II and I	Zone-IV: 10, Zone-III: 8, Zone-II: 4, Zone-I: 0
3.	Flood	a) CWC data on flood prone areas in States b) Flood Vulnerability Index of NRSC c) Flood prone cities with population above 100,000+ and million+ population	a) 80% b) 20% c) 20% (10% each)
4.	Drought	a) Moisture index b) Unirrigated cropped area c) Drought prone area d) Number of drought years	Equal weights
5.	Cyclone	a) Number of cyclones b) Number of severe cyclones c) Probable maximum wind speed d) Probable maximum precipitation e) Probable maximum rainfall	a) Equal weights of 15% for (a) and (c) to (e) b) 25% weights for (b) c) 15% weights from c to f
6.	Tsunami	a) Length of coastline b) Population living within ½ km of coasts c) Average height of tsunami wave	a) 25% b) 25% c) 50%
7.	Avalanche	Avalanche hazard zonation: Zone- V, IV, III, II and I	Zone-IV: 10, Zone-III: 8, Zone-II: 4, Zone-I: 0
8.	Heat Wave	a) Average Heat Index based on NOAA methodology b) Numberof days with heat index above 54 c) Number of heat wave (temperature above 40°C for 5+ days) d) Longest duration of heat wave	Equal weights
9.	Cold Wave		
10.	Coastal Erosion	a) Length of coastline b) Coastal length (km) under erosion c) Coastal area (sq km) under erosion	Equal weights
11.	Lightning	Normalized annual average lightning mortality in districts	Mortality Index scaled 0 to 10
12.	Forest Fire	Forest fire zonation in very dense, dense and open forests a) High risk zone b) Moderate risk zone c) No risk zone	Values of 10, 5 and 0 for three risk zones with weights 50%, 30% and 20% on three types of forests
13.	Fire	Normalized fire index of districts based on average annual a) Number of accidents of fire b) Number of deaths c) Number of injuries	Equal weights
14.	Industrial Hazards	a) MAH industries b) MPI industries c) CEPI index	a) 50% b) 25% c) 25%

Similarly, the following parameters were selected for vulnerabilities:

Table 4: Parameters and Weights on Vulnerabilities

	Vulnerabilities	Parameters on vulnerabilities	Weights on parameters
1.	Unsafe buildings	Number of buildings constructed predominantly with materials used for construction of roofs and walls and classified as Very High, High, Moderate, Low and Very Low risk in earthquake, landslide, flood and cyclone	VH:10, H:8, M: 6, L:4, VL: 2, as classified by Committee of Experts
2.	Social infrastructure	Number of educational and health institutions in the district	a) 40% weight on primary educational institutions b) 10% weight on higher educational institutions c) 25% weight on primary health institutions d) 25% weight on hospitals
3.	Physical infrastructure	a) Length of roadways b) Length of railways c) Number of airports and seaports d) Number of large dams and reservoirs e) Number of hydel, thermal and nuclear power stations	Equal weights of each indicator and further equal weights on sub-indicators within each indicator
4.	Net cropped area	a) Cropped area b) Irrigated area	a) 80% b) 20%
5.	Livestock population	Number of livestock in district a) Bovine animals b) Other animals	a) 80% b) 20%
6.	Industries	a) Number of MSME in districts b) Number of industrial clusters c) Number of SEZ	a) 40% b) 40% c) 20%
7.	Vulnerable women	a) Sex ratio b) Illiteracy c) MMR d) WHH e) WPR f) VAW	Equal weights
8.	Vulnerable children	a) Age group 0-6 and 7-18 b) Non-schoolgoing children c) Working children d) IMR	Equal weights
9.	Disabled people	Types of disability a) Visual b) Physical c) Mental	Equal weights
10.	Aged people	a) Age group 60+ b) Age group 80+ c) Dependency Ratio	Equal weights
11.	Rural/Urban poor	a) BPL population (rural and urban) b) Homeless population	Equal weights on both with further equal weights on rural and urban BPL and Homeless
12.	Deforestation	Change of forest cover (positive, negative, overall) during 2001-2015 a) Dense forests b) Open forests	Equal weights

13.	Depletion of mangroves	Change of mangrove cover (positive, negative, overall) during 2001-2015 a) Dense mangrove b) Open mangrove	Equal weights
14.	Water stress	a) Terrestrial water as captured in moisture index b) Surface water as captured in area under irrigation c) Sub-surface area as reflected CWGB data on	Equal weights

For exposures, two selected parameters are (a) population and (b) GDP. Both are given equal weights of 50 percent.

d) Hazard, Vulnerability and Exposure index

Based on these parameters and weights on parameters, hazard index, vulnerability index and hazard index has been worked out for each of 14 hazards, 14 vulnerabilities and 2 hazards for each of 640 census districts, 29 States and seven Union Territories of the country. The statistical tables of these indexes on the districts were earlier prepared in three volumes. The tables on the States and Union Territories are provided in Statistical Appendices of this study.

e) Hazard-specific vulnerabilities

Every indicator of vulnerability is not relevant for every hazard. For example, vulnerable buildings and infrastructure are extremely relevant for earthquake and landslide, but these are not relevant for drought. Therefore, depending on their relevance, a hazard vulnerability matrix has been developed and hazard-specific vulnerabilities have been factored for measuring risks in each instance.

Table 5: Hazard Vulnerability Matrix on Risks of Disasters

HAZARD MATRIX	VULNERABILITY MATRIX													
	Built Environment			Production System			Vulnerable Socio-economic Conditions					Vulnerable Environment		
	Buildings	Social infrastructure	Physical infrastructure	Agriculture	Livestock	Industries	Poverty	Women	Children	Disabled	Elderly	Forest cover	Mangrove cover	Water stress
Earthquake	√	√	√	√	√	√	√	√	√	√	√			
Landslide	√	√	√	√	√	√	√	√	√	√	√	√		
Tsunami	√	√	√	√	√	√	√	√	√	√	√		√	√
Drought				√	√	√	√	√	√	√	√	√		√
Flood	√	√	√	√	√	√	√	√	√	√	√	√		√
Cyclone	√	√	√	√	√	√	√	√	√	√	√		√	√
Heat Wave							√	√	√	√	√	√		
Cold Wave							√	√	√	√	√			
Avalanche	√	√	√				√	√	√	√	√	√		
Lightning							√	√	√	√	√			
Coastal erosion	√	√	√	√			√	√	√	√	√		√	
Forest fire	√	√	√	√	√		√	√	√	√	√	√	√	√
Fire	√	√				√	√	√	√	√	√			√
Industrial hazard							√	√	√	√	√			√

√ denotes the vulnerabilities in horizontal matrix that are relevant to the hazards in vertical matrix

f) Relative weights on indicators on hazards, vulnerabilities and exposures

Every hazard and every indicator on vulnerability do not create the same magnitude of risks. For example, an earthquake would create much more intense risks of disasters than landslide or forest fire. Similarly, every vulnerable condition may not result in the same level of damage and losses. For example, vulnerable physical conditions of houses and infrastructure may cause more deaths, injuries and economic losses than vulnerable human conditions of poverty or gender discrimination. In the absence of any robust time series data sets on disasters and its impacts, existing datasets of disaster damage and losses have been used to develop relative weights on hazards and vulnerabilities for measuring composite risks of disasters. These have been further refined based on the feedback received during the process of consultations.

Table 6 : Relative Weights on Hazards, Vulnerabilities and Exposures

Hazards		Vulnerabilities		Exposures	
Indicators	Weights %	Indicators	Weights %	Indicators	Weights %
Earthquake	15	Buildings	15	Population	50
Landslide	7	Physical infrastructure	5	Economy	50
Flood	15	Social infrastructure	5		
Drought	15	Agriculture	10		
Cyclone	15	Livestock	6		
Tsunami	3	Industries	6		
Coastal erosion	3	Poverty	10		
Avalanche	3	Women	8		
Heat wave	6	Children	8		
Cold wave	6	Disability	6		
Lightning	3	Aged	6		
Forest fire	3	Depletion of forests	5		
Fire	3	Depletion of mangrove	5		
Industrial hazard	3	Water Stress	5		

g) Relative weights on hazards, vulnerabilities and exposures

Equal weights on hazards, vulnerabilities and exposures magnify the risk level of districts with high density of population and GDP. Since hazards are the primary triggers of risks of disasters, it was decided that relative weights of H, V and E shall be given in the ratio of 4:2:1.

h) Measuring composite Disaster Risk Index

Based on hazard, vulnerability and exposure indexes, hazard specific vulnerabilities, and relative weights on indicators on hazards, vulnerabilities and exposures, a Composite Disaster Risk Index has been developed for each of 640 census districts of the country. Districts have been ranked at national and state levels according to their risk scores. The statistical tables on Disaster Risk Index were submitted separately in three volumes, and the Disaster Risk Index of States and UTs are presented in this report. Additionally, a Statistical Note on Methodology for computation of Disaster Risk Index is placed in the Statistical Appendices of this report.

TECHNICAL NOTE ON DATA

Carrying out the collection, compilation, collation, validation and analysis of data on 30 indicators of hazards, vulnerabilities and exposures involving 640 census districts of the country and 70 indicators on resilience from 29 States and seven Union Territories was challenging. Only a fraction of the data was available in the public domain, and therefore, these had to be collected from the concerned agencies of multiple departments of Central and State governments.

DATA ON HAZARDS

a) Earthquake



Earthquake Hazard Zoning Atlas of India (2016) prepared by Building Materials & Technology Promotion Council (BMTPC) has been taken as the basis for compilation of district and state level data on earthquake hazard. In this atlas, district-wise areas falling in four seismic zones - Zone-V (Very High Risk), Zone-IV (High Risk), Zone-III (Moderate Risk) and Zone-II (Low Risk) – have been mapped on the basis of IS 1893 (Part-1): 2002.³¹

The National Centre for Seismology, Ministry of Earth Sciences calculated the percentage of geographical area of the district falling in each zone. Based on the frequency and intensity of earthquakes, and in consultation with experts, following values on a scale of 0 to 10 have been adopted for various seismic zones and accordingly the hazard index of districts has been worked out: Zone-V: 10, Zone-IV: 6, Zone-III: 4, Zone-II: 2.

b) Landslide



Landslide Hazard Zonation Atlas of India (2003), prepared jointly by BMTPC and Centre for Disaster Mitigation and Management, Anna University Chennai³² is the only pan India study on landslides till date which maps and classifies landslide prone areas at the district level. In this atlas, the entire landmass of India has been classified into four landslide hazard zones: Zone-IV (Very High), Zone-III (High), Zone-II (Moderate to Low) and Zone-I (Unlikely). A catalogue of landslides in the country since 2000 has been collected. This broadly confirms the landslide zonation of 2003 atlas.

The area falling in each zone has been calculated district-wise and percentage falling in each zone has been worked out, at our request, by Dr GP Ganapathy, who was involved with the development of the 2003 atlas. Based on this area analysis, and in consultation with experts, we have worked out the landslide hazard index of each district on the basis of following values ascribed to each zone in the scale of 0 to 10: Zone-IV: 10, Zone-III: 8, Zone-II: 4, Zone-I: 0

c) Flood



Comprehensive flood hazard zonation for the entire country on a uniform format has not been undertaken as yet. Central Water Commission (CWC), which is the nodal agency for flood risk assessment, has mapped the flood prone area based on occurrences of flood since 1950. The assessment is based entirely on riverine flood and does not include coastal flood,

31 Earthquake Hazard Zoning Atlas of India (2016), Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India and National Disaster Management Authority.

32 Landslide Hazard Zonation Atlas of India (2003) Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India and Centre for Disaster Mitigation and Management, Anna University, Chennai.

flash flood etc. Based on this assessment, Vulnerability Atlas of India (2006) has worked out the percentage of flood prone areas in each district.³³ However, no hazard zonation has been undertaken to determine the level of flood hazards in different parts of the district. In the absence of time series data on different parameters of flood at district and State levels, the Vulnerability Atlas was used for measuring the flood prone area in the districts and CWC data on areas which were actually flooded during 1950-2016.

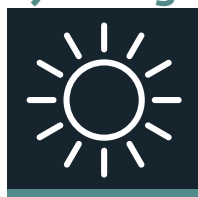
The National Remote Sensing Centre (NRSC) has worked out flood zonation of districts in four States, Assam, Bihar, Odisha and Uttar Pradesh, based on satellite imageries of flood-affected areas during 1998-2015.³⁴ This is extremely useful data, but in the absence of comparable data from other States, it could not be adopted towards the development of a flood hazard index of districts throughout the country.

NRSC has separately developed a potential Flood Vulnerability Index (FVI) for the entire country based on long-term daily rainfall data, runoff potential, slopes, drainage density, etc.³⁵ The FVI has classified the entire country into five flood zones: very high, high, moderate, less and very less. At our request, NRSC has worked out the percentage of area in each district falling in each zone.

Since floods in India are mostly riverine and the CWC database, as adopted in the Vulnerability Atlas of India, has a longer time span, 60% weights have been given to this data and 20% weights given to the NRSC Flood Vulnerability Index. Values of 10, 8, 6, 4 and 2 have been given to the five flood zones of NRSC.

Urban floods have become a major recurrent hazard in this country. Cities with population of (a) 1 million and above and (b) between 100,000 and 1 million located in flood prone areas in each district, as shown in the Vulnerability Atlas of India, have been identified; 20% weights have been given on flood prone cities in each of these two categories.

d) Drought



Drought hazard zonation of districts has not been carried out by any agency. In the absence of such zonation, parameters of drought have been captured through four indicators: (a) moisture index, (b) cropped area not irrigated, (c) drought prone area, and (d) number of drought years. Equal weights of 25% have been given on each indicator.

District wise data on the Moisture Index has been made available by Central Research Institute for Dryland Agriculture. Data on cropped area of districts that are not irrigated have been collected from the Directorate of Economics and Statistics, Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India. Data on drought prone area in districts has been collected from the database on the erstwhile Drought Prone Area Programme maintained by the Department of Land Resources, Ministry of Rural Development, Government of India. Number of droughts declared in each district has been compiled from the Farmers Portal, maintained by the Ministry of Agriculture, Cooperation and Farmers Welfare.³⁶

33 Vulnerability Atlas of India (2006), Building Materials & Technology Promotion Council, Ministry of Housing & Urban Poverty Alleviation, Government of India.

34 <http://bhuvan-noeda.nrsc.gov.in/disaster/disaster/disaster.php#>

35 <http://bhuvan-noeda.nrsc.gov.in/governance/rail#>

36 <http://farmer.gov.in/Drought/Droughtreport.aspx>

e) Cyclone



Parameters of cyclone have been captured through six indicators: (a) total number of cyclones, (b) number of severe cyclones, (c) possible maximum wind speed, (d) possible maximum storm surge, (e) possible maximum precipitation, (f) whether located in flood zone, as adopted by the Expert Committee on Cyclones constituted by National Disaster Management Authority.³⁷ The database on number of cyclones and severe cyclones have been updated. Equal weight of 15% has been given to indicator (a) and indicators (c) to (f), while 25% weights have been given to indicator (b) for calculating cyclone hazard index.

f) Tsunami



Parameters of tsunamis are captured through three indicators: (a) total length of coastline, (b) population living within half a kilometer of the coast, and (c) average height of tsunami wave. Length of coastline has been calculated from the Survey of India base map of India. Population living within half a kilometer of the coast has been calculated from Census 2011 population data of coastal districts. Data on average probable maximum height of tsunami wave in each coastal district has been provided by India National Centre on Oceanic Information Services; 25% weights have been given on indicators (a) and (b) and 50% weights are given on parameter (c).

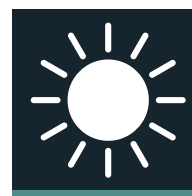
g) Avalanche



For the purpose of this study, Snow and Avalanche Study Establishment of DRDO provided the hazard zonation of avalanches. Avalanche prone districts have been classified into five zones: Zone-V (Very High Risk), Zone-IV (High Risk), Zone-III (Moderate Risk), Zone-II (Low Risk) and Zone-I (No Risk). Areas falling in each zone have been calculated district-wise and percentage of area falling in each zone has been worked out accordingly.

Based on this area analysis, avalanche hazard index of relevant districts has been worked with the following values: Zone-V: 10, Zone-IV: 8, Zone-III: 6, Zone-II: 4, Zone-I: 0

h) Heat Wave



Daily temperature and humidity data from 481 Surface Stations and 675 Automated Weather Stations of the India Meteorology Department throughout the country for the last 16 years (2001-2016) have been collected from India Meteorological Department (IMD) Pune. The data has been processed to develop a heat wave hazard index through a complex methodological process.

First, the weather stations have been matched with districts, and districts without weather stations have been linked with nearest stations in consultation with the scientists of IITM. Second, average heat index of districts has been worked out based on the methodology adopted by National Oceanic and Atmospheric Administration (NOAA) USA³⁸ and endorsed by NDMA India.³⁹ Third, district-wise annual average of number of days with a heat index above 54 have been calculated. Fourth, number of heat waves (temperature above 40°C or more for Plains and at least 30°C or more for hilly regions continuously for 5+ days) have been worked out.⁴⁰ This partial-

37 'Cyclone Hazard Prone Districts of India; A Report (2010)', India Meteorological Department.

38 http://www.nws.noaa.gov/om/heat/heat_index.shtml

39 Guidelines on Preparation of Action Plan – Prevention and Management of Heat Waves (2016), National Disaster Management Authority.

40 Based on IMD Forecasting Circular No.5/2015 (3.7).

ly fulfills the criteria adopted by IMD for defining Heat Wave as given in Annexure II. Finally, longest duration of heat wave in each district has been worked out. All four parameters have been given equal weight to calculate the heat wave hazard index of the districts on a scale of 0 to 10 in other indexes.

i) Cold Wave



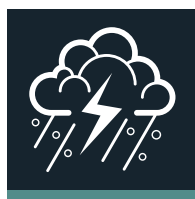
Cold Wave Hazard Index has been worked out following IMD Weather Forecast Circular No. 5/2015 (3.7) which defines a day cold when the temperature goes below 4°C in plain areas and below - 4°C in hilly areas. This partially fulfills the criteria adopted by IMD for defining a Cold Wave, as given in Annexure II. Percentage of days with cold wave conditions in three different temperature brackets in each district have been worked out with equal weight to calculate the heat wave hazard index of the districts on a scale of 0 to 10 in other indexes.

j) Coastal Erosion



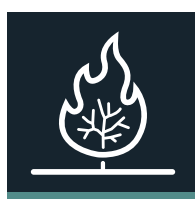
Parameters of coastal erosion are captured in three indicators: (a) total length of coastline, (b) coast line changes, and (c) coastal area changes, the last two again sub-divided into three indicators: erosion, accretion and stability. Only erosion has been considered, as stability and accretion do not create risks of disasters. The data on coastline changes and coastal area changes have been compiled from Shoreline Change Atlas of Indian Coast, prepared by Space Application Centre Ahmedabad and Directorate of Coastal Erosion, Central Water Commission, Ministry of Water Resources, Government of India.⁴¹ An equal weight of 33.33% is given on all three indicators.

k) Lightning



Lightning accounts for large mortalities during disasters in a number of States in India, but there has never been any scientific study on lightning covering the entire country. The only available pan India indicator on the number of deaths due to lightning in the States is part of an annual publication compiled by National Crime Bureau every year since 2001, titled 'Accidental Deaths and Suicides in India'.⁴² In the absence of any other database, State level lightning mortality data has been normalized at the district level according to population and annual averages have been worked out. Lightning mortality index, on a scale of 0 to 10, has been worked out on the basis of this annual average.

l) Forest Fire



The study on 'Vulnerability of India's Forests to Fire' published by Forest Survey of India (FSI) is the basis for data on forest fire.⁴³ The study has classified districts in terms of three types of forest fire: high, moderate and no risk. This has been supplemented with data on types of forests in the districts—very dense, dense and open forests—as brought out in the annual India State of Forest Report.⁴⁴

In terms of ecological value 'very dense' forests are given weights of 50%, 'dense' forests 30% and 'open' forests

⁴¹ Shoreline Change Atlas of Indian Coast (2014), Space Application Centre Ahmedabad and Directorate of Coastal Erosion, Central Water Commission, Ministry of Water Resources.

⁴² 'Accidental Deaths and Suicides in India (2001-2015)', National Crime Record Bureau, Ministry of Home Affairs, Government of India.

⁴³ 'Vulnerability of India's Forests to Fire (2012)', Forest Survey of India, Ministry of Environment and Forests, Government of India

⁴⁴ India State of Forest Report (2015), Forest Survey of India, Ministry of environment and Forests, government of India.

20%. The value of 10 is ascribed to 'high' risk zones, 5 to 'moderate' risk zones and 0 to no risk zones. This implies that districts in a no risk zone gets a score of 0 irrespective of size or type of forest cover, while high and moderate risk zone districts get a score in proportion to the area of different types of forests and types of risks.

m) Fire



The Directorate General of NDRF and Civil Defence commissioned a study on fire hazard and risk analysis in the country for revamping fire services in the States.⁴⁵ The study did not cover risks of fire in the districts, nor did it compile data on fire in the districts.

In the absence of any district level database on fire, the NCRB State-level database has been relied to assess (a) number of cases of fire accidents registered, (b) number of injuries and (c) number of deaths during 2001-2015.⁴⁶ Data has been normalized at district level based on population. Fire hazard index has been worked out on the basis of equal weights of 33.33% on these three indicators.

n) Industrial Hazards



Development of an industrial hazard index has been challenging as no database on industrial hazards has been maintained by any agency. Ministry of Environment, Forests and Climate Change (MOEFCC)—the nodal ministry on industrial hazards—provided data on district-wise location of Maximum Hazard Industries (MHI). Central Pollution Control Board (CPCB) provided data on district-wise location of 17 categories of Maximum Polluting Industries (MPI) This include pharmaceuticals, cement, caustic (chemical), copper, distillery, dye and dye intermediates, fertilizer, iron and steel, refinery, pesticide, petrochemicals, pulp and paper, sugar, power plants, aluminium, zinc and tannery.

No nation-wide data on the level of potential and actual hazards of these industries is available. However, CPCB conducted a study to develop Comprehensive Environmental Pollution Index (CEPI) for 88 selected industrial clusters in the country. CEPI measures the level of air, water and soil pollution in and around the clusters. Although pollution does not directly lead to disasters, it definitely contributes to the process of creation of hazards that may eventually lead to disasters.

In the absence of any other database MHI, MPI and CEPI have been factored in the ratio of 50:25:25 for the calculation of industrial hazard index of districts and States. For CEPI, the following values have been ascribed:

Dangerous level of pollution: 10, critical level of pollution: 8, high level of pollution: 6, moderate level of pollution: 4 and low level of pollution: 2.

⁴⁵ Fire Hazard and Risk Analysis in the Country for Revamping Fire Services in the Country (2011), RMSI Private Limited.

⁴⁶ 'Accidental Deaths and Suicides in India (2015)', National Crime Record Bureau, Ministry of Home Affairs, Government of India.

DATA ON VULNERABILITIES

a) Buildings

A Committee of Experts constituted by BMTPC had worked out the vulnerability of buildings based on prominent materials used for construction of walls and roofs. This is summarized in the below:

Legend of hazard zones: Zone V: Very High Damage Risk Zone, Zone IV: High Damage Risk Zone, Zone III: Moderate Damage Risk Zone, Zone II: Low Damage Risk Zone, Zone I: No Risk Zone

Legend of vulnerable buildings: VH= Very High (damage potential 100%); H= High (50%); M=Medium (25%); L= Low (10%); VL= Very Low (5%)

This table has been compiled using information in the database of Census 2011. This includes residential as well as commercial, institutional, community and religious buildings. This data has been correlated with levels of hazards in the district that have the potentiality of causing damage to buildings. These hazards include earth-

Table 7 : Vulnerability of buildings based on prominent materials used for construction of walls and roofs

		Earthquake Zone				Landslide Zone				Cyclone Zone				Flood Zone			
		V	IV	III	II	V	IV	III	II	V	IV	III	II	V	IV	III	II
WALL																	
1.	Grass/Thatch/Bamboo	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
2.	Plastic Polythene	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
3.	Mud And Un-Burnt Bricks	VH	H	M	L	H	M	L	VH	VH	H	M	L	VH	VH	M	M
4.	Wood	M	L	VL	VL	M	L	VL	VL	VH	H	M	L	H	M	L	VL
5.	Stone Packed with Mortar	H	M	L	VL	H	M	L	VL	H	M	L	VL	M	L	VL	VL
6.	Stone not Packed with Mortar	VH	H	M	L	VH	H	M	L	H	M	L	VL	H	M	L	VL
7.	GI/Metal/Asbestos	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
8.	Burnt Brick	H	M	L	VL	H	M	L	VL	H	M	L	VL	M	L	VL	VL
9.	Concrete	M	L	VL	VL	M	L	VL	VL	L	VL	VL	VL	L	VL	VL	VL
10.	Any Other Materials	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
ROOF																	
1.	Grass/Thatch/Bamboo/Wood/Mud etc.	M	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M
2.	Plastic Polythene	M	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M
3.	Handmade Tiles	H	M	L	VL	H	M	L	VL	H	M	L	VL	H	M	L	VL
4.	Machine Made Tiles	H	M	L	VL	H	M	L	VL	H	M	L	VL	H	M	L	VL
5.	Burnt Brick	H	M	L	VL	H	M	L	VL	L	VL	VL	VL	H	M	L	VL
6.	Stone Slate	H	M	L	VL	H	M	L	VL	H	M	L	VL	H	M	L	VL
7.	G.I./Metal/Asbestos Sheets	H	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M
8.	Concrete	M	L	VL	VL	M	L	VL	VL	L	VL	VL	VL	L	VL	VL	VL
9.	Any Other Materials	M	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M

quake, landslide, cyclone and flood.

b) Agriculture

Crop Vulnerability Index has been worked out on the basis of two indicators: cropped area and irrigated area. District-wise data on area under crops and area under irrigation have been collected from Directorate of Economics and Statistics, Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India.

Standing crops as well as irrigation networks are vulnerable to hazards of nature, but susceptibility of damage is

higher for crops than irrigation. Moreover, irrigation network surviving impacts of disaster can support revival of agriculture. Considering the relative importance of crop and irrigation, 80% weight has been given to area under crops and 20% to irrigated areas.

c) Livestock

Livestock data has been compiled from Livestock Census 2012.⁴⁷ Livestock Vulnerability Index has been worked out on the basis on two indicators—number of bovine animals and other animals—with 75:25 weights between the two, considering importance of bovines for life and economy.

d) Industries

District-wise data on industries has been collected from multiple sources on three indicators: number of MSME, number of industrial clusters and number of Special Economic Zones (SEZ). Data on micro, small and medium enterprise has been collected from the database of Development Commissioner (MSME)⁴⁸, while data on Industrial Clusters and Special Economic Zones in districts have been collected from Ministry of Industrial Policy and Promotion.

Industrial vulnerability index has been worked out on the basis of differential weights of 40% on MSME, 40% on Industrial Clusters and 20% on SEZ.

e) Physical Infrastructure

District-wise data on six types of physical infrastructure—roadways, railways, airports, sea ports, dams and reservoirs, and power plants—have been collected from multiple sources. Total length of roadways and railways in each district have been compiled by NRSC using remote sensing and GIS tools. Data on airports in districts has been collected from Airport Authority of India, while data on seaports has been compiled from Basic Port Statistics of India⁴⁹ Data on dams and reservoirs is drawn from the National Register on Large Dams⁵⁰ District-wise data on hydel power stations is compiled from the WRIS database ⁵¹, while data on thermal and nuclear power projects in districts have been collected from Ministry of Power and Department of Atomic Energy respectively.

Equal weights have been given to each of these six indicators, with sub-indicators within some of the indicators also given equal weight towards calculating Physical Vulnerability Index.

f) Social Infrastructure

Social infrastructure data has been limited to health and educational institutions in the districts as these are considered critical lifeline infrastructure in any major disaster. Data on number of such institutions in districts have been compiled from the village and town amenities database of Census 2011.

Social vulnerability index has been worked out with equal weights on these two indicators. However, sub-sets within the two broad indicators are given different weights. Under education, school education gets 40 percent

47 Livestock Census (2012), Volumes I to IV, Department of Animal Husbandry, Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India.

48 Entrepreneurs Memorandum – Part II - Data on MSME Sector (2015), Development Commissioner (MSME), Ministry of Micro, Small and Medium Enterprises, Government of India.

49 Basic Port Statistics of India (2015), Ministry of Transport and Highways, Government of India.

50 National Register of Large Dams (2017), Ministry of Water Resources, Government of India

51 http://www.india-wris.nrsc.gov.in/wrpinfo/index.php?title=Hydro_Electric_Project

weight and higher education and polytechnics together (columns 6 to 10) 10 percent. In health, primary health care (columns 11 to 13) and hospitals (column 14) carry 25 percent each.

g) Poverty

There is no district-wise national database on the population living Below Poverty Line (BPL). Districts have their own database on BPL populations based on local surveys that are not considered reliable. Socio Economic and Caste Census 2011 did count number of households based on monthly income of highest earning household member⁵² but this cannot be accepted as a robust database on poverty for two reasons: first, the data excluded income from other sources and from other members of households, and second, the survey excluded urban households.

In the absence of any national database on poverty, the estimate of the erstwhile Planning Commission on the number and percentage of people living below poverty line in States and UTs in rural and urban areas ⁵³ was adopted as the basis for calculating BPL population in districts in the same ratio. As this does not capture intra-state variation in poverty, Census 2011 data on district-wise population of homeless has been adopted, additionally. Both these indicators—BPL and Homeless Population—have two sub-indicators for rural and urban areas. An equal weight of 25 percent has been given to each of these four sub-indicators towards working out poverty vulnerability index.

h) Women

Gender Vulnerability Index is worked out on the basis of six indicators: sex ratio (women per 1000 men), illiteracy (%), woman-headed households (%), women not employed (%), MMR (maternal mortality rate per 100,000 child births) and crime against women (cases registered per 100,000 women). District-wise data on first four indicators were compiled from Census 2011. In the absence of district-wise data on MMR, the latest state-wise data from Ministry of Health and Family Welfare⁵⁴ has been adopted for calculating district-wise data in the same ratio.

Equal weight has been given to each of these six indicators.

i) Children

Child vulnerability index has been worked out on the basis of four indicators: age group of children, children not going to school, children working, and IMR. District-wise data on the first three indicators has been compiled from Census 2011. In the absence of any credible district-wise data on IMR, the latest state-wise data on IMR from the Ministry of Health and Family Welfare⁵⁵ has been adopted for calculating district-wise data in the same ratio.

Each indicator has been given an equal 25 percent, while two sub-indicators on age group of children—0 to 6 and 7 to 18—have been given differential weights in a 60:40 ratio as younger children are more vulnerable during disasters.

j) Disability

Disability vulnerability index has been worked out on the basis of three indicators: visual, physical and mental

disability. The data on all these indicators has been compiled from Census 2011. Each indicator is given an equal 33.3%

k) Elderly

Elderly vulnerability index has been worked out on the basis of three indicators: population in 60+ age group, population in 80+ age group and dependency ratio (ratio of population in 60+ age group over working population in 19-59 age group). District-wise data on all three indicators have been compiled from Census 2011. Each indicator is given an equal 33.3%.

l) Depletion of Forest Cover

Changes in forest cover in the districts between 2000 and 2015 have been captured on two indices: dense forests and open forests. District-wise database on these two reference years has been collected from India State of Forest Reports.⁵⁶ Positive, negative and overall changes have been calculated to determine net depletion, if any. Equal weight has been given to both the indicators while calculating the index.

m) Depletion of Mangrove Cover

Changes in mangrove cover in the districts between 2000 and 2015 have been captured on two indices: dense and open mangroves. District-wise database on these two reference years has been collected from India State of Forest Reports.⁵⁷ Positive, negative and overall changes have been calculated to determine net depletion, if any. Equal weight has been given to both indicators while calculating the index.

n) Water Stress

Extent of water stress in districts is captured through three indicators: terrestrial, surface and sub-surface water. Stress on terrestrial and surface water sources is captured in Moisture Index while cropped area not irrigated data is used in calculating drought hazard index and agricultural vulnerability index. Stress on sub-surface water has been compiled from the district database on ground water made available by Central Ground Water Board.

An equal 33.3% is given on each indicator for calculating the water stress index. Sub-surface water has four sub-indicators: over-exploited, critical, sub-critical and safe. This is distributed as follows: 50% is given to over-exploited, 30% to critical, and 20% to sub-critical components. Safe water zones are not calculated in our indexes.

⁵⁶ India State of Forest Report (2000 and 2015), Forest Survey of India, Ministry of Environment and Forests, Government of India.

⁵⁷ India State of Forest Report (2000 and 2015), Forest Survey of India, Ministry of Environment and Forests, Government of India.

⁵² <http://secc.gov.in/categorywiseIncomeSlabReport?reportType=All%20Category#>

⁵³ Press Note on Poverty Estimates (2013), Planning Commission, Government of India.

⁵⁴ Family Welfare Statistics in India (2015), Ministry of Health and Family Welfare, Government of India.

⁵⁵ Family Welfare Statistics in India (2015), Ministry of Health and Family Welfare, Government of India.

DATA ON EXPOSURE

Data on exposures has been collected on two indicators in each district: exposure of population and exposure of economy as reflected in district GDP. While data on exposure of population is compiled easily from Census 2011, exposure of district GDP is not available so easily.

State GDP is estimated by the Directorate of Economics and Statistics (DES) in the States, but these are adopted by Central Statistical Organization (CSO) only after verification. District GDP estimates are prepared by the DES but these are not subjected to further scrutiny by CSO. Only 11 out of 36 States/ UTs prepare GDP estimates for districts. These are: Andhra Pradesh, Bihar, Karnataka, Kerala, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. But none of the States prepare the estimates regularly and for some of the States, the data is as old as 2009-2010. This poses problems on multiple counts. First, for the States that have never estimated district GDP some broad approximation of such data has to be constructed for the purpose of the study, even though it may not be accurate. Second, for the States that have old district GDP estimation, the data has to not only be updated for the current year, such data has also got to be constructed for the census districts that were created subsequent to last estimation.

The following methodology was adopted for quick construction of data on district GDP in the States. First, data on current State GDP is collected from CSO. CSO has released State GDP estimates of 2016-2017 at current prices (base year 2011-12) for 17 States/ UTs. For the year 2015-2016, such data is available for all States/ UTs except West Bengal as the State GDP of West Bengal at 2011-12 prices has not been adopted ever since the new series was started. In this scenario, there was no other alternative but to work with the State GDP estimate prepared by the West Bengal State DES for the year 2015-2016, and State GDP estimates adopted by the CSO for the remaining States/ UTs.

Second, for the States that have never prepared district GDP, data was constructed on the basis of state per capita GDP multiplied by district population. For the States that prepared district GDP, the data was updated by working out district share of State GDP as per latest estimate and apportioning current State GDP in the same ratio to the districts. For the newly created districts, the share was apportioned on the basis of per capita population.

Exposure index has been worked out by estimating density of population and per capita income in district and assigning equal weight to both the indicators on a scale of 10.

HAZARDS

A hazard is defined as ‘a dangerous phenomenon that is likely to cause damage’.⁵⁸ In the context of disaster management, this dangerous phenomenon was seen almost exclusively as natural, arising out of the process of nature, through geology, meteorology, hydrology and climate.⁵⁹The exclusive focus on natural hazards gradually broadened to cover various human-induced hazards that include not only technological hazards and accidents,⁶⁰ but also socio-natural hazards which are a ‘combination of natural and anthropogenic factors, including environmental degradation and climate change’⁶¹. The Sendai Framework for Disaster Reduction has significantly expanded the scope of hazards to include ‘small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters caused by natural and man-made hazards as well as related environmental, technological and biological hazards’⁶².

Classification of Hazards

Hazards have been classified and catalogued differently in different countries and in different contexts. International database on disasters (EM-DAT) classifies hazards into two broad groups: natural and technological hazards. Natural hazards are further classified into six sub-groups—biological, climatological, extra-terrestrial, geo-physical, hydrological, meteorological—and several types under each sub-group.⁶³ Integrated Research on Disaster Risks (IRDR) has catalogued hazards as 48 perils which are further classified in 19 events of 6 families.⁶⁴

Specifically, in the contexts of India, the High-Powered Committee on Disaster Management (HPC) identified 31 hazards under five categories: geological, hydro-climatic, chemical, industrial and nuclear, accident related and biological.⁶⁵ Disaster Management Act endorsed two broad classifications of hazards, natural and man-made, ⁶⁶ while National Policy on Disaster Management makes explicit mention of four main hazards: earthquake, flood, landslide and cyclone-in-

58 <https://dictionary.cambridge.org/dictionary/english/hazard>

59 The International Decade for Natural Disaster Reduction (1990-1999) was based on the assumption that disasters caused by hazards are ‘natural’.

60 UNISDR Terminology on Disaster Risk Reduction, 2009.

61 Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction, UN General Assembly, A/71/644, 1 December 2017.

62 Sendai Framework for Disaster Reduction 2015-2030, para 15. **CITE PROPERLY**

63 The types of hazards under various sub-groups of natural hazards include geophysical (earthquake, mass movement (dry), volcanic activity), meteorological (extreme temperature, fog, storm), hydrological (flood, landslide, wave action), climatological, (drought, glacial lake outburst, wild fire), biological (epidemic, insect infestation, animal accident), and extraterrestrial (space weather).

64 Integrated Research on Disaster Risks (IRDR), Peril Classification and Hazard Glossary, Beijing, 2014.

65 The hazards listed under these five categories are: (a) Geological - earthquake, landslide and mudflows, dam bursts, and mine fires; (b) Hydro-climatic - flood, cyclones, tornadoes and hurricanes, hailstorm, cloudbursts, heat and cold wave, snow avalanche, drought, soil erosion, and thunder and lightning; (c) Chemical, Industrial and Nuclear; (d) Accident-related - forest fires, urban fires, mine flooding, oil spill, major building collapse, serial bomb blasts, festival-related disasters, electrical disasters and fires, air, road and road accidents, boat capsizing, and village fire, and (e) Biological - human epidemics, cattle epidemics, pest attacks and food poisoning. High Powered Committee on Disaster Management, Ministry of Agriculture, Government of India 2001.

66 Section 2 (d) of Disaster Management Act 2005.

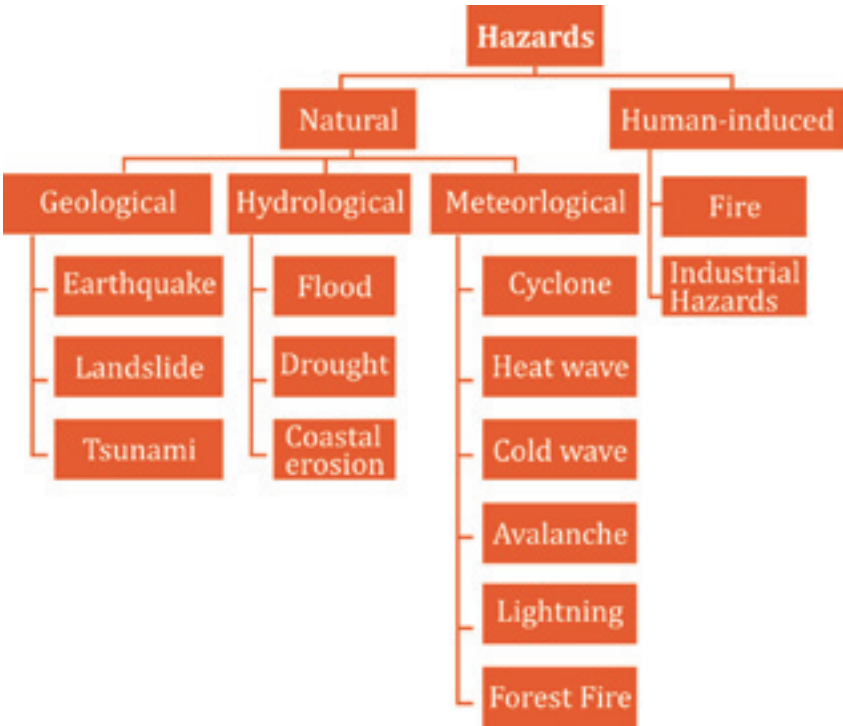
cluding winds,⁶⁷ following the Vulnerability Atlas of India which is similarly restricted to these four main hazards of India.⁶⁸ National Plan on Disaster Management focuses on nine natural hazards—cyclone and wind, flood, urban flood, earthquake, tsunami, landslide, snow avalanche, drought, and cold wave and frost—and three human-induced hazards—industrial, nuclear and radiological, and fire.⁶⁹ National Disaster Management Authority has issued separate guidelines for the management of disasters caused by most of these 12 hazards.⁷⁰

For the purpose of allocating funds to the States for disaster management, the successive Finance Commissions of India recognized 10 natural and one man-made hazard. These are earthquake/ tsunami, landslide, flood, drought, cyclone, cloudburst, hailstorm, avalanche, frost and cold wave, pest attack and fire. The Fourteenth Finance Commission permitted the States to spend 10 percent of the total allocation on State-specific hazards not included on the recognized list of 11 hazards.⁷¹ Requisite details regarding state specific hazards could not be obtained from any source.

SELECTION OF HAZARDS

For the purpose of measuring risks of disasters in the States and Union Territories and developing Disaster Risk Index of districts, 12 natural and two human induced disasters, as shown in the figure below, were selected.

Figure 1: Selection of hazards for measuring risks of States



67 National Policy on Disaster Management 2009, pages 2-5.

68 Vulnerability Atlas of India, Building Materials and Technology Promotion Council, Ministry of Housing and Urban Poverty Alleviation, Government of India, 2006.

69 National Plan on Disaster Management, National Disaster Management Authority, 2016

70 Comprehensive national guidelines have been issued for the management of disasters arising out of earthquakes, landslides, floods, urban floods, tsunamis, droughts, heat waves and industrial hazards.

71 Report of Fourteenth Finance Commission of India, 2014.

These 14 hazards were selected through a process of consultation with experts of various scientific and technical agencies and the State Governments. The overriding considerations for the selection of these hazards were (a) importance of the hazards for loss of lives and damage of built-up and productive assets, and (b) availability of data in a uniform format throughout the country. Such databases on scientific parameters of hazards are available for earthquakes, landslides, tsunamis, floods, droughts, cyclones, heat waves, cold waves, avalanches and forest fires. In the absence of a comprehensive database on coastal erosion, lightning, fire, and industrial hazards, available datasets had to be relied upon. Among the 11 hazards recognized by the Finance Commission, hailstorm and cloudbursts had to be excluded as it was difficult to gather time series data on scientific parameters of these two hazards for the entire country. Among the 12 hazards included in National Plan on Disaster Management, nuclear and radiological emergencies had to be excluded as hardly any information was available on such emergencies. Lightning, heat wave, forest fire and coastal erosion were included for measuring risk index even though these do not figure in Finance Commission dispensation and National Plan prescription for two reasons: (a) mortalities on lightning and heat wave were quite significant; (b) States wanted these to be excluded.

These 12 natural hazards are classified into three broad categories of geological, hydrological and meteorological, which may overlap for some hazards; landslides may often be triggered by rainfall and tsunamis may have both hydrological and geological impacts through wave action. Similarly, coastal erosion may be caused by both geological and hydrological processes. Anthropogenic factors may also precipitate many of these hazards.

EARTHQUAKE

Earthquakes are the only hazard for which hazard zonation has been worked out for the entire country. Based on a number of scientific parameters, such as magnitude, intensity, seismic coefficients and maximum expected ground acceleration, the entire landmass of the country has been mapped into five zones: Zone-V (Very High Risk), Zone-IV (High Risk), Zone-III (Moderate Risk), and Zone-II (Low Risk). This zonation has been adopted for assessing vulnerability of all existing buildings and for designing and retrofitting new buildings.⁷²

As per this zonation, 11.66 percent of the total geographical area of the country is in very high risk seismic Zone-V. Seven Northeastern States (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura) and the Union Territory of Andaman & Nicobar Islands fall exclusively in very high risk seismic Zone-V. Other States in Zone-V include Uttarakhand (41 percent), Himachal Pradesh (35.20 percent), Gujarat (18.84 percent), Bihar (15.44 percent), Jammu & Kashmir (9.7 percent) and Punjab (0.91 percent).

Areas in High Risk Seismic Zone-IV (13.69 percent of total geographical area of the country) are spread out in the Himalayan States of Sikkim (100 percent), Jammu & Kashmir (90.3 per cent), Himachal Pradesh (64.80 percent) and Uttarakhand (59 percent) and the Indo-Gangetic plain States of Bihar (65.12 percent), Punjab (50.79 percent), Haryana (37.06 percent), West Bengal (31.31 percent), Uttar Pradesh (30.74 percent) and the Union Territories of Delhi and Chandigarh, both falling exclusively in Zone-IV. Four other States have parts of land in Zone-IV: Gujarat (15.41 percent), Maharashtra (4.80 percent), Jharkhand (3.80 percent), and Rajasthan (3.65 percent).

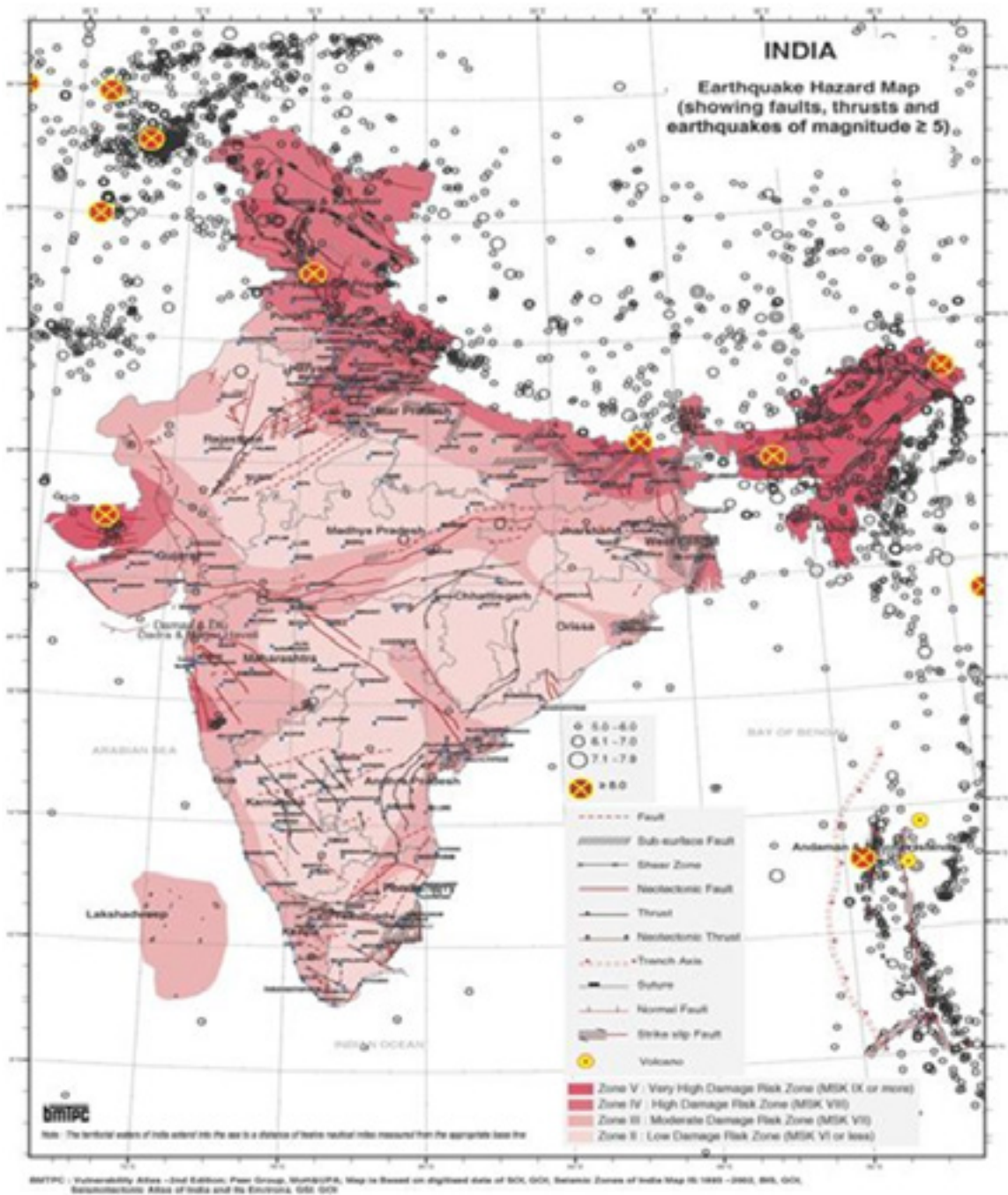
72 IS 1893 (Part-1): 2002, Bureau of Indian Standards; Vulnerability Atlas of India, BMTPC, 2006; Earthquake Hazard Zoning Atlas of India, BMTPC and NDMA, 2016.

Table 8: Areas falling in Seismic Hazard Zones and Earthquake Hazard Index of States/UTs

	State/UTs	Total Area (Sq km)	Area in Earthquake Hazard Zones								Earthquake Hazard Index
			Zone-V		Zone-IV		Zone-III		Zone-II		
			Area	%	Area	%	Area	%	Area	%	
STATES											
1	Andhra Pradesh	160205	0.00	0.00	0.00	0.00	53924.43	33.66	106280.57	66.34	2.67
2	Arunachal Pradesh	83743	83743.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
3	Assam	78438	78438.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
4	Bihar	94163	14537.09	15.44	61314.78	65.12	18311.13	19.45	0.00	0.00	6.23
5	Chhattisgarh	135192	0.00	0.00	0.00	0.00	20670.61	15.29	114521.39	84.71	2.31
6	Goa	3702	0.00	0.00	0.00	0.00	3702.00	100.00	0.00	0.00	4.00
7	Gujarat	196244	36962.81	18.84	30234.86	15.41	127551.95	65.00	1494.37	0.76	5.42
8	Haryana	44212	0.00	0.00	16386.32	37.06	23844.01	53.93	3981.46	9.01	4.56
9	Himachal Pradesh	55673	19598.72	35.20	36074.28	64.80	0.00	0.00	0.00	0.00	7.41
10	Jammu & Kashmir	101387	9838.89	9.70	91548.11	90.30	0.00	0.00	0.00	0.00	6.39
11	Jharkhand	79716	0.00	0.00	3030.71	3.80	41718.94	52.33	34966.35	43.86	3.20
12	Karnataka	191791	0.00	0.00	0.00	0.00	25472.81	13.28	166318.19	86.72	2.27
13	Kerala	38852	0.00	0.00	0.00	0.00	38070.02	97.99	781.98	2.01	3.96
14	Madhya Pradesh	308252	0.00	0.00	0.00	0.00	111292.77	36.10	196959.23	63.90	2.72
15	Maharashtra	307713	0.00	0.00	14784.01	4.80	156957.34	51.01	135971.65	44.19	3.21
16	Manipur	22327	22327.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
17	Meghalaya	22429	22429.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
18	Mizoram	21081	21081.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
19	Nagaland	16579	16579.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
20	Odisha	155707	0.00	0.00	0.00	0.00	21757.43	13.97	133949.57	86.03	2.28
21	Punjab	50362	460.27	0.91	25581.11	50.79	23013.96	45.70	1306.62	2.59	5.02
22	Rajasthan	342239	0.00	0.00	12486.96	3.65	92862.49	27.13	236889.12	69.22	2.69
23	Sikkim	7096	0.00	0.00	7096.00	100.00	0.00	0.00	0.00	0.00	6.00
24	Tamil Nadu	130060	0.00	0.00	0.00	0.00	36380.64	27.97	93679.36	72.03	2.56
25	Telangana	114840	0.00	0.00	0.00	0.00	33649.57	29.30	81192.32	70.70	2.59
26	Tripura	10486	10486.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
27	Uttar Pradesh	240928	0.00	0.00	74065.88	30.74	116406.91	48.32	50455.21	20.94	4.20
28	Uttarakhand	53483	21928.77	41.00	31554.23	59.00	0.00	0.00	0.00	0.00	7.64
29	West Bengal	88752	2563.15	2.89	27784.99	31.31	49908.88	56.23	8494.98	9.57	4.61
UNION TERRITORIES											
1	Andaman & Nicobar	8249	8249.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
2	Chandigarh	114	0.00	0.00	114.00	100.00	0.00	0.00	0.00	0.00	6.00
3	Dadra and Nagar Haveli	0.00	0.00	0.00	0.00	491.00	100.00	0.00	0.00	0.00	4.00
4	Daman and Diu	111	0.00	0.00	0.00	0.00	111.00	100.00	0.00	0.00	4.00
5	Delhi	1483	0.00	0.00	1483.00	100.00	0.00	0.00	0.00	0.00	6.00
6	Lakshadweep	30	0.00	0.00	0.00	0.00	30.00	100.00	0.00	0.00	4.00
7	Puducherry	490	0.00	0.00	0.00	0.00	39.00	7.96	451.00	92.04	2.16
	TOTAL	3166620	369221.71	11.66	433539.24	13.69	996166.87	31.46	1367693.39	43.19	

The rest of the land mass of the country falls in the Moderate Risk Zone-III (31.46 per cent) and Low Risk Zone-II (43.19 per cent). Based on damage potential of earthquakes in different seismic zones, the earthquake hazard index has been prepared for all the 640 districts in 29 States and Union Territories. These are detailed in the statistical appendix of this publication. A State/ UT-wise summary of the same is given in the table above.

Figure 2: Earthquake Hazard Zonation Map of India



Source: BMTPC: Vulnerability Atlas 2nd edition; Peer Group, MOH & UPA; Map is based on digitised data of SOI, GOI; Seismic Zones of India Map IS: 1893-2002, BIS, GOI, Seismotectonic Atlas of India and its Environs, GSI, GOI

Earthquake zonation map of India is prepared in a resolution of 1:12 million, which is too coarse to capture the intra-zonal variations in seismicity. These variations are quite significant for assessing the risks of earthquakes, particularly in large areas of human settlements that have large concentrations of population as well as built-up assets, which are both vulnerable to the damaging impacts of earthquakes.

Some of the important urban centers of India are located in Very High, High and Moderate Risk seismic zones of India. Cities and towns with populations above one million located in Seismic Zones V, IV and III are shown in the Table below. Two metropolitan capital cities —Srinagar and Guwahati—are located in seismic zone V, while the National Capital Region (NCR) is in Zone-IV. Three out of four remaining mega cities of India—Mumbai, Kolkata and Chennai—are located in seismic zone III.

Table 9: Mega and Metropolitan Cities in Seismic Zones V, IV and III

Size/ Class of Cities (based on population)	Very High Risk Seismic Zone -V	High Risk Seismic Zone - IV	Moderate Risk Seismic Zone- III
Mega Cities (5 million+)	-	Delhi: Delhi	Maharashtra: Mumbai Tamil Nadu: Chennai West Bengal: Kolkata
Metropolitan Cities (1 to 5 million)	Assam: Guwahati Jammu & Kashmir: Srinagar	Bihar: Patna Chandigarh: Chandigarh Haryana: Faridabad Punjab: Amritsar, Ludhiana Uttar Pradesh: Ghaziabad, Noida, Meerut	Andhra Pradesh: Vijayawada Gujarat: Ahmadabad, Rajkot, Vadodara Jharkhand: Dhanbad Kerala: Kannur, Kochi, Kollam, Kozhikode, Malappuram, Thiruvananthapuram, Thrissur Madhya Pradesh: Jabalpur Maharashtra: Nashik, Pune Tamil Nadu: Coimbatore Uttar Pradesh: Agra, Kanpur, Lucknow, Varanasi West Bengal: Asansol

Capital cities of the States of Arunachal Pradesh (Itanagar), Manipur (Imphal), Meghalaya (Shillong), Mizoram (Aizawl), Nagaland (Dimapur), Tripura (Agartala), and Andaman & Nicobar Islands (Port Blair), although smaller in size than metropolitan cities, are all located in seismic Zone-V. The capitals of Himachal Pradesh (Shimla) and Uttarakhand (Dehradun) and winter capital of Jammu & Kashmir (Jammu) are located in Zone-IV. Census of 2011 has registered more than 300 Class-I cities, each having a population of more than 100,000. More than half of these cities are located in seismic zones III to V.

Earthquake risks of urban areas can be assessed in a comprehensive manner through seismic micro-zonation studies in high resolution. This makes it possible to assess variations in seismic hazards within cities and develop appropriate land use and building regulations for various micro-zones in cities. Such studies have been undertaken in only a few cities so far, largely through the initiatives of scientific and technical institutes like Indian Institute of Science and Indian Institutes of Technologies. National Centre for Seismology of the Ministry of Earth Sciences has taken up systematic seismic micro-zonation of 30 cities located in zones V, IV and III in a scale of 1: 25,000. For the national capital of Delhi, micro-zonation has been undertaken in a higher resolution of 1: 10,000.

Table 10: Status of Seismic Micro-Zonation of Cities in India

Completed	Ongoing
Assam: Guwahati Chandigarh: Chandigarh Delhi: Delhi Gujarat: Ahmedabad Madhya Pradesh: Jabalpur Maharashtra: Mumbai Mizoram: Aizwal Sikkim: Gangtok Uttarakhand: Dehradun West Bengal: Kolkata	Andhra Pradesh: Vijayawada Bihar: Patna Gujarat: Bhavnagar, Surat, Vadodara Jharkhand: Dhanbad Jammu & Kashmir: Srinagar, Jammu Karnataka: Mangalore Kerala: Kochi, Kozhikode, Thiruvananthapuram Madhya Pradesh: Indore Maharashtra: Bhiwandi, Nashik, Pune Punjab: Amritsar, Jalandhar Odisha: Bhubaneswar, Cuttack Tamil Nadu: Chennai, Coimbatore Uttar Pradesh: Agra, Bareilly, Kanpur, Lucknow, Meerut, Varanasi West Bengal: Asansol

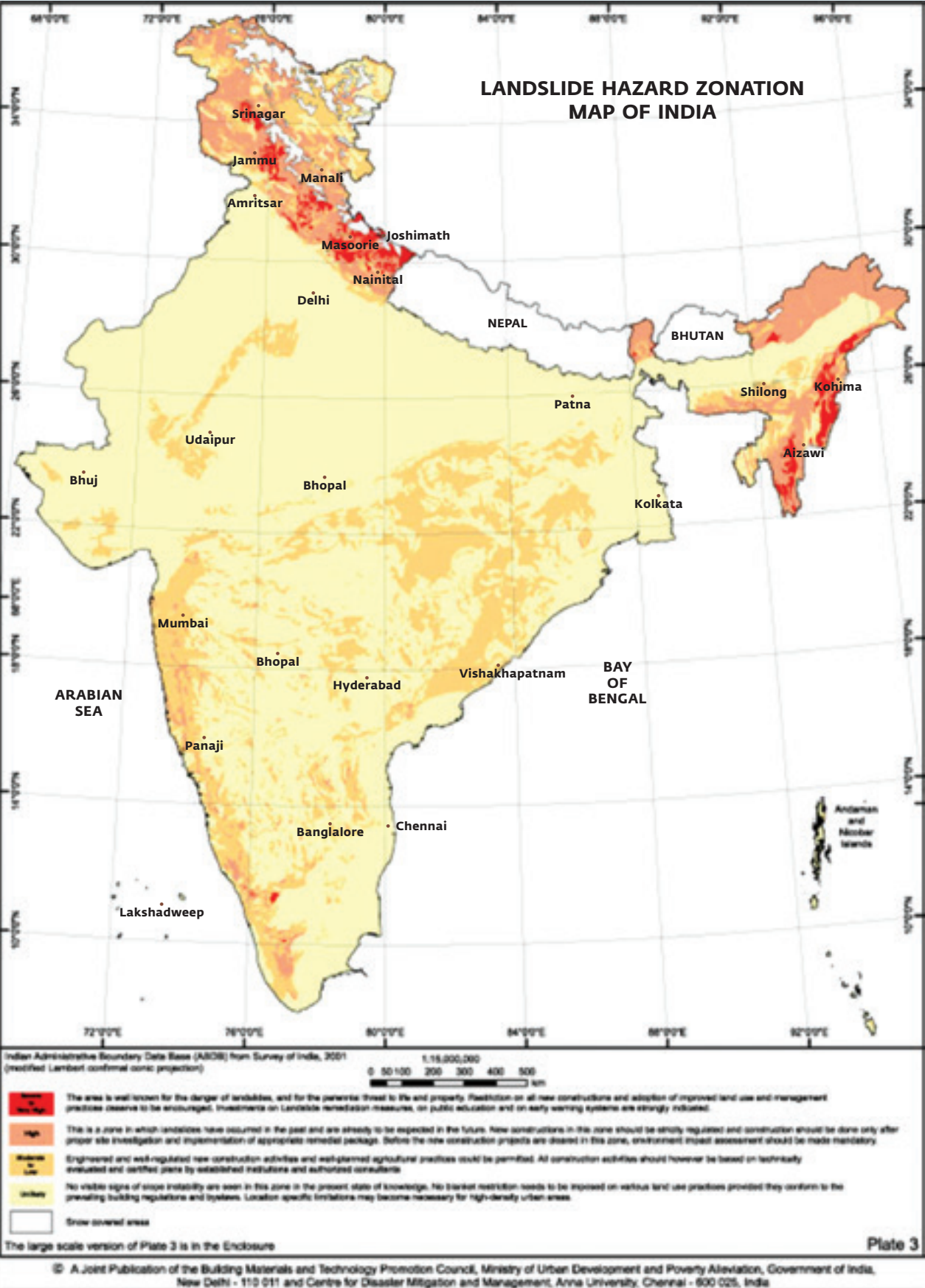
It is imperative that the development authorities and municipal bodies of the States revise their city master plans and building by-laws on the basis of seismic micro-zonation to ensure that all development and building activities in the cities conform to the standards of earthquake resistance and safety. It is also imperative that micro-zonation studies are undertaken in every city located in seismic zones V, IV and III.

LANDSLIDES

Landslide Hazard Zonation Atlas of India was developed jointly by BMTPC and Centre for Disaster Mitigation and Management of Anna University, Chennai.⁷³ Published in 2003, this atlas has not undergone much-needed revision and updating, despite subsequent events and pattern of landslides largely conforming to the zonation laid down in the atlas. he atlas was prepared on very coarse resolution of 1:17 million, with a focus on major landslide and hazard prone areas of the Himalayas and the Western Ghats. However, on a pan-India scale, the atlas classified the entire landmass of the country into five zones—severe to very high (Zone-IV), high (Zone-III), moderate to low (Zone-II), and unlikely (Zone-I)—on the basis of six parameters: slope, land use, rainfall, geology, geomorphology and tectonics. Based on this classification, 67 per cent of the geographical areas of the country are landslide-free Zone-I, and 23 per cent are in moderate hazard Zone-II, where a landslide is not likely to cause any damage to life and property. It is the 8.5 per cent area in Zone-III and 1.65 per cent area in Zone-IV that are areas of concern. These areas are almost entirely located in 11 Himalayan States and two Western Ghat States, as shown in the Table below. These States account for 88.6 and 98.7 per cent of the total area under landslide Zone III and IV of the entire country.

73 Landslide Hazard Zonation Atlas of India, Building Materials and Technology Promotion Council and Centre for Disaster Mitigation and Management of Anna University, Chennai, 2003.

Figure 3: Landslide Hazard Zonation Map of India



Based on the existing landslide zonation map, Landslide Hazard Index has been developed for all the districts, States and UTs and are mentioned in the statistical index.

Table 11: Major Landslide Hazard Prone States of India

	STATES	Total Area (Sq. Km)	Moderate (Zone-III)		High (Zone-IV)		Severe (Zone-V)	
			Area	%	Area	%	Area	%
1	Arunachal Pradesh	83743	3590.66	4.29	65159.97	77.81	2505.09	2.99
2	Assam	78438	13475.35	17.18	5947.11	7.58	6.26	0.01
3	Goa	3702	2203.25	59.52	303.5	8.20	0	0
4	Himachal Pradesh	55673	7285.46	13.09	38960.86	69.98	7949.24	14.28
5	Jammu and Kashmir	101387	40161.94	39.61	40129.36	39.58	5604.31	5.53
6	Kerala	38852	22049.62	56.75	9046.27	23.28	355.23	0.91
7	Manipur	22327	2781.4	12.46	11185.7	50.10	6832.69	30.60
8	Meghalaya	22429	9269.2	41.33	9379.62	41.82	256.32	1.14
9	Mizoram	21081	1536.75	7.29	14695.35	69.71	4801.20	22.78
10	Nagaland	16579	3113.67	18.78	9252.87	55.81	3630.56	21.90
11	Sikkim	7096	477.09	6.72	6452.69	90.93	165.62	2.33
12	Tripura	10486	4167.69	39.75	2561.51	24.43	0	0
13	Uttarakhand	53483	7146.38	13.36	23677.37	44.27	19588.30	36.63
	Total	515276	117258.46	22.76	236752.18	45.95	51694.82	10.03
	All India	3166620	730217.95	23.05	267204.56	8.43	52340.02	1.65

Considering that coarse resolution of existing Landslide Hazard Zonation (LHZ) maps are not very congenial for assessing the hazards of landslides as well as for designing landslide risk mitigation projects, NDMA had recommended that LHZ maps should be developed at 1: 50,000 scale to begin with, progressively enlarging on higher resolution for specific areas.⁷⁴ Geological Survey of India (GSI), which is the nodal agency for landslides, maintains a catalogue of landslides in India with details regarding location, triggers, intensity and impacts that are useful for landslide zonation. GSI has been supporting landslide hazard mapping of selected areas to facilitate construction of roads, hydro-electric and other projects.⁷⁵

The Department of Science and Technology, Government of India, has been funding projects for high resolution landslide maps in selected States.⁷⁶ Indian Institutes of Technology and Geology Department of a few universities have taken up projects on micro-zonation of landslide hazards in selected areas. State level landslide zonation map has also been developed in States like Kerala.⁷⁷

National Remote Sensing Agency has developed GIS based high resolution LHZ maps in some extremely high-risk landslide prone areas of Himachal Pradesh, Meghalaya and Uttarakhand. Based on these maps, experimental landslide early warning systems have also been developed for rainfall-triggered landslides along Rishikesh-Badrinath, Rishikesh-Uttarkashi-Gaumukh, Chamoli-Okhimath, Rudraprayag-Kedarnath and Pithoragarh-Malpa corridors of Uttarakhand that are frequented by pilgrims and trekkers.⁷⁸ All these initiatives are progressively scaling up assessment of landslide hazards in the country, but it may take several years before all the landslide hazard zones are mapped comprehensively in high resolution on the basis of various scientific parameters that trigger such hazards.

74 National Guidelines on Management of Landslide and Snow Avalanches, NDMA, 2009.

75 https://www.gsi.gov.in/webcenter/portal/OCBIS/page17/pageLANDSLIDEHAZRD/page174?_afLoop=605485433313617&_adf.ctrl-state=1djpqtjyuuw_51#!%40%40%3F_afLoop%3D605485433313617%26_adf.ctrl-state%3D1djpqtjyuuw_55

76 Thrust Areas Under Landslide in India, Department of Science and Technology, 2016.

77 Landslide Atlas of Kerala, Department of Geology, University of Kerala, 2017.

78 <http://bhuvan-noeda.nrsc.gov.in/disaster/disaster/disaster.php#>



Source: UNDP

FLOODS

Floods are the most common natural hazard of India. Every year, large parts of the country get inundated by floods of various types, such as riverine floods, coastal floods, flash floods etc. Sometimes, the discharge from large dams and reservoirs may compound flooding of many low-lying areas. Changing climate has created a new hazard, Glacial Lake Outburst Flood (GLOF), which may be triggered by melting glaciers or cloudbursts in high altitude. Unplanned developments in floodplains and clogging of drainage systems may cause floods in urban areas, as is becoming increasingly common in many metropolitan and other large cities of the country.

Comprehensive flood hazard zonation of India based on these multiple dimensions and parameters of flood is yet to be undertaken. Central Water Commission, which is the nodal agency of Government of India for flood hazard assessment, has focused mainly on riverine floods. Based on the actual area flooded in different river basins in the country during 1953 to 2016, CWC has worked out the average and maximum annual flooding in each State and UT, which is presented in the adjacent table.

Table 12: Average and Maximum Annual Flooding in States / UTs

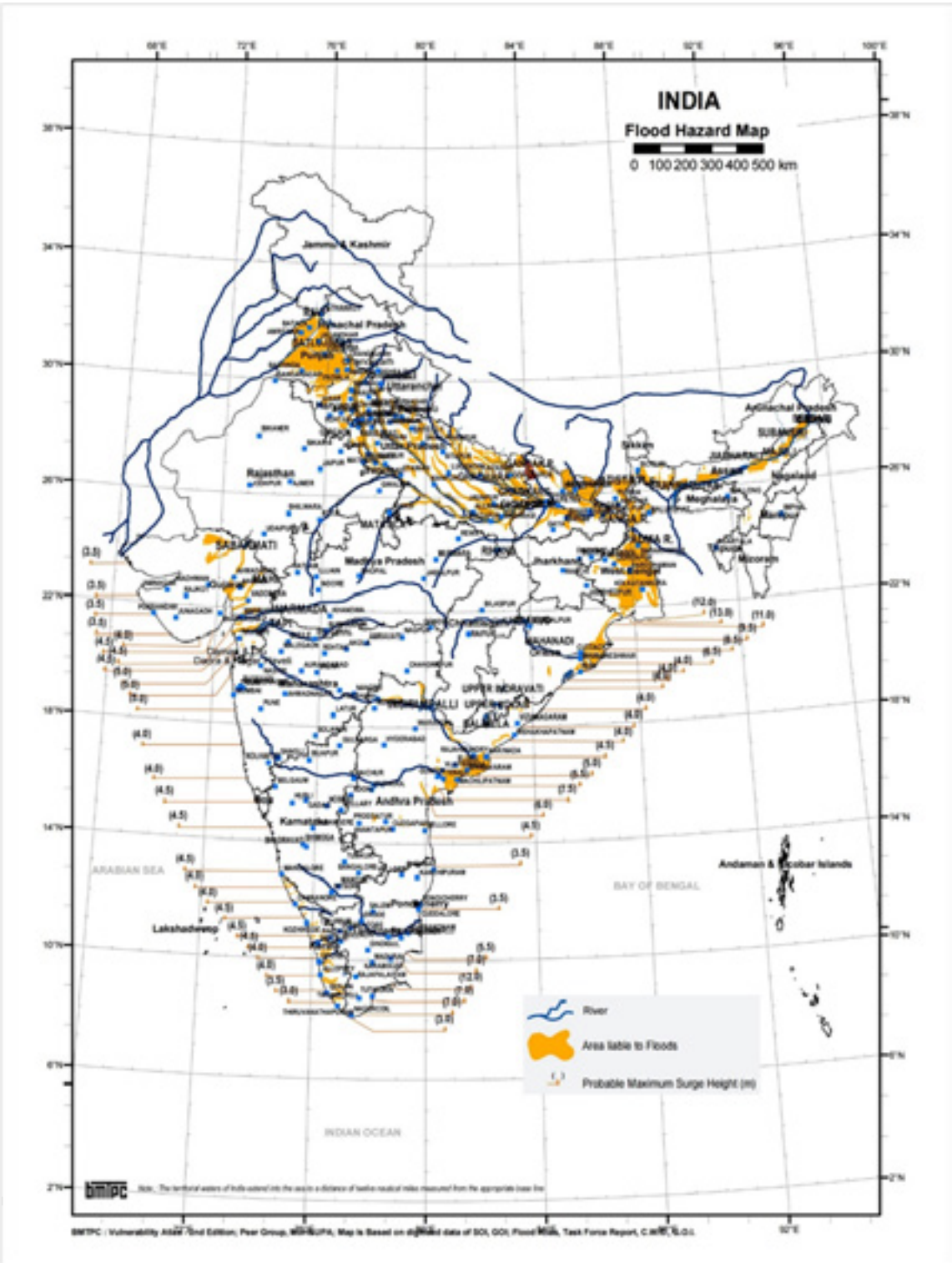
No.	State Union Territory	Total Area (Sq. Km)	Flood Affected Area in Sq. Km (1953-2016)				
			Average Annual Flooding	Maximum Annual Flooding	Year of Maximum Flooding	Average Flooded Area (%)	Maximum Flooded Area (%)
	STATES						
1	Andhra Pradesh	160205	5280	90400	2005	3.30	56.43
2	Arunachal Pradesh	83743	640	3100	2010	0.00	3.70
3	Assam	78438	8320	38200	1988	10.61	48.70
4	Bihar	94163	13116	42600	1971	13.93	45.24
5	Chhattisgarh	135192	130	890	2001	0.10	0.66
6	Goa	3702	0	0	-	0.00	0.00
7	Gujarat	196244	3550	20500	1988	1.81	10.45
8	Haryana	44212	1960	10000	1977	4.43	22.62
9	Himachal Pradesh	55673	3560	8700	1999	6.39	15.63
10	Jammu & Kashmir	101387	380	5140	1987	0.37	5.07
11	Jharkhand	79716	50	410	2012	0.06	0.51
12	Karnataka	191791	1600	23900	2009	0.87	12.46
13	Kerala	38852	1670	14700	1989	4.30	37.84
14	Madhya Pradesh	308252	540	3770	1994	0.18	1.22
15	Maharashtra	307713	550	3910	2002	0.18	1.27
16	Manipur	22327	540	1160	2002	2.42	5.20
17	Meghalaya	22429	90	950	1987	0.40	4.24
18	Mizoram	21081	340	5410	1993	1.61	25.66
19	Nagaland	16579	10	90	1993	0.06	0.54
20	Odisha	155707	5500	39700	2014	3.53	25.50
21	Punjab	50362	3540	27900	1988	7.03	55.40
22	Rajasthan	342239	3100	32600	1977	0.91	9.53
23	Sikkim	7096	530	1170	2000	7.47	16.49
24	Tamil Nadu	130060	1600	14660	2010	1.23	11.27
25	Telangana	114840	NA	NA	-	0.00	0.00
26	Tripura	10486	320	3300	1963	3.05	31.47
27	Uttar Pradesh	240928	16670	73400	1978	6.92	30.47
28	Uttarakhand	53483	0	20	2001	0.00	0.04
29	West Bengal	88752	7910	30800	1978	8.91	34.70
	UNION TERRITORIES						
1	A & N Islands	8249	10	300	1988	0.12	3.64
2	Chandigarh	114	0	0	-	0.00	0.00
3	Dadra & Nagar Haveli	491	0	0	-	0.00	0.00
4	Daman & Diu	111	0	0	-	0.00	0.00
5	Delhi	1483	230	458	1997	15.51	30.88
6	Lakshadweep	30	0	0	-	0.00	0.00
7	Puducherry	490	20	50	1977	4.08	10.20
	TOTAL	3166620	71110	518188	-	2.25	16.36

Source: Central Water Commission, Ministry of Water Resources

Average annual flooding is the highest in Bihar (13.93 per cent of its total geographical area is flooded on an average every year), followed by Assam (10.61 per cent), West Bengal (8.91 per cent), Sikkim (7.47 per cent), Punjab (7.03 per cent) and Uttar Pradesh (6.92 per cent). Maximum flooding in a single year took place in Andhra Pradesh in 2005, when 56.43 per cent of its total geographical area was under water. Punjab and Assam had seen 55.40 and 48.70 per cent of the States flooded in 1988. Bihar had its worst flood in 1971 and West Bengal in 1978, when 45.24 and 34.70 percent of the land mass of these two neighboring States were submerged.

A district-wise break-up of the actual area flooded could not be obtained from any sources. Central Water Commission does not maintain such disaggregated data. None of the State Governments, with the sole exception of Kerala, could make the data available for this study.

Figure 4: Flood Hazard Map of India



Source: BMTPC: Vulnerability Atlas 2nd edition; Peer Group, MOH & UPA; Map is based on digitised data of SOI, GOI; Flood Atlas, Task Force Report, C.W.C, G.O.I

A flood hazard map of India, unlike earthquake and landslide maps, does not make a classification of flood zones based on the intensity of the hazard. Such a zonation can be created on the basis of comprehensive data sets on a number of parameters, such as contour, slope, run-off, ground permeability, land use land cover, vegetation, settlement pattern etc. that are not available on a uniform scale throughout the country.

The Vulnerability Atlas of India (2006) provided data on district-wise flood prone areas, but this does not seem to be very realistic, as none of the districts in as many as 17 States (Arunachal Pradesh, Chhattisgarh, Goa, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Rajasthan, Sikkim, Tamil Nadu and Tripura) was shown as flood prone.

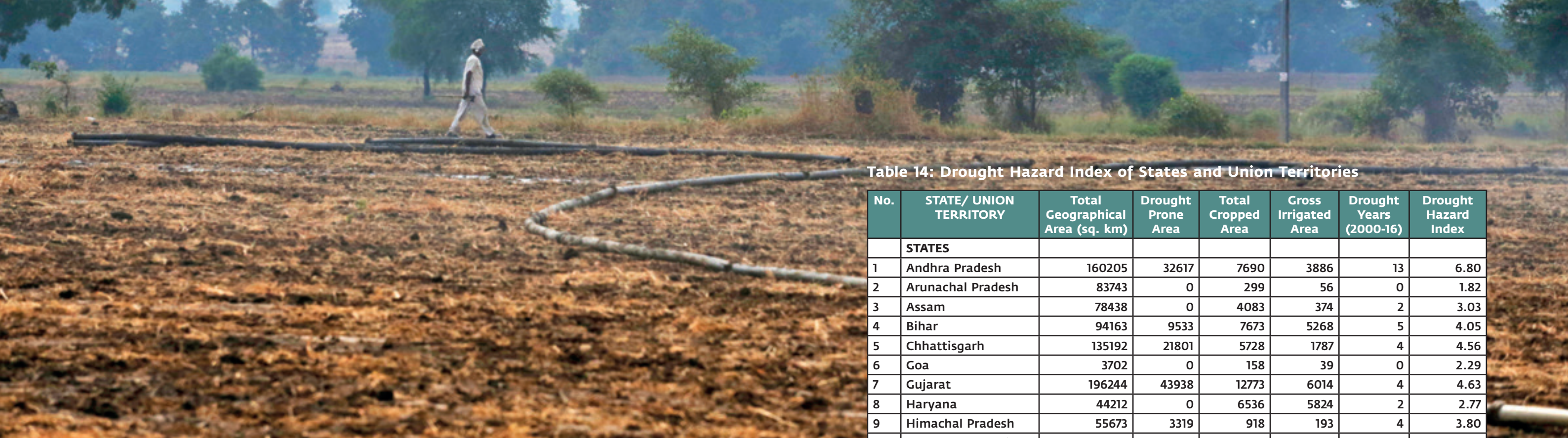
National Remote Sensing Centre (NRSC) has used spatial hydrology techniques to develop Flood Vulnerability Index (FVI) based on available data on rainfall frequency, digital elevation, soil map and drainage map. Although developed for the Indian railways to assess flood vulnerability of rail bridges, FVI provides the only flood hazard zonation map of India that covers the entire country, including the non-river basin areas. Flood hazard zones are classified into five types: very high, high, moderate, less and very less. State-wise district-wise areas falling under various flood zones are provided in Figure 4.

In a separate study, NRSC has worked out district-wise flood hazard zonation of four States—Assam, Bihar, Odisha and Uttar Pradesh—based on satellite datasets acquired during floods of the past decade and half, followed by ground verification. The overall picture that emerges is shown in the Table below.

Table 13: Flood hazard zonation of Assam, Bihar, Odisha, Uttar Pradesh

STATE	Flood Hazard Area (% of total area)				
	Very High	High	Moderate	Less	Very Less
Assam	2.16	4.73	12.54	24.66	55.91
Bihar	3.39	5.01	11.01	21.36	59.23
Odisha	1.41	2.21	4.27	13.04	79.07
Uttar Pradesh	0.28	1.11	6.27	16.42	75.92

Similar flood hazard zonation in higher resolution is necessary for the entire country. It is also necessary to conduct comprehensive flood risk assessment in every large and medium city that has faced the hazards of floods in recent years. Unplanned developments in the flood plains and inadequate drainage systems have compounded the risks of flooding in many cities, and these include cities that are neither located on the coasts nor on river-sides. All the six mega cities of India—Mumbai, Delhi, Kolkata, Chennai, Bangalore and Hyderabad— with a population of more than five million have each faced major floods in recent years. And, 28 out of 46 metropolitan cities of India (with population of more than 1 million each) and as many as 84 large cities (with population of less than a million but more than 100,000) are located in flood prone areas. These make urban flooding a major recurring hazard of the country.



Source: UNDP

DROUGHT

The hazard of drought is three-dimensional. It starts as a meteorological phenomenon when rainfall is less than adequate; it turns into a hydrological issue when alternate sources of surface or sub-surface water is not adequate to bridge the deficit of rains to a reasonable degree; and eventually it may become agricultural drought when either sowing suffers (due to early monsoon deficit) or crops fail (mid-monsoon or late monsoon deficit).

Agricultural drought is what matters most as it impacts the livelihood and nutrition of millions of people who subsist on agriculture, but hydro-meteorological drought may have adverse impacts on sectors other than agriculture, such as forests, pastures, industry, power and drinking water. It may also impact on sectors related to agriculture, such as horticulture and animal husbandry.

An area is known to be drought prone when annual rainfall is less than 75 percent of the normal consistently over a long period of time. 23.5 per cent of the landmass of India, spread over 745914 sq. km in 193 districts of 16 States, have been classified as drought prone areas⁷⁹, but drought-like conditions may prevail in areas not so classified as is evident in declaration of drought in parts of States like Assam, Haryana, Kerala, Manipur, Nagaland and Punjab, that are not classified as drought prone.

India faced 42 major drought years since 1800, averaging one drought every five years, but there have been localized droughts at more frequent intervals. Climate change is likely to further increase the frequency and intensity of droughts in the country. Intensity of drought in specific years have been studied, but as yet, drought hazard zonation of the country has not been mapped. Based on the currently available datasets on moisture index, net cropped area, net area under irrigation, area declared as drought prone and number of drought years, a drought hazard index has been developed for all the 640 districts of the country. The same is shown in the table below.

⁷⁹ Report on Development of Drought Prone Areas, Planning Commission 1981

Table 14: Drought Hazard Index of States and Union Territories

No.	STATE/ UNION TERRITORY	Total Geographical Area (sq. km)	Drought Prone Area	Total Cropped Area	Gross Irrigated Area	Drought Years (2000-16)	Drought Hazard Index
	STATES						
1	Andhra Pradesh	160205	32617	7690	3886	13	6.80
2	Arunachal Pradesh	83743	0	299	56	0	1.82
3	Assam	78438	0	4083	374	2	3.03
4	Bihar	94163	9533	7673	5268	5	4.05
5	Chhattisgarh	135192	21801	5728	1787	4	4.56
6	Goa	3702	0	158	39	0	2.29
7	Gujarat	196244	43938	12773	6014	4	4.63
8	Haryana	44212	0	6536	5824	2	2.77
9	Himachal Pradesh	55673	3319	918	193	4	3.80
10	Jammu & Kashmir	101387	14705	1178	504	2	2.77
11	Jharkhand	79716	34843	1554	221	7	5.98
12	Karnataka	191791	84332	12247	4186	12	7.05
13	Kerala	38852	0	2625	470	5	3.96
14	Madhya Pradesh	308252	89101	23810	10301	7	5.30
15	Maharashtra	307713	194473	23474	4282	10	7.23
16	Manipur	22327	0	383	69	1	3.09
17	Meghalaya	22429	0	343	128	0	1.30
18	Mizoram	21081	0	145	21	0	2.49
19	Nagaland	16579	0	500	106	1	2.92
20	Odisha	155707	28178	5173	1485	5	4.34
21	Punjab	50362	0	7857	7757	1	1.95
22	Rajasthan	342239	31963	24235	10171	12	6.67
23	Sikkim	7096	0	136	12	0	1.88
24	Tamil Nadu	130060	29143	5995	3394	3	5.66
25	Telangana	114840	66601	5315	2529	7	5.85
26	Tripura	10486	0	483	116	0	3.16
27	Uttar Pradesh	240928	35698	26147	20965	6	3.83
28	Uttarakhand	53483	15796	1097	542	7	5.74
29	West Bengal	88752	115914	9690	5700	2	3.10
	UNION TERRITORIES						
1	Andaman& Nicobar Islands	8249	0	24	0	0	2.85
2	Chandigarh	114	0	2	0	0	1.52
3	Dadra & Nagar Haveli	491	0	23	8	0	2.71
4	Daman & Diu	111	0	3	0	0	4.35
5	Delhi	1483	0	35	29	0	1.60
6	Lakshadweep	30	0	3	0	0	2.86
7	Puducherry	490	0	27	22	0	2.35
	TOTAL	3166620	745914	198360	96457		

CYCLONE

Nine coastal States of India (Andhra Pradesh, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Odisha, Tamil Nadu and West Bengal) and five Union Territories (Andaman & Nicobar Islands, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep and Puducherry) are directly affected by the hazard of cyclones. A number of other non-coastal districts may also be affected indirectly by the strong cyclonic winds and rainfall, which may trigger landslides in some places. For example, cyclone Aila in West Bengal precipitated rainfall which caused several landslides in the Darjeeling hills. Such secondary consequences of cyclones in non-coastal districts in the shape of floods or landslides are included in the assessments of these hazards.

Vulnerability Atlas of India has clubbed the hazards of cyclones and winds together, showing a substantially large part of the country, located far away from the coasts, facing wind hazards.⁸⁰ High wind speed in some parts of the country, without accompanying hazards like heavy rain or storm surge, are regular phenomena and do not cause much damage. It would, therefore, not be proper to club these two hazards together in the same map.

Based on the five parameters of cyclonic hazards—number of cyclones, number of severe cyclones, height of storm surge, wind speed and level of precipitation⁸¹—cyclone hazard index has been worked out for 13 coastal States/UTs and the same is provided in Figure 5. This includes 73 coastal districts touching the sea and another 27 districts that do not touch the sea but are so affected by cyclones that they require evacuation of people to safer locations.⁸²

East coast States facing the Bay of Bengal score over west coast States facing the Arabian Sea in terms of number of cyclones, number of severe cyclones, maximum wind speed and maximum storm surge. However, west coasts have faced higher precipitation than east coasts, as shown in the table below.

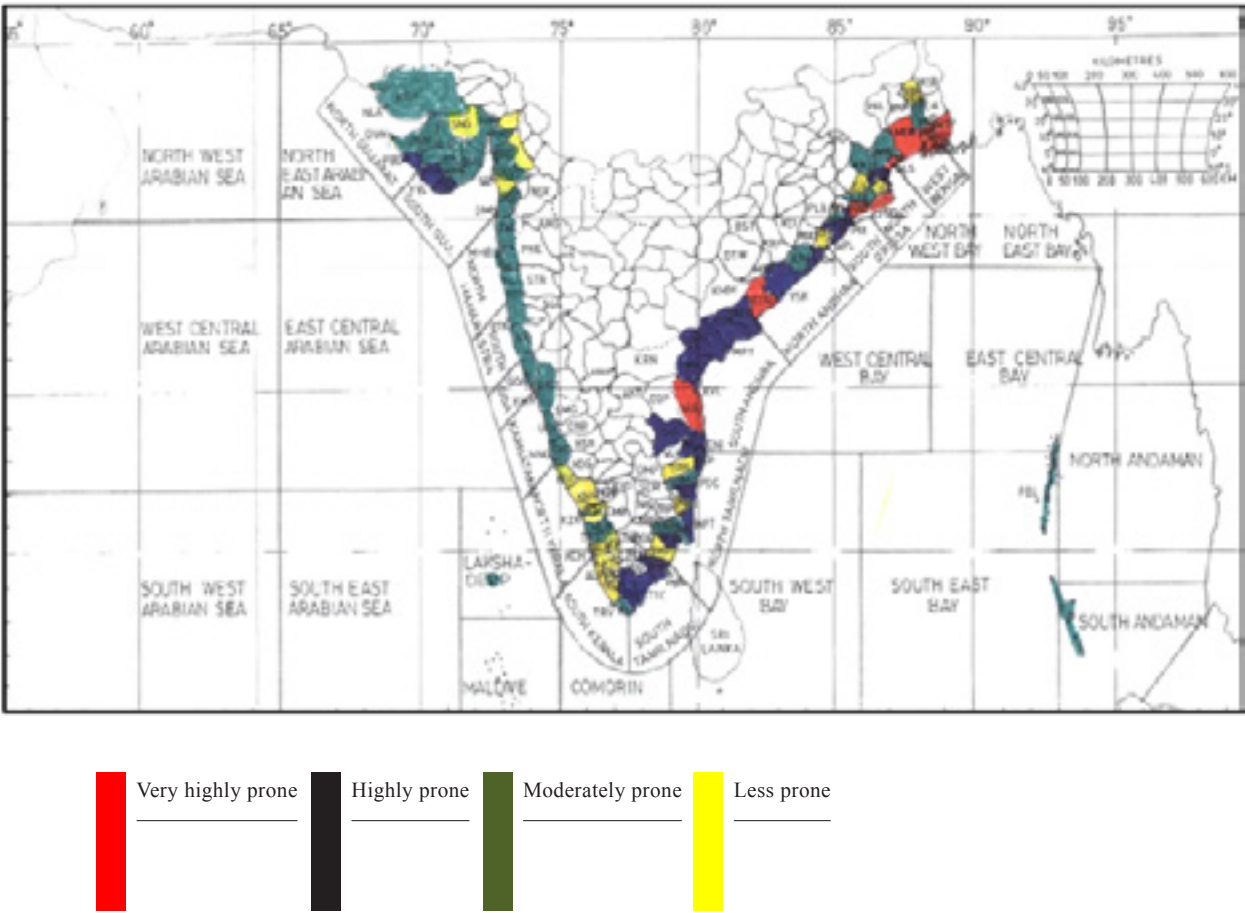
Table 15: Cyclone Hazard Index of States and Union Territories

	States/ UTs	No of Cyclones	No of Severe Cyclones	Maximum Storm Surge (meter)	Maximum Wind Speed (km/ph)	Maximum Precipitation (cm)	Cyclone Hazard Index
East Coast – Bay of Bengal							
1.	Andhra Pradesh	19	8	7.5	127	60	6.34
2.	Odisha	28	6	11	140	60	6.87
3.	Tamil Nadu	10	8	10	95	68	5.77
4.	West Bengal	29	16	13	115	56	8.88
5.	Andaman & Nicobar	8	1	4.25	90	58	3.06
6.	Puducherry	17	4	4.5	125	68	4.08
West Coast – Arabian Sea							
1.	Goa	0	0	4.5	55	64	2.37
2.	Gujarat	9	4	4.5	90	104	4.90
3.	Karnataka	0	0	4.5	45	92	2.72
4.	Kerala ⁸³	3	2	4.5	55	60	2.54
5.	Maharashtra	2	2	5	55	95	3.22
6.	Daman & Diu	9	4	5	90	80	3.45
7.	Lakshadweep	9	5	4.25	90	22.03	2.36

80 Vulnerability Atlas of India, BMTPC, 2016.
81 Report of the Expert Committee on Cyclone Hazard Prone Districts of India, NDMA, 2008.
82 Based on the recommendations of the Expert Committee of the NDMA, all the hundred districts in 14 States/ UTs have been included in the cyclone hazard index.
83 Accidental Death Statistics database of NCRB.

A number of cyclones originating from Bay of Bengal have affected States on the west coast, particularly Kerala. Historically, such cyclones have dissipated once these crossed over the States on the west coast. Considering the history of such cyclones, the Expert Committee of the NDMA classified these as cyclones of the Bay of Bengal. However, there are notable exceptions, the most important being the cyclone Ockhi that originated in the Gulf of Thailand, developed into a deep depression over Bay of Bengal, and passed over the southern coasts of Tamil Nadu, Sri Lanka and Lakshadweep, causing widespread damage before hitting the coasts of Kerala, Maharashtra and Gujarat.

Figure 5: Cyclone Hazard Zonation Map of India



Source: Report of Expert Committee on Cyclone Hazard of Districts, NDMA, 2008

TSUNAMI

A tsunami is triggered by earthquakes, mainly in the sea bed, which causes oceanic waves to surge and hit coastal areas far away from the epicenter of the quake. Unlike cyclones, a tsunami is not caused by any meteorological phenomenon and therefore it has no impact on weather, precipitation or winds. Tsunami is an under-sea geological phenomenon which causes huge turbulence in the ocean, with damaging impacts on the coasts. Therefore, a tsunami is typically confined to coastal districts touching the sea and that too for a small stretch of half a kilometer from the coastline or even less, depending on the epicenter, magnitude and intensity of the earthquake triggering the tsunami. Two potential seismic faultlines that can cause tsunamis in India are

the pacific ring of fire off the coast of Sumatra in Indian Ocean and the Makran subduction zone off the coasts of Iran and Pakistan in Arabian Sea. The former caused the Indian Ocean Tsunami in 2004 and the later triggered the Arabian Sea Tsunami in 1945, both causing considerable damages to lives and property on Indian coasts.

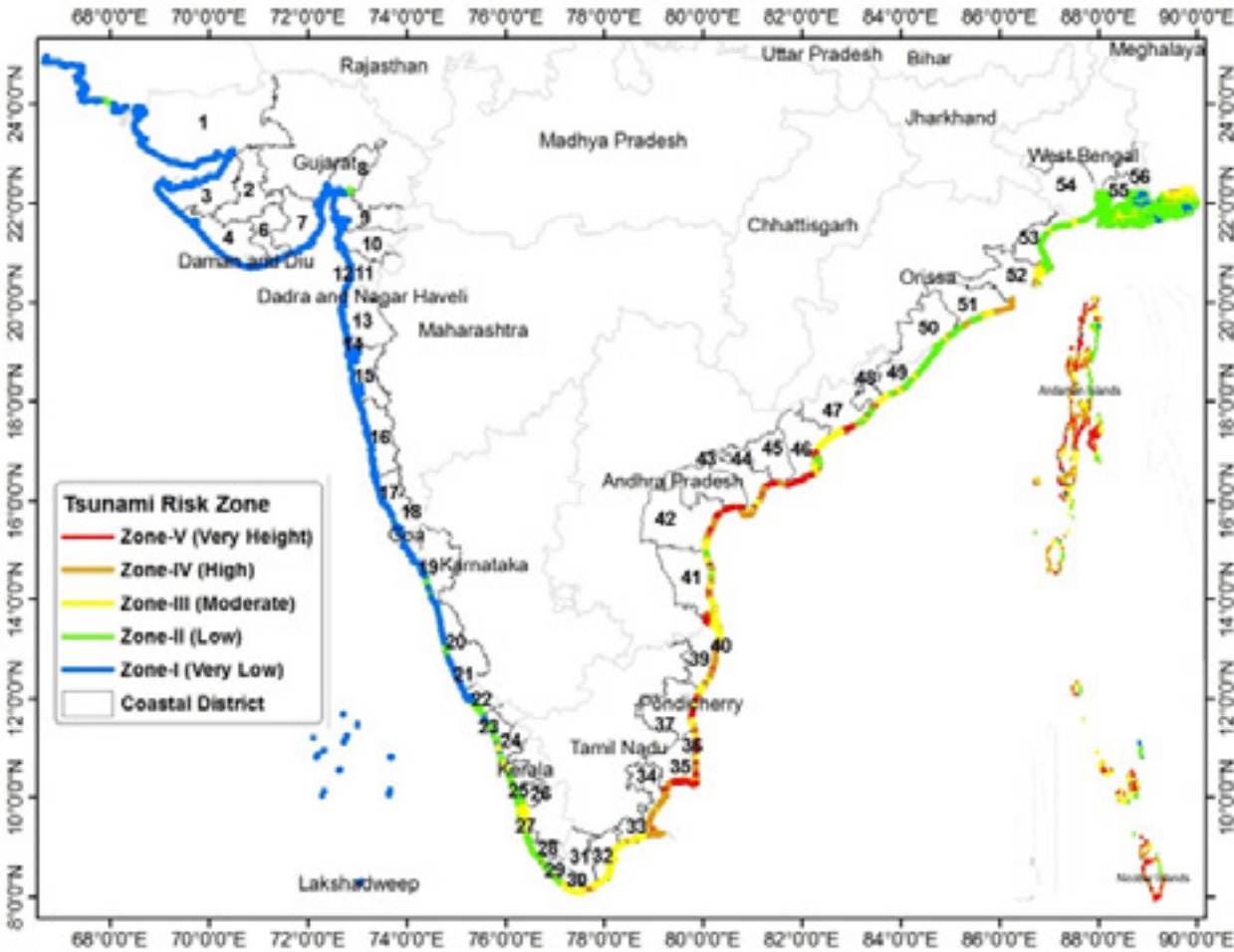
Taking the damaging potentials of tsunamis on the east and west coasts of India into consideration, based on three parameters—length of coastline, human settlements within half kilometers from the coasts and average height of tsunami waves—Tsunami Hazard Index of States and UTs have been worked out and the same is shown in the table below.

Table 16: Tsunami Hazard Index of States and Union Territories

	States/ UTs	No. of coastal districts	Total length of coastline (Km)	Population living within ½ km of Shoreline	Average height of tsunami wave (M)	Tsunami Hazard Index
	East Coast – Bay of Bengal					
1.	Andhra Pradesh	9	971.27	189874	3.57	5.29
2.	Odisha	6	435.57	119856	2.56	3.49
3.	Tamil Nadu	13	786.91	451271	3.12	5.45
4.	West Bengal	3	282.20	161628	1.14	1.98
5.	Andaman & Nicobar	3	2499.65	53520	4.78	7.67
6.	Puducherry	4	62.81	79600	3.52	3.99
	West Coast – Arabian Sea					
1.	Goa	2	155.39	30342	0.88	1.18
2.	Gujarat	12	1482.13	226522	0.56	2.78
3.	Karnataka	3	298.08	36401	1.24	1.71
4.	Kerala	9	585.77	325667	1.81	3.49
5.	Maharashtra	6	742.29	8082.30	0.63	3.90
6.	Daman & Diu	2	55.5	59822	0.70	0.98
7.	Lakshadweep	1	136.28	146433	0.73	1.35

As in the case of cyclones, east coast districts in general have higher levels of tsunami hazard than west coast districts. Within the States, there are significant variations.

Figure 6: Tsunami Hazard Zonation Map of India



HEAT WAVE

A heat wave is a period of abnormally high temperatures, occurring during the summer, typically between March to June, and in some rare cases even in July. Although they chiefly persist in northern parts of India, mainly over Rajasthan, Punjab, Haryana, Delhi, Uttar Pradesh, Madhya Pradesh, Gujarat, Bihar and West Bengal, heat waves also prevail in parts of peninsular India, in States like Vidarbha, Telangana, Andhra Pradesh and Karnataka, coastal States like Gujarat and Odisha and parts of Maharashtra and Rajasthan. Heat waves adversely affect human and animal lives, leading to physiological stress, sometimes even deaths, besides causing major disruption in community infrastructure such as power, public transport and other essential services.

During 2005-2017, as many as 15,839 people are known to have died due to heat wave⁸³. Heat wave deaths peaked in 2016, with 2442 deaths⁸⁴. However, this figure declined sharply in 2017, with only 162 deaths, which is largely attributed to improved warning systems and proactive implementation of a heat wave action plan in many States.⁸⁵

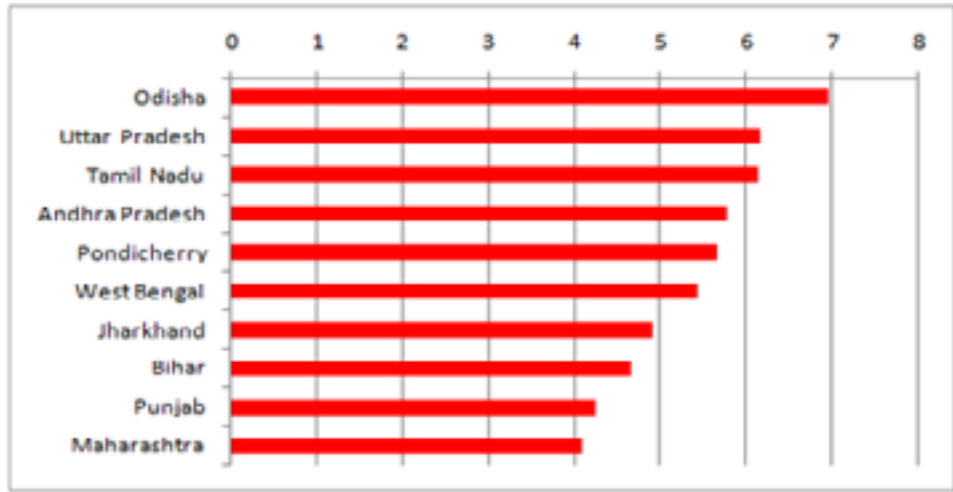
84 National Disaster Management Authority, Guidelines for Preparation of Action Plan _ Prevention and Management of Heat Wave, 2016, page-3. <https://ndma.gov.in/images/guidelines/heatwaveguidelines2017.pdf>

85 Statement of India Meteorological Department on the occasion of 143 Foundation Day of IMD <http://www.uniindia.com/fall-in-heat-wave-deaths-in-2017-compared-to-2016-imd/india/news/1107110.html>

A number of scientific studies have been carried out on the prevalence of heat waves in India,⁸⁶ but heat wave hazard zonation has not been worked out for the country. According to India Meteorological Department (IMD), heat wave conditions are created when actual maximum temperature is $\geq 45^{\circ}\text{C}$ for three consecutive days, recording a departure of 4.5°C to 6.4°C from normal temperature⁸⁷. This also partially fulfills the criteria adopted by IMD for defining heat wave as mentioned in annexure II. National Disaster Management Authority has endorsed the NOAA methodology of heat index worked out on the basis of two factors: relative humidity and extreme temperature.⁸⁸ Applying this methodology and based on the maximum temperature and humidity recorded in IMD stations all over the country during the past 20 years, a heat index has been developed for the districts and States and this has been coupled with number of heat waves as per IMD methodology to work out the composite heat wave index. Presently, however, IMD issues heat wave warnings based on temperatures only, not off the heat index. Work on this index is in progress in the heat wave prone states identified by NDMA.

States with a composite heat wave above 4.0 in scale of 10 are shown in the figure below:

Figure 7: States with Composite Heat Wave Index above 4.0



A number of States with a lower composite Heat Wave Index have districts that rate high on this index. For example, Gujarat with an average index of a moderate 3.07, has four districts with a high heat wave index. Similarly, Haryana, Karnataka, Madhya Pradesh and Rajasthan have several districts that have a high heat wave index.

⁸⁶ A K Jaswal, P C S Rao and Virendra Singh, 'Climatology and trends of summer high temperature days in India during 1969–2013', Journal of Earth Sciences, Volume 124, Issue 1, February 2015; D S Pai, Smitha Anil Nair and A N Ramanathan, 'Long term climatology and trends of heat waves over India during the recent 50 years (1961-2010)', Mausam, No. 64, Issue 4, October 2013.

⁸⁷ India Meteorological Department, Forecasting Circular No. 5/2015 (3.7).

⁸⁸ <https://www.weather.gov/safety/heat-index>

COLD WAVE

A Cold Wave has been defined as a sudden drop of temperature below the normal minimum level and the continuance of the phenomenon for a few days. According to the IMD, cold wave conditions are created when actual minimum temperature falls below 4°C in plain areas and -4°C in hilly areas.⁸⁹ This partially fulfills the criteria adopted by IMD for defining Cold Wave, as given in Annexure II. Applying this methodology and based on the minimum temperature recorded in IMD stations all over the country during the past 20 years, a cold wave index has been developed for the States and Union Territories, as detailed in Table-H.10 of the Statistical Appendices.

As per EM-DAT, the global database on disasters, 5768 people lost their lives due to a cold wave in India during 1960-2017, registering an annual average mortality of 101. Most cold wave mortalities are reported from the north Indian plains of Uttar Pradesh, Bihar, Delhi and Madhya Pradesh, not so much due to the severity of cold wave as to the exposure of homeless people to harsh wintry conditions.

AVALANCHE

An avalanche is a rapid, downward movement of large masses of snow, ice or associated debris such as rocks and vegetation, on a slope. Avalanches are caused mostly by blizzards and heavy loads of snow that hilly slopes cannot hold. Avalanches can also be triggered by ruptures in snow blocks due to a rise in temperature or an earthquake, or rock falls; even by blasts of sounds or explosives.

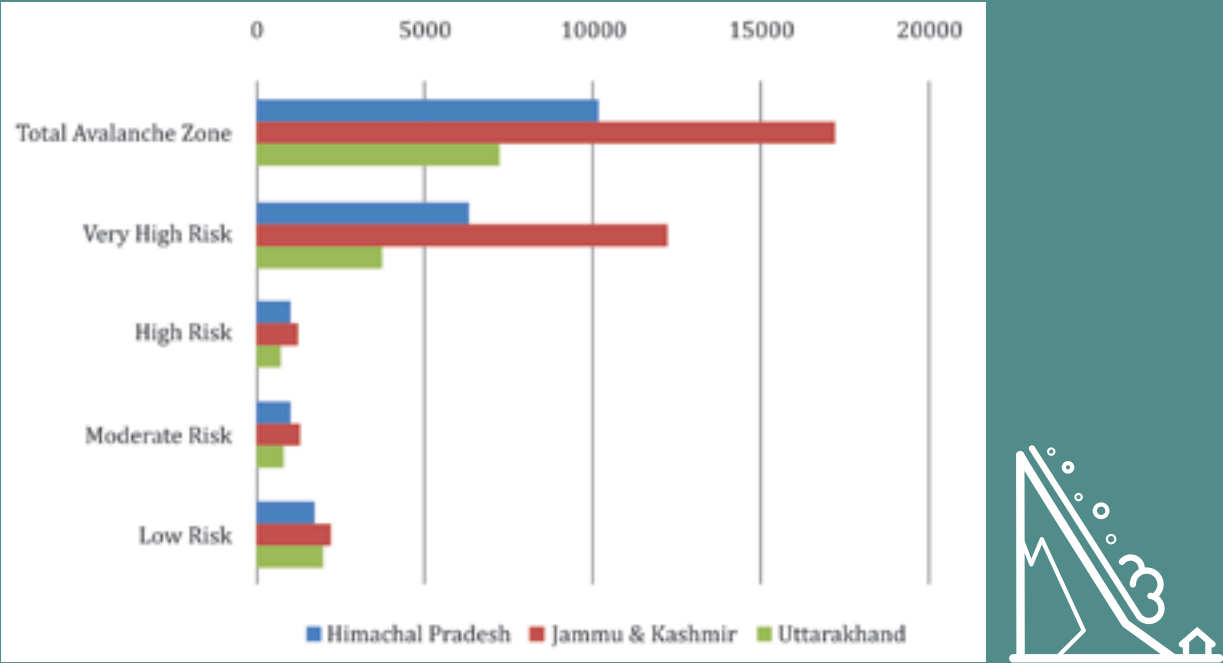
Avalanches are common throughout the snow-covered mountain ranges of the Himalayas, from Jammu & Kashmir in the north west to Arunachal Pradesh in the north east, but this hazard has been studied systematically only in three Himalayan States—Jammu & Kashmir, Himachal Pradesh and Uttarakhand—due to the higher incidence of the hazard as well as the major damaging impacts of the hazard on the life and critical infrastructure in these States.

Twenty out of 24 districts of Jammu & Kashmir face the hazard of avalanche, but it is two trans-Himalayan districts of Kargil and Leh and two adjoining districts of Ganderbal and Kishtwar that together face almost 73 per cent of the hazard. In Himachal Pradesh, 88.4 per cent of avalanche hazard zones are located in the four districts of Chamba, Kinnaur, Kullu and Lahaul & Spiti, while in Uttarakhand more than 80 percent of the avalanche hazard zone lies in the three districts of Chamoli, Pithorgarh and Uttarkashi.

The total avalanche hazard zone of the three northwestern States is 34306 sq. km. Snow and Avalanche Study Establishment (SASE) has classified this area into three avalanche hazard zones: very high risk, high risk, moderate risk and low risk. The extent of area in these risk zones in three States is shown in the figure below:

⁸⁹ India Meteorological Department, Forecasting Circular No. 5/2015 (3.7).

Figure 8: Avalanche Hazard Zone of North West Himalayan States (Area in Sq Km)



COASTAL EROSION

India has a coastline of 8493.85 km, touching four States and one UT on the east coast (West Bengal, Odisha, Andhra Pradesh, Tamil Nadu and Puducherry) and five States and one UT on the west coast (Gujarat, Maharashtra, Goa, Karnataka, Kerala and Daman & Diu), besides two island UTs of Andaman & Nicobar Islands and Lakshadweep in the Bay of Bengal and Arabian Sea respectively. Together, these States and UTs account for nearly half of the population (604 out of 1280 million) and % of the GDP of the country. The long coastline presents a mix of sandy beach (43%), muddy flats (36%), rocky surface (11%) and marshy lands (10%).⁹⁰

Large parts of the coastline are facing erosion due to a variety of factors, both natural (ingress of sea waves, effect of high speed wind energy, impact of cyclone and tsunami) and anthropogenic (reduced flow of sediment from river estuaries, pressure of human settlement, denudation of mangroves, sea level rise etc.). A study conducted by a team of scientists from Space Application Centre Ahmedabad and Central Water Commission has established that more than 45% of the coastline is facing erosion, leading to total loss of 250.45 sq. km of coastal areas, mostly in the island of Andaman & Nicobar Islands and the States of Andhra Pradesh in east coast and Gujarat and Maharashtra in west coast.⁹¹ Although accretion of both coastline and coastal areas has taken place as a natural process, the extent of such accretion has been much less. Further, erosion takes away established areas of coastal eco-system, while it takes years for such systems to be generated in newly accreted areas.⁹²

⁹⁰ Nation Coastal Issues and Concerns, Centre for Sustainable Coastal Management, Anna University, Chennai, 2010.

⁹¹ Space Application Centre, Ahmedabad (ISRO) and Coastal Erosion Directorate (CWC), Shoreline Change Atlas of the Indian Coast, Volume-I (Gujarat, Daman and Diu), Volume-II (Maharashtra and Goa), Volume-III (Karnataka and Kerala), Volume-IV (Andhra Pradesh, Tamil Nadu and Puducherry), Volume-V (West Bengal and Odisha) and Volume-VI (Andaman & Nicobar Islands and Lakshadweep), 2013.

⁹² A S Rajawat, H B Chauhan and others, Assessment of coastal erosion along the Indian coast on 1 : 25,000 scale using satellite data of 1989–1991 and 2004–2006 time frames, Current Science, Vol. 109, No. 2, 25 July 2015

Table 17: Coastal Erosion in States and Union Territories

No	States/ UTs	Coastline (km)	Coastline Changes (km)			Coastal Area Changes (sq. km)			Coastal Erosion Index
			Erosion	Accretion	Net gain/Loss	Erosion	Accretion	Net gain/Loss	
1.	Andhra Pradesh	971.27	443.88	186.94	-256.94	46.89	25.14	-21.75	3.68
2.	Goa	155.39	27.03	46.98	19.95	0.771	1.53	0.759	0.29
3.	Gujarat	1482.13	486.43	297.99	-188.44	27.3	43.46	16.16	3.88
4.	Karnataka	298.08	106.12	118.65	12.53	5.16	6.26	1.1	0.79
5.	Kerala	585.77	218.04	294.13	76.09	5.31	9.54	4.23	1.43
6.	Maharashtra	742.29	449.55	244.42	-205.13	7.83	5.08	-2.75	2.25
7.	Odisha	435.57	198.79	204.61	5.82	13.79	13.34	-0.45	1.44
8.	Tamil Nadu	786.91	267.86	490.32	222.46	16.06	41.53	25.47	2.13
9.	West Bengal	282.2	115.07	19.46	-95.61	11.64	1.53	-10.11	0.98
10.	Andaman & Nicobar	2499.65	1430.43	1013.17	-417.26	112.64	27.83	-84.81	9.91
11.	Daman & Diu	55.5	6.41	7.9	1.49	0.12	0.11	-0.01	0.09
12.	Lakshadweep	136.28	72.03	63.24	-8.79	1.7	0.83	-0.87	0.40
13.	Puducherry	62.81	16.5	26.3	9.8	1.24	1.21	-0.03	0.16
	Total	8493.85	3838.14	3014.11	-824.03	250.451	177.39	-73.061	

Andaman & Nicobar Islands have been facing the maximum impact of coastal erosion, with 417.26 kms of its coastline and 84.81 sq. km of coastal area under erosion, followed by Gujarat (188.44 km of coastline and 16.16 sq. km of coastal area), Andhra Pradesh (256.94 of coastline and 21.75 sq. km of coastal area) and Maharashtra (205.13 of coastline and 2.75 sq. km of coastal area).

FOREST FIRE

India's total forest cover is 708273 square kilometres, which accounts for 21.54% of the total geographical area of the country. Out of this, 12.24 percent is dense forest, and the remainder is equally shared by moderately dense and open forests. Madhya Pradesh has the largest forest cover, at 77,414 square kilometres, followed by Arunachal Pradesh with 66,964 sq. km and Chhattisgarh (55,547 sq. km). In terms of percentage of forest cover, with respect to the total geographical area, Lakshadweep (90.33%) has the highest forest cover, followed by Mizoram (86.27%) and Andaman & Nicobar Island (81.73%).

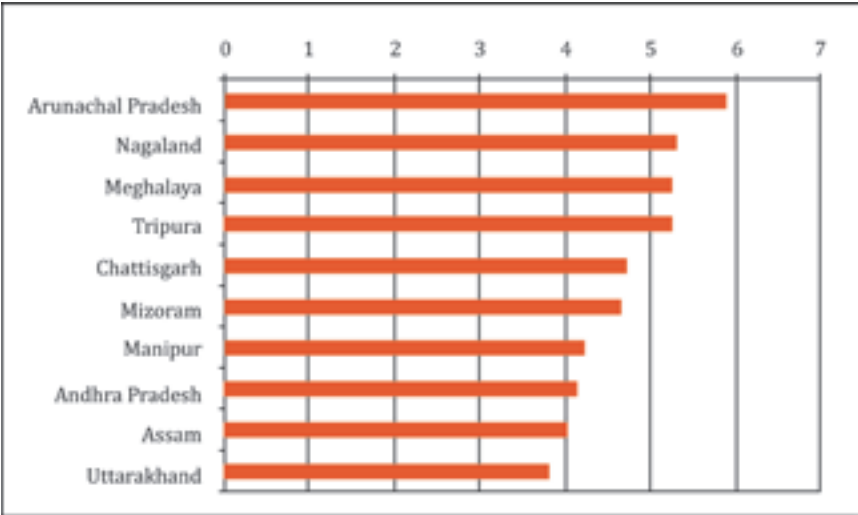
Every type of forest in almost every State and Union Territory has been exposed to forest fires. However, the maximum incidences of forest fires have been reported in tropical dry deciduous forests, followed by tropical moist deciduous forests and tropical semi-evergreen forests. Forest fires have been caused due to multiple reasons, which include both natural (high temperature, dry spell, and scanty rainfall, etc.) and human induced factors (shifting cultivation, dependence on forests for livelihood, poverty, illiteracy etc.).

According to Forest Survey of India (FSI), a total number of 134,225 incidences of forest fires were reported during 2004-2005 to 2010-2011, which works out to an average of 22,370 incidences every year.⁹³ Fifteen percent of total forest areas spread over 348 districts of the country are vulnerable to forest fire, of which 168 districts are highly vulnerable, 69 are moderately vulnerable and 111 districts are less vulnerable.

⁹³ Vulnerability of India's Forests to Fire, Forest Survey of India, 2012

Based on the FSI classification of districts that are highly vulnerable, moderately vulnerable, less vulnerable of forest fires and the areas of dense, moderately dense and open forests in these districts, Forest Fire Hazard Index has been developed in a scale of 10. The top ten States in this index are shown in the Figure below.

Figure 9 : Top 10 States in Forest Fire Hazard Index



The seven sister States of the North East figure prominently on this list, as these States have a larger share of forest cover than many states.

LIGHTNING

Lightning is a sudden discharge of electricity, typically generated during a thunderstorm, when ‘cells’ of storm clouds get charged and the electricity is transmitted to the earth with loud sounds through a conductive path which may hit any animate (human beings or animals) or inanimate objects (buildings or other structures), causing deaths, injuries, fire or explosions.⁹⁴ Based on the average number of thunderstorm days in different locations in the country the Bureau of Indian Standards had developed average lightning flash density for designing lightning protection systems of buildings and other structures.⁹⁵ Based on the data on number thunderstorm days, as mentioned in this standard, Dr C Laxmi Narasimhan and Dr DVS Bhagavanulu have developed a thunderstorm map of India.⁹⁶ The map is not based on time series data on number of thunderstorms in the States and districts, nor does it provide any information on the frequency, intensity or speed of lightning generated by the thunderstorms in different parts of the country.

India Meteorological Department is yet to develop a lightning detection and prediction system for the country.

94 <http://www.lightningsafety.com/>
95 Bureau of Indian Standards, IS 2309: 1989 Protection of Buildings and Allied Structures Against Lightning- Code of Practice, Second Revision, 2006.
96 Dr. C Laxmi Narasimhan and Dr. DVS Bhagavanulu, Culture of Safety Against Lightning – An Indian Perspective, Centre for Disaster Mitigation and Management, Vellore Institute of Technology, 2007.



Figure 10 : Lightning Hazard Map of India



In the absence of any credible database on various parameters of the hazard of lightning, lightning mortality data maintained by the National Crime Record Bureau for the years 2001-2015 has been used. This shows that, on an average, 2261 people have lost their lives every year due to lightning, which is the highest rate in the world.

Based on this database, Lightning Hazard Index has been developed for the States and districts. The top 10 States in this index are shown in the table below.

Table 18: Top 10 States in Lightning Hazard Index

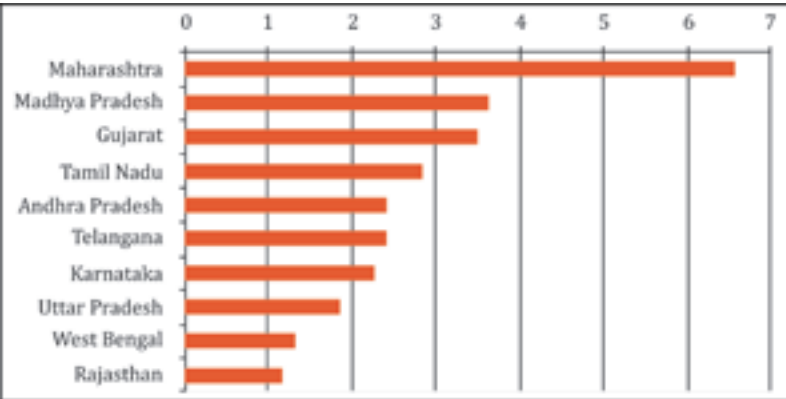
	States	Lightning Mortalities 2001-2015	Lightning Hazard Index
1.	Odisha	4211	7.92
2.	Madhya Pradesh	5268	6.90
3.	Maharashtra	4546	5.55
4.	Chhattisgarh	3250	6.11
5.	Uttar Pradesh	2934	5.52
6.	West Bengal	2135	4.01
7.	Jharkhand	1773	3.33
8.	Karnataka	1677	3.15
9.	Bihar	1642	3.09
10.	Andhra Pradesh	1573	2.96

FIRE

Fire in rural and urban areas is one of the most important manmade hazards of India. As per the database on unnatural deaths in India, maintained by the National Crime Record Bureau, more than three lakh accidents due to fire were registered in the country during 2001-2015, leaving 317,646 persons dead and 35,792 injured. Although rural-urban breakup of the data is not available at the national level, most of these incidents are known to take place in urban areas due to a variety of reasons, ranging from electrical short circuits, leakages of oil, gas or other inflammable materials, bursting of crackers, storms, and negligence in compliance of fire safety measures etc. Most of these accidents are small scale fires in residential houses, while incidents of large scale fire in commercial, institutional and industrial establishments are rising.

Directorate General of Fire Services in the Ministry of Home Affairs had commissioned a study in 2012 on Fire Hazard and Risk Analysis, towards revamping the fire services in the country. Based on the population, built-up residential and industrial areas, the study report classified the districts of the country into four main categories of very high, high, medium and low fire risks.⁹⁷ Fire Hazard Index of States and Union Territories is presented in Table H.13 of Statistical Appendices. Top 10 States in this index is shown in the figure below.

Figure 11: Top 10 States in Fire Hazard Index



⁹⁷ Directorate General of Fire Services, Fire Hazard and Risk Analysis in the Country for Revamping the Fire Services in the Country, study conducted by RMSI India, 2012.

Maharashtra has the highest fire index, twice more than the second highest, as is clearly established in the number of accidents of fire, injuries and deaths due to fire in the State during 2001-2015.

INDUSTRIAL HAZARDS

In the absence of any scientific study of industrial hazard zonation of the States and districts in India, the available database on number of Maximum Accident Hazard (MAH) industries, Heavily Polluting Industries (HPI) and Comprehensive Environmental Pollution Index (CEPI) of selected major industrial clusters have been used to develop a composite Industrial Hazard Index. As per the database maintained by the Ministry of Environment, Forests & Climate Change, there are a total of 1853 MAH industries in the country as defined under the provisions of the Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 notified under the Environment (Protection) Act, 1986. Central Pollution Control Board has compiled a database of 3109 maximum polluting industries in seventeen categories which include pharmaceuticals, cement, caustic (chemical), copper, distillery, dye & dye intermediates, fertilizer, iron and steel, refinery, pesticide, petrochemicals, pulp and paper, sugar, power plants, aluminium, zinc and tanneries.

No nation-wide data on the level of potential and actual hazards of these industries is available. However, CPCB conducted a study to develop Comprehensive Environmental Pollution Index (CEPI) for 88 selected industrial clusters in the country. CEPI measures the level of air, water and soil pollution in and around the clusters. Although pollution does not directly lead to disasters, it definitely contributes to the process of creation of hazards that may eventually lead to disasters.

In the absence of any other database, MHI, MPI and CEPI have been factored in the ratio of 50:25:25 for the calculation of industrial hazard index of States. Complete details are provided in Table-H.14 of Statistical Appendices, while the table below shows the top 10 States in industrial hazard index.

Table 19-Top 10 States in Industrial Hazard Index

	States	Number of MAH industries	Number of MPI industries	Average CEPI of industrial clusters	Industrial Hazard Index
1.	Maharashtra	363	495	74.51	6.97
2.	Gujarat	372	270	83.95	6.86
3.	Uttar Pradesh	106	389	68.37	4.89
4.	Telangana	69	317	70.07	4.53
5.	Tamil Nadu	126	161	73.88	4.51
6.	West Bengal	102	119	73.49	3.97
7.	Rajasthan	92	99	74.66	3.74
8.	Karnataka	71	228	69.36	3.61
9.	Haryana	58	116	74.49	3.37
10.	Andhra Pradesh	79	148	65.695	3.31

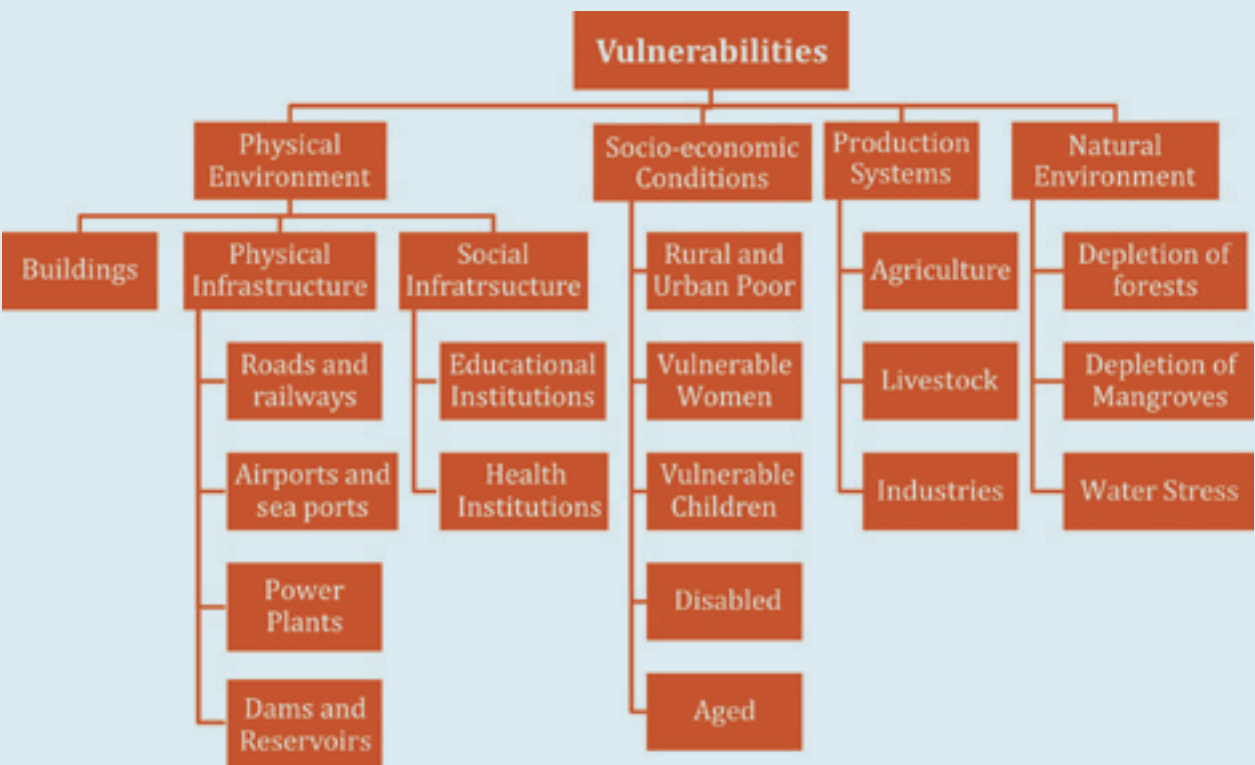
VULNERABILITES

Hazards do not cause disasters suo moto. Hazards become disastrous when these are exposed to vulnerable conditions in society, economy and the environment that are not able to absorb shocks and cope with their impacts, leading to loss of lives, livelihoods, assets and infrastructures. UNISDR has defined vulnerabilities as ‘the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards’.⁹⁸

The greater the vulnerability, the more intense the impact of hazards. An earthquake of magnitude 7.7 on the remote island of Andaman & Nicobar on 10 August 2009 killed only 26 people, as the island was sparsely populated, and built-up assets were minimal; damage was accordingly low. In contrast, a much less severe quake of 6.3 on 30 September 1993 in Latur district of Maharashtra killed nearly 10,000 people; their dwellings and buildings in the area were constructed with stones which did not provide ductility to withstand the shock of ground motion. More women and children died in this instance, due to the collapse of buildings; they were mostly indoors and did not have any knowledge or awareness about do’s and don’ts for survival in earthquakes.

Vulnerabilities are embedded in multiple layers, related to physical environment, socio-economic conditions, production systems, and natural environment. They are complex and not always easy to measure. Considering the scarce datasets on vulnerabilities in a uniform format throughout the country, the following layers have been selected for this study.

Figure 12: Layers of vulnerabilities for measuring risks of disasters



98 UNISDR Terminology on Disaster Risk Reduction, 2017. <https://www.unisdr.org/we/inform/terminology>

VULNERABLE PHYSICAL ENVIRONMENT

The physical environment comprises of what has been built up: the buildings (residential, commercial, institutional, religious etc), physical infrastructure (roadways, railways, bridges, airports and seaports, power plants, dams and reservoirs etc.) and social infrastructure (health and educational institutions etc.). These built-up environments are results of human endeavor over years, decades and centuries for better conditions of living that have contributed immensely to social and economic development of countries, communities and people. At the same time, vulnerable houses and infrastructure have suffered extensive damage and losses during disasters. While many existing infrastructures have aged over the years and need a complete overhaul, many others have not been built as per hazard resistant standards and specifications, requiring retrofitting. New vulnerable stocks of houses and infrastructure are being added to the existing stocks, particularly in developing countries, compounding the vulnerabilities of physical environment.

Data on physical environment is not difficult to collect throughout the country on a uniform format, but there are hardly any datasets on the vulnerability of these built-up structures, except partially for buildings.

o) Buildings

The collapse and damage of buildings of various types—residential, commercial, institutional and community—account for a major share of disaster damage and losses, particularly for disasters like earthquake, landslides, flood and cyclones.⁹⁹ Not every building will collapse in such disasters; it is the unsafe building stocks that are particularly vulnerable. The vulnerability of buildings would depend on a variety of factors, ranging from type of building materials used for construction to design and technology for construction, standard of maintenance, age of buildings etc. Unfortunately, country-wide data on all these parameters are not available. Various empirical studies have indicated that most of the buildings in rural area are non-engineered constructions by owners or local masons, and these do not follow any prescribed standards and specifications.¹⁰⁰ Building activities in urban areas are regulated by municipal authorities who are guided by the standards prescribed by National Building Codes¹⁰¹ and Bureau of Indian Standards.¹⁰² Enforcement of these standards are very poor in most cities, resulting in constructions of large number of buildings that are raised without approved building plans or constructed in violation of these plans. It is estimated that such ‘illegal’ constructions would account for a majority of buildings in urban India

In the absence of any national database on the vulnerability of buildings, census data on prominent building materials used for construction of roofs and walls have been used for the study, following the methodology adopted by the Building Materials and Technology Promotion Council for their decennial publication, Vulnerability Atlas of India.¹⁰³ A Committee of Experts constituted by BMTPC worked out vulnerability of buildings based on prominent materials used for construction of walls and roofs. This is summarized in the table below.

99 A survey of memorandums of State Governments for central assistance for post-disaster response and recovery during 2010-2015 shows that nearly 25 percent of disaster losses are due to the collapse of buildings.

100 A S Arya, ‘Non-engineered Constructions in Developing Countries: An Approach Towards Earthquake Risk Reduction’, 2000

101 National Building Code of India, 2016.

102 Bureau of Indian Standards on hazard resistant constructions, www.standardsbis.in

103 BMTPC, Vulnerability Atlas of India, 2006.

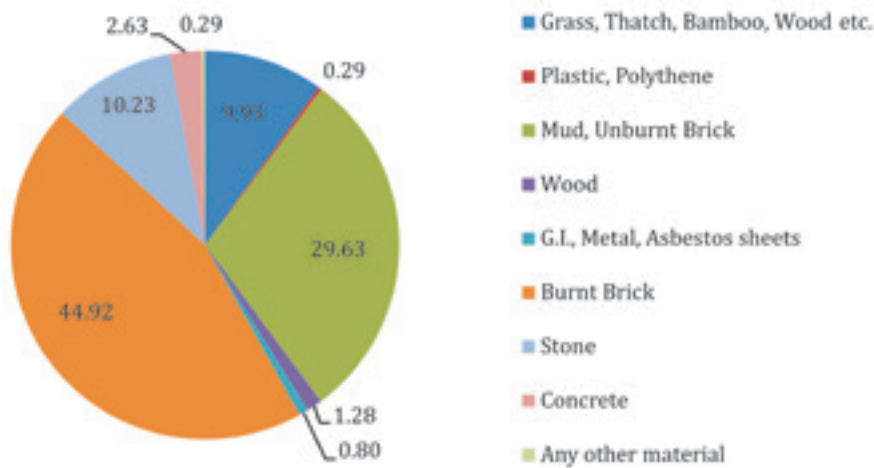
Table 20 : Vulnerability of buildings based on prominent materials used for construction of walls and roofs

		Earthquake Zone				Landslide Zone				Cyclone Zone				Flood Zone			
		V	IV	III	II	V	IV	III	II	V	IV	III	II	V	IV	III	II
WALL																	
1.	Grass/Thatch/Bamboo	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
2.	Plastic Polythene	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
3.	Mud And Un-Burnt Bricks	VH	H	M	L	H	M	L	VH	VH	H	M	L	VH	VH	M	M
4.	Wood	M	L	VL	VL	M	L	VL	VL	VH	H	M	L	H	M	L	VL
5.	Stone Packed with Mortar	H	M	L	VL	H	M	L	VL	H	M	L	VL	M	L	VL	VL
6.	Stone not Packed with Mortar	VH	H	M	L	VH	H	M	L	H	M	L	VL	H	M	L	VL
7.	GI/Metal/Asbestos	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
8.	Burnt Brick	H	M	L	VL	H	M	L	VL	H	M	L	VL	M	L	VL	VL
9.	Concrete	M	L	VL	VL	M	L	VL	VL	L	VL	VL	VL	L	VL	VL	VL
10.	Any Other Materials	M	VL	VL	VL	M	VL	VL	VL	VH	H	M	L	VH	VH	M	M
ROOF																	
1.	Grass/Thatch/Bamboo/Wood/Mud etc.	M	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M
2.	Plastic Polythene	M	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M
3.	Handmade Tiles	H	M	L	VL	H	M	L	VL	H	M	L	VL	H	M	L	VL
4.	Machine Made Tiles	H	M	L	VL	H	M	L	VL	H	M	L	VL	H	M	L	VL
5.	Burnt Brick	H	M	L	VL	H	M	L	VL	L	VL	VL	VL	H	M	L	VL
6.	Stone Slate	H	M	L	VL	H	M	L	VL	H	M	L	VL	H	M	L	VL
7.	G.I./Metal/Asbestos Sheets	H	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M
8.	Concrete	M	L	VL	VL	M	L	VL	VL	L	VL	VL	VL	L	VL	VL	VL
9.	Any Other Materials	M	M	L	VL	M	M	L	VL	VH	VH	H	M	VH	VH	M	M

Source: Vulnerability Atlas of India, BMTPC, 2006
Legends: Zone V: Very High Damage Risk Zone; Zone IV: High Damage Risk Zone; Zone III: Moderate Damage Risk Zone; Zone II: Low Damage Risk Zone; Zone I: No Risk Zone; VH: Very High (damage potential 100%); H: High (50%); M: Medium (25%); L: Low (10%); VL: Very Low (5%)

Census of India 2011 had enumerated a total number of 249, 095, 869 buildings in India, Prominent building materials used for construction of walls and roofs of these buildings are shown in the following two diagrams:

Figure 13: Percentage of buildings as per prominent materials used for walls



There are significant rural-urban as well as inter-state differences in the use of materials for construction of building. Burnt brick is the predominant material for construction of walls in urban India (68.72%), whereas it makes up a modest 35.33% in rural India. Mud has been used for construction of 37.07% of building walls in rural India and 11.17% in urban India, and, surprisingly, the share of mud walls has gone up over the previous decade.¹⁰⁴ A significant number, 12.48% of houses in rural India, have walls made of grass, thatch, bamboo, wood etc and another 11.48% have stone walls. The corresponding numbers in urban India are 3.60 and 7.17 percent respectively.

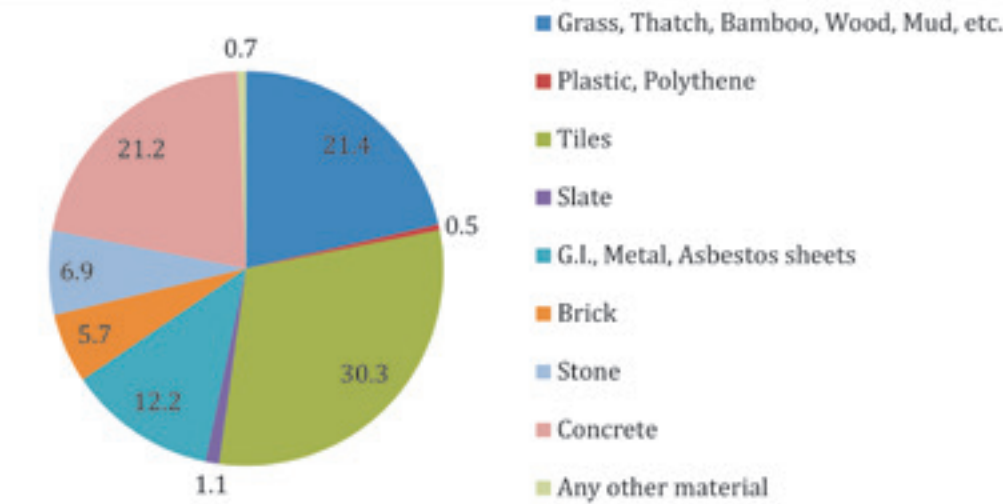
Table 21 - Rural-Urban difference in use of materials for walls (%)

Predominant Material Used	All India		
	Total	Rural	Urban
Grass, Thatch, Bamboo, Wood, etc.	9.93	12.48	3.60
Plastic, Polythene	0.29	0.27	0.34
Mud, Unburnt Brick	29.63	37.07	11.17
Wood	1.28	1.33	1.17
GI, Metal, Asbestos Sheets	0.80	0.49	1.57
Burnt Brick	44.92	35.33	68.72
Stone	10.23	11.46	7.17
Concrete	2.63	1.27	5.99
Any Other Material	0.29	0.30	0.27

Walls made of mud and unburnt bricks are most vulnerable in earthquakes and landslides, as well as in floods and cyclones. Grass, thatch, bamboo, plastic and polythene walls are most vulnerable in cyclones and floods, while stone walls which are not packed with mortar are very vulnerable in earthquakes. Other materials like wood, burnt brick and wood have different degrees of vulnerability in different hazard scenarios.

Tiles, grass-thatch-bamboo-mud, concrete, and metal-asbestos sheet are the four predominant materials used for construction of roofs, as shown in the figure below.

Figure 14: Percentage of buildings as per prominent materials used for roofs



104 The comparable figure of Census 2001 was 26.4 percent in rural India and 3.2 percent in urban India.

Here, again, there are significant rural-urban and inter-state differences according to the climatic conditions and economic well-being of the people.

Considering the level of risk involved in the construction of walls and roofs with different building materials in different hazard zones of earthquakes, landslides, floods and cyclones, the vulnerability index of buildings in the States/ UTs on a scale of 0-10, is as presented in the figure below.

Figure 15 : Vulnerability Index of Buildings



p) Physical infrastructure

Elements of physical infrastructure such as roads and bridges, railway lines, airports and seaports, dams and reservoirs, power system network, telecommunication system etc are routinely damaged during disasters, creating a cascading adverse impact on economy. Such damage has taken place in every hazard prone region of the country and included almost every type of infrastructure, old and new. While the nature and extent of such damages have been assessed post-disaster, no mechanism is still in place in India, as is the case in most countries, to systematically assess the vulnerability of important and critical infrastructures on a regular basis throughout the country. The factors that make infrastructure vulnerable to natural or manmade hazards include quality of design and construction, standards of maintenance, age of infrastructure, changing dynamics of

hazards etc. In the absence of any comprehensive database on all these parameters, there is no alternative but to apply the standard statistical technique of using available data on physical infrastructure as proxy indicators of vulnerabilities, presuming that every infrastructure is equally vulnerable to disasters, even though it need not be so always.

The same technique has been applied to work out the vulnerability index of physical infrastructure, as further explained in the statistical notes on methodology.

Figure 16 : Vulnerability Index of Physical Infrastructure



q) Social infrastructure

Social infrastructure is broadly defined to include buildings and other related structural and non-structural facilities that support social services, such as healthcare, education and public facilities. Public facilities include a wide range of services—community and recreational centers, sports, places of worship etc. In the absence of any organized database on public facilities, vulnerability of social infrastructure has been worked out on the basis of available data on health care and educational institutions in the State, as enumerated in the Census of 2011. Health care institutions include dispensaries, family welfare centres, primary health centres, hospitals etc. Educational facilities include primary, middle, secondary and other schools, colleges, universities, engineering and other technical institutes, medical colleges etc.

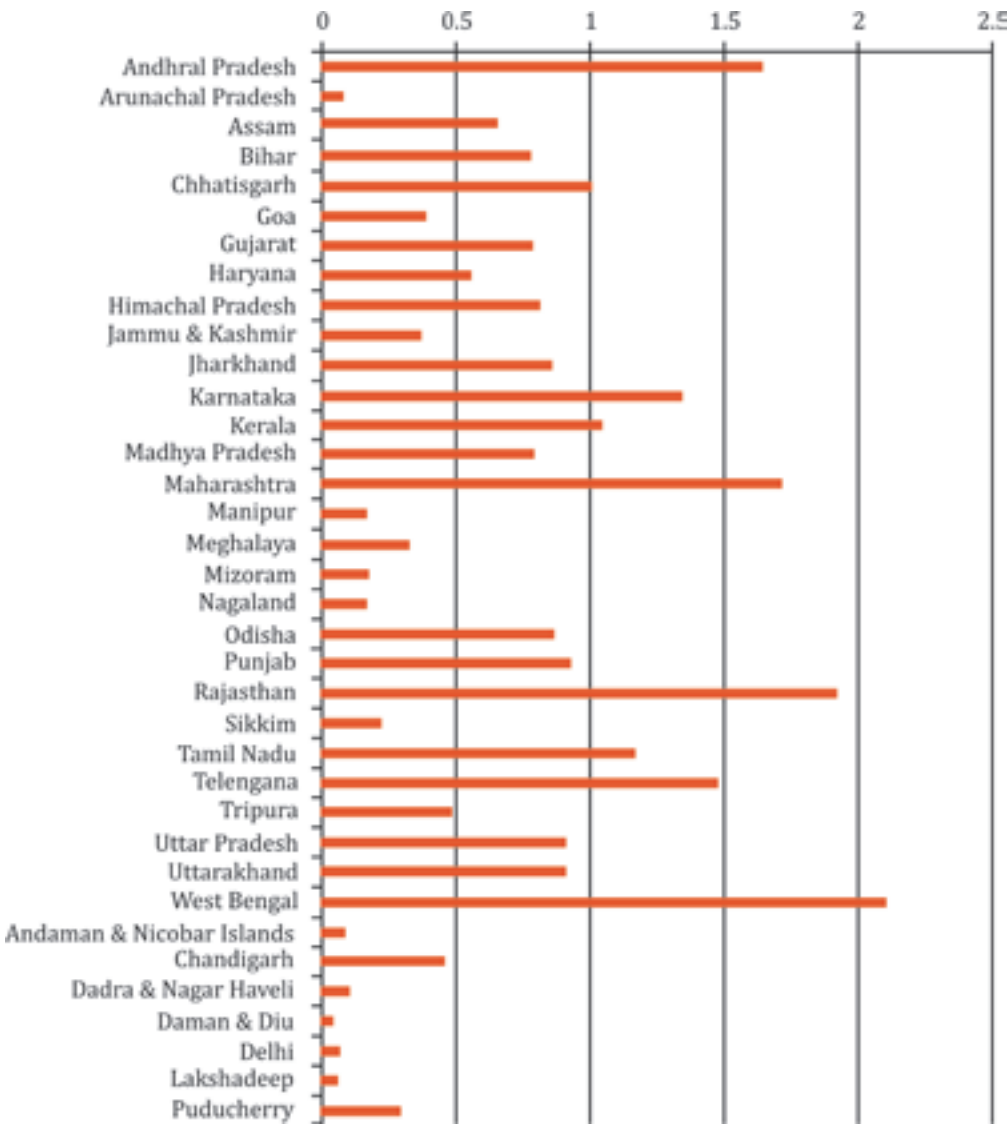
Many of these facilities are routinely damaged during earthquake, flood, landslides and cyclone, but as in the case of physical infrastructure, there is no comprehensive database on vulnerable health care and educational

institutions in the country. Therefore, the same standard statistical technique of using available data as proxy indicators of vulnerabilities has been applied to work out the vulnerability index of social infrastructure.

Figure 17: Vulnerability Index of Social Infrastructure

Primary data on various parameters of physical environment—buildings, physical infrastructure and social infrastructure—collected from various sources have been compiled in the statistical tables appended with the report. Vulnerability indexes on these parameters have been worked out on the basis of methodologies explained in Chapter 2. The resultants indexes are presented in the table below.

Table 22: Vulnerability Index of Physical Environment



No.	States and Union Territories	Buildings	Physical infrastructure	Social infrastructure
STATES				
1.	Andhra Pradesh	2.86	5.27	2.27
2.	Arunachal Pradesh	4.48	0.54	0.12
3.	Assam	3.67	2.23	1.56
4.	Bihar	2.39	2.58	3.27
5.	Chhattisgarh	2.19	2.04	1.8
6.	Goa	2.79	0.76	0.1
7.	Gujarat	2.38	8.31	2.54
8.	Haryana	2.00	2.06	1.34
9.	Himachal Pradesh	4.74	2.74	1.19
10.	Jammu & Kashmir	4.32	2.17	0.84
11.	Jharkhand	2.13	2.52	2.12
12.	Karnataka	2.13	7.49	4.49
13.	Kerala	3.02	4.86	1.92
14.	Madhya Pradesh	1.75	5.37	3.51
15.	Maharashtra	2.25	9.44	6.78
16.	Manipur	5.17	0.35	0.16
17.	Meghalaya	4.52	0.72	0.26
18.	Mizoram	5.09	0.14	0.17
19.	Nagaland	4.80	0.24	0.4
20.	Odisha	2.63	4.51	2.61
21.	Punjab	2.20	2.32	2.11
22.	Rajasthan	1.74	5.18	6.78
23.	Sikkim	3.45	0.25	0.17
24.	Tamil Nadu	2.13	9.29	4.79
25.	Telangana	1.90	2.73	1.54
26.	Tripura	4.63	0.59	0.21
27.	Uttar Pradesh	1.88	6.69	6.96
28.	Uttarakhand	4.34	2	1.25
29.	West Bengal	2.76	4.1	4.46
UNION TERRITORIES				
1.	Andaman & Nicobar	4.65	0.9	0.03
2.	Chandigarh	1.83	0.12	0.07
3.	Dadra & Nagar Haveli	3.11	0.01	0.01
4.	Daman & Diu	2.55	0.15	0.01
5.	Delhi	1.82	0.72	0.08
6.	Lakshadweep	2.08	0.32	0.01
7.	Puducherry	2.26	0.21	0.15

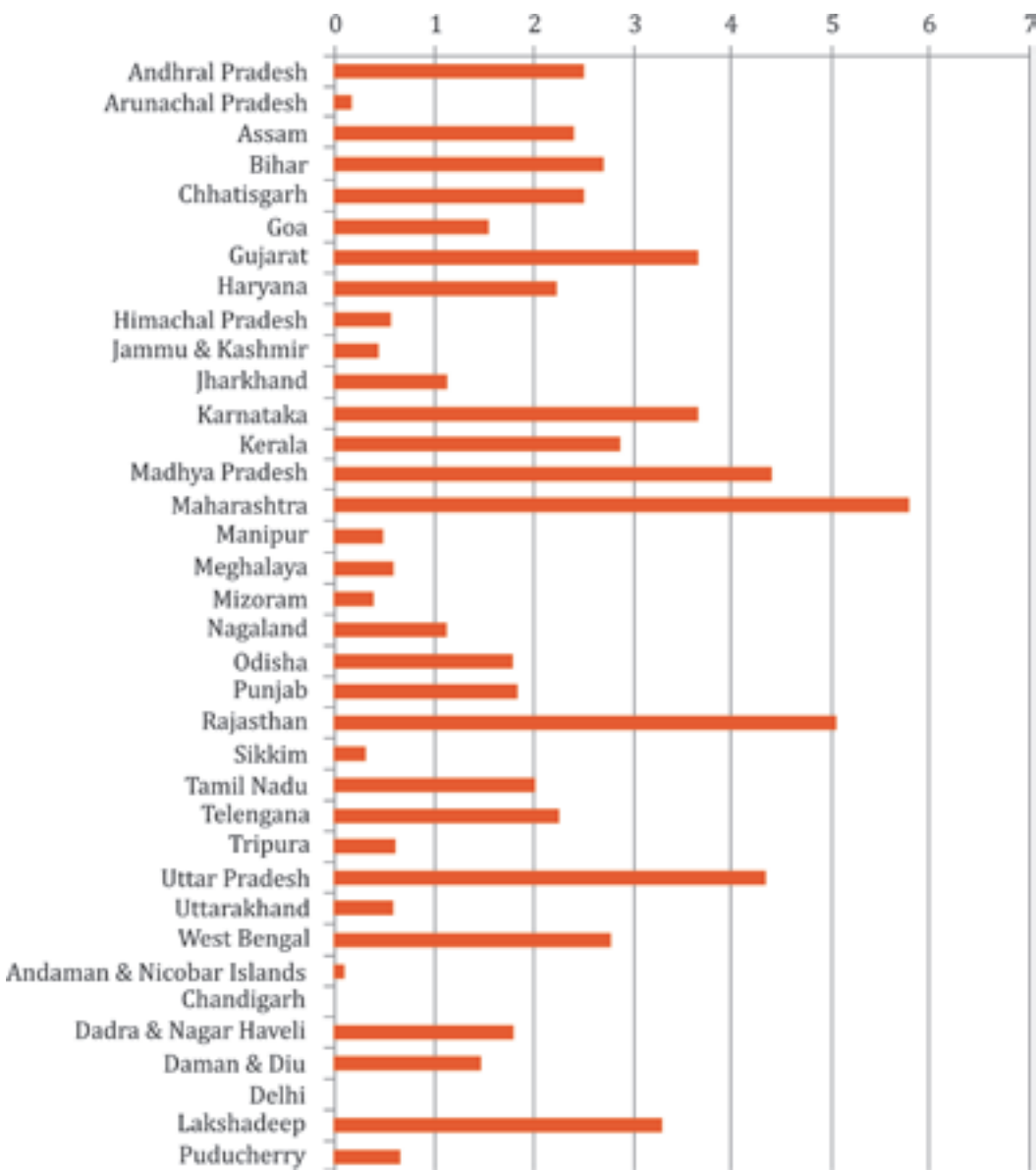
PRODUCTION SYSTEM

a) Agriculture

Crop Vulnerability Index has been worked out on the basis of two indicators—cropped area and irrigated area. District-wise data on area under crops and area under irrigation have been collected from Directorate of Economics and Statistics, Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India.

Standing crops as well as irrigation networks are vulnerable to hazards of nature, but susceptibility of damage is higher for crops than irrigation. Moreover, irrigation network surviving impacts of disaster can support revival of agriculture. Considering the relative importance of crop and irrigation, 80% weights have been given on area under crops and 20% on irrigated area.

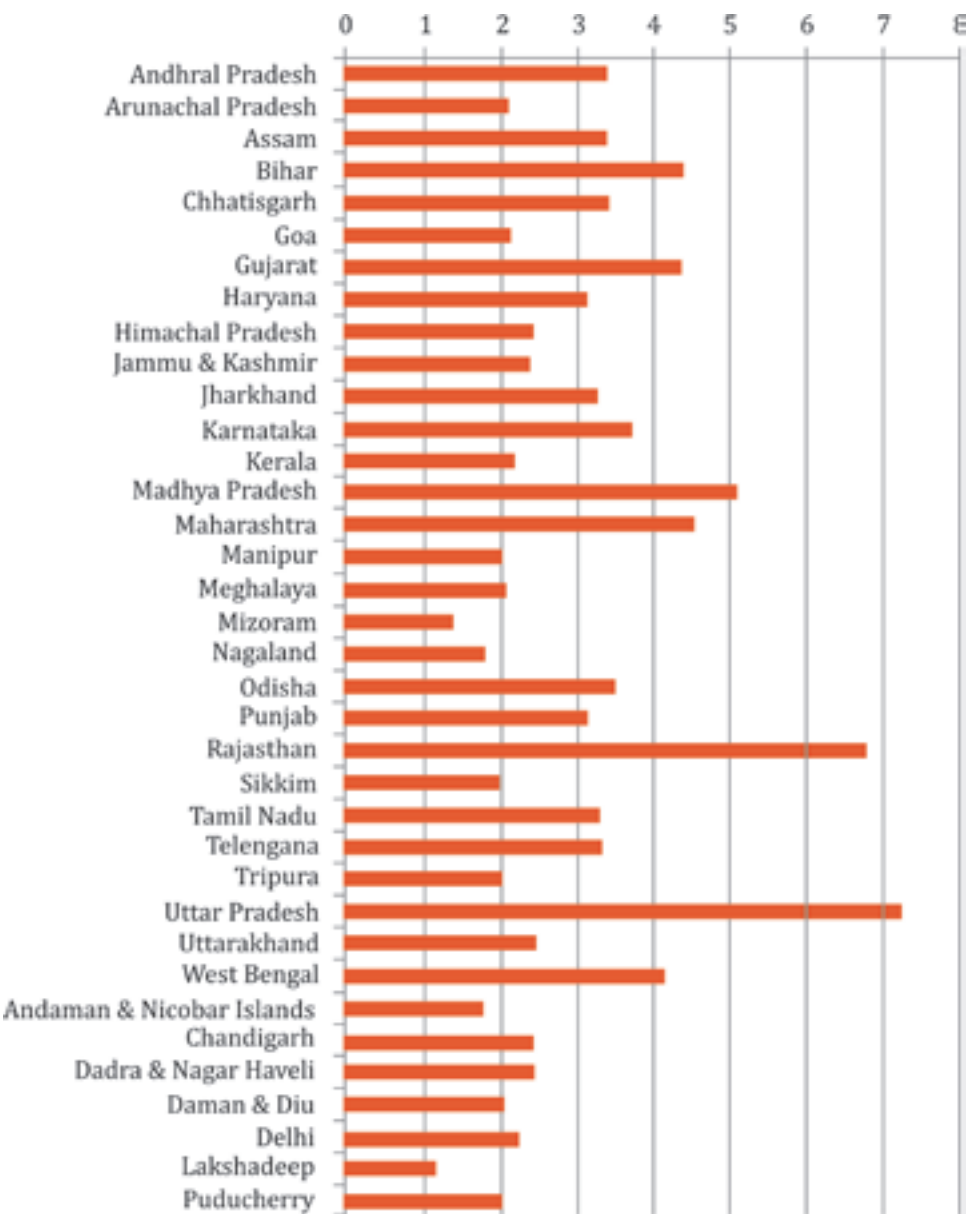
Figure 18 : Vulnerability of Productive System: Agriculture



b) Livestock

Livestock data has been compiled from Livestock Census 2012.¹⁰⁵ Livestock Vulnerability Index has been worked out on the basis on two indicators—number of bovine animals and other animals—with a 75:25 ratio, taking the importance of bovines for life and economy into consideration.

Figure 19: Vulnerability of Productive System: Livestock



c) Industries

District-wise data on industries has been collected from multiple sources on three indicators: number of MSME, number of industrial clusters and number of Special Economic Zones (SEZ). Data on micro, small and medium enterprise has been collected from the database of Development Commissioner (MSME)¹⁰⁶, while data on Industrial Clusters and Special Economic Zones in districts has been collected from Ministry of Industrial Policy

105 Livestock Census (2012), Volumes I to IV, Department of Animal Husbandry, Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India.
106 Entrepreneurs Memorandum – Part II - Data on MSME Sector (2015), Development Commissioner (MSME), Ministry of Micro, Small and Medium Enterprises, Government of India.

and Promotion. Industrial vulnerability index has been worked out on the basis of differential weights of 40% on MSME, 40% on Industrial Clusters and 20% on SEZ.

Figure 20 : Vulnerability of Productive System: Industries



Composite Vulnerability Index of productive systems is presented in the table below.

Table 23 : Vulnerability Index of Production Systems

	States/UTs	Agriculture	Livestock	Industries	Total
	STATES				
1	Andhra Pradesh	2.51	3.41	2.64	2.85
2	Arunachal Pradesh	0.16	2.12	0	0.76
3	Assam	2.4	3.39	0.35	2.05
4	Bihar	2.71	4.41	0.38	2.50
5	Chhattisgarh	2.51	3.43	0.53	2.16
6	Goa	1.54	2.15	0.28	1.32
7	Gujarat	3.65	4.37	6.28	4.77
8	Haryana	2.24	3.15	2.46	2.62
9	Himachal Pradesh	0.56	2.45	0.37	1.13
10	Jammu & Kashmir	0.43	2.4	0.25	1.03
11	Jharkhand	1.13	3.29	0.53	1.65
12	Karnataka	3.66	3.74	4.56	3.99
13	Kerala	2.87	2.21	2.23	2.44
14	Madhya Pradesh	4.39	5.1	1.94	3.81
15	Maharashtra	5.78	4.53	6.41	5.57
16	Manipur	0.49	2.03	0.04	0.85
17	Meghalaya	0.58	2.08	0.03	0.90
18	Mizoram	0.39	1.38	0.01	0.59
19	Nagaland	1.12	1.8	0.07	1.00
20	Odisha	1.8	3.5	1.16	2.15
21	Punjab	1.85	3.14	2.21	2.40
22	Rajasthan	5.07	5.62	2.41	4.37
23	Sikkim	0.31	2.02	0	0.78
24	Tamil Nadu	2.02	3.31	7.87	4.40
25	Telangana	2.27	3.35	2.83	2.82
26	Tripura	0.61	2.03	0.01	0.88
27	Uttar Pradesh	4.35	7.26	5.36	5.66
28	Uttarakhand	0.59	2.49	0.3	1.13
29	West Bengal	2.78	4.16	2.47	3.14
	UNION TERRITORIES				
1	Andaman & Nicobar Islands	0.1	1.78	0	0.63
2	Chandigarh	0	2.46	0.01	0.82
3	Dadra & Nagar Haveli	1.79	2.44	0.01	1.41
4	Daman & Diu	1.48	2.06	0	1.18
5	Delhi	0	2.25	1.09	1.11
6	Lakshadweep	3.29	1.18	0	1.49
7	Puducherry	0.67	2.03	3.61	2.10

VULNERABLE SOCIO-ECONOMIC CONDITIONS

Vulnerable socio-economic conditions are reflected in the living conditions as well as in the state of health, nutrition, education, employment and protection of vulnerable sections of the community, such as poor, women, children, disabled, aged etc. Together, they comprise the overwhelming majority of the population of any country and contribute substantially to the economic growth as well as social well-being of the community, yet they suffer from discrimination on multiple counts, and are often subjected to exploitation and excluded from decision-making which affects their lives. Every vulnerable section of the community is vulnerable for different reasons and these factors need to be captured statistically, while measuring vulnerabilities.



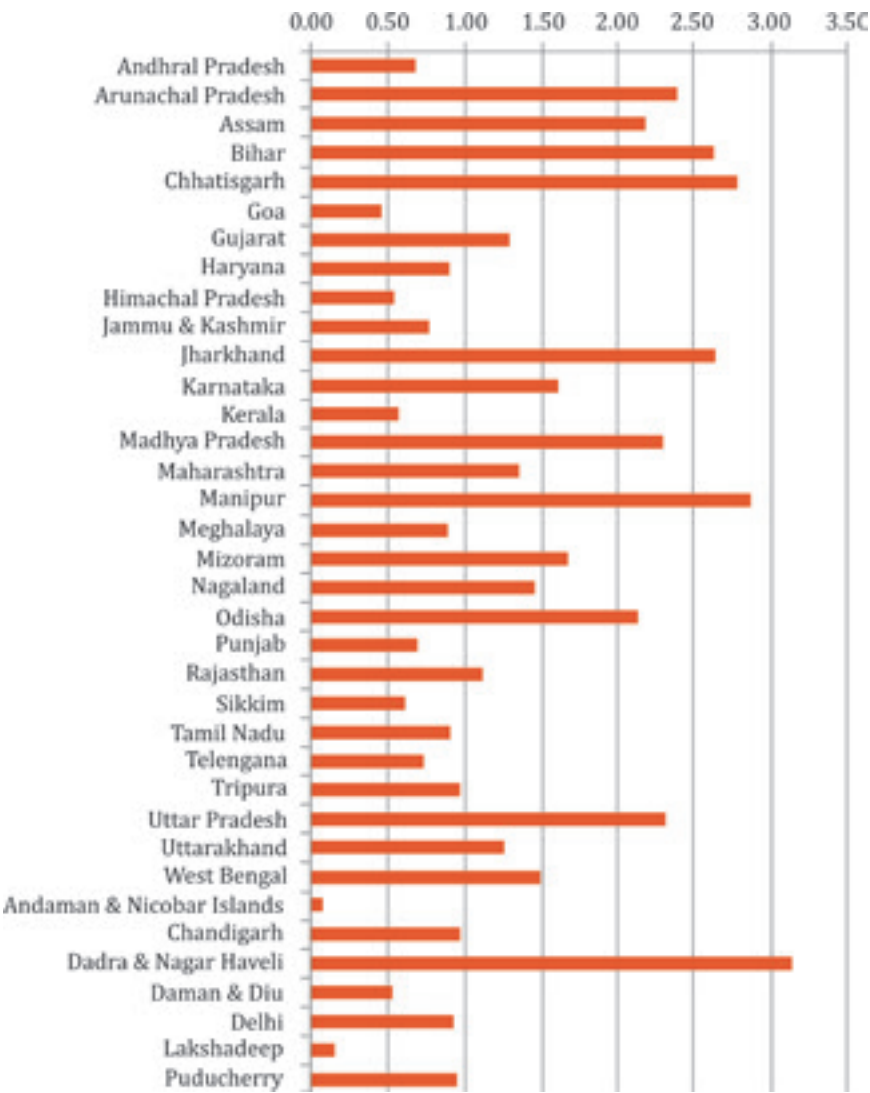
Source: UNDP

a) Poverty

The population below the poverty line is more vulnerable to disasters as they are more exposed to natural or manmade hazards and their overall capacity to cope with the hazards are limited. Rural poor are either agricultural labourers or small or marginal farmers depending on subsistence agriculture. When agricultural crops are damaged or lost due to drought or flood or ingress of saline water into the fields, they are deprived of their livelihood and have to either sell their limited assets or borrow from moneylenders for survival. Very few rural poor are covered under crop insurance or other economic or social protection measures.

Urban poor mostly live in slums and other informal settlements with inadequate basic facilities of water and sanitation and without legal titles of ownership or tenancy, which does not provide incentives for upgrading the standards of makeshift houses. More often, such settlements are located in hazard prone areas of cities, such as banks of rivers and canals and edges of railway lines or highways that are vulnerable to flood and accidents. The makeshift dwellings of the poor without any structural safety are the first to be damaged during any disasters, which render them homeless till they are able to collect dole or debts for reconstructing their lives and livelihoods. Poverty in some of the multi-hazard districts and cities has been perpetuated through the vicious cycle of poverty-disasters-debts, over generations.

Figure 21: Vulnerability Index of Poverty



There are several indicators of multi-dimensional poverty, but it is very difficult to collect data on all these indicators across the country in a uniform format. Districts have their own database on BPL population based on local surveys that are not considered reliable. Socio Economic and Caste Census 2011 did count number of households based on monthly income of the highest earning household member¹⁰⁷ but this cannot be accepted as a robust database on poverty for two reasons: first, the data excluded income from other sources and from other members of households, and second, the survey excluded urban households.

¹⁰⁷ <http://secc.gov.in/categorywiseIncomeSlabReport?reportType=All%20Category#>

In the absence of any national database on poverty, the estimate of the erstwhile Planning Commission on the number and percentage of people living below poverty line in States and UTs in rural and urban areas ¹⁰⁸ was adopted as the basis for calculating BPL population in the States. This has been supplemented by Census 2011 data on population of homeless. Both these indicators—BPL and Homeless Population—have two sub-indicators for rural and urban areas. Equal weights of 25% have been given to each of these four sub-indicators towards working out the Poverty Vulnerability Index.

As per Tendulkar’s study, the top five States as per BPL population are: Chhattisgarh (39.93%), Jharkhand (36.96%), Arunachal Pradesh (34.67%), Manipur (36.89%), and Odisha (32.59%), against the national average of 21.92%. Rural poverty is also highest in these five States, while urban poverty is high in Bihar (31.23%) and Uttar Pradesh (26.06%), next only to Manipur (32.59%). Among the Union Territories, Dadra and Nagar Haveli has the highest incidence of poverty (39.31%) and, quite surprisingly, rural poverty in this Territory was estimated as high as 62.59%—nearly three times the national average.

There are significant variations in intra-State distribution of poverty that are not captured in national statistics. Some of the districts of Odisha, for example, have indices of poverty that are much worse than the State averages. Again, aspects of poverty that are reflected in the status of health, education, nutrition, housing and other basic services for dignified living, are not captured in these data. As the collection and compilation of national statistical system on poverty improves, the vulnerability index on poverty will undergo qualitative changes.

b) Vulnerable Women

Women are often more vulnerable in disasters, even though they often have greater coping capacity to deal with the impacts of disasters and in building resilience of families and communities. These paradoxes are reflected in some stark realities: more women than men die and get injured in disasters; women are generally the last to be rescued; health and nutrition of women, especially pregnant and lactating women, get adversely affected after disasters; school dropout rates of girl children rise post-disasters; women and girls often become victims of trafficking and exploitation; the burden of responsibilities of women increases after disasters, as they have to perform the usual household chores as well as care for the sick and injured, and earning a livelihood for the family when male bread-earners have not survived.

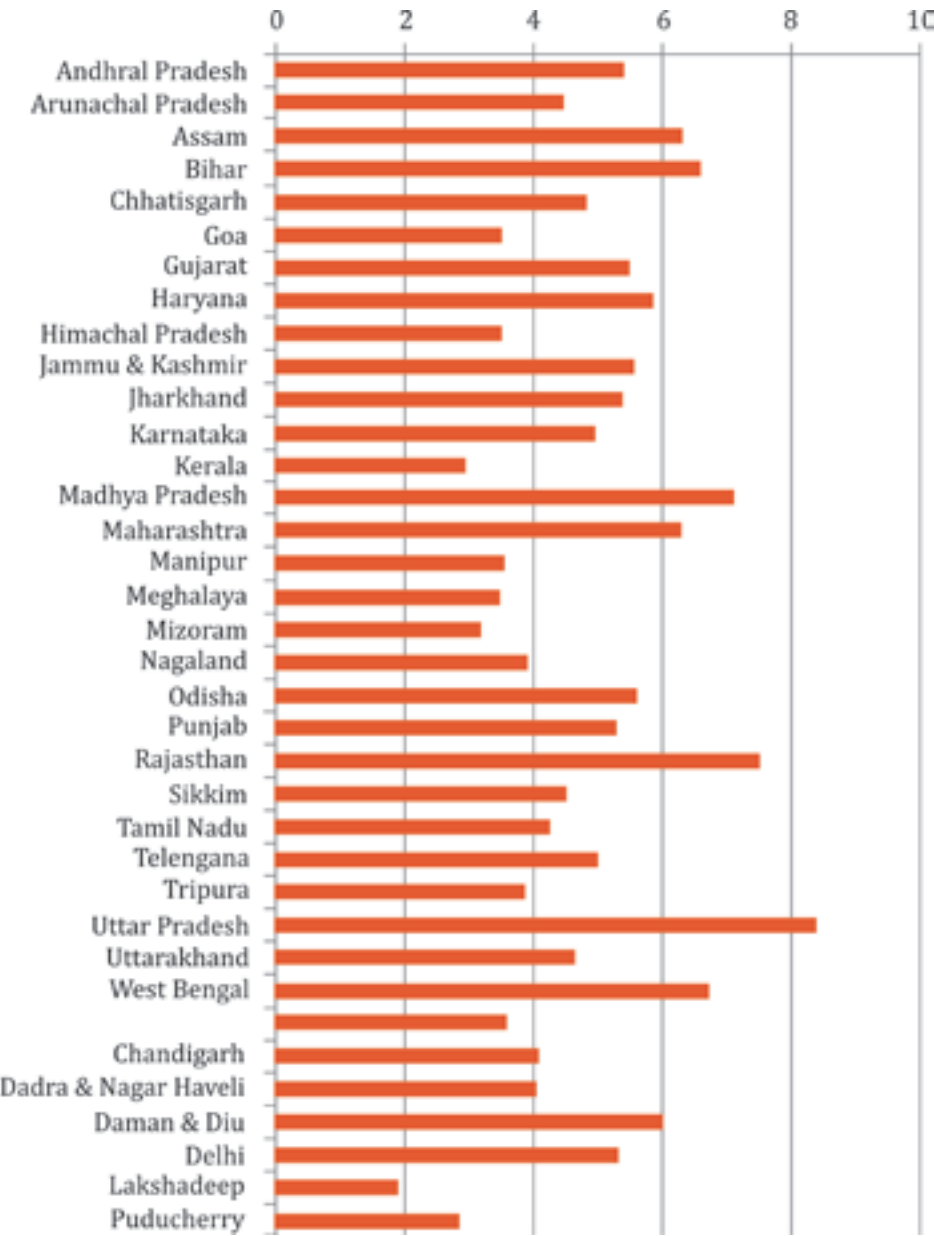
¹⁰⁸ Press Note on Poverty Estimates (2013), Planning Commission, Government of India.



Source: UNDP

The multi-dimensional vulnerabilities of women in disasters are difficult to capture statistically on a pan-India basis. Available datasets on vulnerabilities—sex ratio, female illiteracy, woman-headed households, unemployed women, Maternal Mortality Ratio (MMR), and crime against women—have been used to develop an index on the vulnerability of women. The methodology adopted for developing the index is explained in Chapter 2, and the compiled datasets are presented in this report’s Statistical Appendices. The Gender Vulnerability Index of the States and UTs is visualized in the figure below.

Figure 22: Gender Vulnerability Index



c) Vulnerable Children

Family, schools and neighborhood are the three main support systems of children in different age groups that are affected during disasters. These can be adversely impacted during disasters, and thus affect the physical and mental growth and development of children. Specific needs of children are not always considered during search

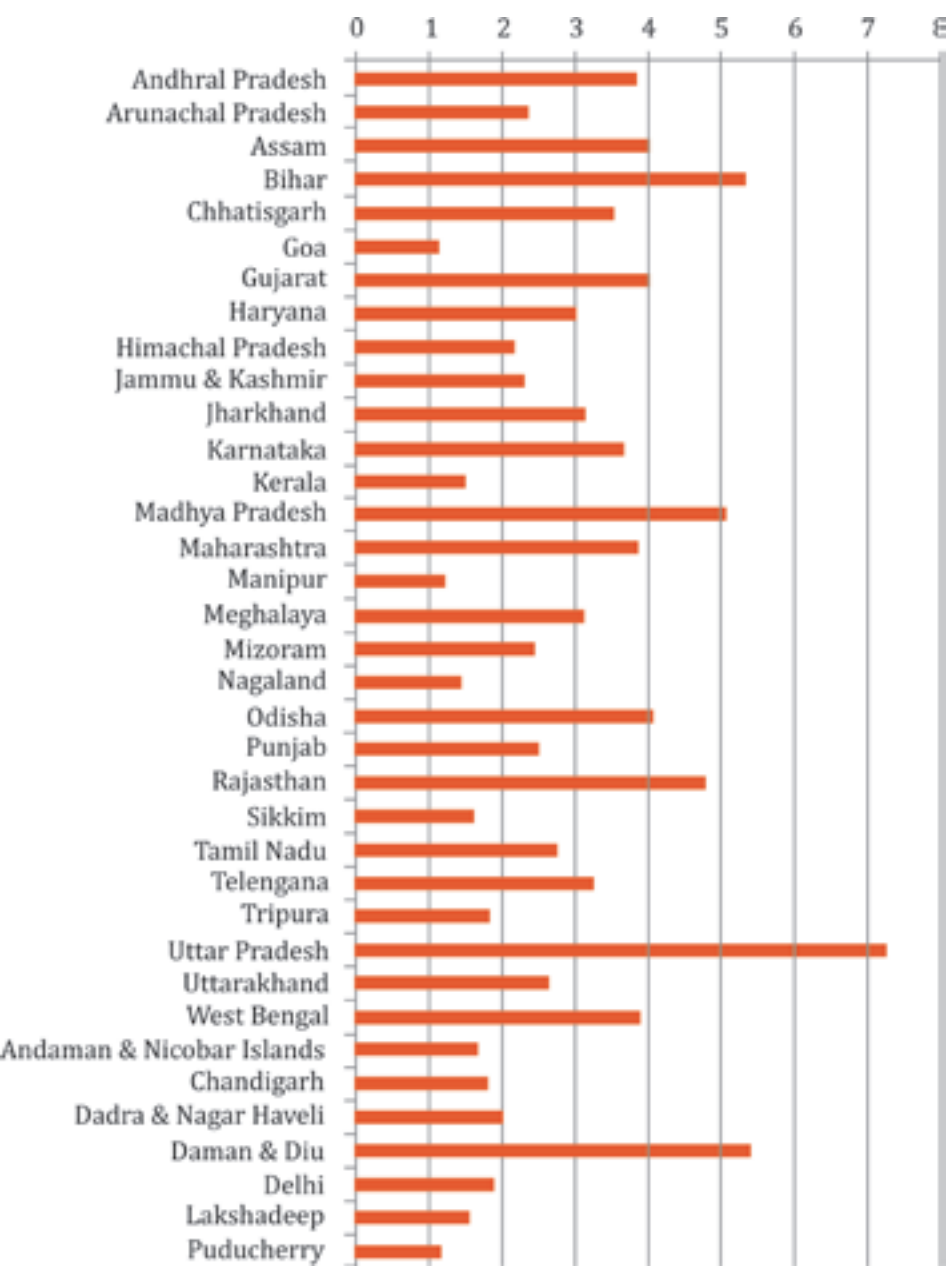


Source: UNDP

and rescue operations and in management of relief camps; deaths and injuries of parents or near relatives have traumatic effects which impair their cognitive growth; health and nutrition suffer after disasters; prolonged closure of schools results in serious disruptions in education.

Child vulnerability index has been worked out on the basis of four indicators, on which data on a uniform scale is available throughout the country: age group of children, children not attending school, children working, and infant mortality rate. Children are classified into 0-6 and 7-18 age groups, as these two groups have different levels of vulnerabilities. The share of children in the 0-6 age group has varied from 29.12% in Sikkim to 38.4% in Bihar, and likewise for children in age group 7-18. The number of non-school going children range from 10.9% in Kerala to 27.5% in Bihar, and that of working children from 0.25% in Lakshadweep to 7.7% in Dadra and Nagar Haveli. Infant Mortality Rate (IMR), a powerful indicator of child care, ranges from 9 in Goa to 50 in Madhya Pradesh.

Figure 23: Children Vulnerability Index

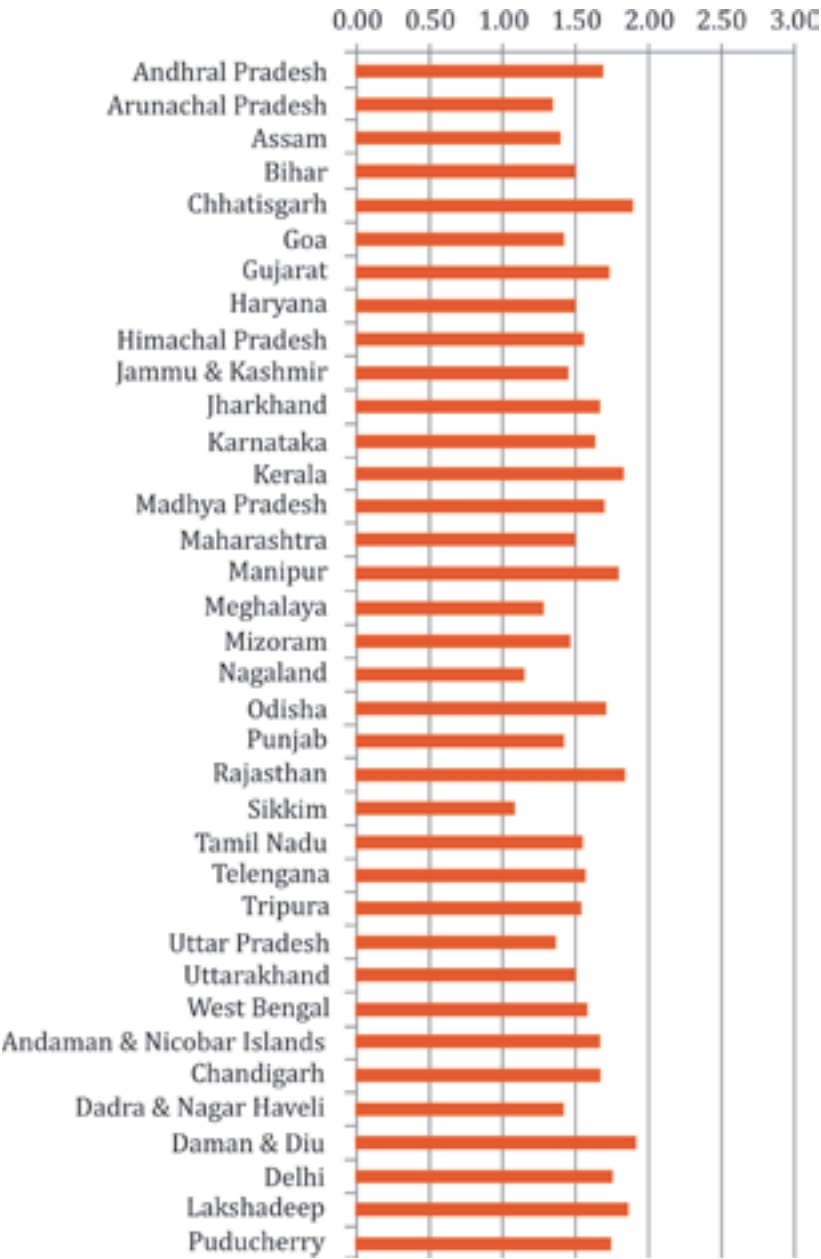


d) Disability

Disasters can increase the numbers of the disabled and aggravate conditions of already disabled people. The latter constitutes more than 2% of the population. The census has enumerated various aspects of disability, such as visual, physical, speech, hearing, mental and others. For the purpose of this study, only three indicators—physical, visual and mental—have been considered.

The share of disabled population has ranged from 0.9% in Daman and Diu to 2.8% in Jammu & Kashmir. The relative share of physically disabled persons is highest in Chhattisgarh (30.40%) and lowest in Manipur (9.41%) while the corresponding figures for visually disabled persons in Manipur is 33.68% and 10.8% in Tamil Nadu. Kerala has the highest share of mentally retarded persons (17.41%) and Sikkim the lowest (5.66%). The datasets and index are presented in Table V.11 of the statistical appendices. The graphics below visualizes the index.

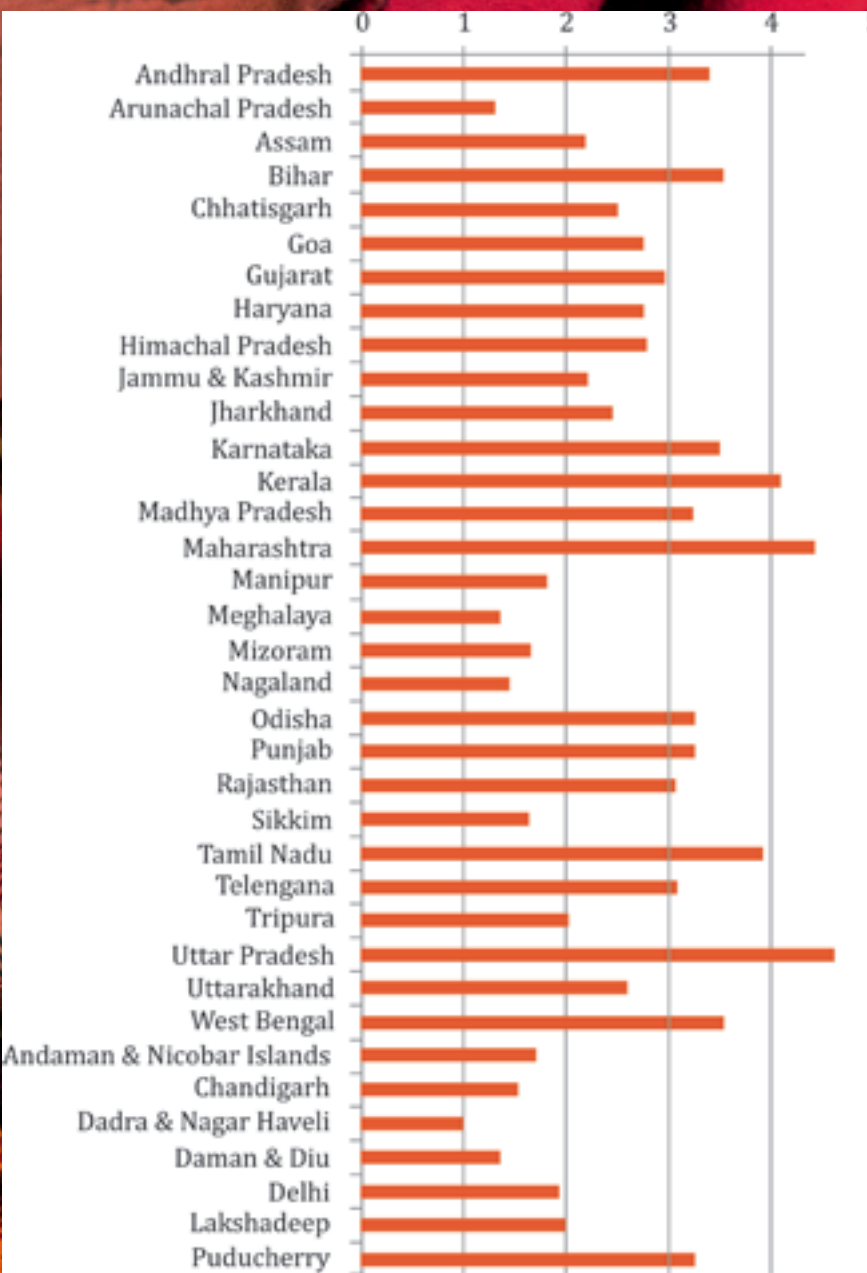
Figure 24: Disability Vulnerability Index



e) Aged

Elderly people suffer disproportionately in disasters. Elderly Vulnerability Index has been worked out on the basis of three indicators—population in 60+ age group, population in 80+ age group and dependency ratio (ratio of population in 60+ age group over working population in 19-59 age group). The resultant Elderly Vulnerability Index is shown in the figure below, while the data sets and index is presented in Table V.12 in the Statistical Appendices.

Figure 25: Elderly Vulnerability Index



Source: UNDP

Average vulnerability index on socio-economic conditions is presented in the table below.

Table 24: Vulnerability Index of Socio-Economic Conditions

States	Poverty	Women	Children	Disabled	Aged	Average
Andhra Pradesh	0.68	5.38	3.83	1.67	3.40	2.99
Arunachal Pradesh	2.39	4.46	2.36	1.33	1.31	2.37
Assam	2.19	6.29	4.03	1.39	2.20	3.22
Bihar	2.63	6.56	5.35	1.48	3.53	3.91
Chhattisgarh	2.79	4.8	3.52	1.88	2.50	3.10
Goa	0.45	3.51	1.13	1.40	2.75	1.85
Gujarat	1.29	5.46	4.01	1.72	2.97	3.09
Haryana	0.90	5.83	2.99	1.48	2.76	2.79
Himachal Pradesh	0.54	3.5	2.14	1.55	2.78	2.10
Jammu & Kashmir	0.77	5.55	2.3	1.43	2.22	2.45
Jharkhand	2.64	5.38	3.14	1.66	2.46	3.06
Karnataka	1.60	4.93	3.66	1.62	3.50	3.06
Kerala	0.57	2.95	1.48	1.82	4.10	2.18
Madhya Pradesh	2.30	7.12	5.06	1.69	3.24	3.88
Maharashtra	1.35	6.28	3.87	1.49	4.43	3.48
Manipur	2.87	3.52	1.21	1.78	1.82	2.24
Meghalaya	0.88	3.46	3.1	1.26	1.36	2.01
Mizoram	1.67	3.18	2.42	1.45	1.65	2.07
Nagaland	1.46	3.88	1.43	1.14	1.44	1.87
Odisha	2.14	5.57	4.06	1.69	3.26	3.34
Punjab	0.69	5.28	2.5	1.41	3.26	2.63
Rajasthan	1.11	7.48	4.79	1.82	3.06	3.65
Sikkim	0.55	4.48	1.59	1.07	1.63	1.86
Tamil Nadu	0.90	4.25	2.75	1.53	3.92	2.67
Telangana	0.68	4.99	3.24	1.56	3.09	2.71
Tripura	0.97	3.85	1.83	1.53	2.02	2.04
Uttar Pradesh	2.26	8.39	7.28	1.35	4.62	4.78
Uttarakhand	1.30	4.63	2.64	1.50	2.59	2.53
West Bengal	1.51	6.73	3.9	1.56	3.54	3.45
Union Territories						
Andaman & Nicobar	0.97	3.57	1.66	1.66	1.70	1.91
Chandigarh	3.14	4.07	1.79	1.41	1.53	2.39
Dadra & Nagar Haveli	0.52	4.02	2.01	1.90	1.01	1.89
Daman & Diu	0.92	5.97	2.10	1.74	1.36	2.42
Delhi	0.14	5.29	1.88	1.85	1.93	2.22
Lakshadweep	0.94	1.87	1.55	1.73	2.00	1.62
Puducherry	0.68	2.83	1.14	1.67	3.26	1.92

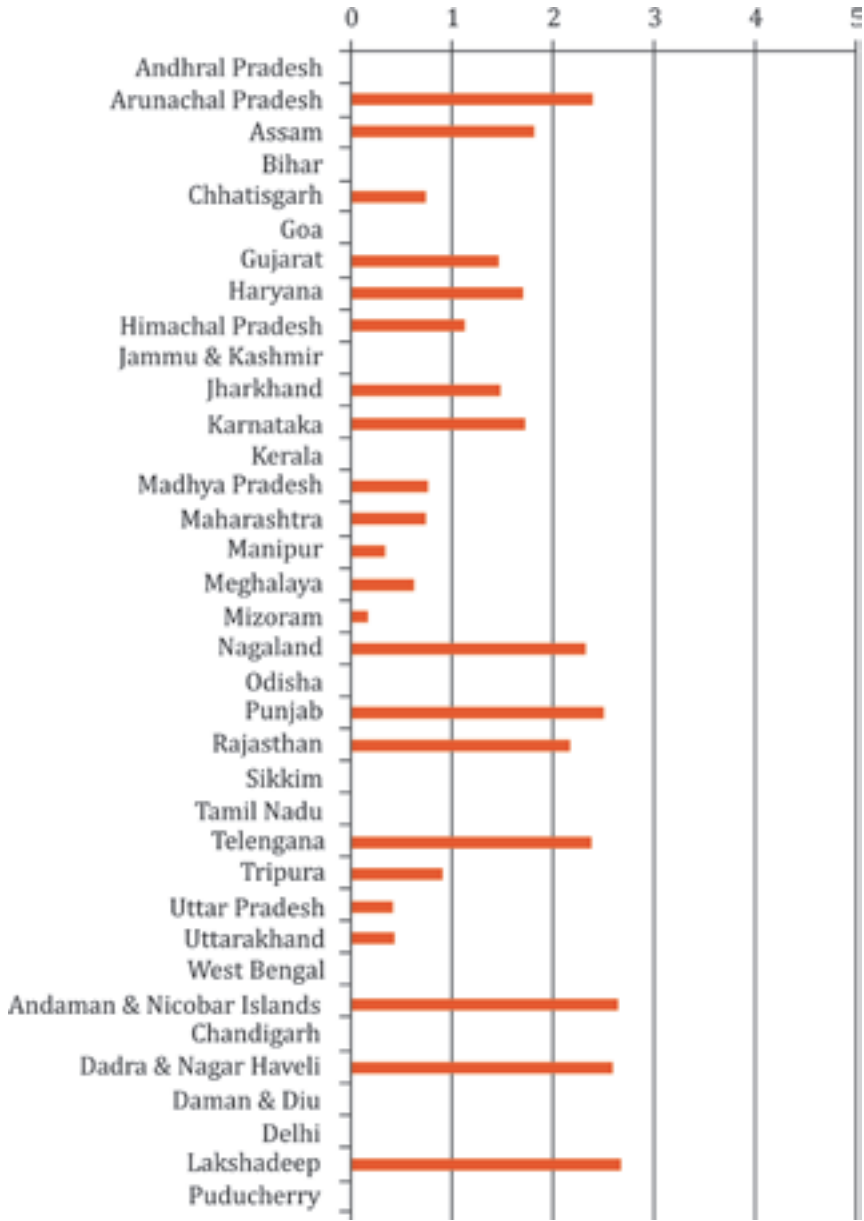
NATURAL ENVIRONMENT

a) Depletion of Forest Cover

Changes in forest cover in the States between 2000 and 2015 have been captured on two indices: dense forests and open forests. Equal weight has given to both indicators while calculating the index. A district-wise database on these two reference years has been collected from the India State of Forest Reports.¹⁰⁹ Positive, negative and overall changes have been calculated to determine net depletion in forest cover, if any.

Only net depletion is factored for measuring environmental vulnerability of forests. The States/ UTs that do not show any net depletion of forests include Andhra Pradesh, Bihar, Goa, Jammu & Kashmir, Kerala, Odisha, Sikkim, Tamil Nadu, West Bengal, Chandigarh, Delhi and Puducherry. Forest covers of remaining States have been depleted in various measures, as shown in the figure below.

Figure 26: Environmental Vulnerability Index: Forest Cover



¹⁰⁹ India State of Forest Report (2000 and 2015), Forest Survey of India, Ministry of Environment and Forests, Government of India.

b) Depletion of Mangrove Cover

Changes in mangrove cover in the coastal States between 2000 and 2015 have been captured on two indices: dense and open mangroves. District-wise database on these two reference years has been collected from India State of Forest Reports.¹¹⁰ Positive, negative and overall changes have been calculated to determine net depletion, which is factored into calculations of the index. Net depletion of mangrove covers has taken place in Andaman & Nicobar Islands, followed by Puducherry, West Bengal, Andhra Pradesh, Odisha, Maharashtra and Gujarat, as detailed in Table V.14 in Statistical Appendices.

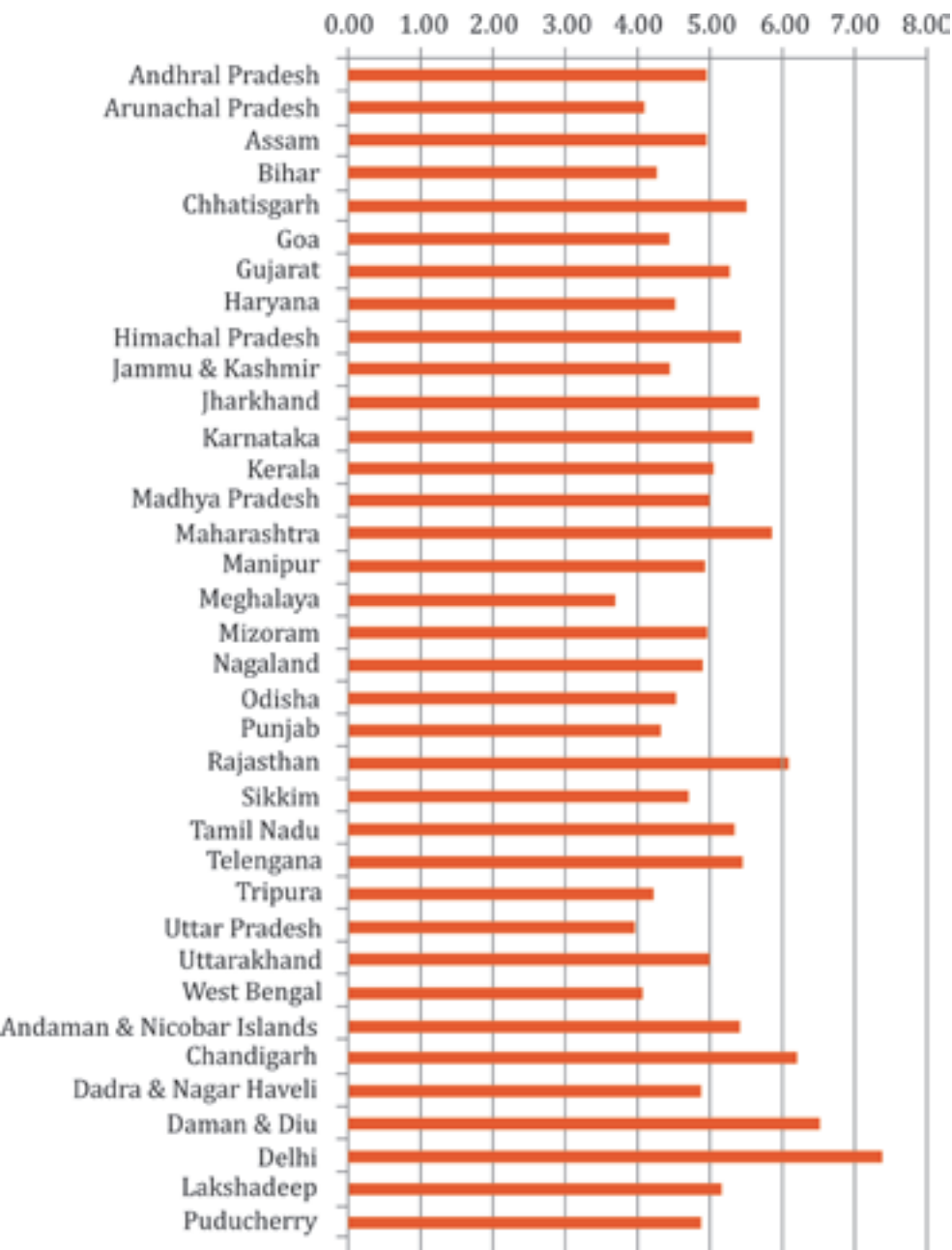
c) Water Stress

The extent of water stress in the States/ UTs is captured in three indicators: terrestrial, surface and sub-surface water. Stress on terrestrial and surface water sources is captured in Moisture Index and Cropped Area Not Irrigated, as used in calculating drought hazard index and agricultural vulnerability index. Stress on sub-surface water has been compiled from the database on ground water made available by Central Ground Water Board. Equal weights of 33.3% are given to each indicator for calculating water stress index.

Sub-surface water has four sub-indicators: over-exploited, critical, sub-critical and safe. This index is calculated as follows: 50% is ascribed to over-exploited, 30% to critical and 20% to sub-critical components. Safe water zones are not calculated in our indexes. The datasets on all indicators are presented in Table V.15, while the index on water stress is shown in the figure below.

110 India State of Forest Report (2000 and 2015), Forest Survey of India, Ministry of Environment and Forests, Government of India.

Figure 27: Environmental Vulnerability Index: Forest Cover



Vulnerability index on three indicators on environmental vulnerabilities are shown in the table below.

Table 25: Vulnerability Index of Natural Environment

	States/UTs	Depletion of forest cover	Depletion of mangroves	Water stress
	STATES			
1	Andhra Pradesh	0	0.86	5.29
2	Arunachal Pradesh	2.39		3.03
3	Assam	1.8		4.19
4	Bihar	0		4.2
5	Chhattisgarh	0.73		5.47
6	Goa	0	0	3.82
7	Gujarat	1.46	0.08	5.82
8	Haryana	1.69		4.95
9	Himachal Pradesh	1.13		4.93
10	Jammu & Kashmir	0		3.37
11	Jharkhand	1.48		5.48
12	Karnataka	1.72	0	5.8
13	Kerala	0	0	4.53
14	Madhya Pradesh	0.76		5.13
15	Maharashtra	0.74	0.09	5.86
16	Manipur	0.34		4.71
17	Meghalaya	0.62		2.17
18	Mizoram	0.16		4.16
19	Nagaland	2.31		4.42
20	Odisha	0	0.42	4.45
21	Punjab	2.49		4.04
22	Rajasthan	2.16		7.5
23	Sikkim	0		3.76
24	Tamil Nadu	0	0	5.64
25	Telangana	2.37		5.65
26	Tripura	0.89		3.39
27	Uttar Pradesh	0.4		4
28	Uttarakhand	0.42		4.98
29	West Bengal	0	0.89	3.65
	UNION TERRITORIES			
1	Andaman & Nicobar Islands	2.64	3.81	4.75
2	Chandigarh	0		7.37
3	Dadra & Nagar Haveli	2.58		4.52
4	Daman & Diu	0	0	7.89
5	Delhi	0		9.74
6	Lakshadweep	2.67		5.09
7	Puducherry	0	1.2	4.51

EXPOSURE

UNDRR has defined exposure as ‘the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas’.¹¹¹ ‘Situations of people’ is generally defined in terms of number of people living and exposed to specific or all types of hazards. ‘Infrastructure, housing, production capacities and other tangible human assets’ can be analyzed separately for each type of hazard in different zones. However, keeping in mind the difficulties of collecting disaggregated data on each of these assets for each hazard zone, and to further take into account both fixed capital assets as well as the rolling stock of wealth and income generated through infrastructure and production systems including human resources, exposure is generally calculated in terms of economy or Gross Domestic Product (GDP) exposed to hazards.

Therefore, for the purpose of this study, data on exposures has been collected on two indicators: exposure of population and exposure of economy as reflected in GDP. While data on exposure of population is compiled from Census 2011, exposure of GDP is not available so easily.

State GDP is estimated by the Directorate of Economics and Statistics (DES) in the States, but these are adopted by Central Statistical Organization (CSO) only after verification. CSO has released State GDP estimates of 2016-2017 at current prices (base year 2011-12) for 17 States/ UTs.

For the year 2015-2016, such data is available for all States/ UTs except West Bengal as the State GDP of West Bengal at 2011-12 price has not been adopted ever since the new series was started. In this scenario, there was no other alternative but to work with the provisional estimate prepared by the West Bengal State DES and final the estimates of the remaining States, both for the year 2015-2016.

State GDPs present a wide range of difference—from Rs 20,01,223 crores (Maharashtra) to Rs 15,339 crores (Mizoram). The same differences persist in per capita income—from Rs 36,648 (Bihar) to Rs 372,117 (Goa). This poses serious methodological challenges, as States with lower level of hazard but higher level of GDP/ per capita would show a high estimation of risks, unless these are normalized with appropriate and uniform criteria.

Similar problems persist regarding exposure of population, both in absolute numbers as well as in density. In absolute numbers, at one end of the spectrum, Uttar Pradesh has a population of 200 million, larger than that of Brazil, the fifth largest country in the world; and at the other end, Sikkim is populated by just 610,000, which is lower than the population of the Solomon Islands. Density of population also presents a wide range of difference—from 17 in Arunachal Pradesh to 1106 in Bihar. Some of the districts of India have population density as high as 25,000 (Kolkata).

Inter-state difference in population and economy is presented in the table below.

111 UNISDR Terminology on Disaster Risk Reduction, 2017 <https://www.unisdr.org/we/inform/terminology>

Table 26: Inter-State difference in population and economy

No.	STATES/ UNION TERRITORIES	Area	Population		Per capita (Rs)	
		(Sq Km)	Total	Density	Total (Rs Cr)	Per capita (Rs)
	STATES					
1	Andhra Pradesh	160205	49386799	308	609934	123501
2	Arunachal Pradesh	83743	1383727	17	20294	146662
3	Assam	78438	31205576	398	226276	72511
4	Bihar	94163	104099452	1106	381501	36648
5	Chhattisgarh	135192	25545198	189	260776	102084
6	Goa	3702	1458545	394	54275	372117
7	Gujarat	196244	60439692	308	1033791	171045
8	Haryana	44212	25351462	573	485184	191383
9	Himachal Pradesh	55673	6864602	123	112852	164397
10	Jammu and Kashmir	101387	12541302	124	119093	94961
11	Jharkhand	79716	32988134	414	231294	70114
12	Karnataka	191791	61095297	319	1016910	166447
13	Kerala	38852	33406061	860	556616	166621
14	Madhya Pradesh	308252	72626809	236	508937	70076
15	Maharashtra	307713	112374333	365	2001223	178085
16	Manipur	22327	2855794	128	19233	67347
17	Meghalaya	22429	2966889	132	25767	86849
18	Mizoram	21081	1097206	52	15339	139801
19	Nagaland	16579	1978502	119	19816	100157
20	Odisha	155707	41974218	270	341887	81452
21	Punjab	50362	27743338	551	391543	141130
22	Rajasthan	342239	68548437	200	672707	98136
23	Sikkim	7096	610577	86	16954	277672
24	Tamil Nadu	130060	72147030	555	1161963	161055
25	Telangana	114840	35193978	306	567588	161274
26	Tripura	10486	3673917	350	34184	93045
27	Uttar Pradesh	240928	199812341	829	1120836	56094
28	Uttarakhand	53483	10086292	189	176171	174664
29	West Bengal	88752	91276115	1028	1039924	113932
	UNION TERRITORIES					
1	Andaman and Nicobar	8249	380581	46	5932	155867
2	Chandigarh	114	1055450	9258	29049	275226
3	Dadra and Nagar Haveli	491	343709	700	2440	70990
4	Daman and Diu	111	243247	2191	1059	43536
5	Delhi	1483	16787941	11320	551963	328785
6	Lakshadweep	30	64473	2149	407	63127
7	Puducherry	490	1247953	2547	24701	197932
	Total	3166620	1210854977	382	13838419	114286

Probabilities of human and economic loss are important elements of risk, and nothing captures such losses better than demography and GDP. This poses a methodological dilemma: while reliance on these two indicators of exposure may underestimate relative hazards that are primary determinants of risk, discarding them would undermine estimation of damage and losses.

This report has sought to address this methodological challenge through two levels of analysis of exposure. At the first level, intensity of exposure of each State has been analyzed by measuring average exposure index based on density of population and per capita income, with equal weight on both these indicators. At the second level, depth of exposure has been captured by measuring hazard specific exposures. Both these indicators—intensity and depth of exposures—are assigned equal weight for measuring exposures of each hazard separately for each State.

Intensity of exposures of States/ UTs are presented in Table E.1 and Hazard Specific Exposures are shown in Table E.2.

CAPACITY

Capacity is defined as ‘the combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience’. This includes infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management. This further includes the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, and cope with risk of disasters. The coping capacity requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions.

Coping capacities contribute significantly to the reduction of risks of disasters. Therefore, the compounding effects of hazards, vulnerabilities and exposures are discounted by capacities for measuring the risks of disasters. Measuring the coping capacity of a large country as India is always a statistical nightmare, as requisite data sets would never be available. Such datasets are difficult to find even in most developed countries, with established statistical systems.

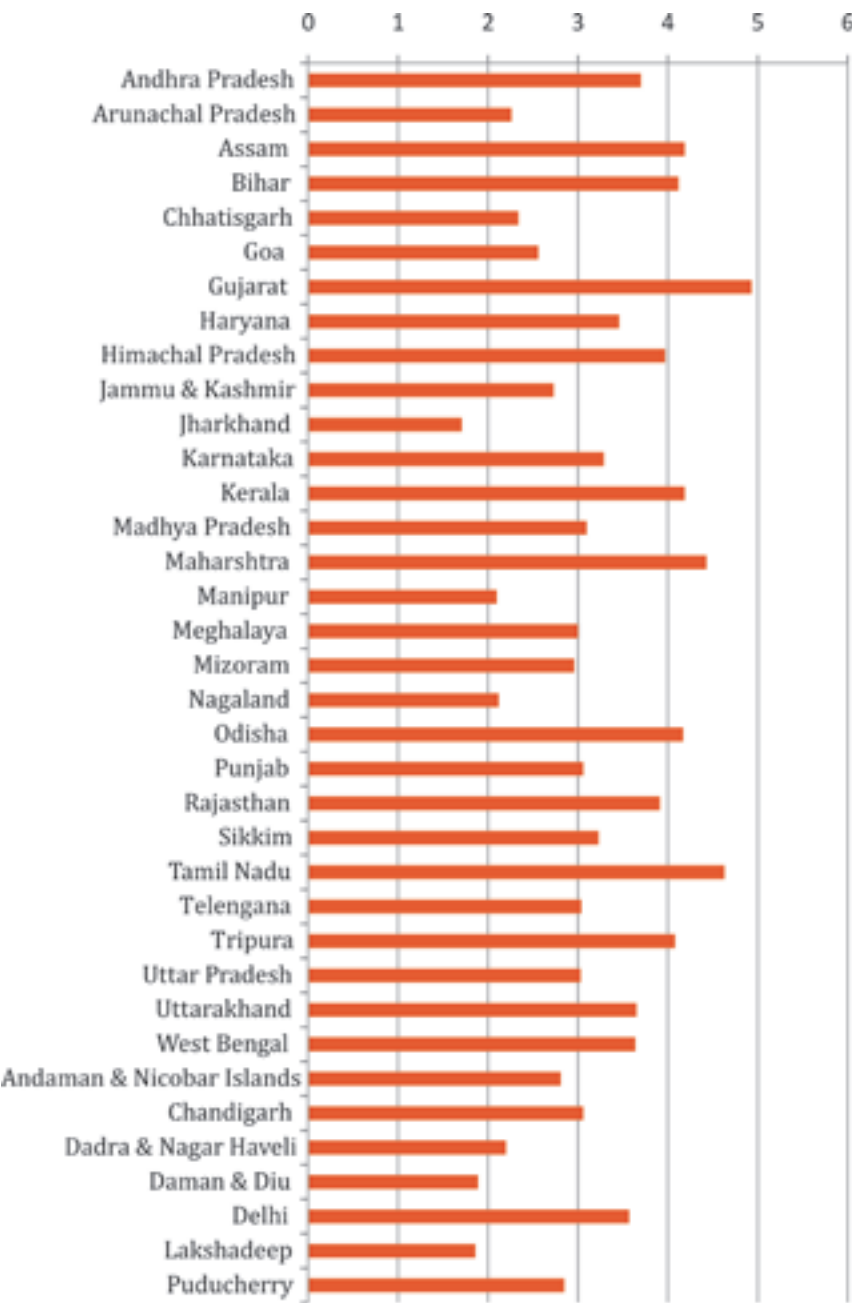
Therefore, for the purpose of this study, the analysis of coping capacity is restricted to the capacity of the State Governments and Union Territory Administrations. It includes neither the capacity of the federal government and its institutions, which significantly augment the capacity of the States/ UTs during every major and medium scale disaster that overwhelms them, nor the capacity of individuals, families and communities that ultimately shape the state of disaster preparedness, response and recovery.

Measuring capacity of State governments and UT administrations for disaster risk management is by no means an easy task as the national, state and local statistical systems do not generate data sets on state capacity for disaster management that can be used for such analysis. The global, national and local agendas of disaster management are so comprehensive, complex and dynamic that it is near impossible to construct such data from

primary or secondary sources that are available in the public domain. While state governments and district administration would be implementing series of plans, programmes and projects, the impacts these have for effective management of risks of disasters generally remain in government documents, reports, correspondences and files. Even if some of these documents are available in public domain, these are not easily amenable to statistical analysis for measuring capacities.

In order to generate easily quantifiable information on state capacity for disaster risk management, as mandated under various global, national and local frameworks, a comprehensive set of questionnaires was designed and circulated to the States Governments and UT Administration for measuring disaster resilience of States/ UTs on a set of 70 indicators, as detailed in Chapter 2 of this study. Information which was collected has been analysed in detail in Part III (Chapters 8-15) of this study. Overall State Resilience Index, as worked out, was taken as proxy indicator for capacity in a scale of 0-10, as shown in the diagram below.

Figure 28: Capacity Index for Disaster Risk Management



DISASTER RISK INDEX

Based on the data collected, collated, compiled and validated on multiple parameters of hazards and vulnerabilities, two separate sets indexes—hazard and vulnerability indexes—have been developed for each of 14 hazards and 14 vulnerabilities in each of 640 census districts of the country. These are aggregated with weights, as explained in this report’s methodology, to construct a Composite Hazard Index and Composite Vulnerability Index of States and Union Territories, as presented in Table H and Table V in the Statistical Appendices. Since every vulnerability is not relevant for every hazard, Hazard Specific Vulnerability Index has also been worked out separately Similarly, in order to resolve the methodological issue of normalizing exposure of population and economy in a country with wide divergences in density of population and per capita income, a Hazard Specific Exposure Index has also been developed Putting these together, Hazard Specific Risk Index has been constructed .

Hazard Specific Risk Index

Hazard Specific Risk Indexes provide interesting insights into how different types of hazards interact with different layers of vulnerabilities and exposures to create different scenarios of risks in different regions of India. For the purpose of this analysis, States/ UTs have been classified under five different regions, as seen in the table below.

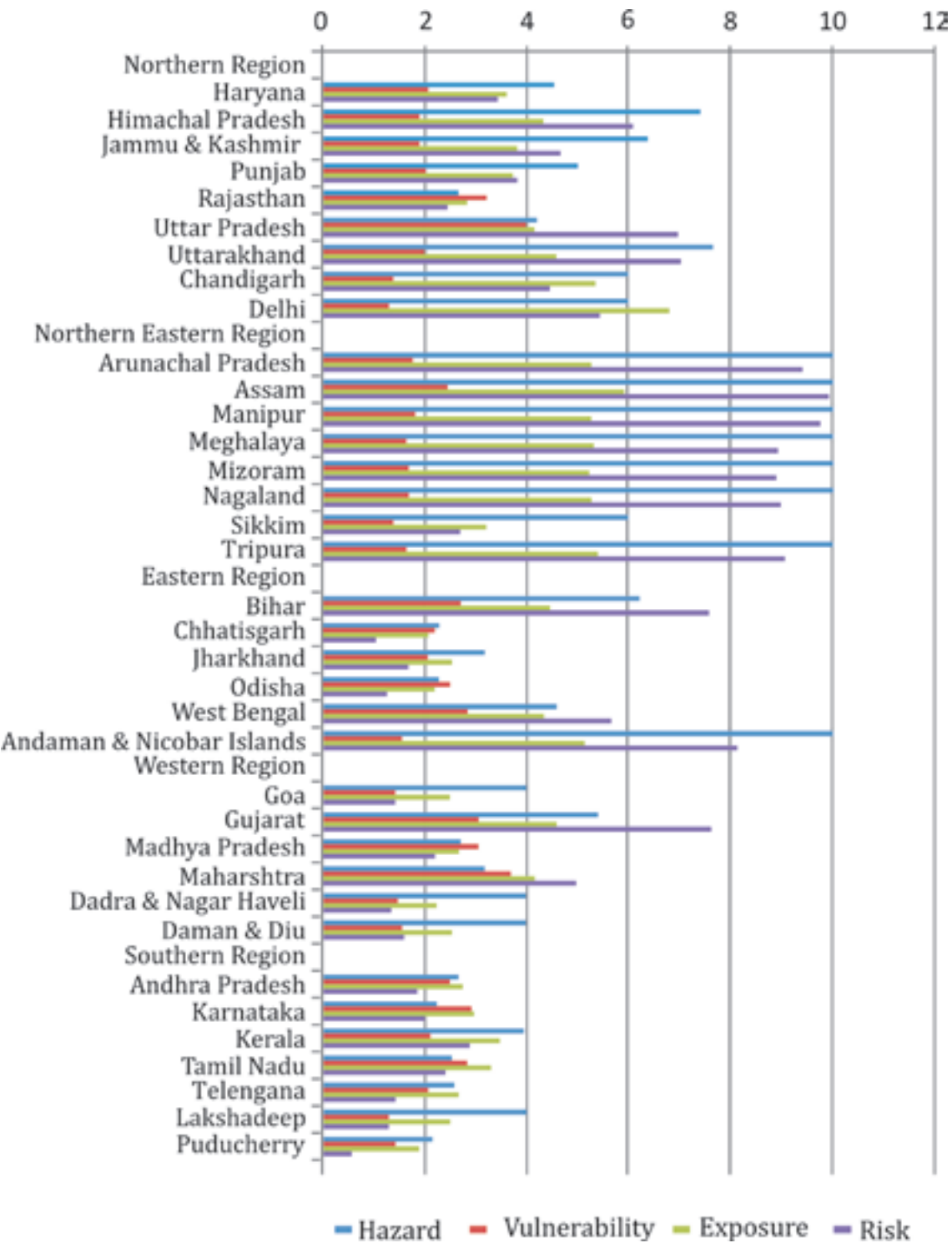
Table 27: Regional Classification of States

Regions	States	UTs
North	Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttarakhand, Uttar Pradesh	Delhi, Chandigarh
North East	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura	-
East	Bihar, Chhattisgarh, Jharkhand, Odisha, West Bengal	Andaman & Nicobar Islands
South	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana	Lakshadweep, Puducherry
West	Goa, Gujarat, Madhya Pradesh, Maharashtra	Dadra & Nagar Haveli, Daman & Diu

Earthquake Risk Index

Seven Northeastern States (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura) and the Union Territory of Andaman & Nicobar Islands fall exclusively in very high risk seismic Zone-V, while Sikkim, Delhi and Chandigarh fall exclusively in high risk Seismic Zone-IV. Large parts of Uttarakhand (41 per cent), Himachal Pradesh (35.20 percent), Gujarat (18.84 per cent), Bihar (15.44 per cent), Jammu & Kashmir (9.7 per cent) are in Zone-V. Most of Jammu & Kashmir (90.3 per cent), Himachal Pradesh (64.80 per cent), Bihar (65.12 per cent), and Uttarakhand (59 per cent) are in Zone-IV. Northeastern States score very high on both the earthquake hazard and earthquake risk index, even though low levels of vulnerability and exposure have lowered the risk level.

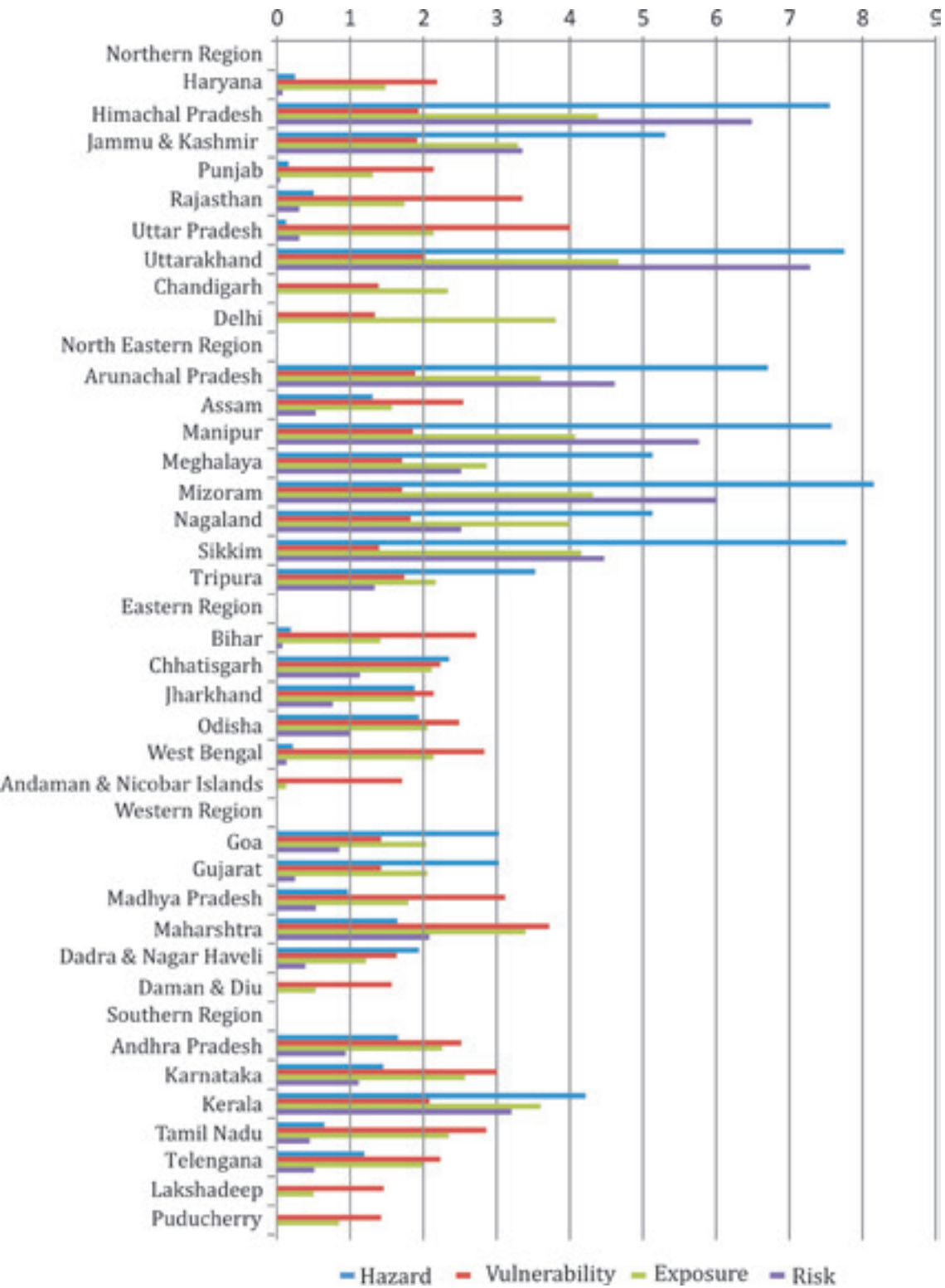
Figure 29: Earthquake Risk Index



Landslide Risk Index

Eleven Himalayan States (8 in the Northeast and 3 in Northwest) and two Western Ghat States (Goa and Kerala) account for more than 95 per cent of the high and very high-risk landslide zones of the entire country. The Himalayan States have landslide risk zone spread out in almost every district, whereas in the Western Ghats it is localized in a few districts only. Therefore, high level of vulnerabilities and exposures in west coasts and an overall risk level of landslides in these States are relatively low.

Figure 30: Landslide Risk Index

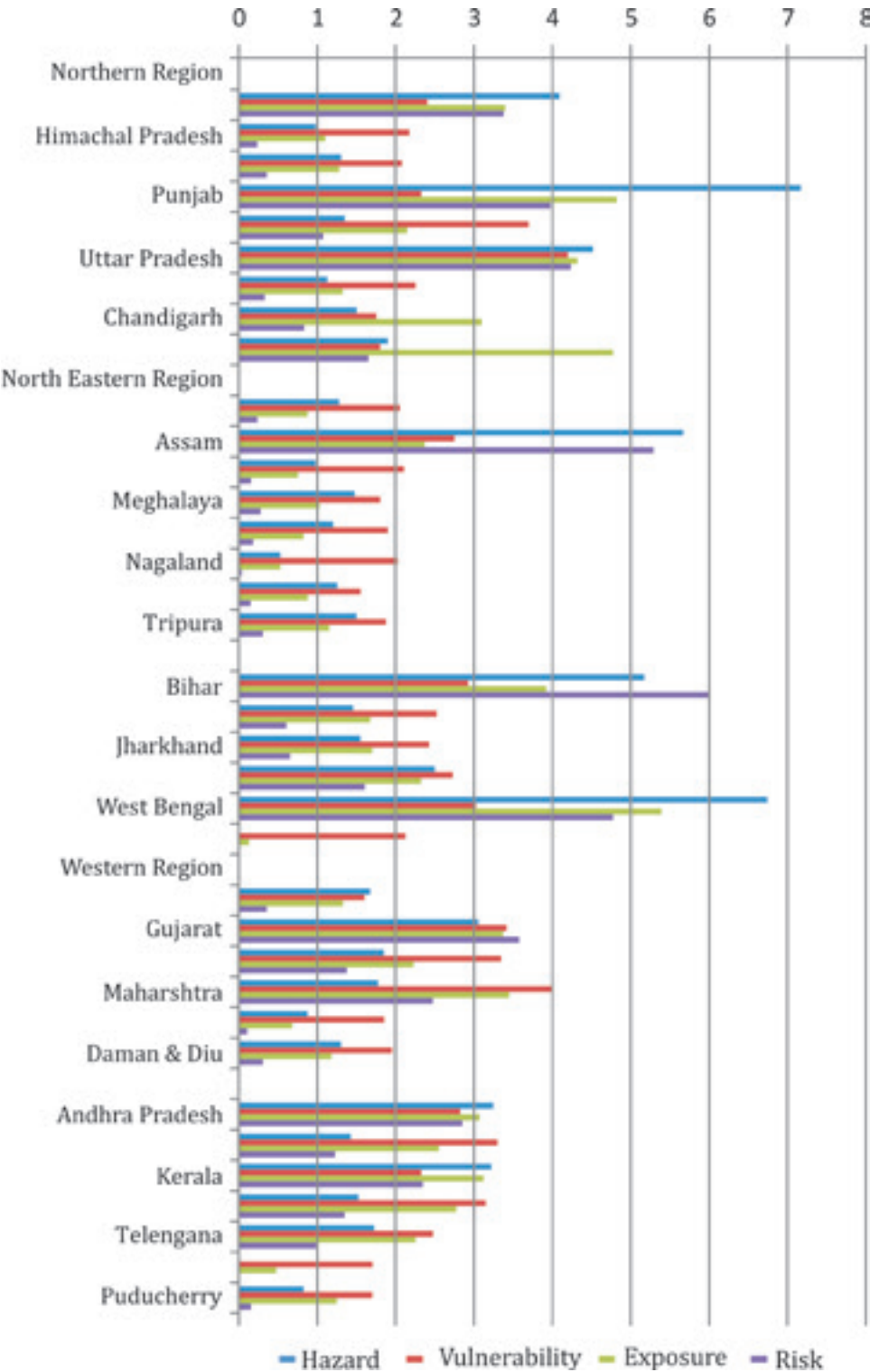


Flood Risk Index

CWC provided data on actual area flooded in different river basins in the country during 1953 to 2016, which was used to work out the average and maximum annual flooding in each State and UT. This data was supplemented by NRSC data on flood hazard zonation and urban flooding data from major cities to develop the flood hazard index. The riverine States of West Bengal, Bihar, Uttar Pradesh, Punjab and Assam score high in hazard ranking.

Some of the districts of Assam and Odisha score higher, but the overall index of the States is low as many districts in these States do not face the hazard of flood. Very high levels of vulnerabilities and exposures of population have jacked up flood risk levels of the State to much higher than the level of hazard.

Figure 31: Flood Risk Index

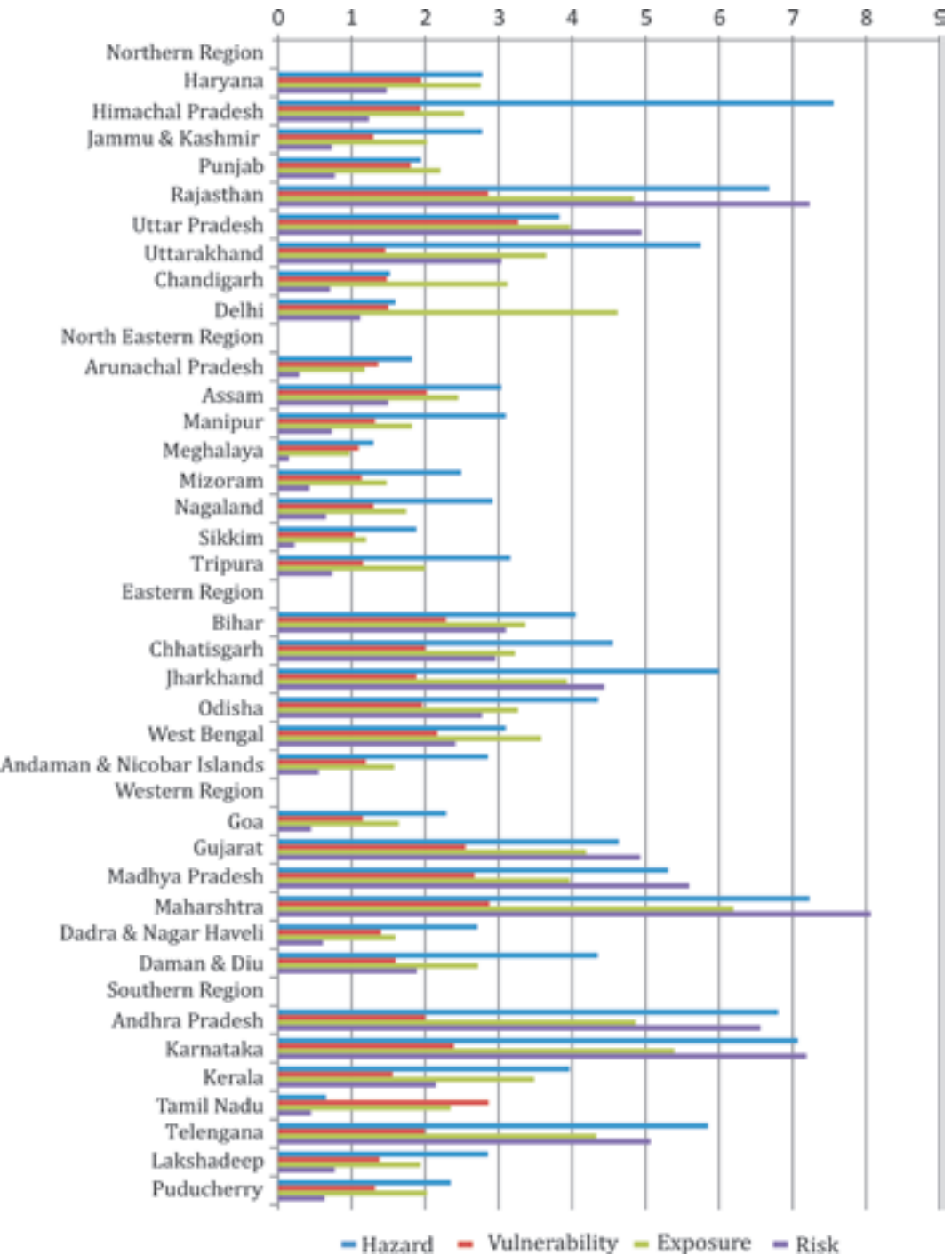


Drought Risk Index

Multiple parameters, such as moisture index, net cropped area, net area under irrigation, area declared as drought prone and number of drought years in a State have been used to develop the drought hazard index. North and North Western States of Maharashtra, Rajasthan, Madhya Pradesh and Gujarat and South and South Eastern States of Andhra Pradesh, Telangana, Karnataka and Tamil Nadu score very high on the drought hazard index. Like in the case of floods, there are disparities; there are districts in other States that are highly drought prone, but the law of averages keeps the overall State index low.

Importantly, high levels of vulnerabilities and exposures in States like Maharashtra, Karnataka and Rajasthan have raised the drought risk index of these States higher than the level of hazards.

Figure 32: Drought Risk Index

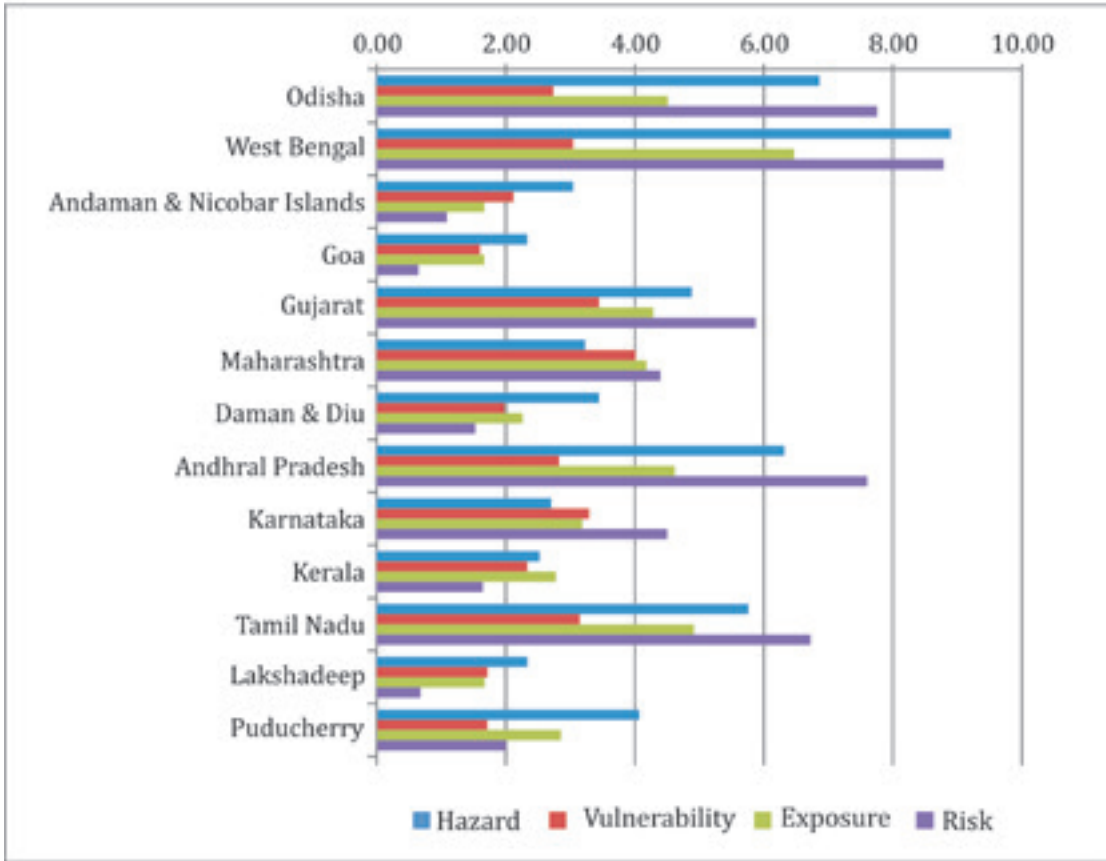


Cyclone Risk Index

Cyclone hazard index has been developed for 13 coastal States and Union territories on the basis of five parameters: number of cyclones, number of severe cyclones, height of storm surge, wind speed and level of precipitation. East Coast States of West Bengal, Odisha, Andhra Pradesh and Tamil Nadu have higher level of hazards than the West Coast States of Gujarat, Maharashtra, Karnataka and Kerala.

West Bengal scores highest on both the cyclone hazard and risk index. Like in other hazards, risk level of West Bengal gets accentuated due to higher level of vulnerabilities and exposures, particularly in its coastal districts, which have the highest density of population in the country.

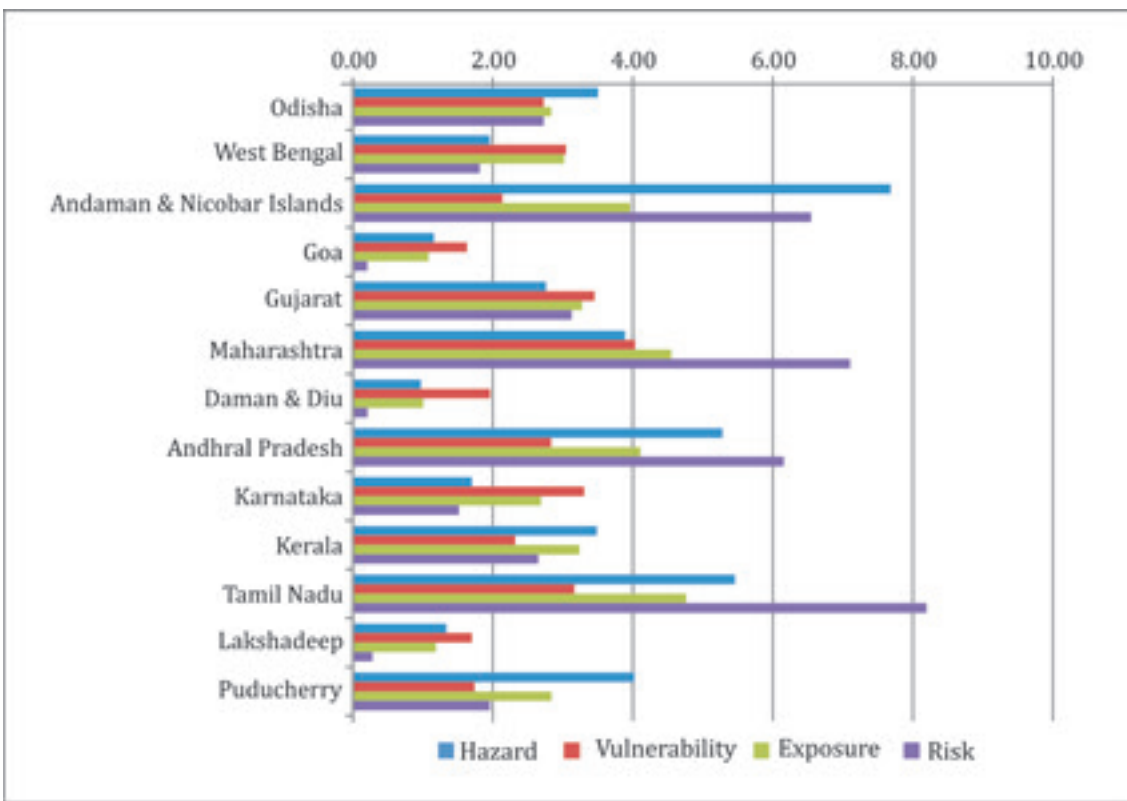
Figure 33: Cyclone Risk Index



Tsunami Risk Index

The hazard of tsunamis has been measured on three parameters: length of coastline, human settlements within half kilometers from the coasts and average height of tsunami waves. Andaman & Nicobar Islands have the highest Tsunami Hazard Index, but Tamil Nadu scores higher in Tsunami Risks due to higher level of vulnerabilities and exposures of the southern State.

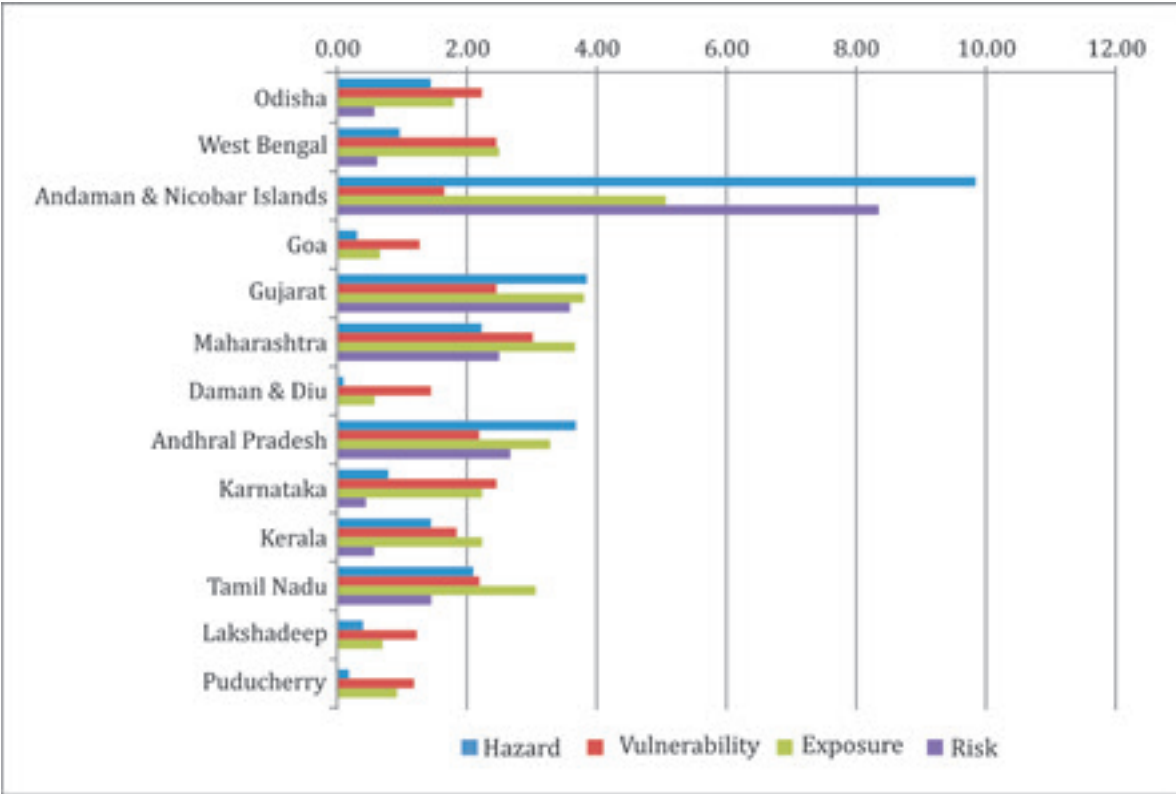
Figure 34: Tsunami Risk Index



Coastal Erosion Risk Index

All the 13 coastal States and Union Territories of India are facing an erosion of coastline due to various natural and anthropogenic processes. While coastlines have changed and coastal areas have been eroded, some gains have been made through accretion. Based on satellite imageries, such losses and gains have been measured and a relevant index has been developed to measure the hazards and risks of coastal erosion. On the basis of its assessment, the Andaman & Nicobar Islands has the highest risks of coastal erosion, followed by Andhra Pradesh, Gujarat and Tamil Nadu, as shown in the figure below.

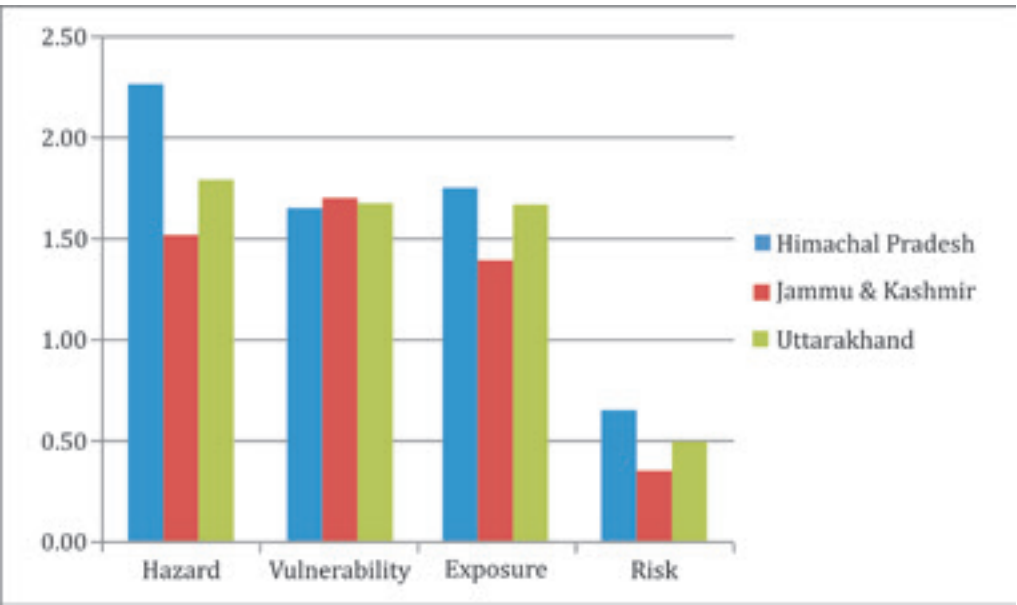
Figure 35: Coastal Erosion Risk Index



Avalanche Risk Index

Three Northwestern States, Himachal Pradesh, Jammu & Kashmir and Uttarakhand, face the hazards of avalanche. Himachal scores higher on both the hazard index and avalanche risk.

Figure 36: Avalanche Risk Index

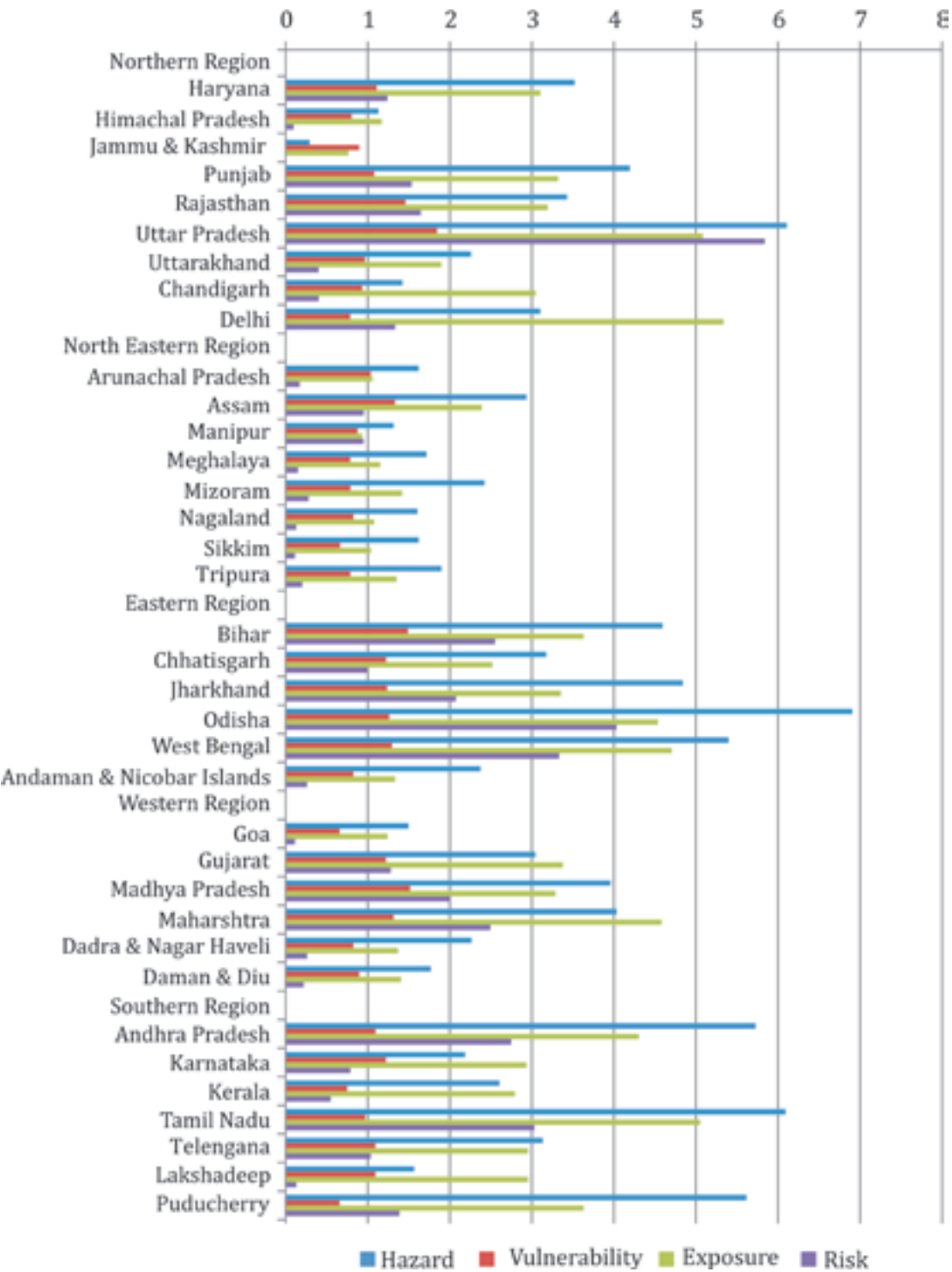


Heat Wave Risk Index

Based on the NOAA methodology of heat index, as endorsed by NDMA, heat index has been worked out on the basis of relative humidity and extreme temperature, recorded in IMD stations across the country during the past 20 years. This has been supplemented by a number of other parameters, such as number of heat waves and longest duration of heat wave, as per IMD methodology, to work out the composite heat wave hazard index of States and Union Territories. This is compounded by human vulnerabilities and exposures to measure heat wave risk index.

The top five States on the heat wave hazard index, from highest to lowest, are: Odisha, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, West Bengal and Jharkhand. The top States on the heat wave risk index are: Uttar Pradesh, Odisha, West Bengal, Tamil Nadu and Bihar.

Figure 37: Heat Wave Risk Index

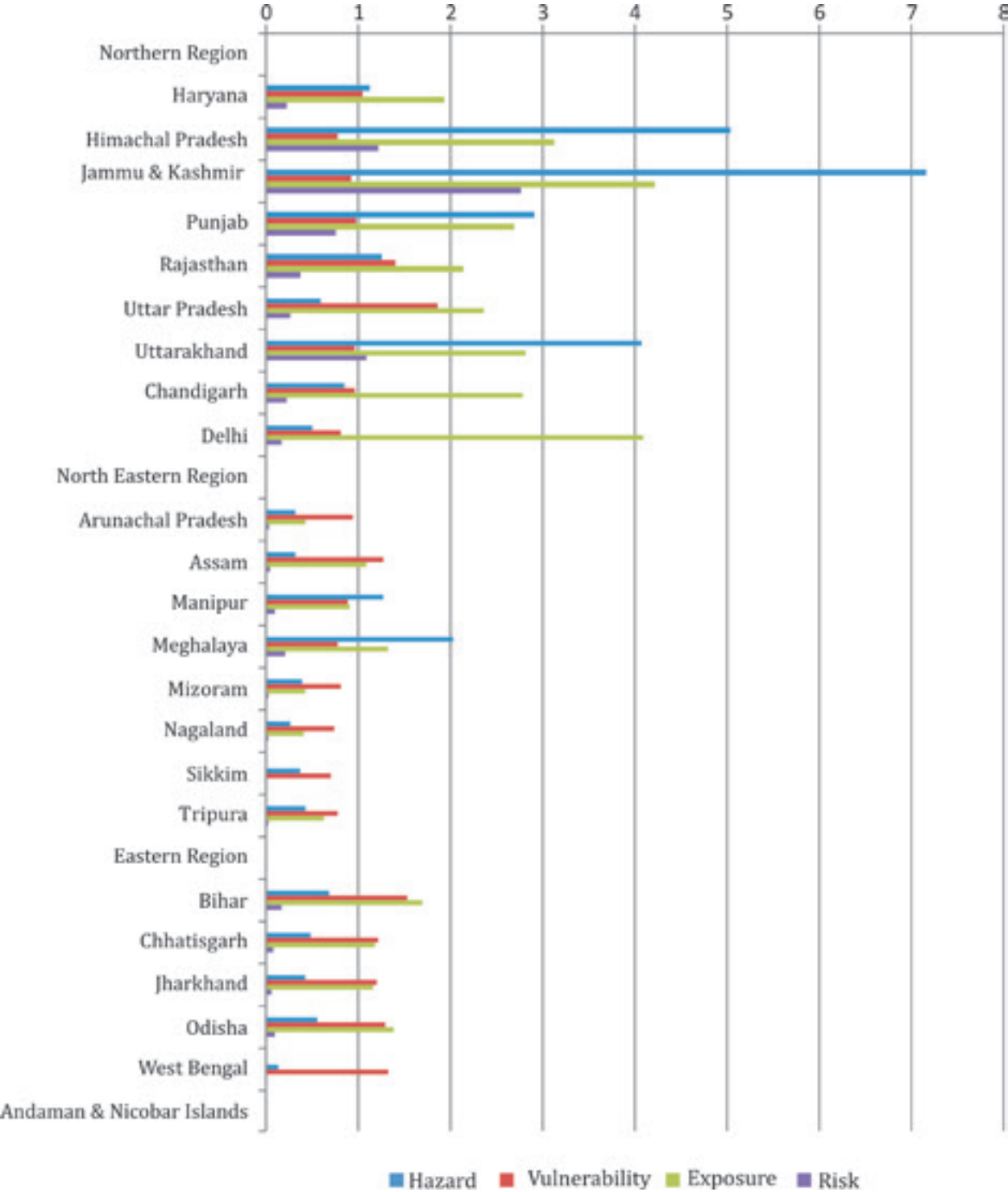


Cold Wave Risk Index

IMD has defined a cold wave as conditions when actual minimum temperature falls below 4°C in plain areas and - 4°C in hilly areas. Following that definition and based on the minimum temperature recorded in IMD stations all over the country during the past 20 years, cold wave hazard index has been developed for the States and Union Territories. This is compounded by human vulnerabilities to measure cold wave risk index.

Among the hilly States, Jammu & Kashmir, Himachal Pradesh and Uttarakhand score high on the cold wave risk index, while Rajasthan, Punjab, Haryana and Madhya Pradesh are high among the plains States.

Figure 38: Cold Wave Risk Index





Forest Fire Risk Index

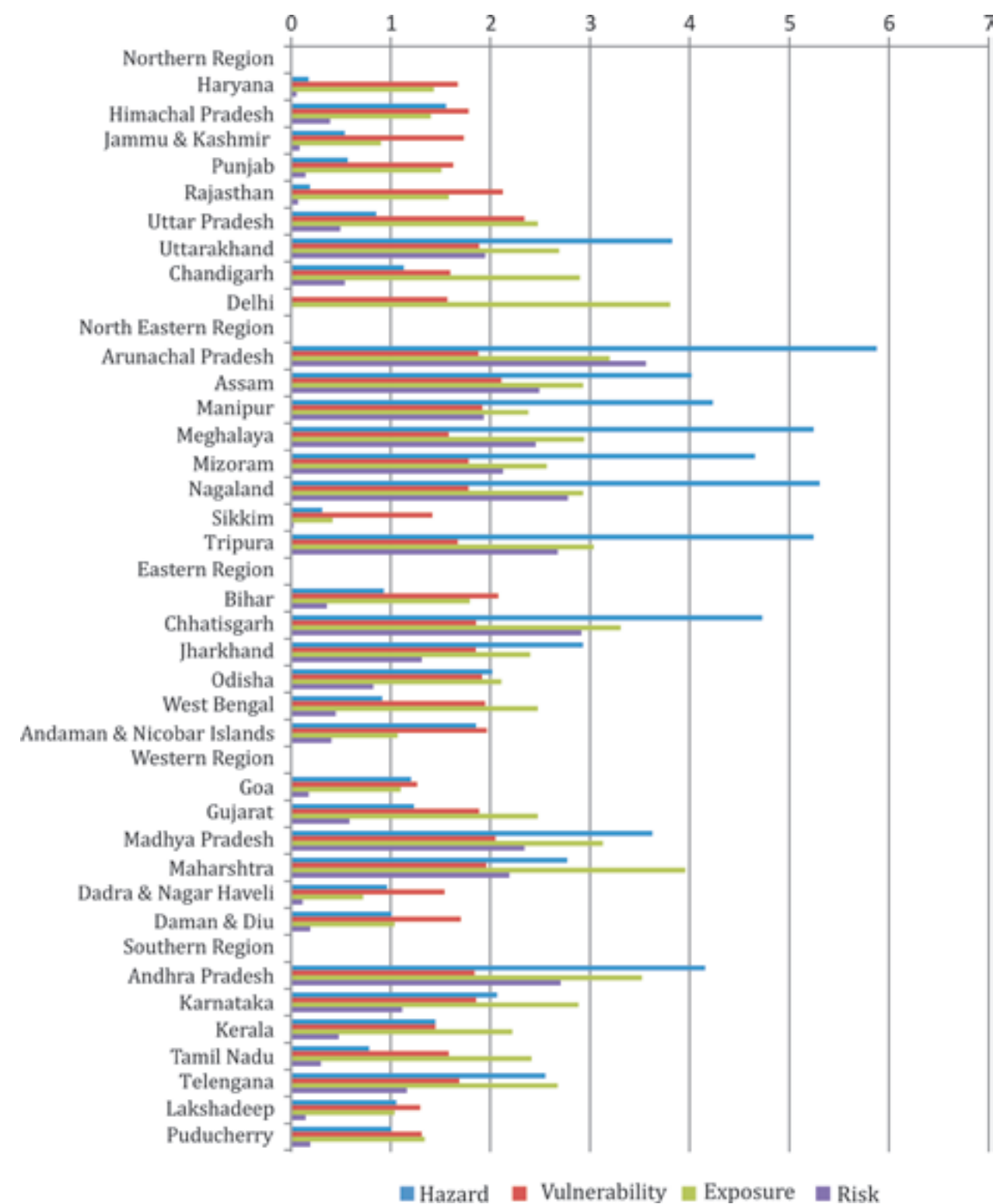
A total number of 134,225 incidences of forest fires were reported during 2004-2011 due to a variety of reasons, ranging from high temperature, low precipitation, shifting cultivation and human ingress into forest areas. Fifteen percent of total forest areas spread over 348 districts of the country are vulnerable to forest fire, of which 168 districts are highly vulnerable, 69 are moderately vulnerable and 111 districts are less vulnerable.

Northeastern States, which have a larger share of forest areas, have recorded a higher incidence of forest fires. Arunachal Pradesh tops the forest fire risk index, followed by Nagaland, Meghalaya, Tripura, Mizoram, Manipur and Assam. Among the northern States, Uttarakhand has the highest fire risk index, followed by Uttar Pradesh and Himachal Pradesh.

Central, south central and east central forests covering large areas of Madhya Pradesh, Chhattisgarh, Jharkhand, Maharashtra and Andhra Pradesh have been particularly vulnerable to forest fires. Human settlements and infrastructure within and adjoining these areas have enhanced the risks as well as the damaging potentials of forest fires.

Outside these main risk zones, forest fires have been sporadic in the remaining States of south, west and eastern India, limited mainly to open forests adjoining human settlements.

Figure 39: Forest Fire Risk Index

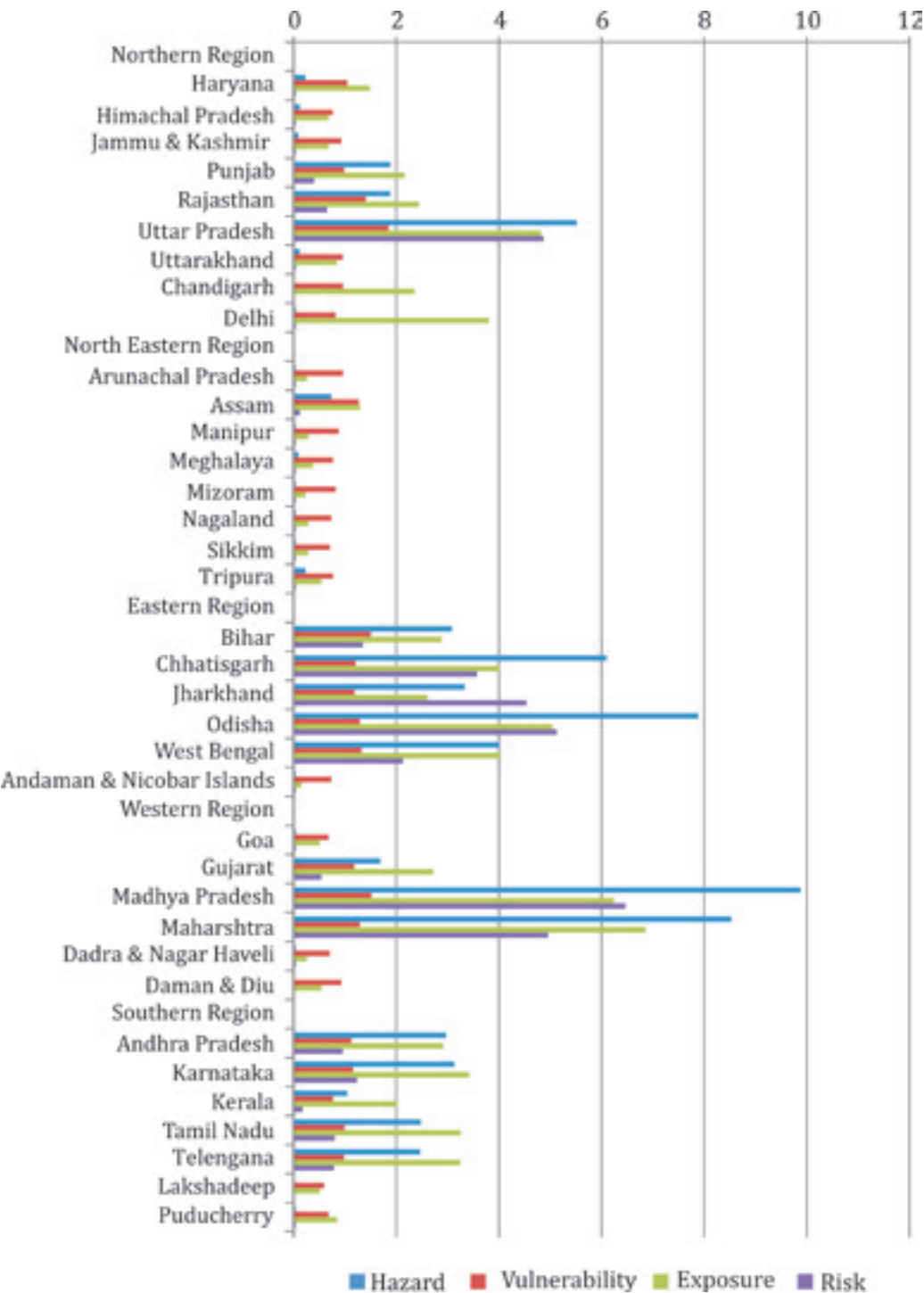


Lightning Disaster Risk Index

Lightning is an offshoot of a thunderstorm, and thus, States having a high incidence of thunderstorms are particularly vulnerable to the risks of lightning. Lightning kills people, damages buildings and infrastructure and may cause explosions leading to fire in vital installations. Considering the hazards, a Lightning Disaster Risk Index has been developed.

Madhya Pradesh displays the highest risks of lightning, followed by Odisha, Maharashtra, Jharkhand, Uttar Pradesh and West Bengal. Other States that are vulnerable to risks of lightning of varying magnitudes include Punjab, Karnataka, Tamil Nadu and Telangana.

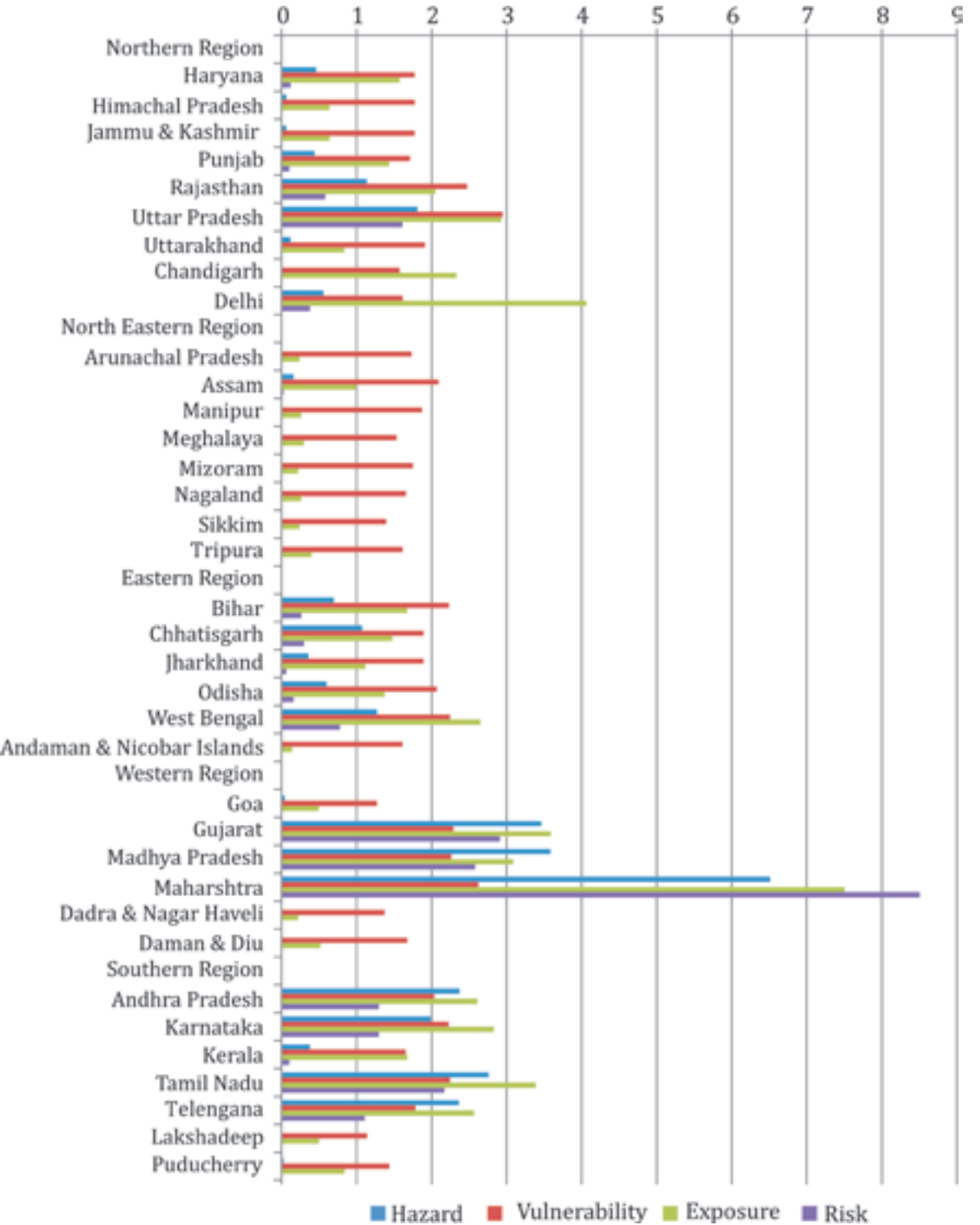
Figure 40: Lightning Risk Index



Fire Risk Index

Western India, being more urbanized, has a higher risk of fire. Maharashtra has the highest risks, followed by Gujarat, Madhya Pradesh, Tamil Nadu and Karnataka. Many thickly congested urban areas have high risks of fire that are better reflected on district risk tables than in State averages.

Figure 41: Fire Risk Index

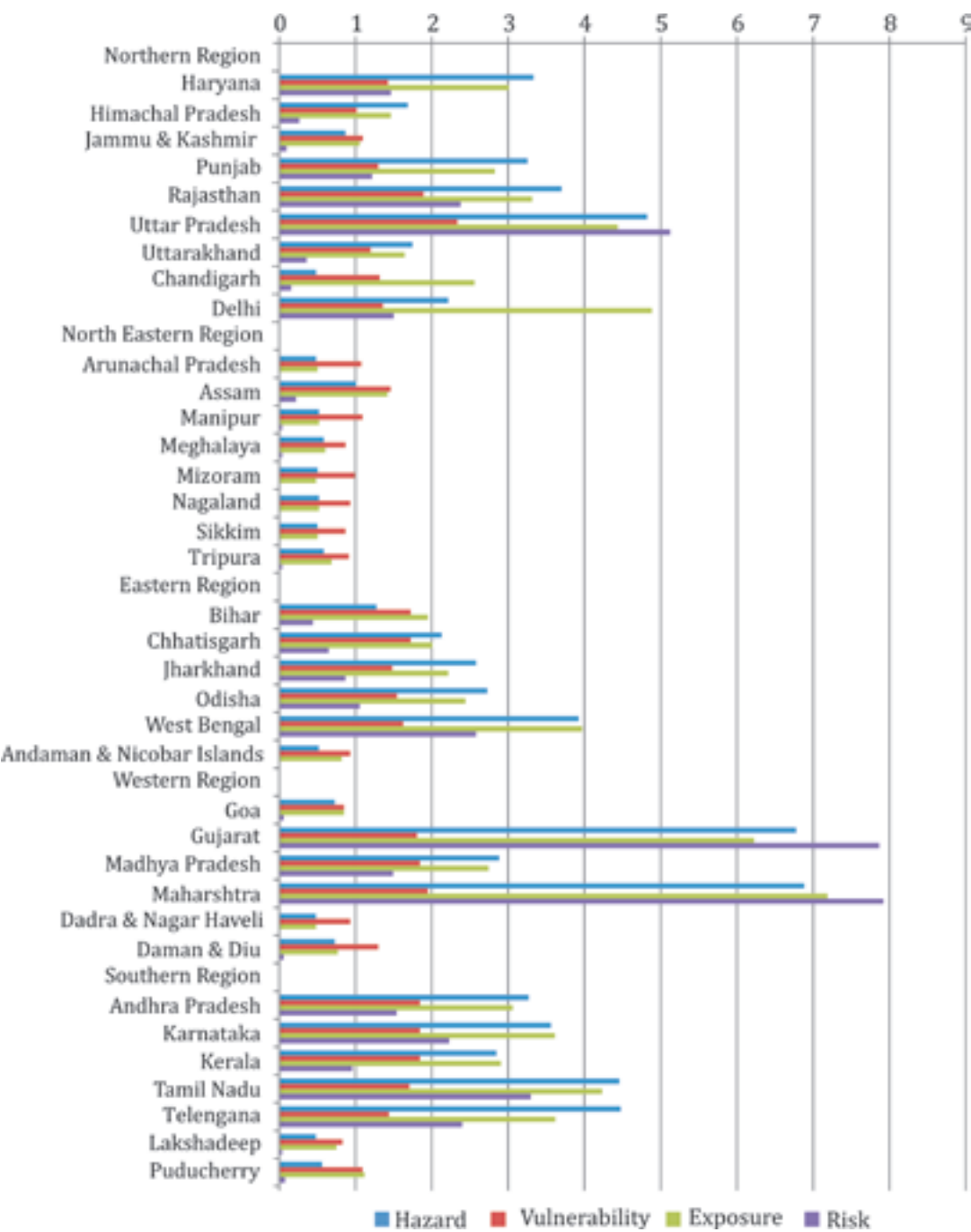


Industrial Disaster Risk Index

Number of Maximum Hazard Industries (MHI), Maximum Polluting Industries (MPI) and Comprehensive Environmental Pollution Index (CEPI) of major industrial clusters are the three indicators chosen for measuring the industrial hazard index of States. Human vulnerabilities and exposures have compounded the risks in many States.

West Indian States of Maharashtra and Gujarat are highest in both industrial hazards and the industrial disaster risk index. There are districts in West Bengal, Tamil Nadu, Telangana, Andhra Pradesh, Jharkhand, Uttar Pradesh, Punjab and Haryana which score very high on the industrial disaster risk index, but the average risk index of these States are relatively low as most of the remaining districts in these States display a low level of hazards and risks.

Figure 42: Industrial Disaster Risk Index



Composite Risk Index

Hazard specific risk indexes in respect of each of 14 hazards have been aggregated with weights to work out the Composite Risk Index. As discussed in Chapter 2 the following weights have been assigned to these hazards.

Table 28: Weights Assigned to hazards

Hazard	Weights assigned (%)	Hazard	Weights assigned (%)
Earthquake	15	Flood	15
Drought	15	Cyclone	15
Landslide	7	Heat wave	6
Tsunami	3	Lightning	6
Coastal erosion	3	Cold wave	3
Avalanche	3	Fire	3
Forest fire	3	Industrial hazards	3

Based on these weights assigned to hazard specific risks, the composite risks of disasters have been worked out as presented in the table below.

Table 29: Disaster Risk Index of States and Union Territories

	STATES / UNION TERRITORIES	Earthquake	Landslide	Flood	Drought	Cyclone	Tsunami	Coastal erosion	Avalanche	Heat wave	Cold wave	Lightning	Forest fire	Fire	Industrial hazards	Composite Disaster Risk Index
	Weights (%)>	15	7	15	15	15	3	3	3	6	3	6	3	3	3	100
	STATES															
1	Andhra Pradesh	1.88	0.95	2.86	6.56	7.61	6.15	2.67		2.78		0.96	2.71	1.32	1.57	3.56
2	Arunachal Pradesh	9.41	4.61	0.24	0.29					0.19	0.01	0.00	3.57	0.00	0.03	1.93
3	Assam	9.93	0.52	5.31	1.50					0.96	0.04	0.12	2.50	0.04	0.22	2.70
4	Bihar	7.57	0.08	6.00	3.10					2.58	0.17	1.35	0.35	0.28	0.45	2.78
5	Chhattisgarh	1.08	1.14	0.63	2.96					1.01	0.07	3.58	2.92	0.32	0.66	1.17
6	Goa	1.43	0.88	0.37	0.44	0.65	0.21	0.02		0.13		0.00	0.17	0.00	0.06	0.52
7	Gujarat	7.61	0.27	3.59	4.92	5.87	3.11	3.60		1.29	0.10	0.54	0.58	2.95	7.95	3.98
8	Haryana	3.45	0.08	3.39	1.47					1.26	0.23	0.04	0.04	0.14	1.49	1.39
9	Himachal Pradesh	6.09	6.47	0.25	1.24				0.66	0.11	1.20	0.01	0.39	0.01	0.26	1.67
10	Jammu &Kashmir	4.70	3.35	0.36	0.72				0.36	0.02	2.75	0.01	0.08	0.01	0.11	1.20
11	Jharkhand	1.70	0.78	0.66	4.42					2.10	0.06	4.53	1.31	0.09	0.88	1.54
12	Karnataka	1.99	1.14	1.24	7.18	2.89	1.53	0.43		0.81		1.24	1.11	1.32	2.27	2.40
13	Kerala	2.91	3.22	2.37	2.14	4.51	2.66	0.59		0.57		0.16	0.47	0.11	0.96	2.20
14	Madhya Pradesh	2.23	0.55	1.40	5.59					2.03	0.45	6.48	2.34	2.62	1.52	2.14
15	Maharashtra	4.96	2.09	2.50	8.05	4.42	7.10	2.53		2.52	0.13	4.95	2.19	8.57	8.01	4.44
16	Manipur	9.76	5.74	0.16	0.74					0.11	0.10	0.00	1.94	0.00	0.03	2.07
17	Meghalaya	8.93	2.51	0.29	0.14					0.16	0.21	0.00	2.47	0.00	0.03	1.67
18	Mizoram	8.89	6.00	0.20	0.42					0.29	0.01	0.00	2.13	0.00	0.03	1.93
19	Nagaland	8.97	5.37	0.06	0.65					0.15	0.01	0.00	2.78	0.00	0.03	1.92
20	Odisha	1.27	1.01	1.61	2.78	7.74	2.71	0.58		4.06	4.06	0.10	5.12	0.82	0.18	1.07
21	Punjab	3.81	0.04	3.98	0.77					1.56	0.75	0.40	0.14	0.12	1.24	1.47
22	Rajasthan	2.47	0.30	1.10	7.23					1.66	0.37	0.64	0.06	0.61	2.40	1.88
23	Sikkim	2.71	4.48	0.18	0.23					0.12		0.00	0.02	0.00	0.02	0.79
24	Tamil Nadu	2.43	0.45	1.37	5.01	6.71	8.18	1.45		3.06		0.79	0.29	2.21	3.34	3.06
25	Telangana	1.47	0.53	0.99	5.06					1.06		0.82	1.15	1.14	2.42	1.42
26	Tripura	9.08	1.33	0.34	0.73					0.21	0.02	0.01	2.67	0.00	0.04	1.71
27	Uttar Pradesh	6.96	0.10	4.26	4.94					5.88	0.26	4.89	0.49	1.64	5.19	3.31
28	Uttarakhand	7.03	7.28	0.35	3.04				0.50	0.43	1.09	0.01	1.94	0.02	0.36	2.22
29	West Bengal	5.65	0.13	4.78	2.41	8.78	1.82	0.61		3.37		2.12	0.44	0.80	2.61	3.77

UNION TERRITORIES																
1	Andaman & Nicobar Islands	8.13	0.00	0.00	0.54	1.10	6.53	8.39		0.27		0.00	0.39	0.00	0.02	1.94
2	Chandigarh	4.46	0.00	0.84	0.70					0.43	0.23	0.00	0.53	0.01	0.17	0.95
3	Dadra & Nagar Haveli	1.35	0.39	0.11	0.60					0.27		0.00	0.11	0.00	0.02	0.36
4	Daman & Diu	1.61	0.00	0.31	1.88	1.55	0.20	0.01		0.24	0.00	0.00	0.18	0.00	0.05	0.83
5	Delhi	5.44	0.00	1.66	1.11					1.36	0.16	0.01	0.00	0.40	1.51	1.37
6	Lakshadweep	1.33	0.00	0.00	0.77	0.68	0.27	0.04		0.15		0.00	0.14	0.00	0.03	0.44
7	Puducherry	0.60	0.00	0.18	0.62	2.03	1.96	0.02		1.41		0.00	0.18	0.01	0.07	0.67

The Composite Risk Index presents the combined risks of all hazards, including the vulnerabilities and exposures associated with the hazards.

A specific index of each of 14 hazards, 14 vulnerabilities and two exposures have been presented in the Statistical Appendices and explained in the preceding chapters. District-wise indexes were presented in an earlier study in three volumes. These provide a comprehensive picture regarding how hazards interact with vulnerabilities to create risks of disasters in each State and Union Territory.

It would be useful to read the Disaster Risk Index of States/ UTs in conjunction with that of the Hazard, Vulnerability and Capacity Index of the States/ UTs. Some of the States with a high index of hazards like Andhra Pradesh, Himachal Pradesh, Uttarakhand and Northeastern States have a relatively low risk index as the level of vulnerabilities in these States are comparatively low. States like Gujarat, Tamil Nadu, Assam, Tripura and Himachal Pradesh have a higher index of capacity, which has discounted the net risk of disasters in these States. States like Uttar Pradesh, Madhya Pradesh and Rajasthan have a high risk index despite having a lower hazard index due to high vulnerability and low capacity index.

The wealth of data presented in the report’s two Statistical Appendices can be used to determine the position of districts inter se and within each State with respect to each hazard, vulnerability, exposure and risk. Various permutations and combination of data can be used to compute risks of individual hazards such as earthquake, flood, drought, landslide etc. or a group of hazards like geological hazards, hydro-meteorological hazards, climate related hazards etc. Similarly, a regional pattern of disaster risks can be worked out to highlight levels of risks in various regions of the country and within different regions in large States.

The data can be visualized in GIS platform to generate hazard, vulnerability, exposure and risk maps of States/ UTs, districts and regions on each indicator. Risks can be measured, compared and ranked in dashboards. This would provide a powerful tool of risk analysis to policymakers, administrators, practitioners and researchers.

PART III: Building Resilience In The Face Of Disasters

Methodology and Data

Risk Assessment

Risk Prevention and Mitigation Risk Governance

Disaster Preparedness

Disaster Response

Disaster Relief and Rehabilitation Disaster Reconstruction

Disaster Resilience Index

METHODOLOGY AND DATA

Methodology

UNDRR has defined resilience as ‘the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner’. There is no consensus among experts, however, regarding what constitutes such abilities.

Broadly, there are three layers of resilience: first, the societal layer, which include capacities of individuals, families, neighborhood, communities and the culture that have developed through experience and wisdom over generations; second, the layer of government, which consists of institutions, systems, regulations, processes, programs and activities which support and strengthen the societal layer; and the third layer, the support system when the capacity of the government is overwhelmed by the magnitude of disasters. In the context of a large federal country like India, the support system is very crucial for the constituent States and UTs.

In this study, we are essentially looking at the second layer—the systems, institutions, processes, programs and activities of the state governments and UT Administration in building resilience as per the national and global frameworks of disaster risk management. The study does not examine resilience at the level of society, nor does it look at the support system of central government or its agencies or at the resilience of the national disaster management system.

There is hardly any database on the initiatives of the States/UTs in building resilience in the face of disasters. Therefore, this database had to be constructed on the basis of information collected from the State Governments and UT Administrations through comprehensive set of questions on different aspects of disaster risk management.

Developing questionnaires on resilience required a selection of issues on which questions were to be framed. A clear consensus emerged during the process of consultations with expert working groups and regional workshops: that there are seven pillars of resilience upon which the questionnaire might be structured.

These are: (a) Risk Assessment; (b) Risk Prevention and Mitigation; (c) Risk Governance; (d) Disaster Preparedness; (e) Disaster Response; (f) Disaster Relief and Rehabilitation; and (g) Reconstruction. These are very well-aligned with the national and global frameworks on disaster risk management. There was further consensus that the catalogue of activities to be performed at the State level under national and global frameworks on disaster risk management (as detailed in Annexure I and III) should form the basis of questions on resilience.

Accordingly, seven pillars of resilience were accepted as seven aggregate indicators of Disaster Resilience Index. Each of these aggregate indicators was further disaggregated into ten indicators, making for a total of 70 indicators on disaster risk resilience at the level of the States and UTs.

Table 30: Indicators of Disaster Resilience Index

Aggregate Indicator	Indicators
Risk Assessment	1. Hazard Vulnerability Risk Assessment 2. Digital Risk Mapping in Public Domain 3. Real-Time Data on Risks and Disasters 4. Micro-zonation of Earthquake Risks 5. Flood Risk Assessment 6. Drought Risk Assessment 7. Dissemination of Risk Information to People 8. Assessing Traditional and Local Knowledge 9. Assessing Patterns of Emerging Risks 10. Developing Database on Disasters
Risk Prevention & Mitigation	1. Disaster Risk Mitigation Projects 2. Mainstreaming DRR in Development 3. State and Disaster Risk Mitigation Fund 4. Safety standards for construction/ land use plans 5. Safety audit/ retrofitting of life line structures 6. Construction of cyclone/ flood shelters 7. Ecosystem Approach for Disaster Risk reduction 8. Social Safety Net for Poor and Vulnerable 9. Mitigating risks of heritage 10. Integration of climate change adaptation with DRR
Risk Governance	1. Institutional mechanisms for risk governance 2. Disaster Management Policy and Plans 3. Disaster Management Manuals and Procedures 4. Decentralisation and Devolution of Functions 5. Community Involvement and Participation 6. Multi-Stakeholder Platform 7. Training and Capacity Development 8. Enforcement and Compliance 9. Transparency and Accountability 10. Monitoring and Evaluation System
Disaster Preparedness	1. End-to-End Early Warning Systems 2. Emergency Operation Centres 3. Disaster Communication System 4. Emergency Medical Preparedness 5. Scenario Building, Simulation and Mock Drills 6. Contingency Plans, SOPs, Manuals 7. Community-based Disaster Preparedness 8. Awareness Generation 9. Resource Inventory 10. Media Partnership
Disaster Response	1. State agencies for disaster response 2. Incident Response System 3. Coordination with GOI, NDRF, Armed Forces 4. Evacuation, Search and Rescue 5. Emergency Medical Response 6. Emergency Support Functions 7. Protection of Women and Children 8. Disposal of dead bodies 9. Disposal of Animal Carcasses 10. Disposal of Debris

Disaster Relief & Rehabilitation	1. Minimum Standard of Relief 2. Ex-gratia Relief 3. Relief Logistics and Supply Chain Management 4. Food and Essential Supplies 5. Drinking Water, Dewatering and Sanitation 6. Health and Mental Health Care 7. Management of Relief Camps 8. Veterinary Care 9. Relief Employment 10. Temporary and Intermediary Shelters
Disaster Reconstruction	1. Damage and Loss Assessment 2. Post-disaster Need Assessment 3. Financing Reconstruction 4. Institutional mechanisms for reconstruction 5. Building Back Better 6. Reconstruction of houses 7. Reconstruction of infrastructure 8. Regeneration of ecology and environment 9. Livelihood Reconstruction 10. Learning from reconstruction and recovery

As all the seven aggregate indicators are not equally important for building resilience to disasters, it was imperative that relative weights were assigned to these indicators. A consensus emerged through the process of consultation, regarding the assessment of the seven aggregate indicators, as detailed on the following table.

Table 31: Weights of Indicators on Disaster Resilience

Aggregate Indicators	Weights
Risk Assessment	10%
Risk Prevention & Mitigation	20%
Risk Governance	20%
Disaster Preparedness	20%
Disaster Response	10%
Disaster Relief & Rehabilitation	15%
Reconstruction	5%

Benchmarks for resilience

It was necessary to set up benchmarks or standards to be achieved over a period of time around each of the indicators, so that the actual conditions could be compared with the ideal situations on a temporal scale. There are national and international standards of disaster resistant technologies and practices, especially in construction related activities. A new ISO standard for emergency management has also been developed¹¹², but there no commonly accepted standards or benchmarks on most of the indicators of disaster management.

Therefore, a consensus was developed through a process of consultations, regarding what the benchmarks should be on each of the indicators in accordance with national vision of building a disaster-resilient India. The following benchmarks were agreed upon.

112 ISO 223201-2011: Societal Security and Emergency Management.

Table 32: Benchmarks on Indicators of Disaster Resilience

	Indicator	Benchmarks
1.	Risk Assessment	State/State/ UT has conducted Hazard Vulnerability Risk Assessment (HVRA) in high resolution; digitized the risk maps, and made these available, along with real time data in the public domain for information and use of all stakeholders; conducted Hazard Vulnerability Risk Assessment (HVRA) in high resolution.
2.	Risk Prevention & Mitigation	State/ UT has developed an action plan for mitigating the risks of disasters and allocated resources for implementation of the plan in a phased manner;State/ UT has further mainstreamed Disaster Risk Reduction into all programmes, activities and projects across all development sectors and at all levels.
3.	Risk Governance	State/UT has activated disaster management institutions;developed and updated DM Plans at all levels;allocated resources for the implementation of the plans in an inclusive, participatory and non-discriminatory manner and set up a strong and effective monitoring and evaluation framework.
4.	Disaster Preparedness	State/UT has an End-to End Early Warning System, well-equipped and functioning Emergency Operation Centre, SOPs and Contingency Plan and trained personnel to respond effectively to disasters as an End-to End Early Warning System, well-equipped and functioning Emergency Operation Centre, SOPs and Contingency Plan and trained personnel to respond effectively to disasters.
5.	Disaster Response	State/UT has a well-coordinated mechanism to respond, along with itscommunities, to events of disaster; toevacuate people to safe places, search and rescue the affected and provide them emergency health care to minimize loss of lives.
6.	Disaster Relief & Rehabilitation	State/ UT has established a system for providing immediate relief to the affected people, including food, clothing, shelter, medical care etc. and extending necessary assistance for their rehabilitation, socially and economically.
7.	Disaster Reconstruction	State/UT seizes every disaster as an opportunity to build back better the houses, infrastructure, livelihood and environment of affected communities

Data on resilience

Data on resilience had to be created through collection of information from the States and Union Territories on various aspects of resilience. Such information was collected on the basis of a Questionnaire, comprising of 172 questions on 70 indicators on resilience.

The questions were framed to elicit basic information in binary format, and further probing questions were asked to obtain detailed information to be supported by means of verification. The questions were revised and refined based on the inputs received during the process of consultations. (The final Questionnaire on Disaster Resilience is annexed— IV.)

The information collected through the Questionnaire was supplemented with information available in various

other documents of the State Government and their agencies, including the documents referred to in responses to the questions. This was done to tide-over the varying levels of responses from the state governments.

The questions were broken into components and norms were developed for evaluating resilience on each component in quantitative terms, based on information collected from responses to the Questionnaire and other sources. Values of 50 were assigned to a set of 10 indicators under each of seven aggregate indicators, making up a total value of 350. (A copy of the norms for evaluation of the responses received from the States is annexed—IV.)

Scores obtained by the States/UTs were rescaled as per weights given on aggregate indicators, as explained in the chapter on methodology. This was further rescaled to: (a) 10 to measure ‘capacity’ for working out Disaster Risk Index and (b) 100 to measure ‘resilience’ for working out Disaster Resilience Index.

RISK ASSESSMENT

Risk assessment marks the starting point of disaster risk management, as unless there is clear and comprehensive understanding of the risks of disasters, subsequent tasks of reducing risks through prevention, mitigation and preparedness cannot be accomplished effectively. Yet, this basic task is often the most difficult and challenging, for a number of reasons.

First, understanding risks is a highly technical task that involves observation, data collection and analysis of hazards, vulnerabilities, exposures and capacities, and the complex manners in which these interact with each other in space and time to create risks of disasters. Risk assessment is a highly multi-disciplinary exercise involving space sciences (satellite observations, remote sensing and GIS etc.), earth sciences (geology, seismology, meteorology, hydrology, oceanography etc.), engineering sciences (buildings, infrastructure, communication systems etc.), social sciences (geography, sociology, demography, economics etc.), environmental sciences (forestry, ecology, environment etc) and many other branches of knowledge and the integration of information and knowledge across all sciences.

Second, risk assessment is dynamic, as patterns of risks are changing due to impacts of both extraneous factors like global warming, climate change (with impacts on temperature, precipitation, sea level rise etc), and changes in demographic pattern (numbers, age structure, dependency ratio etc) as well as intrinsic factors like the process of development that may either create new risks or reduce existing risks of disasters. Compounding and discounting the dynamics of risks is a continuous process and is by no means an easy task.

Third, risk assessment is a highly specialized task that cannot be undertaken unless data on hazards, vulnerabilities and exposures are available in different spatial and time scales, which is extremely difficult in most of the countries. The tasks of integrating and analyzing the data are carried out through modelling, computation and other advanced tools of research, which is even more difficult in most situations.

Not many national governments or institutions in the world have the capacity of nation-wide comprehensive

risk analysis in high resolution with multiple parameters of hazards, vulnerabilities and exposures. Capacity of sub-national governments have been even limited.

Global Assessment

Considering the importance as well as the challenges of risk assessment, both the Hyogo Framework of Action 2005-2015 and the Sendai Framework for Disaster Risk Reduction2015-2030 have given priority to risk assessment for reducing risks and building resilience to disasters. The Hyogo Framework adopts risk assessment and monitoring as the second out of five priorities of action and identifies three key activities for risk assessment at the national and local levels. These are:

- a) Development, periodic updating and wide dissemination of risk maps and related information to decision-makers, the general public and communities at risk;
- b) Development of risk indicators at national and sub-national scales that will enable decision-makers to assess the impact of disasters;
- c) Analysis of statistical information on disaster occurrences, impacts and losses on a regular basis.

In addition, regional cooperation for assessment of trans-boundary hazards through exchange of information, research and early warnings were highlighted as a key activity of risk assessment.

The Sendai Framework made ‘Understanding Risks’ the first among its four priorities of action, and prescribed a series of 15 activities to be undertaken at national and local levels, and nine at the global and regional levels. The new elements of risks assessment that were introduced are the following:

- a) Real-time access to reliable data, making use of space and in situ information, including GIS, and ICT innovations for collection, analysis, and dissemination of data;
- b) Dialogue and cooperation among scientific and technological communities, policymakers and other relevant stakeholders to facilitate a science-policy interface;
- c) Use of traditional, indigenous and local knowledge and practices to complement scientific knowledge in disaster risk assessment;
- d) Investments in innovation and technology development in long-term, multi-hazard and solution-driven research in disaster risk management; and
- e) Regional and international cooperation for sharing of data and transfer of technology including communication, geospatial and space-based technologies and related services.

Based on the mandates of the global frameworks on disaster risk reduction, UNISDR in collaboration with leading scientific institutions, UN agencies, development banks and national governments, developed an open Risk Data Platform for profiling risks of disaster of countries. In the absence of any national database on disasters in India,

EM-DAT database¹¹³ for the period 1990-2014 was used to work out the Average Annual Loss (AAL) of disasters. This was pegged at US\$ 9,825 million, registering 0.52% of the GDP of the country.¹¹⁴

In terms of frequencies and economic losses, floods clearly stand out as the most important disaster in India, contributing as much as 59.4% of all disasters and 66.3% of economic losses. Earthquakes comprised of only 3.7% of total disasters but accounted for 41.7 % of total mortalities.

Table 33: Risk Profile of India: 1990 – 2014 (% of total)

Hazard	Frequency	Mortality	Economic Losses
Earthquake	3.7	41.7	7.1
Flood	59.4	31.0	66.3
Drought	-	-	2.8
Storm	22.7	16.7	23.1
Landslide	9.4	-	-
Extreme Weather	-	8.8	-
Others	2.3	1.8	0.7

Source: Global Assessment Report 2015

Probable Maximum Loss (PML) of four disasters—earthquake, cyclonic wind, storm surge and tsunami—was also worked out for mean return periods of 100 to 1500 years. In a 100 year scenario, PML of cyclonic wind and storm surge was shown almost 10 and 4 times higher than that of the earthquake.¹¹⁵

Note: This study has its obvious limitations as it excludes multi-hazard framework in the analysis of both AAL and PML, and, further, it is not backed by any authentic database on disasters.

Vulnerability Atlas of India

Vulnerability Atlas of India is the only pan-Indian study of disaster risk assessment in India. The study was initiated by the Building Materials and Technology Promotion Council (BMTPC), an agency of Ministry of Urban Development of Government of India, following the publication of Census 1991 data on buildings in India based on predominant materials used for construction of roofs and walls. This data was collected, for the first time ever during the Census, at the request of Ministry of Urban Development to assess the vulnerability of the built environment of India.

BMTPC brought together experts and concerned scientific and technical agencies (IMD, GSI and CWC) to map the entire land mass of the country that are prone to four different natural hazards—earthquake, landslides, wind and flood—and to assess the vulnerability of buildings of various types in each hazard zone of the country. Based on these hazard maps and vulnerability assessment of buildings, State-wise hazard maps and district-wise damage risk tables of houses were prepared for all the census districts of the country. The first edition of

113 EM-DAT (Feb. 2015) : The OFDA/CRED - International Disaster Database, Université catholique de Louvain Brussels – Belgium, <http://www.emdat.be>.

114 UNISDR, Global Assessment Report on Disaster Risk Reduction (2015), Country Risk Profile: India, <https://www.preventionweb.net/english/hyogo/gar/2015/en/home/data.php?iso=IND>.

115 In a mean return period of 100 years, the PML of the earthquake is calculated at USD 2773 million, while the cyclonic storm is USD 20,139 and storm surge USD 4523. The methodology of the calculation is not disclosed.

the Vulnerability Atlas of India was published in 1996 and the second edition was released in 2006, updating both the hazard maps and the housing stock, based on latest available knowledge on hazards and Census 2001 data on buildings. The third edition of the atlas, expected to be released in 2016, is not finalized as yet.

The Vulnerability Atlas of India continues to remain the basic document on risk assessment in India. The national policies, plan and guidelines on disaster management have drawn from this atlas, as have the State policies and plans and the downstream plans of departments and districts.

Notwithstanding the seminal contribution of Vulnerability Atlas in shaping disaster management policies and plans of action, the limitations of the atlas are hard to overlook. First, although known as the vulnerability atlas, it has covered only one aspect of vulnerability. Analysis of building vulnerabilities is limited to studying predominant materials used for construction of building walls and roofs, while other parameters such as structural designs, foundations or quality of construction and maintenance are not factored in, as it is impossible to get datasets at this level of detail on a nation-wide scale.

Importantly, other aspects of vulnerabilities, such as vulnerable physical and social infrastructure, production systems and environment, and above all, vulnerable population, are not considered in the study. Secondly, only four hazards are included in the study. Other important hazards like drought, tsunami, avalanche, heat and cold wave, forest fire and manmade hazards like fire and industrial hazards, are not considered in the study. Thirdly, hazard mapping has been carried out at a very coarse resolution, which may be good for a broad overview of hazards at national level but may not be adequate to assess risks at a local level, which would be much more complex.

Again, hazard zonation has been used for the earthquake and partly for the landslide, but no such zonation has been used for the cyclone and flood to assess the intensities of these hazards.

Road map for risk assessment

Therefore, comprehensive assessment of risks of disasters calls for much more detailed study and analysis. National Policy on Disaster Management 2009 laid down the following road map for risk assessment:

Hazard zonation, mapping and vulnerability analysis in a multi-hazard framework will be carried out utilizing Geographic Information System (GIS)-based databases such as the National Database for Emergency Management (NDEM) and National Spatial Data Infrastructure (NSDI). As a first step towards addressing disaster vulnerabilities, Central Ministries and Departments, National agencies, knowledge-based institutions and DM authorities at the State and District levels need to carry out risk and vulnerability assessment of all disaster-prone areas. Hazard zonation mapping and vulnerability analysis based on GIS and remote sensing data need to mandatorily include a ground check component.

NDEM is a web based geo-spatial repository of data on natural hazards like flood, cyclone, landslide, earthquake, forest fire and drought developed by the National Remote Sensing Centre (NRSC) of the Indian Space Research Organisation.¹¹⁶ Launched in 2013, the portal has been upgraded with additional features like disaster

¹¹⁶ <https://ndem.nrsc.gov.in>

dashboard, alerts and warning, incident reporting, data inventory etc. High resolution satellite imageries of emerging, live and post-disaster situations are extremely useful for decision in emergency situations, but in the absence of ground level data on vulnerabilities, exposures and capacities, NDEM has obvious limitations for risk assessment, even though it provides a powerful tool for assessing the dynamics of hazards on a real time basis.

NSDI was envisioned as a common platform on which to integrate spatial data on topography, geology hydrology, soil, vegetation, settlement etc.¹¹⁷ which would eventually provide digital layers for GIS based analysis of risks. But the portal has not been very effective in facilitating risk assessment, as data is available on a limited number of layers, based primarily on satellite observations.

The National Plan on Disaster Management 2016 identified the following five thematic areas of risk assessment:

- a) Observation Networks, Information Systems, Research and Forecasting;
- b) Zoning and Mapping;
- c) Monitoring and Warning Systems;
- d) Hazard Risk Vulnerability Assessment; and
- e) Dissemination of Warnings, Data and Information

The National Plan prescribed the activities to be undertaken by various agencies of the Central and State Governments on each of these thematic areas in respect of eight natural hazards—cyclone and wind, floods, urban flooding, seismic, tsunami, landslides and snow avalanches, drought and cold wave and frost—and three manmade hazards—industrial disasters, nuclear and radiological emergencies and fires.

Most of the activities of the first three thematic areas (observation and forecasting, zoning and mapping and early warnings) are to be undertaken by various scientific and technical agencies of Government of India, with State Governments providing support and coordination for the smooth functioning in the agencies in the respective States. Activities for the last two thematic areas (hazard risk vulnerability assessment and dissemination of early warnings) are to be undertaken jointly the Central and State Governments.

Hazard Vulnerability Risk Assessment (HRVA) lies at the heart of risk assessment. The National Plan has outlined the responsibilities of the Central and State Governments for HRVA uniformly for all the hazards, as per the following table.

Table 34: Responsibilities of Central and State Governments for HRVA

Thematic Area	Responsibility of Central Government	Responsibility of State Governments
Hazard Risk Vulnerability Assessment	• Promote studies, provide guidelines • Studies on vulnerability covering social, economic, ecological, gender, and equity aspects • Change in vulnerability and risk under climate change scenarios	Undertake HRVA as part of preparation and periodic revision of DM plans, and for development planning

Source: National Plan on Disaster Management 2016

¹¹⁷ <https://nsdiindia.gov.in/nsdi/nsdiportal/index.jsp>

Various scientific and technical agencies of Government of India have conducted studies on most of the natural and human induced hazards of India. Despite the limitations of some of these studies on issues related to resolution, zonation, coverage etc, as discussed in detail in Chapter 3, these studies provide a good database on the probability of hazards in different geographical areas of the country. Similarly, data on various dimensions of physical, social, economic and environmental vulnerabilities are available from multiple agencies of the Central Government, even though there are shortcomings in some of these data regarding risk analysis. Data on exposures can be inferred from the demographic and economic data, but data on the capacity of institutions, communities and individuals to deal with disasters is extremely scarce.

There have been studies on how hazards, vulnerabilities, exposures and capacities interact in different space and time to create risks of disasters, but most of these studies have been limited to a few hazards and vulnerabilities and confined to the limited space of cities or isolated communities. The only pan-India HRVA study is the Vulnerability Atlas of India that has taken four natural hazards (earthquake, landslides, flood, cyclone and wind) and one vulnerability (buildings based on materials used for construction of walls and roofs) to analyze the risks of built environment in different conditions of these hazards.

Therefore, it would not be very unfair to conclude that a comprehensive assessment of hazards, vulnerabilities and risks of disasters, as envisioned in the National Policy and laid down in the National Plan, still remains an unfinished task of disaster management in India.

State Initiatives

Initiatives of the State Governments for assessing the risks of disasters have mostly been limited to Hazard Risk Vulnerability Assessment as part of the preparation of the State Disaster Management Plan. Several State Governments have taken other initiatives on risk assessment, such as risk mapping, real time access to risk information, dissemination of risk information to people, special hazard-based risk assessment, assessment of emerging risks, developing data base on disasters etc. Considering global frameworks, national policy and national plan, the following 10 indicators have been selected for measuring the progress of risk assessment in the States.

- 1) Hazard Risk Vulnerability Assessment
- 2) Digital Risk Mapping in Public Domain
- 3) Real Time Data on Risks and Disasters
- 4) Micro-zonation of Earthquake Risks
- 5) Flood Risk Assessment
- 6) Drought Risk Assessment
- 7) Dissemination of Risk Information to People
- 8) Assessing Traditional and Local Knowledge
- 9) Assessing Patterns of Emerging Risks
- 10) Developing Database on Disasters

Hazard Risk Vulnerability Assessment

Most of the State Governments have conducted their HRVAs, based primarily on the Vulnerability Atlas of India, with additional narratives on remaining hazards and vulnerabilities drawn from various secondary sources. Several State Governments have conducted HRVAs on state-specific hazards and vulnerabilities on high resolution, which captures risks of disasters at district and sub-district levels.



Gujarat was the first State to engage a professional agency (Taru Leading Edge Private Ltd.) to prepare a comprehensive Hazard Risk and Vulnerability Atlas for the entire State, covering six major hazards, namely: Earthquake, Tsunami, Flood, Cyclone, Drought and Chemical and industrial hazards. Part of the World Bank-funded project on Gujarat Earthquake Reconstruction, the Atlas has been developed from one of the largest and most detailed digital GIS databases covering all the 226 talukas and 25 districts of the State. The hazards have been examined in detail, using advanced, computer-assisted GIS models, probabilistic analysis and detailed field studies. The most vulnerable Talukas, possible areas of highest loss of human life, population concentrations, crops, buildings and lifeline infrastructure have been identified in a descending order of risk that enables planning, intervention and investments in a prioritized, phased manner—making effective use of scarce resources.

Gujarat has conducted special studies on risk assessment of some of the vulnerable regions within the State, such as: Flood and Seismic Vulnerability Study of Ahmedabad-Dholera Special Investment Region (ADSIR), Seismic Micro-Zonation of Gandhidham-Kandla Region, Multi-Hazard Risk Assessment of Jamnagar, Flood Vulnerability Study of Ahmedabad, Surat and Bharuch etc. Further, Gujarat commissioned a study on Climate Variability and Climate Change that highlighted the probable impacts of climate change on population, economy and infrastructure of the State.

Himachal Pradesh has a similar HRV atlas, developed for the entire State through a professional agency. The atlas is available in a digital format, and it is in the public domain. A specially designed, user-friendly software enables the generation of hazard, vulnerability and risk maps of the State down to the block level. This provides a powerful tool for risk analysis for all stakeholders across all sectors and at all levels.

Assam State Disaster Management Authority has utilized the services of North Eastern Space Application Centre to develop GIS-based multi-hazard maps, vulnerability maps and risk maps for the city of Guwahati and the towns of Silchar and Dibrugarh, in high resolution of 1:10,000 scale; the Dhemaji districts are shown in 1:25,000 scale. The multi-hazard maps include flood, landslide, seismic and industrial hazards. The vulnerability maps include physical infrastructure (buildings) and social aspects (population exposure and other socio-economic vulnerabilities).

Additionally, as part of the World Bank-assisted Uttarakhand Disaster Recovery Project (UDRP), the State Government of Uttarakhand is developing a digital database on hazards, vulnerabilities and exposures for assessing the risks and potential consequences of flooding, earthquakes, landslides, and industrial hazards in the State. The Central American Probabilistic Risk Assessment (CAPRA) tool is being applied for measuring

risks in terms of physical damage as well as economic and human losses.

The study would be unique, the first of its kind in the country, as it would create a dynamic platform for risk assessment through development of base level datasets that would be updated on a continuing basis. These datasets would include the following:

- (a) Hazard datasets (nature, severity and frequency) at State, district, block, town, village and habitation cluster levels
- (b) Vulnerability (physical, social, economic) and exposure (population and economy) at all these levels
- (c) Development of specific and composite risk datasets, through probabilistic and deterministic risk

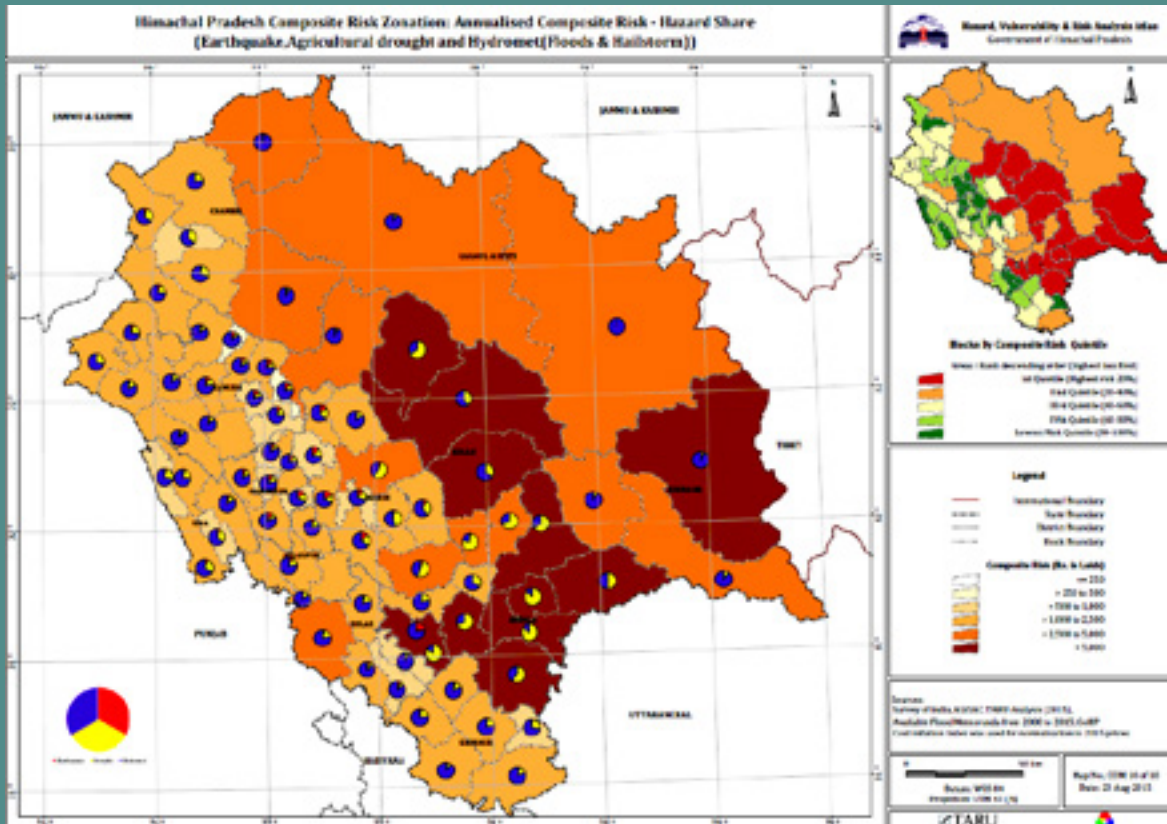
Himachal Pradesh Digital HRVAtlas

Himachal Pradesh has prepared its unique high-resolution GIS based Digital Risk Atlas that integrates existing and new data on various parameters of hazards, vulnerabilities and exposures, and generate composite risk maps for the State and its administrative at districts and block level.

Developed by TARU Leading Edge Pvt. Ltd. this first of its kind digital HRV Atlas of the State has been uploaded in the website of Himachal Pradesh State Disaster Management Authorityhttp://www.hpsdma.nic.in/along with an open source software for the use of all State Government departments and agencies, district administration and other public and private

stakeholders as well as members of the general public.

The Atlas has mapped the intensities of four natural (earthquake, landslide, flood, drought, avalanche and GLOF) and two human-induced hazards (forest fires and industrial accidents) on the basis of data obtained from a mix of primary and secondary sources and overlays the same on GIS layers on physiography (topography, hydrology, watersheds etc.), critical facilities (roads, schools, hospitals, police stations, fire stations, hydro power plants, helipads, telecom towers etc), and administrative boundaries of various administrative units (State, districts and blocks) in a scale of 1:50,000.



The Atlas further analyses the socio-economic vulnerabilities in general and building vulnerabilities in particular of Himachal Pradesh and generates user friendly maps on annualised composite risks as well as hazard-wise and sector-wise risks of disasters.

analysis at State, district and block levels

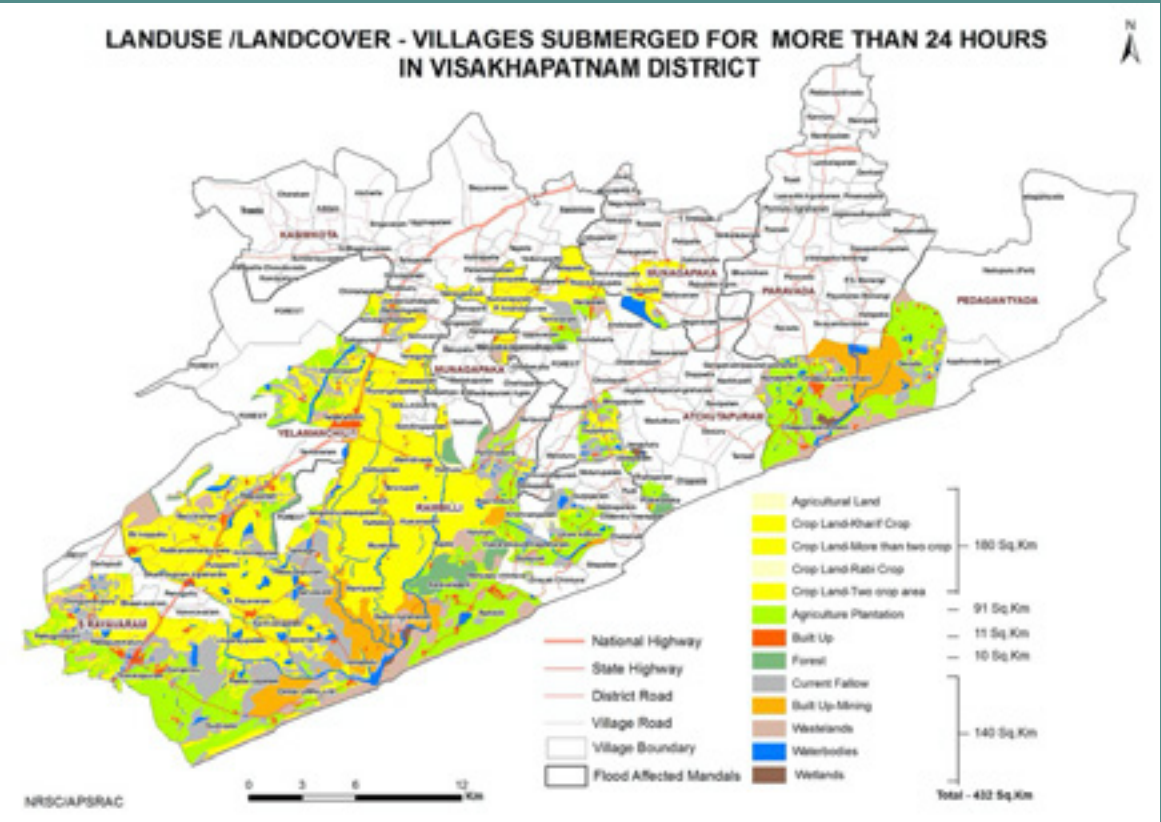
- (d) Development of a Digital Risk Data Base (DRDB) which would comprise hazard, vulnerability, exposure and risk information for different hazards. DRDB would support user friendly access to and sharing of data, as per agreed protocol.
- (e) Development of disaster risk reduction strategies for five urban and rural hotspots and for critical economic sectors such as agriculture and tourism.

Andhra Pradesh State Disaster Mitigation Society (APSDMS)

The Andhra Pradesh Government established the AP State Disaster Mitigation Society (APSDMS) in 2003 as an autonomous Society under the administrative control of the Planning Department, to take up Disaster Mitigation studies relating to 'Rainfall, Run-off, Flood Forecasting, Cyclone Modelling for Tracking Wind and Storm Surge forecast to improve the early warning capabilities of the State on natural disasters. The society, in the course of its working, also started studies on Coastal Zone Management, Delta Water management, Preparation of Disaster Management Plans related to Cyclone, Drought

and Earthquakes, as part of its long-term mitigation measures.

APSDMS was restructured and re-named the Andhra Pradesh State Development Planning Society (APSDPS) in 2012 and its mandate was widened to support the Planning Department in undertaking activities pertaining to result oriented planning and growth forecasting through professional support, mainstreaming disaster mitigation and networking with various national and international organizations.



APSDMS has its own Early Warning Center (EWC), which is a unique facility created at the State level. The Center has installed 1602 Automated Weather Stations (AWS), 93 river gauges, 5 coastal stations and 76 reservoir level recorders across the state to acquire data on various hazards on real time basis. The AWS measures six weather parameters—Rainfall, Wind Speed, Wind Direction, Atmospheric Pressure, Humidity and Temperature—at every one-hour interval and transmits it in the form of an SMS using GSM technology. River gauges measures the water level in the river at various locations and transmits data at hourly intervals, using satellite technology. This data is being used by various government agencies such as Agriculture Department, Disaster Management, Irrigation Department, Energy Department etc., towards proper planning and implementation of varied programs and schemes. AWS data is also being used by the Agriculture Insurance Company of India for implementation of Weather Based Crop Insurance Scheme (WBICIS) for various crops in the districts.

Three South Indian States of Andhra Pradesh, Karnataka and Kerala have established specialized centres for monitoring real-time hazards and risks as these unfold in the specific contexts of the States.

Karnataka is the first State to have set up Drought Monitoring Cell (DMC) through a network of automated weather and rain gauge stations that provide temperature and precipitation data on a real time basis. This has enabled the State to take proactive measures for drought management, from the early monsoon season of sowing to the post monsoon season of harvest. Initially set up in 1988, DMC has been widening its activities to include every natural hazard and was renamed the Karnataka State Natural Disaster Monitoring Centre (KSNDMC) in 2007.

KSNDMA has installed 5,978 automated, solar-powered, GPRS-enabled Telemetric Rain Gauges (TRG) at village panchayat level and 747 Telemetric Weather Stations in metropolitan area, which has enabled real time transmission of rainfall and weather data. The data is analyzed automatically through web-enabled applications, and the scientific reports that are subsequently generated are transmitted to users through SMS, email, help desk (Varuna Mitra) and electronic and print media. These databases are used for a variety of applications, such as Early Warnings and Advisories to farming communities and general public, Drought Management Information Systems, Agro-meteorological Crop Yield Modelling, Crop Water Budgeting Studies, Water Balance Studies, Weather-Based Crop Insurance etc.

Source: UNDP



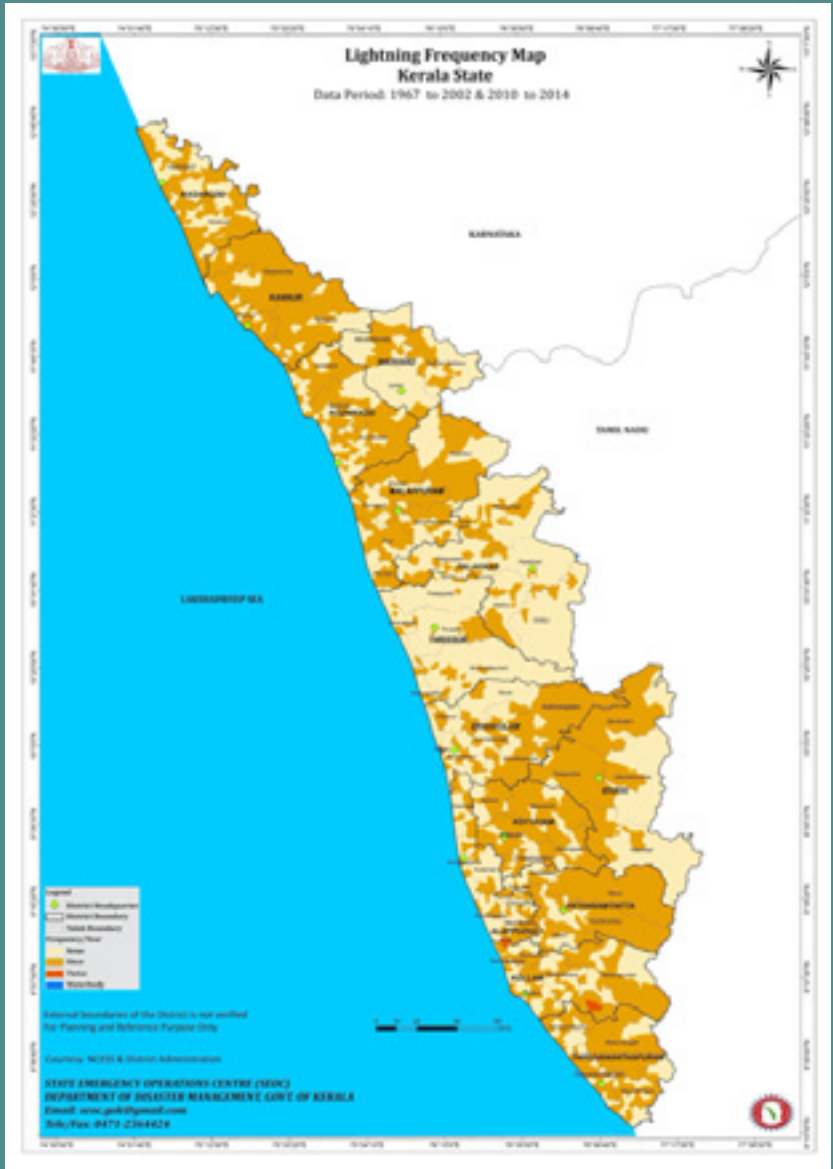
KSNDMC has developed capabilities for hydrological modelling and flood early warning system in BBMP areas, monitoring of seismic activities in Karnataka and adjoining States, and Early Warning Dissemination Systems (EWDS) for cyclones in coastal areas, with last mile connectivity. These capabilities are used for conducting training programs and workshops on monitoring and early warning of natural hazards.

KSNDMC is an autonomous body registered under the Societies Act, set up initially by the Department of Science and Technology, and now transferred to the Department of Revenue of Government of Karnataka. It has a team of 25 scientists and 15 support staff, for conducting its activities under the supervision of its Director.

Kerala State Emergency Operation Centre (KSEOC)

In 2012, the Government of Kerala created the Hazard Vulnerability Risk Assessment (HVRA) Cell as the 'research and technical laboratory' of KSDMA, under the scientific supervision of the Centre for Earth Science Studies. Two years later the HVRA Cell was converted into Kerala State Emergency Operations Centre (KSEOC). It is a unique in-house institution created in the State not only for emergency management but also for scientific analysis of state specific risks on a continuing basis.

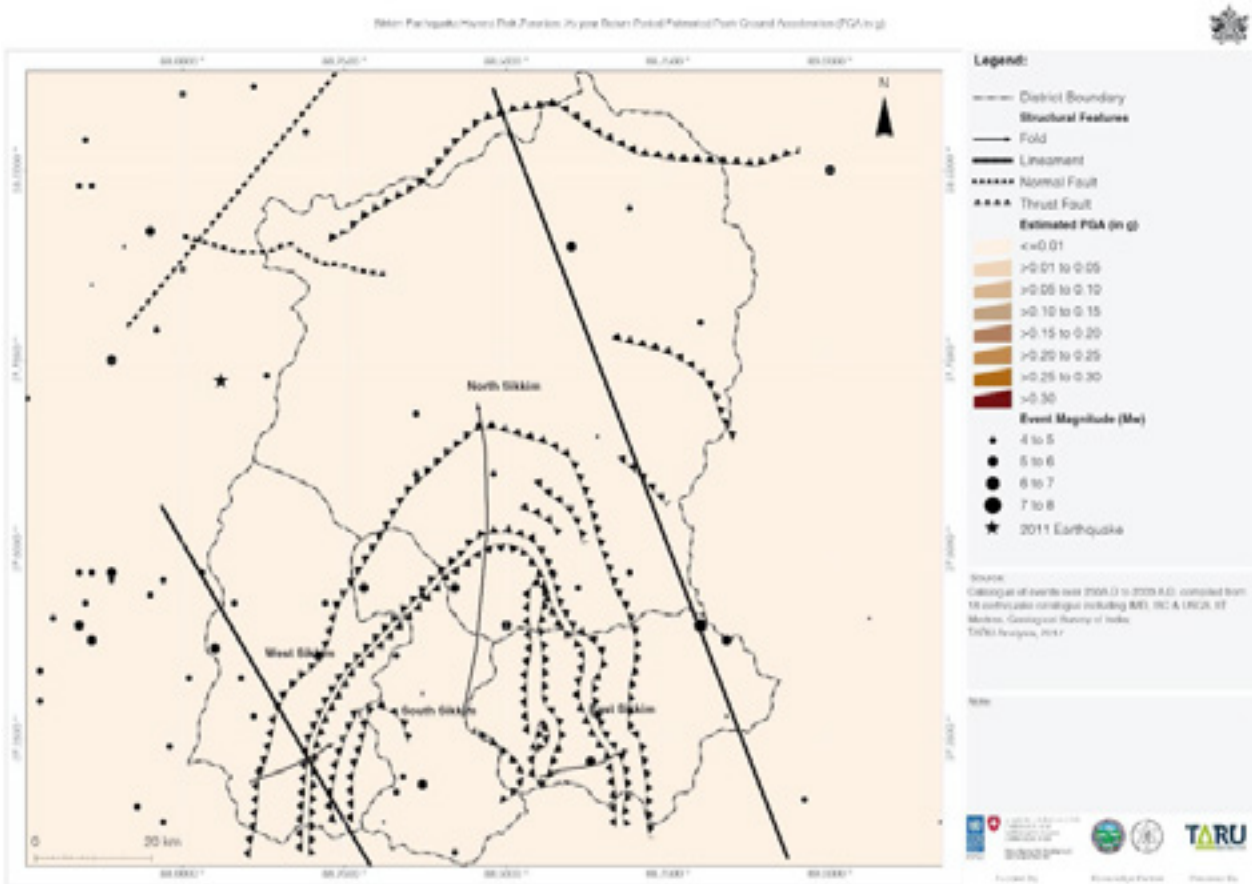
KSEOC is staffed with a multi-disciplinary scientific team of 21 professionals and is in the process of acquiring state-of-art equipment and facilities for multi-dimensional research on risk assessment, and for early warning of disasters. Once made fully operational, SEOC is expected to provide an intelligent decision support system for prediction and early warning of major hydro-meteorological hazards as well as for emergency management.



KSEOC has assessed some State specific hazards, like coastal erosion, lightning, natural radioactivity, MAH industries etc, and produced several handbooks, maps, SOPs, research reports and investigative reports on disaster management.

The government of Sikkim has conducted Hazard, **Risk and Vulnerability Assessments of the three townships of Mangan, Gyalshing and Namchi**, through Taru Leading Edge Pvt Ltd. with assistance from UNDP and Swiss Development Cooperation. Although designed primarily to assess climate risks, the study has included analysis of the hazards of earthquake, landslides, forest fires as well as temperature, rainfall and urban heat island effects. The study has further looked comprehensively into the building profiles of three study towns and assessed multi-dimensional vulnerabilities as well as capacities of institutions to prevent, mitigate, respond and recover from the damage and losses from disasters.

Figure 43: Earthquake Hazard Risk Map of Sikkim: 50 Year Return Period



Based on the HRVA, a series of actions have been suggested to help local and regional administrations in staying prepared and coping with the disasters. These suggested actions are targeted towards town specific issues, and some of the state and national policy level intervention for building resilience to natural disasters such as earthquake and heavy rainfall.

Despite the initiatives taken by several agencies of the Central and State governments, there are still serious gaps in assessing hazards, vulnerabilities and risks of disasters in India. First, risk assessment has focused primarily on some of the hazards of nature like earthquakes, landslides, floods and cyclones, while remaining natural and manmade hazards have generally been excluded from the purview of risk assessment. Secondly, barring a few States, risk assessment has taken place on coarse scales that are not very useful for local level risk assessments, which are still driven primarily by local knowledge. Scientific tools and techniques are available at affordable costs to downscale hazard maps and there is no reason why such maps shall not be made available in public domain for enhancing understanding of the risks of disasters for all stakeholders. Third, vulnerability

analysis has focused mainly on buildings and that too on limited parameters of walls and roofs of buildings. There is no reason why multi-dimensional vulnerabilities of physical and natural environment as well as production systems and socio-economic conditions shall not be factored for developing comprehensive vulnerability atlas of India. Finally, risk analysis would be incomplete without analysis of exposures of population and economy to the risks of disasters and the capacities that are available at various levels to cope with and reduce these risks of disasters.

These gaps in HRVA have been addressed to some extent in Part I of this report, titled 'Measuring Risks of Disasters'. Various parameters are captured in the Disaster Resilience Index of the States, and given the appropriate weight in the assessment: 14 Hazards (earthquake, landslide, flood, drought, landslide, tsunami, avalanche, heat wave, cold wave, lightning, coastal erosion, forest fire, fire and industrial hazards), 14 Vulnerabilities (buildings, social infrastructure, physical infrastructure, agriculture, livestock, industries, poverty, gender, children, aged, disabled, depletion of forest depletion of mangroves and water stress), two exposures (population and economy) and overall capacity have been factored, as agreed through a consultative process, to measure the Disaster Risk Index in each of 640 census districts of 29 States and seven Union Territories of the country.

Digital Risk Mapping in Public Domain

Risk mapping is always layered with types of hazards and vulnerabilities which interact to create different kinds of disasters. Advanced tools of GIS enable us to map the layers with precision and accuracy, overlapping them to analyze how they interact with each other and zooming the maps from the national and provincial down to the district, block and village levels. These digital maps in public domain provide critical information to stakeholders across sectors to assess the risks of disasters in their respective spatial and functional areas of operation. The technology is simple, affordable and cost-effective, and skilled manpower to develop and maintain such maps is available in the country. Highlighting the importance of digital risk maps, Sendai Framework prescribed that one of the priority activities of 'understanding disaster risks' is to develop, update periodically and disseminate risk maps to decisionmakers, the general public and communities at risk of disaster in the appropriate format, using geospatial information technology.¹¹⁸

It is surprising that very few States have developed an online portal on risk mapping in the public domain. Himachal Pradesh is the only State that has developed digital HRV mapping and made this accessible to all, through easily downloadable software.¹¹⁹ Several States like Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Odisha, Sikkim, Tami Nadu, Tripura and Uttar Pradesh have put up soft copies of risk maps on specific hazards and districts on their website, but these are no substitutes for GIS-enabled digital risk maps.

Every State and Union Territory should develop such maps in a time-bound manner. Alternatively, State specific, multi-layered HRV maps may be developed under the NDEM portal in a common format for the benefit of every State/ UT. This would provide technical support to disaster managers at State, district and local levels, for assessing dynamic risks of disasters.

¹¹⁸ Sendai Framework for Disaster Risk Reduction,

¹¹⁹ <http://www.hpsdma.nic.in/>, http://www.hpsdma.hp.gov.in/GIS_Disaster.aspx

Real Time Data on Risks and Disasters

Technology has made it possible for real time dissemination of information about impending hazards and risks. While early warnings of cyclones, tsunami and avalanche are routinely communicated by the IMD to the State government and district administration and these are further disseminated to the people at the last mile, there are strong grounds for dissemination of such information even at the pre-EWS stage and with respect to all hazards, to the extent that these are feasible. Such information is generally available on a real time basis with the central agencies responsible for monitoring these hazards, such as IMD, CWC, INCOIS, SASE NCMRWF etc, and it would not be technologically challenging to provide such information on a scroll/link/dashboard on State Portals, as some States like Assam¹²⁰, Bihar¹²¹, Kerala¹²², and Tripura¹²³ have done.

Some of the States, like Andhra Pradesh and Karnataka, have developed their own network of Automated Weather Station (AWS) for monitoring rainfall and temperature at the local level, as detailed earlier in this chapter. These stations provide more localized information on the emerging risks of drought and flood.

The Municipal Corporation of Greater Mumbai has set up 60 automatic rain gauges which transmit rainfall data to the Disaster Control Room of MCGM every 15 minutes. Many of the rain gauges have been installed at Fire Brigade stations as they are the first respondents during disasters and are on 24-hour alert. The rain gauges also have a console capable of giving an audible alarm if pre-set rainfall intensity exceeds 10 mm in 15 minutes.¹²⁴.

Micro Zonation of Earthquake Risks

Most of the States/ UTs have undertaken HRVA for fulfilling the requirement of the State Disaster Management Plan as per the template circulated by the NDMA. HRV of districts have largely drawn from these State Plan chapters. However, several States have conducted State specific and hazard specific comprehensive risk assessment, particularly for hazards like earthquake, flood and drought.

As many as 34 million plus cities of India in 16 States/ UTs are located in seismic zone V, IV and III. Another 150 Class-I cities with populations of more than one lakh each are located in these zones. Ideally, every such city should have comprehensive micro-zonation of earthquakes to assess intra-city variation of risks of earthquakes and accordingly revise land use plans and municipal by-laws of the cities for regulating development planning and building activities.

Only nine cities have undertaken such studies so far, namely Guwahati, Chandigarh, Delhi, Ahmedabad, Jabalpur, Mumbai, Aizawl, Gangtok and Kolkata. Unfortunately, none of the study reports are available in public domain and none of these have been followed up with any initiative for corresponding changes in land use regulations and building by-laws.

Several other cities have undertaken such studies under the central sector scheme of seismic micro-zonation of cities implemented by the National Centre for Seismology of the Ministry of Earth Sciences.

120 <http://asdma.gov.in/index.htm>

121 <http://bsdma.org/Home.aspx>

122 <http://sdma.kerala.gov.in/>

123 <https://tdma.tripura.gov.in/>

124 <http://dm.mcgm.gov.in/auto-weather-stations>

Flood Risk Assessment

Floods are a recurrent phenomenon in most of the States, accounting for most of the disaster damage and losses. A few States commissioned flood risk assessment and some the flood prone districts and cities; namely, Andhra Pradesh, Assam, Bihar and Odisha.

Drought Risk Assessment

Similarly, some of the drought prone States have set up mechanisms for assessing and monitoring the emerging risks of drought so that measures can be initiated for mitigating the risks right at the onset of drought and subsequently as the conditions intensify during the years of low precipitation. Andhra Pradesh, Karnataka, Tamil Nadu, Telangana have a well-established system of drought monitoring.

Dissemination of Risk Information to People

The importance of communicating risks to common people has been highlighted in every global and national framework on disaster management. Risk communication is not limited to placing risk assessment reports in the public domain or issuing early warning of impending risks of disasters like cyclone or floods. It is a much broader function of making the general public aware of the natural and anthropogenic factors that create risk, as well as measures that can be taken at the individual level to reduce these risks and be prepared for disasters.

Several States have made innovative use of technology, particularly social media, for risk communication, even though this has been limited mostly to communicate early warnings of disasters. Assam, Haryana, Kerala, Maharashtra, Odisha, Tamil Nadu have reported extensive use of social media for communicating risks.

Assessing Traditional and Local Knowledge

Traditional and local knowledge of disaster management have developed over years of observation and practice and been transmitted over generations. These are based on intimate local knowledge about topography, climate and resources that are not always factored into assessing the risks of larger administrative units like States or districts. Much traditional knowledge and practices on disaster management have been validated by scientific studies, while others can be further reinforced with the application of science and technology. Documentation, analysis of indigenous and traditional knowledge and its integration with scientific knowledge have been emphasized in several policy documents, including national policy on disaster management, but every few States have taken measure for giving practical shape to such policies. Odisha and Tripura have reported using traditional knowledge for the preparation of community-based disaster management plans.

Assessing Patterns of Emerging Risks

Risks are dynamic in nature, always evolving with changing nature of hazards, vulnerabilities and the ways these interact in time and space. Therefore, risk assessment is not a one-time undertaking; rather, it is a continuous exercise, which must be undertaken periodically. Disaster Management Act has called for revising DM plans annually, which necessarily implies that risk assessment must also be updated based on new knowledge and experience and lessons learnt from past disasters—but this is hardly taking place on the ground.

Most of the States have routinely responded that climate change and urban growth are the two important risk drivers, but such statements are rarely substantiated with scientific studies of how pattern of risks are changing in the States over the years in the same manner that the Global Assessment Report does biennially. Institutions like SDMAs are legally mandated to assess the dynamics of disaster risks and this must not be off their radars.

Developing Database on Disasters

Developing a comprehensive database on types of disasters, frequencies and intensities of disasters and the damage and losses incurred due to disasters is extremely important for formulating and revising policies and strategies for disaster risk management. Such databases are also crucial for monitoring the progress achieved in reducing the risks of disasters, as is now mandated under the Sendai Framework.

Unfortunately, a sound system of disaster statistics is yet to be developed in the country, even though every event of disaster leaves its footprint on the records of government. Deaths due to disasters are registered in police records of natural deaths, ex-gratia payments are made for disaster deaths, injuries, and damages, state governments submit voluminous memorandums on disaster damage and losses, and the central government releases funds from State and National Disaster Response Fund, which makes it binding for the States to submit periodic reports on disaster damage and losses.

Several attempts have been made in the past to develop disaster statistics in the States, but they have not met with much success. The conceptual and methodological framework of DesInventar, to collect disaster data from newspapers and other sources¹²⁵, was applied in the States of Odisha, Tamil Nadu, Uttarakhand and Uttar Pradesh through the initiative of UNDP. These had made some initial headway but could not make much progress due to the reluctance of the State Governments to own such data, which was found to be either exaggerated or under-reported.

In the recent past, Himachal Pradesh released disaster damage and loss data for the State over the period 2007-2015, which is quite revealing for a number of reasons.¹²⁶ First, though the State did not face any major disaster during the period, it lost as many as 13,422 lives Second, disaggregated data on disaster type or sex and age of victims are not provided, making it difficult to assess how hazards and vulnerabilities have contributed to losses of lives. Third, average annual loss of agricultural and horticultural products is also quite high, considering that agriculture is the mainstay of livelihood of nearly 69% of the people of the State. Details of damages to infrastructure like roads and bridges, power supply installations, water and sewerage system, irrigation network, dams and reservoirs etc are supplied, but these are neither quantified in monetary terms nor in terms of opportunity costs. This makes it difficult to quantify the share of the average annual loss of disasters to the State GDP.

Other Initiatives

Tamil Nadu has launched the Tamil Nadu System for Multi-hazard potential impact assessment, alert, emergency response planning and tracking (TN-SMART) in collaboration with the Regional Integrated Multi-Hazard Early Warning System (RIMES). TN-SMART has been designed as a ‘dynamic web-based decision support system with

125 <https://www.desinventar.net/whatisdesinventar.html>

126 Loss, Rescue, Relief and Management (LREconomics and Statistics Department, Government of Himachal Pradesh, 2016.

advanced predictive and prescriptive data analytical capabilities to archive, analyze, model and communicate disaster risk information’.

Progress achieved by the States and UTs on various parameters of risk assessment is presented in the table below:

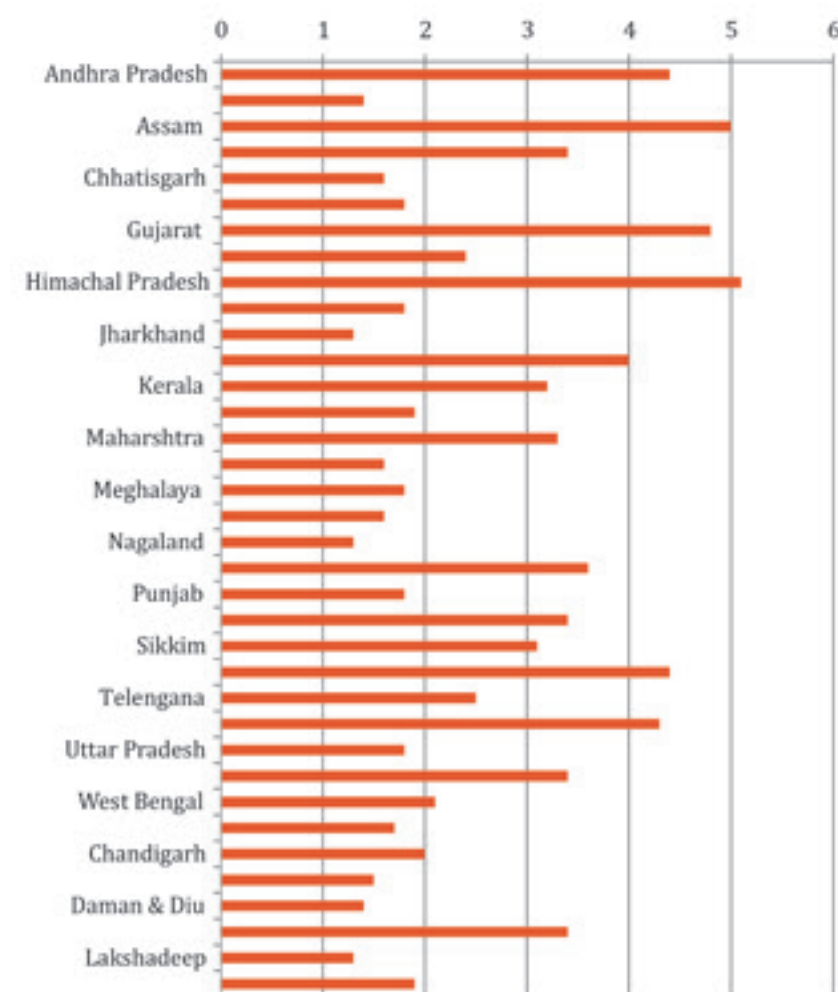
Table 35: Measuring Progress of States/ UTs on Risk Assessment

STATES	Hazard Vulnerability Risk Assessment	Digital Risk Mapping in Public Domain	Real Time Data on Risks and Disasters	Micro Zonation of Earthquake Risks	Flood Risk Assessment	Drought Risk Assessment	Dissemination of Risk Information to People	Assessing Traditional and Local Knowledge	Assessing Patterns of Emerging Risks	Developing Database on Disasters	Others	Total
Maximum Values	10	5	5	3	3	5	3	3	3	5	5	50
Andhra Pradesh	5.5	2.5	3	0	2.5	3	1.5	1	1	1	1	22
Arunachal Pradesh	2.5	1	0	0	1.5	0.5	0.5	0	0.5	0.5	0	7
Assam	6	3.5	2.5	2	2.5	2	2	1	1	0.5	2	25
Bihar	5	2	2	0	2.5	1	1	1	1	0.5	1	17
Chhattisgarh	2.5	0	0	0	1.5	2	1	0	0.5	0.5	0	8
Goa	2.5	0	0	0	1.5	1	1	1	1	1	0	9
Gujarat	7.5	2.5	2	2.5	2	3	1.5	0.5	1.5	1	0	24
Haryana	3.5	0	1.5	0	2	1	2	0	1	1	0	12
Himachal Pradesh	8	4	1.5	1	2	2	1.5	1	1	2.5	1	25.5
Jammu & Kashmir	2.5	0	0	0	2	1.5	1	1	0.5	0.5	0	9
Jharkhand	2.5	0	0	0	0	1	1	1	0.5	0.5	0	6.5
Karnataka	4.5	2.5	3	0	2	3.5	1.5	0.5	1	0.5	1	20
Kerala	4.5	1.5	1.5	0.5	2	1.5	2	0.5	1	1	0	16
Madhya Pradesh	2.5	0	0	1	1.5	2	1	0.5	0.5	0.5	0	9.5
Maharashtra	5	0	1	0	2.5	2.5	2	1	1.5	1	0	16.5
Manipur	2.5	0	0	0	2	1.5	1	0	0.5	0.5	0	8
Meghalaya	3.5	0	0	0	0	1.5	1	0.5	1	0.5	1	9
Mizoram	3.5	0	0	0	1.5	0.5	1	0	0.5	1	0	8
Nagaland	2.5	0	0	0.5	0	0.5	1	0.5	0.5	1	0	6.5
Odisha	6	1.5	0	0	2.5	2	2	1.5	1	1.5	0	18
Punjab	2.5	0	0	0	2	1.5	1	0	1	1	0	9
Rajasthan	4	1	2	0	1.5	3	1.5	1	1	2	0	17
Sikkim	4.5	2.5	2	0	1.5	0.5	1.5	1	1	1	0	15.5
Tamil Nadu	4	2	2	1	2	3.5	2	1	2	1.5	1	22

Telangana	4	0	0	0	1.5	2.5	1.5	1	1	1	0	12.5
Tripura	5	2.5	2	1	2	1.5	1	1.5	1.5	1.5	2	21.5
Uttar Pradesh	2.5	1	0.5	0	1	1	1	1	0	1	0	9
Uttarakhand	5.5	2	0	1	2	0.5	1	1	1.5	1	1.5	17
West Bengal	3	1	0	1.5	1	0.5	1	0	1	1.5	0	10.5
UNION TERRITORIES												
Andaman & Nicobar Islands	3.5	0	0	0	0	0	1	1	1	1	1	8.5
Chandigarh	4	1	1	0	0	0	2	0	0	2	0	10
Dadra and Nagar Haveli	3.5	0	0	1	0	1	1	0	0	1	0	7.5
Daman and Diu	3	0	0	0	0.5	1	1	0	0.5	1	0	7
Delhi	4	1	1	3	2	2	2	0	1	1	0	17
Lakshadweep	2.5	0	0	0	1	0	1	0	1	1	0	6.5
Puducherry	2	0	0.5	0	1	1	2	0	1	1	1	9.5

The overall progress on a scale of 10 is presented in the following diagram, wherein Himachal Pradesh tops in risk assessment, with a score of 5.1, followed by Assam (5.0), Gujarat (4.8), Andhra Pradesh (4.4) and Tripura (4.3).

Figure 44: Overall progress of States/ UTs on Risk Assessment



RISK PREVENTION AND MITIGATION

Prevention and mitigation are two important aspects of disaster risk reduction. While risk prevention means preventing creation of new risks of disasters ab initio, risk mitigation implies that existing risks of disasters are reduced to minimize or lessen the adverse impacts of disasters on lives, livelihoods and assets of individuals, communities and countries.

Risk prevention requires a sound understanding and anticipation of the dynamics of creation of new risks. As risks are created when vulnerable conditions are exposed to the hazards, natural or man-made, they can be prevented by three alternative approaches, taken either in isolation or in combination, as appropriate in specific situations.

First, risks can be prevented if hazards are eliminated. Elimination of natural hazards is near impossible, as these are endemic tonature—too much rain would cause floods, and too little drought would cause seismic fault lines, which would trigger earthquakes, and oceanic low pressure would generate cyclones. However, anthropogenic activities that have the potential to increase the frequencies and intensities of natural hazards, such as global warming and climate change, which impact hydro-meteorological hazards, can be controlled and regulated to reduce incremental impacts on natural hazards. Many manmade hazards can be eliminated together through regulation, enforcement; hazardous chemicals can be banned, restricted or substituted in the production, storage and transportation of goods, for example. There are costs as well as benefits in such regulations, requiring a trade-off depending on the contexts of space and time.

Second, exposure of vulnerabilities to hazards can be reduced through policies and regulations. For example, land use regulations may not permit constructions in flood plains, high-rise buildings may not be allowed in high risk seismic zones, heavy industries and mining may be banned altogether in ecologically sensitive regions. All such measures shall reduce exposure of vulnerable population, buildings, infrastructure, production systems and environment to the hazards.

Third, vulnerabilities can be reduced through a combination of various structural and non-structural measures, so that even if exposed to hazards, these can withstand the adverse impacts. Structural measures typically include hazard resistant designs, constructions, production systems etc. Non-structural measures include operating systems, management practices, capacity development etc. In a country like India, where large populations live in different hazardous regions and no region can be excluded from the process of development, reducing vulnerabilities is the most preferred option for risk prevention. However, this option has not been optimally used, resulting in the creation and accumulation of new risks of disasters in the process of development.

Existing risks of disasters (when vulnerable conditions are already exposed to hazards) can be mitigated by reducing vulnerabilities and strengthening capacities. Vulnerabilities can be reduced again through a combination of structural and non-structural measures. Vulnerable buildings and bridges can be retrofitted, vulnerable coastal areas can be protected through regeneration of mangroves, depleted aquifers can be recharged by water shed management and rainwater harvesting.

Disaster risk prevention and mitigation are crucial to the process of development for three separate but inter-related reasons. First, disasters provide setbacks to the hard-earned gains of development. The strong tremors of an earthquake of a few seconds can destroy and damage houses, roads and other infrastructure built over

decades. High velocity storm surges of a few hours can wreak havoc in coastal life and economy. Slow onset creeping drought over a few months can damage agriculture and livestock of millions of rural populations. Measures for risk prevention and mitigation can protect the lives, livelihoods and infrastructure and make development sustainable. Second, the process of development can reduce the layers of social, economic, physical and environmental vulnerabilities that have accumulated over the years and thereby reduce the risks of disasters. Reduction of poverty and improvements in living conditions of the poor would make them less vulnerable to disasters. Hazard resistant houses and infrastructure would survive the onslaughts of floods, cyclones and even earthquakes. Rehabilitated forests can prevent landslides and soil erosion. Third, unplanned and unregulated developments without consideration of hazards, vulnerabilities and risks would create new risks of disasters, as has been happening knowingly, and sometimes unknowingly. Construction of houses on hilly slopes and in flood plains are exposing both the properties and the people owning and using them to the risks of landslides and flood. Non-compliance of building codes are adding to the existing stock of unsafe buildings making these vulnerable to earthquakes. Increasing loads of silts in rivers and reservoirs due to indiscriminate felling of trees and resulting erosion of soil and the encroachments of water bodies are aggravating conditions of flood even in regions that had never experienced the hazards of inundation before.

This three-dimensional view of disasters and development make it imperative that hazards, vulnerabilities and risks of disasters are fully factored into the planning, design and implementation of every development plan, program and project, so that development becomes risk sensitive and sustainable in the long run.

Global Frameworks

The Hyogo Framework of Action 2005-2015 had flagged the issues of risk prevention and mitigation mostly in Priority of Action - 4, 'Reduce the underlying risk factors'. (Some of the non-structural issues of mitigation like training, capacity development, public awareness etc feature in Priority of Action-3, 'Use knowledge, innovation and education to build a culture of safety and resilience at all levels'.)

Eighteen key activities were prescribed in Priority of Action-4, under three main categories: (a) environmental and natural resource management, (b) social and economic development practices, and (c) land use planning and other technical measures. Every national, regional and global review of implementation of Hyogo Framework found that the least progress was achieved in preventing and mitigating the underlying risk factors, and that the main reason responsible for the slow progress across countries and continents was a lack of resources and investments for disaster risk reduction.

Therefore, the Sendai Framework rightly flagged 'Investing in disaster risk reduction for resilience' as the Priority-3 of the global agenda for disaster risk reduction during 2015-2030. Priority 3 identified 17 activities towards investing for risk reduction, to be undertaken at the national and local levels, and nine activities at the global and regional levels. These include: mainstreaming of disaster risk reduction in development plans, programs and projects; allocation of resources for risk prevention and mitigation at all levels; promotion of mechanisms for risk transfer and insurance; strengthening of disaster resilient public and private investments through structural, non-structural and functional measures for risk prevention and mitigation measures in critical facilities, in particular schools and hospitals and physical infrastructures; strengthening the design and implementation of inclusive policies and social safety-net mechanisms; and increasing business resilience and protection of livelihoods and productive assets throughout the supply chains.

National Framework

The national vision for disaster risk prevention and mitigation was articulated for the first time in the Tenth Five Year Plan (2002-2007). Heralding a paradigm shift in public policy on disaster management, the Plan stated:

The traditional perception relating to the management and mitigation of natural disasters has been limited to the idea of “calamity relief,” which is seen essentially as a non-plan item of expenditure. However, the impact of major disasters cannot be mitigated by the provision of immediate relief alone, which is the primary focus of calamity relief efforts. Disasters can have devastating effects on the economy; they cause huge human and economic losses, and can significantly set back development efforts of a region or a State. With the kind of economic losses and developmental setbacks that the country has been suffering year after year, the development process needs to be sensitive towards disaster prevention and mitigation aspects. There is thus a need to look at disasters from a development perspective as well.¹²⁷

The Plan further laid down a blueprint for the future:

The future blue-print for disaster management in India rests on the premise that in today’s society while hazards, both natural or otherwise, are inevitable, the disasters that follow need not be so and the society can be prepared to cope with them effectively whenever they occur. The need of the hour is to chalk out a multi-pronged strategy for total risk management, comprising prevention, preparedness, response and recovery on the one hand, and initiate development efforts aimed towards risk reduction and mitigation, on the other. Only then can we look forward to “sustainable development.”¹²⁸

Disaster Management Act 2005 has made it categorical that measures for risk prevention and mitigation shall be included in National Plan (section 11(3)(a), State Plan (section 23(4)(b), District Plan (section 31(3)(b), Departmental Plans of Central Government (section 36(b) and Departmental Plans of State Government (section 40(1)(a)(i). The Act has further provided that Central and State Governments shall ensure that measures for disaster risk prevention and mitigation are integrated into the development plans of each department (sections 35(2)(b) and 38(2)(f) of respective departments.

In addition, the Act has made it a responsibility for NDMA to take such other measures as necessary for prevention and mitigation of disasters (Section 6(2)(i), for SDMA to ensure that prevention and mitigation measures are integrated in development plans of different department (section 18(2)(g), and for DDMA to ensure that the guidelines for prevention of disasters, mitigation of its effects as laid down by the National and State Authority are followed by all departments at district level. (section 30(2)(iv). The Act has further provided for constitution of National Disaster Mitigation Fund (section 47), State Disaster Mitigation Fund (section 48(c) and District Disaster Mitigation Fund (section 48(d) for financing projects exclusively for the purpose of mitigation of disasters (section 30(2)(viii).

The National Plan on Disaster Management 2009 laid down that a multi-pronged approach shall be adopted to undertake mitigation measures. This includes:

¹²⁷ Tenth Five Year Plan (2002-07) Vol -I, p 189.

¹²⁸ Tenth Five Year Plan (2002-07) Vol -II, p 202.

- a) Building mitigation measures into all development projects;
- b) Initiation of National level mitigation projects by the NDMA in high priority areas, with the help of the Central Ministries and Departments concerned and the States;
- c) Encouraging and assisting State-level mitigation projects in accordance with the guidelines; and
- d) Providing due weightage to Indigenous knowledge on disaster risk reduction and coping mechanisms.

National Plan on Disaster Management 2016 has provided a comprehensive matrix of hazard-specific structural and non-structural measures to be adopted by the different agencies of the Central and State Government for the prevention and mitigation of disasters.

Central initiatives

Echoing the global and national frameworks on disaster management, every State and District Management Plan has a separate chapter on Risk Prevention and Mitigation which outlines the measures to be adopted for preventing the creation of new risks and for mitigating the existing risks of disasters.

Unfortunately, very few States have formulated programs, schemes and projects for risk prevention and mitigation and allocated resources for the same from the State budget or other sources. Whatever meagre resources are being invested for this purpose are either on (a) central sector schemes that are funded 100% by various Ministries/ Departments of Government of India and its agencies, or (b) centrally sponsored schemes that are funded on a sharing basis between the Central and State Governments, or (c) grants received from the UN or other multi-lateral or bi-lateral agencies.

Central sector or centrally sponsored schemes and programs on disaster risk reduction are very miniscule compared to the needs for the same. Analysis of budgetary allocations of for the period 2005-12 shows that eight Central Ministries/ Departments had allocated funds on schemes and projects that are related to disaster risk management, and that this accounted for 0.97% of total budget Central Government. Almost 84% of the allocations on disaster management were earmarked for disaster preparedness and response; risk prevention and mitigation accounted for 13.52%,¹²⁹ and almost the entire amount was spent on central sector schemes that were planned, designed and implemented directly by the Central Government.

The National Cyclone Risk Mitigation Project (NCRMP) was started in 2011 as a centrally sponsored program with loan assistance of Rs 3187.39 crores from the World Bank and cost sharing of 75:25 between the Central and participating State Governments. Initially two coastal States (Andhra Pradesh and Odisha) joined the Phase-I of the program (2011-17) and six more States (Goa, Gujarat, Karnataka, Kerala, Maharashtra and West Bengal) joined for the NCRMP Phase-II (2015-20) with additional bank loan assistance of 2361.35 crores.¹³⁰ NCRMP has improved access to cyclone shelters, evacuation and protection against storms and flooding, strengthened early warning dissemination systems and enhanced capacity of local communities to respond to disasters.

NDMA has been implementing a few central sector schemes on disaster risk management through the State Governments on a pilot basis, mainly to guide and encourage the State Governments in discharging their responsibilities under the DM Act 2005. The details of these schemes are:

¹²⁹ This amounted to Rs 1580 crores for the financial year 2011-12. Details of allocation of Central Ministries/ Departments on schemes, programs and projects related to disaster management are provided in the Appendix.

¹³⁰ <https://ncrmp.gov.in/about-ncrmp>

Table 36: Central Sector schemes on disaster management implemented by NDMA

No.	Name of scheme	Start	Closing	States involved	Allocation (Rs Crores)
1	National School Safety Programme	2011	2013	22 States/ UTs	48.47
2	Preparation of State DM Plans	2010	2013	28States, 7 UTs	3.52
3	Strengthening of SDMAs and DDMAs	2010	2012	28 States, 6 UTs	22.35
4	Sustainable Reduction in Disaster Risk	2016	2019	10 districts, 5 States	6.07
5	Training of Community Volunteers in Disaster Response	2016	2019	25 States	15.47

State Government projects on risk mitigation

Source: UNDP



The fact that the State Government and its functionaries have to be sensitized about disaster risk reduction on a continuing basis for over a decade and half and further incentivized for performing some of its basic and primary functions, such as strengthening of disaster management institutions created under law or formulating disaster management plans as mandated under DM Act, only confirms that the States in general are reluctant to consider disaster risk prevention and mitigation as a priority area of investment. This is clearly established from the admission of almost all the States and UTs that there are no separate budgetary allocations for risk mitigation projects other than those made available through central sector/ centrally sponsored/ UNDP programmes and grants available under Finance Commission awards.

State Governments of Gujarat, Bihar, Odisha, Kerala, Maharashtra, Tamil Nadu and Uttarakhand have reported sizeable investments in disaster risk reduction since 2005, but most of these investments were actually part of the World Bank/ ADB assisted post-disaster reconstruction projects.¹³¹ Some of the State Governments have continued with budgetary allocations for disaster risk reduction even after the completion of reconstruction projects. Government of Gujarat has been allocating funds to GSDMA for implementation of projects on risk assessment, community-based disaster risk management, school safety etc.

¹³¹ Details of the reconstruction projects are provided in Chapter 14.

Government of Bihar has constructed permanent flood shelters in five flood prone districts. It has established a telemetry-based earthquake forecasting and ground water monitoring systems. Government of Odisha have utilized funds made available under NCRMP/ ODRP/ ICZ Mp for reducing risks of cyclone and other hazards in coastal districts of the State.

Flood and River Erosion Management Agency (FREMAA) of Water Resources Department of Government of Assam has mobilized resources from NABARD and other sources for construction of dykes and other flood protection works in flood prone districts of the State. ASDMA has conducted several scientific and technical studies for mitigating risks of earthquake, flood, landslide etc. and shared the findings with the line departments. ASDMA has further implemented projects on early warning of floods, sustainable livelihood in chronic flood prone villages and mainstreaming of disaster risk reduction in development programmes. Additionally, pilot projects on School Disaster Management Plan, GO-NGO Protocol on disaster management, flood hazard atlas and GIS mapping of utilities and infrastructure of Assam have been completed.

Government of Kerala has implemented location specific projects on risk mitigation such as Mazhapolima Drought Mitigation project, Jalavarshini Drought Mitigation project, Operation Anantha on flood mitigation etc.

Government of Maharashtra has been implementing Maharashtra Disaster Risk Management Programme since 2009 to support Disaster Management Unit in Revenue & Rehabilitation Department and to strengthen disaster management institutions in the districts.

Government of Tamil Nadu has reported implementation of six projects for risk mitigation, These are: World Bank funded Emergency Tsunami Reconstruction Project (ETRP), ADB Tsunami Emergency Assistance Project (TEAP), JICA funded Japan Fund for Poverty Reduction (JFPR), Rajiv Gandhi Rehabilitation Package (RGRP), Universal Health Insurance Scheme (UHIS) and Coastal Disaster Risk Reduction Project (CDRRP)

Mainstreaming DRR in Development

Every State Disaster Management Plan has routinely incorporated a chapter on mainstreaming disaster risk reduction in development across sectors, but very few States have taken concrete measures of actually mainstreaming DRR in various flagship and other development programmes of Central and State Governments. There are a few notable exceptions.

Government of Bihar has formulated DRR Roadmap for 2015-30, which stands on Five Pillars of Resilience: resilient village, resilient livelihood, resilient cities, resilient basic infrastructure and resilient critical infrastructure. The Road Map was developed after consultation with all the 27 major departments of the state, and specific activities of each of the departments have been documented in the Road Map. An Annual review of the progress on the activities has also been initiated from 2017 onwards as State Platform for Disaster Risk Reduction.

Government of Tamil Nadu has reported that Disaster Risk Reduction has been mainstreamed into various development sectors through some of the flagship projects. These include the projects on Vulnerability Reduction to Coastal Communities (Rs1959 crores), Coastal Disaster Risk Reduction Project (Rs1481 crores), Community Based Disaster Risk Management Programme (Rs15 crores), Irrigated Agriculture Modernization and Water Resources Management Project (Rs 2547 crores), Integrated Watershed Development Project (Rs

781.73 crores), Mission for Sustainable Development (Rs 802.90 crores) and ADB-assisted Climate Change Adaptation Programme (Rs 960 crores).

Andhra Pradesh SDMA, with UNDP assistance, developed reports on mainstreaming DRR and Climate Change Adaptation in four sectors: urban development, forestry, education and agriculture. Reports clearly bring out the challenges of capacity constraints in mainstreaming and opportunities in scaling up with better designing, implementation and monitoring of the projects.

State and Disaster Risk Mitigation Fund

Section 48 of DM Act has ordained that the State Governments 'shall' establish State Disaster Mitigation Fund (SDMF) and District Disaster Mitigation Fund (DDMF). Very few States have actually constituted these funds, while a few States like Himachal Pradesh have notified the constitution of the funds but not made them operational so far.

Government of Bihar has been making an annual allocation of Rs five crores to SDMF since 2008-09 for implementing various risk mitigation programmes. Gujarat has been releasing grants to GSDMA for undertaking mitigation activities without constituting such funds. Government of Maharashtra has opened a separate account of the SDMF and allocated a sum of Rs 50 crores in 2011-12. Government of Kerala has released an amount of Rs 33.34 crores to SDMF since its constitution in 2012. Government of Uttar Pradesh has been allocating a token amount of Rs five crores to SDMF annually since 2008-09, but funds allocated have not been utilised.

Jammu & Kashmir is the only State to have constituted Disaster Mitigation Fund at the State, Divisional and District levels. An amount of one crore has been allocated to each district and division of the State.

Safety standards for construction/ land use plans

Bureau of Indian Standards (BIS) notifies standards and specifications of construction of buildings and infrastructure in different hazard zones, based on which National Building Codes (NBC) are revised from time taking into consideration recent advances in building technology and practices. These codes cannot be implemented unless these are incorporated in the building by-laws of municipal corporations, which are the local authorities for regulation of constructions in urban areas where most building construction takes place.

The process of amending the Town Planning Act, Development Act and Land Use Zoning Regulations to conform to hazard zonation of towns has been much more difficult. Model amendments to these laws and regulations, suggested by an expert committee of the Ministry of Home Affairs in 2003, are yet to be adopted by almost all the States and UTs.

Safety audit/ retrofitting of life line structures

Very few States have conducted safety audit and retrofitting of lifeline structures like hospitals, schools, administrative headquarters etc. in earthquake and other hazard zones. Gujarat has taken the lead in this regard, having conducted safety of all schools and hospitals in seismic zone V and retrofitted one State hospital, five district hospitals, 4268 school buildings, 178 bridges and 245 dams/ reservoirs.

Government of Tripura has reported that Rapid Visual Screening (RVS) of 400 school buildings have been undertaken and detailed vulnerability assessment of houses and buildings and houses in Agartala city have been completed. Additionally, six heritage buildings have been retrofitted.

Government of Uttarakhand has informed that safety audit of all lifeline structures are being undertaken under the World Bank-assisted Uttarakhand Disaster Recovery Project. RVS of five Primary Health Centres and 400 school buildings have been completed, and seven schools retrofitted.

Construction of cyclone/ flood shelters

Cyclone shelters have been constructed in all coastal States, particularly on the east coast, which is more affected by cyclones. The programme has received a boost under NCRMO in the States of Andhra Pradesh and Odisha, where access to the shelters have been improved with construction of link roads, facilitating evacuation of people to the shelters at short notice.

Government of Bihar has constructed flood shelters in some of the perennially flood affected districts of the State.

Ecosystem Approach for Disaster Risk Reduction

Ecosystem approach focuses on understanding the role ecology plays in reducing risks of disasters and adopting measures for strengthening environment and ecology in sensitive areas, towards protection against landslide, flash floods, drought and other local disasters. The importance of environment and ecology in preventing the creation of new risks and reducing existing risks of disasters have been highlighted in global as well as national frameworks on disaster risk management.

The regeneration of mangroves is one of the major activities under several programmes, such as cyclone risk mitigation, tsunami reconstruction and coastal area development. Some of the degraded mangroves have been successfully regenerated in States like Tamil Nadu, Goa, Karnataka and Odisha. Some of the Himalayan States like Sikkim and Meghalaya has taken the lead in protecting the environment for reducing risks of disasters.

Social Safety Net for Poor and Vulnerable

Every State Government administers a large number of central sector, centrally sponsored and state specific schemes for the upliftment of the poor and vulnerable, which include the supply of food grains at a subsidised rate, rural employment guarantee programme, social security schemes for disabled, aged, widows etc., accident insurance scheme etc. Some of the benefits of these schemes are repeated for disaster affected people under the norms prescribed for State Disaster Response Fund. States like Tamil Nadu, Kerala, Andhra Pradesh, West Bengal and Odisha have been effective in administering the schemes, but these have not been adequate to protect the poor and vulnerable in some disaster prone areas. This probably calls for a complete overhauling of social protection schemes so that basic social protection measures are available for every poor and vulnerable population, irrespective of whether they are affected by disasters. This would provide a stronger social safety net than the existing practices of multiple schemes administered by diverse agencies without coordination. This would also avoid duplicity in approach, simplify the process of implementation and reduce the cost of delivery of the programmes.

Mitigating risks for cultural heritage

Mitigating risks for our cultural heritage is an important activity flagged in the Sendai Framework¹³². NDMA has also issued guidelines for the same¹³³, but hardly any State Governments have taken measures to protect our heritage from disasters—even though hundreds of such pieces of heritage are lying out in the open, displayed and stored in museums. As a part of their earthquake reconstruction programme, the Government of Gujarat restored the Bhuj Museum, which was damaged during the earthquake. The Government of Tripura retrofitted three heritage sites: Ujjayanta Palace, Neer Mahal and Umakant Academy.

Integration of climate change adaptation with DRR

The need for integrating disaster risk reduction with climate change adaptation has been highlighted in various global and national frameworks on climate action and disaster management, to provide a common and holistic approach for reducing the risks of extreme climatic events across sectors and avoiding duplicities in the investment of scarce resources for similar programmes and activities by diverse agencies. The National Policy on Disaster Management prescribed encouragement and promotion of synergies in approach and certain strategies in climate change adaptation and disaster risk reduction.

Climate change is impacting our glacial reserves, water balance, agriculture, forestry, coastal ecology, bio-diversity and human and animal health. There are definite indications that climate change would increase the frequency and intensity of natural disasters like cyclones, floods and droughts in the coming years. In order to meet these challenges in a sustained and effective manner, synergies in our approach and strategies for climate change adaptation and disaster risk reduction shall be encouraged and promoted.

The same has been routinely repeated in most of the State policies and plans on disaster management, but unfortunately these do not find much resonance in concrete measures for synergies and integration. Almost every State has referred to the State Action Plan on Climate Change, but none of these plans has outlined the measures to be taken for synergies in approach, strategies and action. None of the States seem to have implemented a single measure for promoting such synergies.

Other initiatives

None of the States has reported any innovating approach or initiatives for risk prevention and mitigation except repeating activities already mentioned above. Government of Kerala made a mention about Operation Anantha to reclaim drains from encroachment for improving flood management systems in the capital city of Thiruvananthapuram. Government of Tamil Nadu has spoken about the Vision Tamil Nadu 2023, which mentioned a comprehensive plan for reducing the impact of natural disasters and creating a dynamic response mechanism to natural calamities.

¹³² Sendai Framework, Priority 3, Para 30 (d).

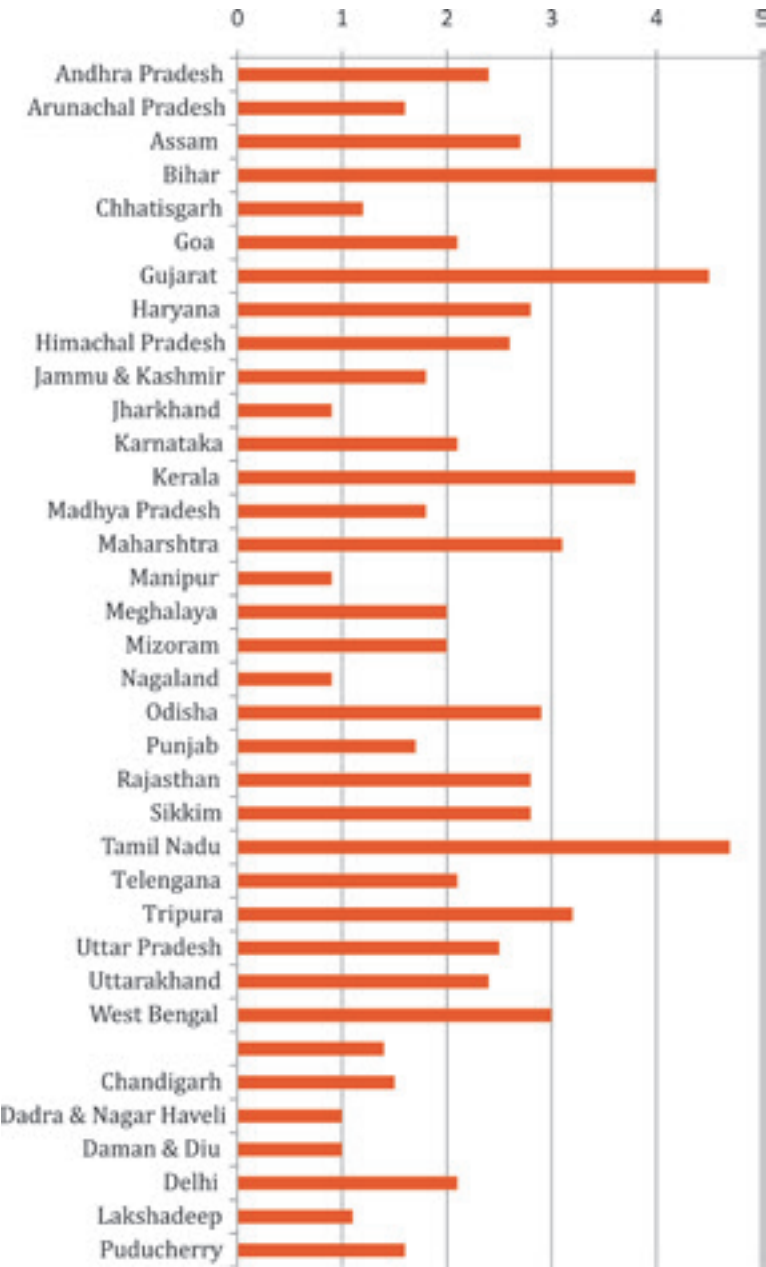
¹³³ NDMA has issued two separate Guidelines on Cultural Heritage Sites and Precincts, 2017 and Guidelines on Museums, 2018.

Table 37: Measuring Progress of States/ UTs on Risk Prevention & Mitigation

STATES	Disaster Risk Mitigation Projects	Mainstreaming DRR in Development	State and District Disaster Risk Mitigation Fund	Safety standards for construction/ land use plans	Safety audit/ retrofitting of life line structures	Construction of cyclone/ flood shelters	Eco System Approach for DRR	Social Safety Net for Poor and Vulnerable	Mitigating risks of heritage	Integration of climate change adaptation with DRR	Others	Total
Maximum Values	8	3	3	7	8	3	3	5	2	3	5	50
Andhra Pradesh	2	1	0	3	0	2	0.5	2.5	0	0.5	0.5	12
Arunachal Pradesh	2	0	0	2	1.5	0	0	2.5	0	0	0	8
Assam	3	1	0	3	3	0	0	2.5	0	1	0	13.5
Bihar	4	2	1.5	4	1.5	1	1	3	0	1	1	20
Chhattisgarh	0	0	0	2	0.5	0	0	3	0	0.5	0	6
Goa	2	0	0	3	1.5	1	1	2	0	0	0	10.5
Gujarat	4.5	1	2	4.5	4	1.5	1	2	1	1	0	22.5
Haryana	2	0	1	4	3	0	0.5	3	0	0	0.5	14
Himachal Pradesh	2	1	0	3	1	0	0	3	0	1	2	13
Jammu & Kashmir	1	0	1.5	3	1	0	0	2.5	0	0	0	9
Jharkhand	0	0	0	2	0	0	0	2.5	0	0	0	4.5
Karnataka	2	1	0	3	0	1	1	2.5	0	0	0	10.5
Kerala	4	1	1	4	2	2	0	2.5	0	1	1.5	19
Madhya Pradesh	1	0	0	3	1	0	0	2.5	0	0.5	1	9
Maharashtra	3	1	1.5	3	2	1	0	2.5	0	1	0.5	15.5
Manipur	0	0	0	2	0	0	0	2.5	0	0	0	4.5
Meghalaya	2	0	0	2	1.5	0	1	2.5	0	1	0	10
Mizoram	2	0	0	3	1.5	0	1	2.5	0	0	0	10
Nagaland	0	0	0	2	0	0	0	2.5	0	0	0	4.5
Odisha	4	1	0	3	0	2	1	2.5	0	1	0	14.5
Punjab	2	0	0	2	0	0.5	0	3.5	0	0.5	0	8.5
Rajasthan	3	0	2	3	0	0	1	3	0	1	1	14
Sikkim	2.5	0	0	2	2	0	1	2.5	1	1	2	14
Tamil Nadu	3	1.5	0	4	1.5	2	2	4	1	2	2.5	23.5
Telangana	2	0	0	3	0	0	0	3	0	0.5	2	10.5
Tripura	2	0	0.5	2	3.5	1	0.5	3	1	1.5	1	16
Uttar Pradesh	2	0	1.5	3	2	1	0	2.5	0	0.5	0	12.5
Uttarakhand	1	0	0	4	3.5	0	0	2.5	0	1	0	12
West Bengal	2.5	0	0	5	1.5	2.5	0	3.5	0	0	0	15
UNION TERRITORIES												
Andaman & Nicobar Islands	0	0	0	3	1	0	0.5	2	0	0	0.5	7
Chandigarh	0	0	0	3.5	1	0	0	3	0	0	0	7.5
Dadra and Nagar Haveli	0	0	0	3	0	0	0	2	0	0	0	5
Daman and Diu	0	0	0	3	0	0	0	2	0	0	0	5
Delhi	1.5	0	0	3	3	0	0	2.5	0.5	0	0	10.5
Lakshadweep	0	0	0	3	0	0	0.5	2	0	0	0	5.5
Puducherry	2	0	0	3	0	0.5	0	2	0	0	0.5	8

States have generally scored poorly in risk prevention and mitigation.

Figure 45: Overall progress of States/ UTs on Risk Prevention & mitigation



RISK GOVERNANCE

Disaster risk governance refers to laws, institutions, rules, conventions, processes and mechanisms by which decisions about risks of disasters are taken, communicated and implemented.

The approach towards disaster risk governance has evolved over the years from limited areas of coordinating humanitarian assistance of relief and rehabilitation to the victims of disasters to the wider canvass of managing risks of disasters involving all relevant sectors at all levels within and outside the government. The United Nations Development Programme, based on their experience of working with several countries around the world, has defined disaster risk governance as follows:

Disaster risk governance refers to the way in which the authorities, public servants, media, private sector, and civil society coordinate in communities, and on regional and national levels in order to manage and reduce disaster and climate related risks. This means ensuring that sufficient levels of capacity and resources are made available to prevent, prepare for, manage and recover from disasters. It also entails mechanisms and processes for citizens to articulate their interests and exercise their legal rights and obligations.

The comprehensive nature of disaster risk governance makes it imperative that sound and effective legal, institutional and operational frameworks are developed, defining roles and responsibilities of institutions and organizations, developing standards and procedures for governance, outlining policies for disaster management plans, programs and projects, allocating resources for implementation, building capacities for governance at all levels, and last, but not the least, setting up systems for monitoring, accountability and evaluation.

India, like most of the countries around the world, started looking at these imperatives of risk governance only towards the beginning of this century, driven mainly by the global concerns for disaster risk reduction, propelled by the International Decade for Natural Disaster Reduction (IDNDR) of the nineties and the Yokohama Strategy for a Safer World, adopted during the middle of the decade. Three successive mega disasters—the Latur earthquake in 1993, Orissa’s Super Cyclone in 1999 and the Gujarat earthquake in 2001—took a heavy toll on lives and property, exposed the weakness of existing systems of risk governance and called for restructuring and strengthening of the system.

In August 1999, Government of India constituted a High-Powered Committee (HPC) to review existing arrangements for preparedness and mitigation of natural disasters and recommend measures for strengthening organizational structures for disaster management. The HPC commissioned several studies on various aspects of disaster risk management; held a series of consultations with central, state and local government authorities, scientific and technical organizations, civil society, NGOs, community-based organisations, corporate sector, media, international agencies and other stakeholders; and organised several workshops and consultation meetings to make a comprehensive study of disaster risk management in the country. The HPC submitted its report in October 2001, providing a blueprint for Constitutional and legal framework, organizational structures and institutional mechanisms for ushering in a culture of preparedness, quick response, strategic thinking and prevention towards achieving the vision of a disaster-free India.



Source: UNDP

After the 2001 Gujarat earthquake, Government of India constituted an All Party National Committee, headed by the Prime Minister at that time, which converted the HPC into a Working Group of the National Committee. The Working Group submitted its report to the Prime Minister in June 2003, recommending the adoption of a national disaster management policy.

While all these initiatives created the necessary groundwork for a new system of disaster risk governance, the final push came a year later when India Ocean Tsunami created massive destruction in several countries, including India. Close to its heel the global community adopted the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.

Global Framework

The Hyogo Framework of Action prescribed a few key activities for strengthening the institutional framework for disaster risk management in the countries.

Law and institutions on disaster management create the foundations for risk governance, but these alone cannot ensure that a sound and effective system of risk governance has been established for holistic management of

risks of disasters that include pre-disaster risk assessment, risk prevention and mitigation and preparedness, as well as post-disaster response, disaster relief and reconstruction. Risk governance evolves over time in the context of the broader political economy, reflecting how social demands, economic compulsions and political priorities emerge, mesh and interweave to create a culture of prevention and preparedness in space and time. This, obviously, is a long, drawn-out process.

The global review of disaster risk governance during the post-Hyogo decade has established that new legal and institutional frameworks for disaster risk management have come up in almost every country around the world; also, that there has been limited success in application and implementation of laws, policies, plans, standards and regulations for disaster risk management. The Global Assessment Report on Disaster Risk Reduction 2015 made the following succinct observations:

Disaster risk management has little success in mainstreaming its priorities and ensuring that development sectors adopt policies, norms, standards and regulations to manage and reduce risks. Similarly, there has been little systematic engagement with the private sector in most countries, except through the lens of corporate social responsibility. In effect the strong political determination by the HFA to promote and integrate disaster risk reduction into development programming has

Hyogo Framework: Strengthening institutional basis for DRR

Hyogo Framework of Action prescribed several key activities for strengthening the institutional basis of disaster risk management, under three broad categories:

(i) Institutional and legislative frameworks

- a) Adopt or modify, where necessary, legislation to support disaster risk reduction, including regulations and mechanism that encourage compliance and promote incentives for undertaking risk reduction and mitigation activities;
- b) Integrate disaster risk reduction into development policies and planning at all levels of government;
- c) Support creation and strengthening of national integrated disaster risk reduction mechanisms, such as multi-sectoral national platforms, with designated responsibilities at the national through local levels to facilitate coordination across sectors;
- d) Decentralize responsibilities and resources to relevant sub-national or local authorities.

(ii) Resources

- a) Develop capacity-building plans and programmes for meeting ongoing and future requirements;
- b) Allocate resources for the development and implementation of disaster risk management policies, programmes in all relevant sectors at all levels.

(iii) Community participation

- a) Promote community participation in disaster risk reduction through policies, networking, strategic management of voluntary resources, delegation and provision of necessary authority and resources.



Source: UNDP

rarely materialized. The practice of prospective disaster management continues to be more symbolic than real. As the HFA comes to a close, it is difficult to identify countries where the strengthening of disaster risk governance has seriously influenced the direction of development.

Against this backdrop, the Sendai Framework for Disaster Risk Reduction 2015-2030 that succeeded the Hyogo Framework placed great importance on improving disaster risk governance. In fact, ‘strengthening disaster risk governance to manage disaster risk’ emerged as Priority-2 of Sendai Framework. A series of measures were prescribed at the national and local as well as global and regional levels, for achieving this priority for action.

National Frameworks

The Parliament of India passed Disaster Management Bill on 23 December 2005 and President of India gave his assent two days later for notification of Disaster Management Act 2005 on the first anniversary of Indian Ocean

Sendai Framework: Strengthening governance to manage disaster risks

Sendai Framework prescribed the following actions to be taken at national and local levels for strengthening disaster risk governance:

- a) Mainstream and integrate disaster risk reduction within and across all sectors. Review and promote the coherence and further development, as appropriate, of national and local frameworks of laws, regulations and public policies;
- b) Adopt and implement national and local disaster risk reduction strategies and plans, across different timescales with targets, indicators and time frames;
- c) Carry out assessment of technical, financial and administrative disaster risk management capacity to deal with the identified risks at local and national level;
- d) Encourage establishment of mechanisms and incentives to ensure high levels of compliance with existing safety-enhancing provisions of sectoral laws and regulations;
- e) Develop and strengthen, as appropriate, mechanisms to follow up, periodically assess and publicly report on progress on national and local plans;

- f) Assign clear roles and tasks to community representatives within disaster risk management institutions and processes and decision-making through relevant legal frameworks;
- g) Establish and strengthen government coordination forums composed of relevant stakeholders at national and local levels, such as national and local platforms for disaster risk reduction;
- h) Empower local authorities through regulatory and financial means to work with local communities in disaster risk management;
- i) Encourage parliamentarians to support implementation of disaster risk reduction through legislations and budget allocations;
- j) Promote development of quality standards for disaster risk management with the participation of private sector, civil society, professional associations and scientific organizations;
- k) Formulate public policies to address the issues and prevention or relocation, where possible, of human settlements in disaster prone areas.

Tsunami. The Act created new institutions for disaster management at the national, state and district levels, defined their powers and functions, roles and responsibilities, mandated formulation and implementation of disaster management plans at all levels and across all sectors, provided for creation of new funds for disaster response and mitigation and created NIDM as an apex institution for training and capacity development and NDRF as a national force for specialist response to disasters.

The Act extends to the whole of India, but in the federal structure of Indian polity States can have their own laws

on disaster management. At least four States have their own disaster management laws and at least one State conducts its disaster management activities based on their own laws.

Disaster risk governance occupies a prominent place in India’s first National Plan on Disaster Management (NDMP). Prepared by NDMA to fulfil the legal mandate under section 11 (1) of Disaster Management Act 2005 (to draw up a plan for disaster management for the whole of the country), and released in May 2016, the NDMP

Legal Framework of Disaster Management in the States

In the federal system of governance in India, disaster management is the primary responsibility of the State Governments, while Central Government plays supporting role with financial and technical support, and wherever necessary, logistic assistance for response, relief and reconstruction when these are beyond the coping capacity of the States. But these division of responsibilities were nowhere clearly defined till the enactment of Disaster Management Act 2005.

Disaster management does not find any mention in the Union, State or Concurrent List of the Seventh Schedule of Constitution of India. This prompted the High-Powered Committee on Disaster Management (2001) to recommend a specific entry in the Concurrent List by way of constitutional amendment. The Committee drafted National Calamity Management Bill for the consideration of Union Government and a Model State Disaster Management Bill for the State Governments.

Gujarat was the first State to enact its own disaster management law in 2003, two years after Bhuj earthquake. Three other States—Gujarat, Bihar, Uttar Pradesh and Uttarakhand— followed, while several other States were in the process of doing so. However, while the Gujarat Disaster Management Act was operationalized immediately after its enactment. the Bihar Disaster Management Act 2004, Uttar Pradesh Disaster Management Act 2005, and Uttarakhand Disaster Mitigation Management and Prevention Act 2005 remained largely non-functional, and other

States shelved their legal initiatives, as the pan-Indian Disaster Management Bill was passed by the Parliament and received the assent of the President on 26 December 2005 on the first anniversary of the Indian Ocean Tsunami.

Interestingly, entry 23, namely, ‘Social Security and Social Insurance, Employment and Unemployment’ in the Concurrent List, was invoked for the Disaster Management Act 2005. This implies that the State Governments retain their jurisdiction to enact their own laws; however, to the extent that a State law is inconsistent with Central law, it is the latter that would prevail in terms of article 254 of the Constitution.

Gujarat Disaster Management Act 2003 remains the only functional state level disaster management law in the country. The Act is comprehensive and covers a wider range of areas than provided for under national law; such as declaration of an area as disaster prone or disaster affected, responsibilities of various stakeholders—such as police, home guard, civil defence, fire services, communities, private sector and other agencies and persons. Additionally, the Act defines the powers and functions of the district collectors and State Relief Commissioner. The Gujarat State Disaster Management Authority (GSDMA) constituted under the State Disaster Management Act 2003, continues to be governed by the provisions of this Act, while for the remaining States, DM Act 2005 alone provides the legal framework for disaster management.

is credited to be the first national plan that is ‘aligned broadly with the goals and priorities set out in the Sendai Framework for DRR’.

NDMP noted that many institutions for disaster risk governance have been created at the centre and the States and there are wide variations in their functioning, structure, and capabilities. The NDMP seeks to strengthen the entire system of disaster risk governance in the country using a responsibility matrix for central and state governments along the following six thematic areas of risk governance:

- 1) Mainstream and integrate DRR and Institutional Strengthening
- 2) Capacity Development
- 3) Promote Participatory Approaches
- 4) Work with Elected Representatives
- 5) Grievance Redress Mechanism
- 6) Promote Quality Standards, Certifications, and Awards for Disaster Risk Management

The responsibility matrix prescribed for the State Governments is shown in the table below.

Table 38: Responsibility Matrix for Strengthening Risk Governance at State Level

	Activities	Responsibilities of State Governments
1. —	a. Mainstream and integrate disaster risk reduction within and across all sectors b. Institutional strengthening	• Promote the coherence and development of relevant laws, regulations, and public policies • Adopt and implement disaster risk reduction strategies and plans, across different levels and timescale • Carry out assessment of the technical, financial and administrative capacity for disaster risk management at all levels within the state • Make institutions efficient and responsive • Improve work culture • Develop mechanisms, and processes to ensure transparency and accountability • Enhance relevant mechanisms and initiatives for transparency • Strengthen/ establish coordination and convergence mechanisms at state, district, and local levels • Promote necessary mechanisms and incentives to ensure high levels of compliance with safety-enhancing provisions
2. —	Capacity development	• Implementation in state ministries, departments, and agencies • Involving communities, panchayats, municipalities, urban local bodies, etc., elected representatives, civil society organizations, private sector, and educational institutions; • Develop capabilities at state, district, block, and local levels to understand disaster risk, develop DM plans, implement relevant policies, laws, and ensure compliance with risk reduction safety standards
3. —	Promote participatory approaches	• Empower local authorities • Implement participatory approaches in disaster management based on a multi- hazard approach, with emphasis on hazards more frequent in the region/ location • Establish and strengthen government coordination forums composed of relevant stakeholders • Promote for participation of individuals, households, communities, and businesses in all aspects of disaster management
4. —	Work with elected representatives	• Sensitize political leadership • Involve political leadership at state, district, block, and local levels in discussions on disaster management
5. —	Grievance redressal mechanism	• Ensuring the functioning of a sound grievance redress mechanism in all the ministries/ agencies involved in disaster response
6. —	Promote quality standards, such as certifications and awards for disaster risk management	• Ensure implementation of standards • Develop suitable by-laws specifically for urban and rural areas • Monitor compliance

Source: National Disaster Management Plan (NDMP), NDMA, 2016

Indicators for disaster risk governance in the States/ UTs

Based on the priorities for action of the Sendai Framework, the provisions of Disaster Management Act, the mandates of National Policy on Disaster Management and the matrix of responsibilities of National Plan, and in consultation with the concerned agencies of Government of India and State Governments, the following 10 indicators have been selected for assessing the progress of the States and Union Territories on disaster risk governance:

- 1. Institutional mechanisms for risk governance
- 2. Disaster Management Policy and Plans
- 3. Disaster Management Manuals and Procedures
- 4. De-centralization and Devolution of Functions
- 5. Community Involvement and Participation
- 6. Multi-Stakeholder Platform
- 7. Training and Capacity Development
- 8. Enforcement and Compliance
- 9. Transparency and Accountability
- 10. Monitoring and Evaluation System

Institutional mechanisms for risk governance

Until the Disaster Management Act came into effect, disaster management in the States of India did not go much further beyond providing humanitarian assistance of relief and rehabilitation to the victims of disasters. During prolonged and creeping disasters like drought, States further provided for relief employment for the survival and livelihood of the rural poor. These functions traditionally remained the exclusive domain of the Revenue Department of the State Governments for three reasons: historical, functional and logistic. Historically, drought and famine were handled by the revenue department during colonial administration as the department collected land revenue and famine caused disruptions in the process and the government came up with the famine code to deal with the situation, not so much for providing humanitarian assistance as for minimizing disruptions in the collections of land revenue. Land revenue today constitutes a miniscule fraction of state revenue, and district collectors hardly collect any revenue for government, yet the legacy continues. Functionally, Revenue Department controls the divisional and district administration which are the only field level agencies for administration of relief and rehabilitation assistance to the victims of disasters. Logistically, Revenue Department is the repository of all records of land ownership and tenancy, which makes it easy to identify the victims.

Over the decades since Independence, various development and regulatory agencies of the government like the Department of Agriculture, Directorate of Land Registration in Finance Department and Department of Municipal Affairs have taken over some of the traditional functions of Revenue Department, but none of these agencies can match the combination of the triple factors that provide primacy to the Revenue Department in disaster management.

During catastrophic disasters when coordination of disaster response, relief and recovery required interventions of multiple agencies of the government and non-government organizations as well as the Central Government and other State Governments, the States made special institutional mechanisms like the Cabinet Committee on Disaster Relief with the Chief Minister at the helm or a Crisis Management Committee with the Chief Secretary as chair, to deal with difficult situations.

Revenue Departments in the States have a separate Directorate, Division or Wing to deal with disaster relief and rehabilitation. In some States, the Directorate is headed by the Relief Commissioner, who still functions under the overall supervision of the Principal Secretary of Revenue Department. In some States, the relief wing was bifurcated to create a separate Department of Relief and Rehabilitation. In a few States, the newly created department was renamed the Department of Disaster Management, with additional related functions like civil defence (like in West Bengal). In most States, the Revenue Department continues to remain the nodal department on disaster management with the new nomenclature of Revenue and Disaster Management Department.

Table 39: Nodal Department on Disaster Management in the States

STATES	Nodal Government Department	Commissionerate/ Directorate/ Centre
Andhra Pradesh	Revenue (Disaster Management) Department	Commissioner (Disaster Management)
Arunachal Pradesh	Directorate of Disaster Management	-
Assam	Revenue and Disaster Management Department	-
Bihar	Disaster Management Department	-
Chhattisgarh	Revenue and Disaster Management Department	-
Goa	Revenue Department	-
Gujarat	Revenue Department	Commissioner of Relief
Haryana	Revenue and Disaster Management Department	-
Himachal Pradesh	Revenue Department	-
Jammu & Kashmir	Disaster Management, Relief, Rehabilitation and Reconstruction Department	-
Jharkhand	Home, Jail and Disaster Management Department	-
Karnataka	Revenue Department	
Kerala	Revenue Department	
Madhya Pradesh	Revenue Department	Relief Commissioner
Maharashtra	Revenue and Forest Department	Disaster Management Unit
Manipur	Relief and Disaster Management Department	-
Meghalaya	Revenue and Disaster Management Department	-
Mizoram	Disaster Management and Rehabilitation Department	-
Nagaland	Home Department	-
Odisha	Revenue and Disaster Management Department	Special Relief Commissioner
Punjab	Revenue and Rehabilitation Department	-
Rajasthan	Disaster Management, Relief and Civil Defence Department	-
Sikkim	Land Revenue and Disaster Management Department	-
Tamil Nadu	Revenue and Disaster Management Department	Relief Commissioner
Telangana	Revenue Department	Disaster Management Commissioner
Tripura	Revenue Department	-
Uttar Pradesh	Revenue Department	Relief Commissioner
Uttarakhand	Disaster Management Department	Disaster Mitigation and Management Centre
West Bengal	Disaster Management and Civil Defence Department	-

In the Union Territories, the nodal responsibility for disaster management is generally vested with divisional and district administration. In Delhi, the Divisional Commissioner is also Secretary of Disaster Management Department, while in Chandigarh, Dadra & Nagar Haveli, Daman & Diu and Lakshadweep Deputy Commissioners are in charge. Puducherry has a separate Revenue and Disaster Management Department, while Andaman & Nicobar Islands has a Directorate of Disaster Management.

Disaster Management Act 2005 has created three new institutions for disaster management at the State level. These are:

- a) State Disaster Management Authority (SDMA) headed by Chief Minister ex-officio;
- b) State Executive Committee (SEC) chaired by Chief Secretary ex-officio; and
- c) District Disaster Management Authority (DDMA) with District Collector/ District Magistrate/ Deputy Commissioner as the Chairperson and the elected representative of the local authority as Co-Chairperson (Chief Executive Officer of District Council in districts of Tribal Areas, as referred in Sixth Schedule of Constitution).

The Act has defined the composition, powers and functions of these institutions, and prescribed the manner in which meetings of these bodies shall be conducted and officers and employees of these bodies shall be appointed. The Act has further provided for constitution of Advisory Committees of SDMA and DDMA.

However, the manners in which the same provisions of the Act have been applied and implemented have varied from one State to another. While SDMAs in a few States have been very active, in most of the States these functions more like one among numerous Committees of governments those meet occasionally than specially created statutory authorities.

Table 40: Status of State Disaster Management Authority

STATES	Year of constitution of SDMA	Number of times SDMA met since its constitution	Has SDMA constituted Advisory Committee?	Does it have its separate establishments	If yes, total no professionals working with SDMA	Number of guidelines etc issued by SDMA	Does SDMA have its own website?
Andhra Pradesh	2007	1	No	Yes	9	4	Yes
Arunachal Pradesh	2006	2	No	No	Nil	0	No
Assam	2007	7	No	Yes	51	10	Yes
Bihar	2007	9	Yes	Yes	10	7	Yes
Chhattisgarh	2009	2	No	No	Nil	0	No
Goa	2008	11	No	No	Nil	0	No
Gujarat	2001 *	14	Yes	Yes	45	11	Yes
Haryana	2007	1	Yes	No	Nil	2	Yes
Himachal Pradesh	2007	5	Yes	No	Nil	5	Yes
Jammu & Kashmir	2007	6	Yes	Yes	4	0	Yes

Jharkhand	2010	3	No	No	Nil	0	No
Karnataka	2008	0	No	Yes	3	0	No
Kerala	2007	8	Yes	Yes	SEOC	4	Yes
Madhya Pradesh	2007	1	No	Yes	3	No	Yes
Maharashtra	2010	7	No	No	3	0	No
Manipur	2010	0	No	No	Nil	0	No
Meghalaya	2008	3	No	No	Nil	0	No
Mizoram	2006	6	Yes	No	Nil	0	No
Nagaland	2011	3	No	Yes	22	2	Yes
Odisha	2010 *	0	Yes	Yes	29	0	Yes
Punjab	2006	1	No	No	Nil	0	No
Rajasthan	2007	11	No	No	Nil	1	No
Sikkim	2010	3	No	Yes	NA	0	Yes
Tamil Nadu	2013	4	Yes	No	Nil	0	No
Telangana	2015	1	No	No	Nil	0	No
Tripura	2008	2	No	Yes	8	7	Yes
Uttar Pradesh	2013	1	No	Yes	6	0	Yes
Uttarakhand	2007	7	Yes	No	Nil	0	No
West Bengal	2007	7	Yes	Yes	9	0	No

*Odisha and Gujarat had created their own SDMAs even before the enactment of Disaster Management Act. Since OSDMA was registered under the Societies Act, a separate Odisha State Disaster Management Authority was created in 2010 to fulfil the legal requirement under the DM Act 2005. However, this has never met as the previous OSDMA continues to function effectively. GSDMA was already a statutory authority and therefore a separate SDMA has not been created in the State.

Although the relevant provision of DM Act regarding the constitution of SDMA was notified in 2006, several States have taken years for the constitution of the Authority. Despite grants provided by NDMA/ UNDP for strengthening these institutions, very few States have provided staff for the functioning of the Authorities. The Secretariat of Revenue Department provides support in most of the States. Notable exceptions are Assam, Gujarat, Odisha and Bihar, which are among the most active SDMAs in the country.

However, success stories of OSDMA and GSDMA seem to have motivated several States to strengthen their SDMA, due mainly to the leadership of political bureaucratic leaderships in the State, such as in Assam and Bihar. States like Kerala and Sikkim have taken initiatives to activate these bodies. Uttarakhand and Jammu & Kashmir have also been activated largely due to the implementation of World Bank-assisted projects for recovery from the devastating floods of 2013 and 2014.

Several States created specialized institutions dealing with disaster management either through laws or by executive orders. Some of these institutions are DMMC Uttrakhand, APSDMS, Andhra Pradesh and KEOC, Kerala.

Odisha showed the way, Gujarat joined and the Nation followed

Odisha is credited to be the first State in the country to have created an autonomous state level organization to deal with various aspects of disaster management before, during and after disasters. Gujarat adopted this model with some modifications and later it was further adapted and replicated throughout the country under the Disaster Management Act.

Orissa State Disaster Mitigation Authority (OSDMA) was set up by the Government of Orissa as an autonomous organization on 29 December 1999 in the intermediate aftermath of the super cyclone in 1999. It was registered under the Societies Registration Act, 1860 as a non-profit making charitable institution for the interest of the people of Orissa, with its headquarters at Bhubaneswar and jurisdiction over the whole State. Subsequently, after the enactment of Disaster Management Act 2005 the name of the Authority was changed to Orissa State Disaster Management Authority by Resolution No. 42317/R&DM dated 27th September, 2008 of Revenue & Disaster Management Department, but OSDMA continues to remain an autonomous registered society with its own organizational structure, functions and procedures that are not exactly the same as prescribed under the DM Act. A Governing Body under the chair of Chief Secretary decides all substantial issues of OSDMA, while the Managing Director is vested with the responsibility of day-to-day implementation, assisted by 19 professionals besides other support staff.

Odisha has separately constituted its State Disaster Management Authority under the provisions of DM Act 2005, with Chief Minister as its Chairman. SDMA has met only twice so far since its constitution on 20 October 2010, while OSDMA meets several times every year. OSDMA provides technical support to SDMA, while the office of

Special Relief Commissioner in Revenue and Disaster Management Department acts as its secretariat.

On the aftermath of the devastating Bhuj earthquake of 26 January 2001, Government of Gujarat wanted to set up an autonomous body to deal with the massive tasks of relief, rehabilitation and reconstruction and further address the long-term issues of risk prevention, mitigation and preparedness. Government found the OSDMA model very handy and established the Gujarat State Disaster Management Authority (GSDMA) on 8 February 2001, less than two weeks after the earthquake, as a society registered under the Societies Registration Act. However, unlike the OSDMA, Chief Minister of the State headed the GSDMA and a Chief Executive Officer (CEO) became its functional head. Subsequently, the society was disbanded and GSDMA became a statutory body under section 7 of Gujarat State Disaster Management Act 2003. GSDMA is now a 14-member body with the CM as chair, two Ministers nominated by CM and 11 officials including Chief Secretary, Director General of Police, Revenue Secretary, CEO and Relief Commissioner, among others, as members. Gujarat has not set up any SDMA under DM Act, nor has it established DDMA, as GSDMA has its own District Project Officer in each district of the State.

Odisha showed the way that disaster management needed 24x7 engagement of a multi-disciplinary autonomous organization separate from the Department of Revenue and Relief. Gujarat adopted the model and later made changes as per its requirement. Government of India found considerable merits in this model of risk governance and made it a mandatory requirement of law for every State throughout the country.

Source: UNDP

DMMC Uttarakhand

Disaster Mitigation & Management Centre (DMMC) is a unique institution created under the provisions of Uttarakhand Disaster Mitigation Management and Prevention Act 2005. Section 16 of the Act provides that DMMC shall work as a ‘think tank’ for State Disaster Management Authority for five specified functions: (a) collection and analysis of data on all aspects of disaster management; (b) repository of information and communication relating to disaster management; (c) development of guidelines for preparation of disaster management plans by the districts, departments and local authorities; (d) promotion of awareness and preparedness of stakeholders and the community to deal with all potential disasters; and (e) formulation of policy relating to risk transfer mechanisms.

DMMC has also undertaken the responsibility of training communities and community-based organizations and through them developing a strong network of grassroots level organisations and individuals for risk assessment, risk prevention and risk mitigation as well as disaster preparedness, disaster response and disaster relief and rehabilitation. DMMC is headed by its Executive Director, who has a skeletal support staff of three managers and three secretarial assistants.

APSDMS, Andhra Pradesh

Andhra Pradesh Government, established as the AP State Disaster Mitigation Society (APSDMS) in 2003 as an autonomous Society under the administrative control of Planning Department, to take up Disaster Mitigation studies relating to ‘Rainfall, Run-off, Flood Forecasting, Cyclone Modelling for Tracking Wind and Storm Surge Forecast’ to improve the early warning capabilities of the State on natural disasters. The society, in the course of its operations, also started studies on Coastal Zone Management, Delta Water management and Preparation of Disaster Management Plans related to Cyclone, Drought and Earthquakes, as part of its long-term mitigation measures.

APSDMS was restructured and re-named Andhra Pradesh State Development Planning Society (APSDPS) in 2012 and its mandate was widened to support the Planning Department to undertake activities pertaining to result-oriented planning and growth forecasting through professional support, mainstreaming disaster mitigation and networking with various national and international organizations.

KSEOC, Kerala

In 2012 Government of Kerala created Hazard Vulnerability Risk Assessment (HVRA) Cell as the ‘research and technical laboratory’ of KSDMA under the scientific supervision of the Centre for Earth Science Studies. Two years later, the HVRA Cell was converted to Kerala State Emergency Operations Centre (KSEOC). It is a unique in-house institution created in the State not only for emergency management but also for scientific analysis of state specific risks on a continuing basis.

KSEOC is staffed with a multi-disciplinary scientific team of 21 professionals and is in the process of acquiring state-of-the-art equipment and facilities for multi-dimensional research on risk assessment and for early warning of disasters. It is also functioning as the secretariat of Kerala State Disaster Management Authority. Once made fully operational, SEOC is expected to provide intelligent decision support systems for prediction and early warning of major hydro-meteorological hazards, as well as for emergency management.

Disaster Management Policy and Plans

Section 23 of Disaster Management Act 2005 has ordained that every State shall prepare its State Disaster Management Plan, which would include, inter alia, the following:

- (a) The vulnerability of different parts of the State to different forms of disasters;
- (b) The measures to be adopted for prevention and mitigation of disasters;
- (c) The manner in which the mitigation measures shall be integrated with the development plans and projects;
- (d) The capacity-building and preparedness measures to be taken;
- (e) The roles and responsibilities of each Department of the Government of the State in relation to the measures specified in clauses (b), (c) and (d) above; and
- (f) The roles and responsibilities of different Departments of the Government of the State in responding to any threatening disaster.

The State Plan shall be prepared by the State Executive Committee, approved by the SDMA and reviewed and updated annually. The Act further provides that the State Governments shall make appropriate provisions for financing implementation of the Plan.

Section 40 of the Act provides that every Department of the State Government shall prepare Disaster Management Plan of the department which would lay down the following:

- (g) The types of disasters to which different parts of the State are vulnerable;
- (h) Integration of strategies for the prevention of disaster or the mitigation of its effects or both with the development plans and programmes by the department;
- (i) The roles and responsibilities of the department of the State in the event of any threatening disaster situation or disaster and emergency support function it is required to perform;
- (j) Present status of its preparedness to perform such roles or responsibilities or emergency support function under sub-clause (iii); and
- (k) he capacity-building and preparedness measures proposed to be put into effect in order to enable the Ministries or Departments of the Government of India to discharge their responsibilities under section 37.

The Plan shall be reviewed and updated annually and a report on the status of implementation of the Plan shall be submitted to the State Executive Committee.

Section 31 of the Act further provides that every district shall have its District Disaster Management Plan, which shall be prepared by District Disaster Management Authority in consultation with the local authorities, approved by the SDMA, and reviewed and updated annually.

NDMA issued guidelines for preparation of State and District Disaster Management Plans, organized workshops to clarify various issues for preparation of the plans and provided special grants to facilitate preparation of the plans. UNDP also assisted States for preparation of DM Plans. However track records for preparation of the Plans have not been very good.

Table 41: Status of Preparation of State, District and Departmental DM Plans

STATES/ UNION TERRITORIES	Year of preparation of State DM Plan	Years of revision of State DM Plan	Total number of districts in the State	How many districts have prepared District DM Plans	Number of times District DM Plans have been revised	Total number of Departments in the State	Number of Departments prepared Departmental DM Plans
STATES							
Andhra Pradesh	2010	No revision	13	13	0	34	15
Arunachal Pradesh	2016	No revision	20	20	1	39	9
Assam	2015	No revision	33	27	1	55	14
Bihar	2014	No revision	38	1	0	44	0
Chhattisgarh	2011	2016	27	27	0	27	0
Goa	Response Plan	2012	2	2	1	41	1
Gujarat	2011	Regular	33	33	Periodic	27	1
Haryana	Draft Plan	--	21	21	1	40	0
Himachal Pradesh	2012	2017	12	12	1	42	35
Jammu & Kashmir	2017	No revision	22	0	0	38	2
Jharkhand	2016	No revision	24	24	1	33	0
Karnataka	2013	No revision	30	30	0	50	4
Kerala	2016	No revision	14	14	0	36	4
Madhya Pradesh	2012	No revision	51	51	0	60	5
Maharashtra	2016	No revision	35	34	1	38	2
Manipur	2016	No revision	16	0	0	46	0
Meghalaya	2016	No revision	11	11	1	51	11
Mizoram	2012	No revision	8	8	0	58	54
Nagaland	2013	No revision	11	11	1 (Partly)	67	0
Odisha	2013	2014, 2016, 2017	30	30	0	40	23
Punjab	2015	No revision	22	22	0	44	0
Rajasthan	2014	No revision	33	33	1	49	7
Sikkim	2015	No revision	4	4	0	44	0
Tamil Nadu	2016	No revision	32	32	0	40	14
Telangana	No	No revision	34	31	0	11	0
Tripura	2016	No revision	8	8	4	20	8
Uttar Pradesh	2016	No revision	75	75	0	82	0
Uttarakhand	2014	2017	13	13	Regular	49	9
West Bengal	2008	2016	22	22	1	40	0
UNION TERRITORIES							
Andaman & Nicobar Islands	2012	2017	3	3	0	35	0
Chandigarh	2005	2014	-	-	-	25	10
Dadra & Nagar Haveli	2016	No revision	-	-	-	45	0
Daman & Diu	-	-	2	2	0	17	0-
Delhi	2015	No revision	11	11	0	79	0
Lakshadweep	2014	No revision	-	-	-	39	1
Puducherry	2015	No revision	4	-	-	47	0

Every State now has its State Disaster Management Plan. Haryana has a draft Plan which is yet to be approved. Goa has a Disaster Response Plan, which does not cover all aspects of disaster risk management. None of the States has reviewed and updated the plans annually. Odisha has completed a maximum number of three revisions, while Chhattisgarh, Himachal Pradesh, West Bengal and Uttarakhand have revised once each. Gujarat has informed the government that the State Plan is revised regularly, but no further details regarding such revisions have been provided. Daman & Diu does not have a UT level DM plan, as the UT is divided into two districts and dispersed geographically, each having its own DM Plan.

All the 640 census districts of the country and the districts created after the last Census of 2011 have their own District Disaster Management Plans, but none of these plans have been reviewed and updated annually, as mandated under the Act. Tripura has said that the DDMPs have been revised four times and Gujarat and Uttarakhand have claimed that these are being revised regularly/ periodically. Departmental Disaster Management Plans have not been prepared generally, except in the States of Himachal Pradesh, Mizoram, Odisha, Assam, Tamil Nadu and Andhra Pradesh, as detailed in the table above.

All the Union Territories, except Daman & Diu, have UT DM Plan, even though there is no legal requirement for the same. All the districts of UTs have their DM Plan, except the three districts of Puducherry, which are subsumed in UT Plan due to the relatively small size of its districts. Single district UTs of Chandigarh, Dadra & Nagar Haveli and Lakshadweep have one common DM Plan for the UT and districts.

Quality of the DM plans prepared at the level of States, districts and departments have varied enormously. Some of the Plans are very well-prepared, with clear ideas and plans of action, and a road map for implementation, clearly defining roles and responsibilities of various agencies and their functionaries, while some are poor adaptations of template documents, and most are poorly conceived, drafted without any time frame for implementation, monitoring and review. Himachal Pradesh State Disaster Management Plan is the only plan that has set short, medium and long term targets to be achieved.

A review of State Disaster Management Pans of five States¹³⁴—Assam, Bihar, Gujarat, Odisha and Uttarakhand—found that although the Plans provided a good basis for coordinating disaster risk reduction and management at the state level, these would be strengthened if the following steps are taken:

- a) all stages of the disaster management cycle are considered equally, as opposed to their current emphasis on post-disaster response and relief;
- b) new and innovative models for financing risk management are analyzed in the specific contexts of the States;
- c) various tools and techniques to mainstream disaster risk reduction across all the relevant sectors and departments are specified;
- d) the socioeconomic vulnerability of different groups, such as women and the very poorest people, are incorporated adequately, into vulnerability assessments;
- e) the additional risks that climate change will bring to vulnerable populations are considered;
- f) baseline assessments and data to track future progress in disaster risk reduction are produced; and
- g) plans are aligned more closely with the Sendai Framework.

134 Aditya Bahadur, Emma Lovell and Florence Pichon, ‘Strengthening of Disaster Risk Management in India: A Review of Five State Disaster Management Plans’, CDKN and ODI, 2016

Disaster Management Manuals and Procedures

States with well-established administrative systems of disaster relief and rehabilitation, such as West Bengal, Maharashtra, Tamil Nadu, Punjab, Uttar Pradesh etc, have a comprehensive Relief Manual that has been amended from time to time to incorporate changes in norms of relief, as notified by Government of India, from time to time. Several States have brought out revised editions of the manual, deleting orders, circulars and guidelines that are no longer relevant, while a few States have replaced the omnibus Relief Manual with a series of manuals and SOPs covering specific aspects of disaster management.

A few States have developed a Disaster Management Manual, while a few others have notified Disaster Management Rules for the implementation of DM Act.

Decentralisation and Devolution of Functions

The DM Act has not been very specific regarding devolution of functions and responsibilities to the urban and rural self-governing institutions of the country. This has not deterred several State Governments from entrusting responsibilities to these institutions, particularly to the Municipal Corporations. Every big city in India now has a Disaster Management Plan, and several cities have set up separate disaster management departments and Emergency Operations Centres. A few States have prepared disaster management plans at block, panchayat and even village levels. Government of Assam have set up village, circle and ward level Committees on disaster management.

Most of such arrangements have taken place informally, which highlights the needs of amending the DM Act to officially charge the panchayats and municipalities with the responsibility of managing risks of disasters at the local level, in the spirit of the 73rd and 74th Constitution (Amendment) Act of 1992.

Community Involvement and Participation

Involving local communities for local level disaster risk management—from assessing risks of disasters to planning mitigation of risks, from being prepared for residual risks of disasters to responding to disasters as and when these happen—has been the stated policy and strategy of disaster management of every State Government, but the practices and progress of such involvements have varied from one State to another. States with good track records of community involvement, such as Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, Uttarakhand etc, have achieved better results in involving communities for risk governance. In Kerala, Tripura and West Bengal community mobilizations have taken place politically, with their strengths and pitfalls. Political support has facilitated quick acceptance, while it has polarized communities even during humanitarian crises.

Multi-Stakeholder Platform

The Sendai Framework has called for an ‘all-of-society’ approach for disaster management, which requires participation of all stakeholders for managing risks of disasters. Institutional arrangements for ‘all-of-society’ engagement are not numerous. Following the prescription of the Hyogo Framework, several countries, including India, had set up a National Platform for Disaster Risk Reduction, which involves governments at all levels, scientific and technical institutions, business, communities, civil society, media and others. Taking a clue from the National Platform, several State Governments have set up multi-stakeholder State Platform for Disaster Risk reduction, while others are yet to follow suit.

Training and Capacity Development

Training and capacity development of the cutting-edge functionaries of government and other agencies are important for disaster risk governance, as without trained manpower at each level and in each sector, it would be difficult to provide efficient, effective, accountable and transparent system of risk governance. Every global and national framework on disaster management has emphasized the critical role of capacity development for risk governance. Recognizing this role, the DM Act has set up the National Institute of Disaster Management (NIDM), with responsibilities inter alia of:

Providing assistance to the State Governments and State training institutes in the formulation of State level policies, strategies, disaster management framework and any other assistance as may be required by the State Governments or State training institutes for capacity-building of stakeholders, Government including its functionaries, civil society members, corporate sector and people’s elected representatives (Section 42(9)e).

Under a central sector scheme, NIDM had been supporting the States Governments with an annual financial grant to set up Disaster Management Centres (DMC) at the premises of Administrative Training Institutes of the States, for conducting training programmes for the functionaries of the State Government, district administration and local agencies. This grant was discontinued after 13th Finance Commission provided a composite grant of Rs 300 crores to the States, to strengthen capacity development for disaster management for the fiscal cycle 2010-15.

NIDM has also played a catalytic role in involving the Central and State Boards of School Education to include disaster management in the curriculum of school education. University Grants Commission, All India Council for Technical Education, and Medical Council of India were involved in starting disaster management courses in higher education, including civil engineering, medicine and nursing. A set of questionnaires was circulated to the State Governments to elicit information on the status of disaster management training and education in the States.

Disaster management is now included in school education in every State except Chhattisgarh, Goa and Nagaland. Disaster management is also included in universities and civil engineering courses in almost all the States. Every State has set up Disaster Management Training Centres either in its ATI or separately.

Table 42: Status of Training and Capacity Development on Disaster Management

STATES/UNION TERRITORIES	Has any Institute or Centre been set up for conducting training on DM?	Number of professionals working in DM Institute/ Centre.	Number of training programmes conducted on DM during 2006-2017?	Number of persons trained in Disaster Management during 2006-2017.	Is disaster management included in entry/ induction level training of State Services?	Is disaster management included in the curriculum of school education?	Is disaster management included in the curriculum of higher education?
STATES							
Andhra Pradesh	Yes	NA	NA	NA	NA	Yes	NA
Arunachal Pradesh	No	NA	NA	NA	Yes	Yes	Yes
Assam	Yes	NA	NA	NA	Yes	Yes	Yes
Bihar	Yes	NA	NA	NA	Yes	Yes	No
Chhattisgarh	Yes	2	99	4939	Yes	No	Yes
Goa	No	NA	NA	NA	Yes	No	No
Gujarat	Yes	NA	NA	NA	Yes	Yes	Yes
Haryana	Yes	NA	NA	NA	Yes	Yes	Yes
Himachal Pradesh	Yes	NA	NA	NA	Yes	Yes	Yes
Jammu & Kashmir	Yes	2	NA	NA	Yes	Yes	Yes
Jharkhand	Yes	NA	NA	NA	No	Yes	Yes
Karnataka	Yes	NA	NA	NA	Yes	Yes	No
Kerala	Yes	NA	NA	NA	NA	Yes	NA
Madhya Pradesh	Yes	18	672	39785	Yes	Yes	Yes
Maharashtra	Yes	4	NA	NA	Yes	Yes	Yes
Manipur	Yes	0	10	560	Yes	Yes	No
Meghalaya	Yes	1	149	3806	Yes	Yes	No
Mizoram	Yes	2	NA	NA	Yes	Yes	No
Nagaland	Yes	0	NA	NA	Yes	No	Yes
Odisha	Yes	NA	NA	NA	Yes	Yes	No
Punjab	Yes	NA	NA	NA	Yes	Yes	Yes
Rajasthan	Yes	3	330	24996	Yes	Yes	Yes
Sikkim	No	NA	NA	NA	Yes	Yes	Yes
Tamil Nadu	Yes	NA	NA	NA	Yes	Yes	Yes
Telangana	Yes	NA	NA	NA	Yes	Yes	Yes
Tripura	Yes	4	109	4044	Yes	Yes	Yes
Uttar Pradesh	Yes	NA	NA	NA	Yes	Yes	Yes
Uttarakhand	Yes	4	588	15,006	Yes	Yes	No
West Bengal	Yes	NA	NA	NA	Yes	Yes	Yes

Gujarat has established its own Gujarat Institute of Disaster Management (GIDM) with state-of-art infrastructure for training. None of the Union Territories has set up training centres, while they have made arrangements with the neighbouring States for training their personnel as per their requirements.

Disaster management is included in entry level training programmes of State Civil Services. Several States have included disaster management in the training programmes of sectoral training institutes of PWD, Health, Agriculture, Forest, Fire Services etc. States have been reluctant in submitting quantitative information on the number of faculty members engaged in training centres and of functionaries trained, however. Chhattisgarh, Manipur, Meghalaya, Rajasthan, Tripura and Uttarakhand are the only States that submitted the details.

None of the States submitted information on the quantum of grants received from various sources (State budget, NIDM, Finance Commission) and expenses incurred on disaster management training, but it is understood that in most of the States the available grants could not be utilized in full, while at the same time sanctioned strength of faculty members in training centres remained vacant.

Training Need Analysis conducted in several States shows huge gaps in personnel trained in basic as well as specialized courses for disaster management. This definitely calls for a complete review of training and capacity development programmes on disaster management in the States.

Enforcement and Compliance

A test of good governance is is the effectivity of the compliance of rules, regulations, standards and procedures. While evacuation of thousands of people to safe places before cyclones or overall reduction in mortalities in disaster may indicate that standards of post-disaster governance for response has improved due to better early warning and deployment of trained response personnel, poor compliance of building and zoning regulations and slow progress in mainstreaming disaster risk reduction in development would suggest that pre-disaster governance has further scope for improvement.

Ease of regulations and incentives for compliance coupled with stringent punishments for violations have been found to be very effective in improving enforcement and compliance, but very few States seem to have taken any initiative in this regard. None of the States has commissioned any study or analysis to evaluate the effectiveness of enforcement of disaster management regulations in the State.

Transparency and Accountability

During post-disaster emergency situations enormous resources are spent within a very short span of time for procuring and distributing materials for humanitarian assistance as well as ex-gratia relief, which raises serious questions of transparency and accountability. Although Relief Manuals and SOPs have laid down the process to be followed for procurement and distribution, such as pre-negotiated prices for supply, scale of entitlements of relief, direct benefit transfer, involvement of communities in management of shelter camps including distribution of relief materials etc, there are many instances of irregularities, malpractices and corruption. These have been highlighted in performance and financial audit reports of the Comptroller and Auditor General in

several States.¹³⁵ These include violation of relief norms, procurement of sub-standard materials, procurement of materials that were never used, distribution of relief materials to unauthorized persons, diversion of relief funds for purposes not related to relief and rehabilitation etc.

States have responded that audit observations are not conclusive; also that discrepancies in many observations have been clarified and corrective measures taken, including disciplinary and vigilance cases, which have been initiated whenever called for. Many of these standard responses have not withstood the scrutiny of Public Accounts Committees of State Legislative Assemblies. These definitely call for serious deliberation, towards further improving the transparency and accountability of disaster governance mechanisms in the States.

Monitoring and Evaluation System

A strong and effective system of monitoring and evaluation of disaster management is yet to be established in the country. Neither the National Policy nor the National Plan on Disaster Management have prescribed a mechanism for monitoring the progress in implementation of laws, policies, plans and guidelines on short and medium terms and evaluating performance on a long terms basis. Several guidelines of NDMA had set a timeline for implementation, but very few of them have been followed. These have not raised any cause of concern, and understandably so, as there is no monitoring mechanisms to point these out and no accountability framework to analyze why this has happened. This has resulted in unusual complacency in the face of mounting discrepancies between promises and action.

The States Governments cannot be blamed for weak monitoring and evaluation systems when such a system is yet to be established at the national level. Most of the States have refrained from responding to the questions on monitoring and evaluation, while some of them have pointed that monitoring is part of the process of governance through internal review meetings and independent evaluations through CAGs and PACs.

Monitoring and evaluation have assumed importance in view of the global targets of disaster risk reduction set up in the Sendai framework and national commitments to achieve the targets as per the set of indicators agreed through a consultative process. It would be near impossible to achieve the targets unless a strong and effective monitoring system is in place, and a supporting database developed for enabling such monitoring on a time scale.

Other initiatives

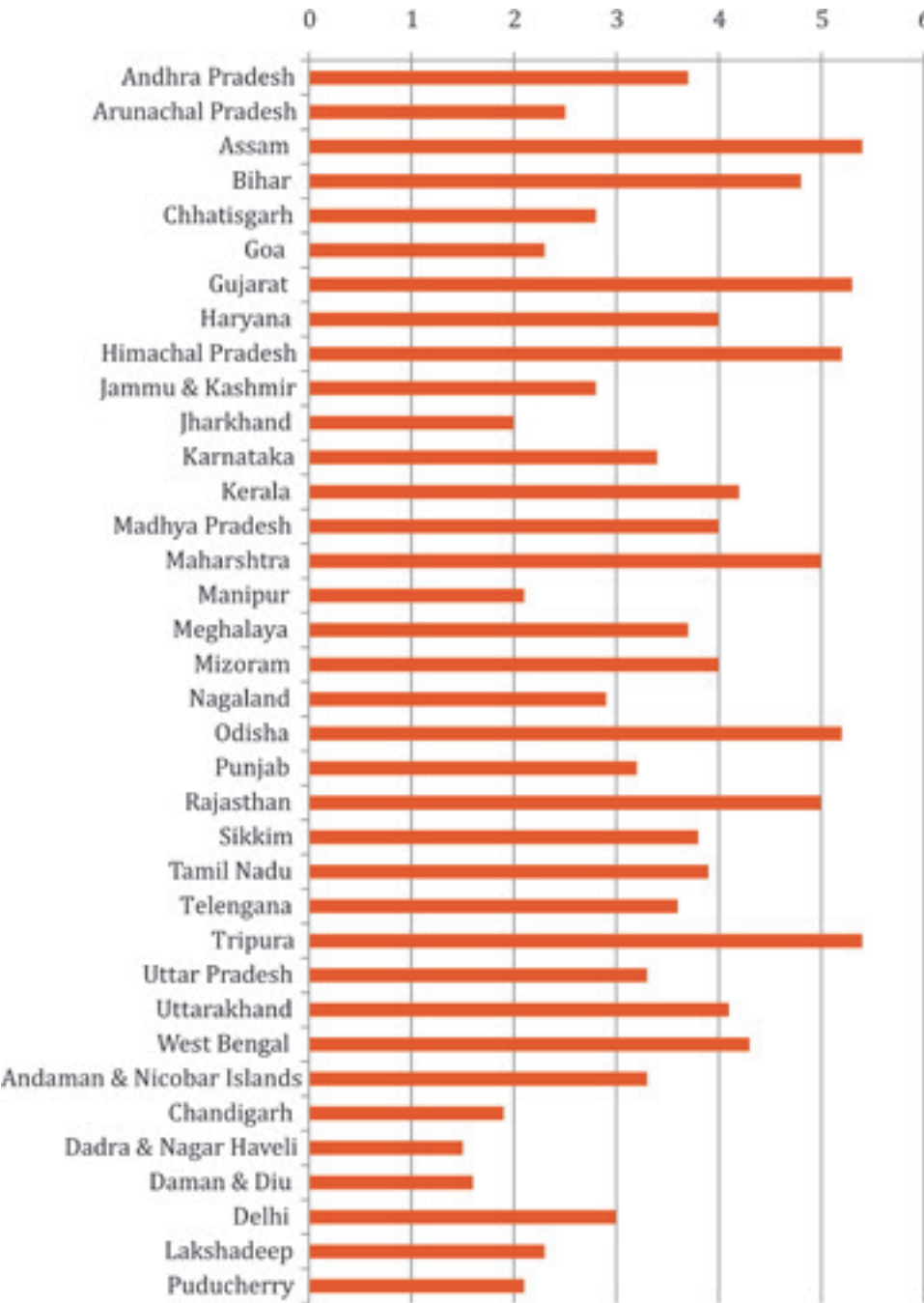
Very few States pointed out any state specific initiative for risk governance that is not covered by the 10 indicators stated above. Government of Assam stated that the disaster risk governance system at the grassroots has been strengthened with the setting up of a Village Land Management and Conservation Committee (VLMCC) in 16500 villages. Besides, Disaster Management Committees have been set up in 154 revenue circles and Ward Level Committees have been established in each municipal wards of cities and towns.

135 Reports of the Comptroller and Auditor General of India on Social, General and Economic Sectors (Non Public Sector Undertakings) for the State of Bihar 2009; Rajasthan 2011; Manipur 2012; Assam, Jharkhand, Maharashtra, Mizoram and Tamil Nadu 2013; Odisha 2014; West Bengal 2015; Jammu & Kashmir and Sikkim 2016; Himachal Pradesh and Kerala 2017.

Table 43: Measuring Progress of States/ UTs on Risk Governance

STATES AND UNION TERRITORIES	Institutional Mechanisms for Risk Governance	Disaster Management Policy and Plans	Disaster Management Manuals and Procedures	Decentralization and Devolution of Functions	Training and Capacity Development	Multi-Stakeholder Platform	Community Involvement and Participation	Enforcement and Compliance	Monitoring and Evaluation System	Transparency and Accountability	Others	Total
Maximum Values	6	10	2	2	10	2	5	4	2	2	5	50
Andhra Pradesh	3	3.5	0.5	1	5	0	3	1	0.5	1	0	18.5
Arunachal Pradesh	1.5	4	1	0.5	4	0	1	0	0	0.5	0	12.5
Assam	5.5	5.5	2	1.5	6.5	1	3	0	0	1	1	27
Bihar	5	5.5	1	1	5.5	1.5	2.5	0.5	0.5	1	0	24
Chhattisgarh	2	5	0.5	0.5	3.5	0	2	0	0	0.5	0	14
Goa	2	3	0.5	0.5	2.5	0	2	0	0	1	0	11.5
Gujarat	3.5	6.5	1	1.5	6.5	0.5	3.5	2	0.5	0.5	0	26.5
Haryana	3	6	1	0.5	6.5	0	2	0	0	1	0	20
Himachal Pradesh	4	9	2	0.5	5	2.5	2	0	0	1	0	26
Jammu & Kashmir	2.5	4.5	0	0.5	5	0	1	0	0	0.5	0	14
Jharkhand	1	3	0	0.5	4	0	1	0	0	0.5	0	10
Karnataka	2	6	1	0.5	4.5	0	2	0	0	1	0	17
Kerala	4	5.5	1.5	1.5	3	0	3	1	0.5	1	0	21
Madhya Pradesh	2.5	5	1	1	6.5	0	2	0.5	0.5	1	0	20
Maharashtra	3	7	1	1.5	6.5	1	3	1	0	1	0	25
Manipur	0.5	3	0.5	0.5	3	0	2	0	0.5	0.5	0	10.5
Meghalaya	3.5	6	1	1	4	0	2	0	0	1	0	18.5
Mizoram	4	6	1	1	4	0	2.5	0	0.5	1	0	20
Nagaland	4.5	3	1	1	2	0	2	0	0.5	0.5	0	14.5
Odisha	4	8	2	1	4.5	0	3	2	0.5	1	0	26
Punjab	3	2	2	1	5	0	2	0	0	1	0	16
Rajasthan	5	6	1	1	7	1.5	2	0	0.5	1	0	25
Sikkim	3	4	1	1.5	4.5	1	3	0	0	1	0	19
Tamil Nadu	2	4	1	1	5.5	0.5	3	0	0.5	1	1	19.5
Telangana	3.5	3	1	1	5.5	0	2	0	1	1	0	18
Tripura	3	8.5	2	1	5.5	1	3	2	0	1	0	27
Uttar Pradesh	3.5	4	1	0.5	5	0	2	0	0	0.5	0	16.5
Uttarakhand	3	5	2	1	5.5	0	2	0	0.5	1	0.5	20.5
West Bengal	4.5	5.5	1	1.5	6	0	1	0	0.5	1	0.5	21.5
Andaman & Nicobar	3	4	3	1	2.5	0	2	0	1	0	0	16.5
Chandigarh	1	4	0	0	1.5	0	2	0	1	0	0	9.5
Dadra and Nagar Haveli	1	3	0	0	2	0	1	0	0.5	0	0	7.5
Daman and Diu	1.5	3	1	0	1	0	1	0	0.5	0	0	8
Delhi	1.5	4	1	0.5	4.5	0	1	1	0.5	0.5	0.5	15
Lakshadweep	2	3.5	0	1	1	0	2	1	1	0	0	11.5
Puducherry	2	2	0.5	0	1.5	0	2	0	0.5	0	0	10.5

Figure 46: Overall progress of States/ UTs on Risk Governance



DISASTER PREPAREDNESS

Risks that are neither prevented nor mitigated nor even transferred through the mechanisms of insurance are the residual risks of disasters for which communities and countries must be prepared. Disaster preparedness includes measures for effectively responding to the impending disasters that could not be prevented or mitigated and to recover from the impacts of the disasters. UNISDR has defined preparedness as ‘the knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters’.



Source: UNDP

Typically, measures for disaster preparedness include early warnings of disasters and dissemination of such warnings to the last mile, developing systems, communications and procedures for emergency operations, contingency planning, SOPs and manuals, medical preparedness, community-based disaster preparedness, mock drills and exercises etc.

Ideally, level of disaster preparedness should match the level of residual risks, which are difficult to achieve even in most advanced countries. The level of residual risks being very high in developing countries, as measures for risk prevention, mitigation and risk transfer have been limited, and most efforts towards disaster risk management have focused on improving disaster preparedness. Investments in such measures have been found to be easy and cost-effective to implement and extremely useful in saving the lives of a vulnerable population.

The Hyogo Framework had its Priorities for Action 4 cut out for ‘Strengthening disaster preparedness for effective response at all levels’. The measures suggested for disaster preparedness included preparation of contingency

plan and policies at all levels, with focus on the most vulnerable areas and groups; regular preparedness exercises, including evacuation drills, with a view to ensuring rapid and effective disaster response and access to essential food and non-food relief supplies to meet local needs; establishment of emergency funds to support response, recovery and preparedness measures; development of mechanisms to engage active participation and ownership of relevant stakeholders, including communities, building on the spirit of volunteerism etc.

Some of these action areas had seen concerted action by many national governments, which boosted the capacity of disaster preparedness of many countries. Yet there were significant gaps in preparedness to respond to both high-intensity low-frequency complex and catastrophic disasters and low-intensity high-frequency disasters. Sendai Framework addressed some of these gaps in its Priority 4, ‘Enhancing disaster preparedness for effective response’. These include development of people-centred, multi-hazard, multi-sectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring telecommunications systems. Such systems and mechanisms need to be developed through a participatory process and tailored to the needs of users, including social and cultural requirements, in particular gender.

The Sendai Framework highlighted the need to build the resilience of new and existing critical infrastructure, including water, transportation and telecommunications infrastructure, educational facilities, hospitals and other health facilities, to ensure that they remain safe, effective and operational during and after disasters in order to provide live-saving and essential services.

The framework further highlighted the need to adopt public policies and actions to strengthen coordination and funding mechanisms and procedures for relief assistance; establish community centres for the promotion of public awareness and the stockpiling of necessary materials to implement rescue and relief activities; and train the workforce and voluntary workers in disaster response and strengthen technical and logistical capacities to ensure better response in emergencies.

National Initiatives

The national visions on disaster preparedness are laid down in its legislations, policy and plan on disaster management. Disaster Management Act 2005 defined preparedness as ‘the state of readiness to deal with a threatening disaster situation or disaster and the effects thereof’ (section 2(m)) and provided that plan on disaster preparedness shall form part of disaster management plans prepared at every level and across all development sectors. This included the National Plan (section 11(3)(c), State Plan (section 23(4)(d), District Plan (section 31(3)(c), Departmental Plans of Central Government (section 36(a) and Departmental Plans of State Government (section 40(1)(a)(iii).

The Act has further made NDMA responsible for taking measures as necessary for preparedness and capacity building for dealing with disasters and the threat of disasters (section 6(2)(i); for NEC to evaluate the preparedness at all levels of government for the purpose of responding any threatening disaster situation (section 10(2)(i); for SDMA to similarly review the measures being taken for preparedness by the departments of the state government (section 18(2)(h); and for DDMA to review the state of preparedness and give directions to the concerned departments at the district level or to other concerned authorities, towards bringing preparedness measures to the levels required for responding effectively to any disaster or threatening disaster situation

(section 30(2)(xi).

The National Policy on Disaster Management 2009 outlined a six-fold strategy for strengthening disaster preparedness in the country. These are (a) improving forecasting and early warning systems; (b) augmenting ICT support for decision making; (c) strengthening emergency operation centres; (d) enhancing capability for medical preparedness and mass casualty management; (e) expanding training, simulation and mock drills; and (f) encouraging community-based disaster preparedness. In addition, the National Policy highlighted the importance of building partnerships towards preparedness, which includes participation of all stakeholders in disaster preparedness, public-private-partnerships, and partnerships with media.

The National Plan on Disaster Management 2016 clubbed the issues of disaster preparedness and response, focusing primarily on emergency support functions during disasters. These are discussed in a separate chapter on disaster response. The only issue of disaster preparedness that finds a mention in the National Plan is Early Warning System. The matrix of responsibilities of Central and State Governments for early warning of disasters is shown in the following table.

Table 44: Early Warning: Matrix of Responsibilities of Central and State Governments

Thematic Area	Responsibility of Central Government	Responsibility of State Governments
Early warning, Maps, Satellite inputs, Information dissemination	• Issue forecasts, alerts, warnings • Provide early warning (wherever possible) to reduce the loss of life and property • Disseminate warnings and information to all Central Ministries/Departments/ Agencies and State Government • Use satellite imageries and other scientific methods for risk assessment and forecasting	• Disseminate early warning signals to the district administration, local authorities, and the public at large in the areas likely to be affected by a disaster so as to reduce loss of life and property • Disseminate warnings and information up to the last mile • Ensure appropriate compilation/ analysis of received data • Use satellite imageries and other scientific methods for risk assessment and forecasting

Government of India has designated agencies responsible for monitoring the onset of eight different hazards, and to set up Early Warning Systems and disseminate necessary warnings and alerts, wherever possible, to the concerned agencies of Central and State Governments, media and the general public.

Table 45: Hazard-wise Responsibilities of Central Agencies on Early Warning

	Hazard	Central Agencies responsible for Early Warning
1	Avalanche	Snow and Avalanche Study Establishment (SASE)
2	Cyclone	India Meteorological Department (IMD)
3	Drought	Ministry of Agriculture and Farmer's Welfare (MoA&FW)
4	Earthquake	National Centre for Seismology (NCS)
5	Epidemics	Ministry of Health and Family Welfare (MoH&FW)
6	Floods	Central Water Commission (CWC)
7	Landslides	Geological Survey of India (GSI)
8	Tsunami	India National Centre for Oceanic Information Services (INCOIS)

These agencies issue warnings and alerts to the Ministry of Home Affairs, Chief Secretaries of the States/ UTs, and District Magistrates of the concerned district. Press notes are also issued for information of print and electronic media and general public. It is the responsibility of the State Governments and District administration to further disseminate warnings to the people on the ground through all possible methods of communications and public announcements.

State Actions

Almost every State Government has stepped up its activities for disaster preparedness. These include dissemination of early warning of disasters to the last mile, establishment of Emergency Operation Centres at State and district headquarters., development of SOPs for the functioning of the Centres, arrangements for conducting mock drills, simulations and exercises, implementation of programmes for community-based disaster preparedness, developing resource inventory for effective response and so on.

End-to-End Early Warning Systems

While generation of early warning of hazards is the responsibility of concerned scientific and technical agencies of Government of India, dissemination of the warning to the people, especially to the communities at the last mile, in a language understandable to them, is the responsibility of the State Governments and district administration. While radio, television, mobile telephony, internet and social media are important channels of fast communication that cover the entire length and breadth of the country, there are many vulnerable and poor communities who may not have access to these channels of communications and even if they have access, they may not be able to understand and appreciate what the warnings mean to them in order to save lives and properties.

State governments have involved the district administration, the local panchayats, community based organizations, youth associations, village headmen and others and adopted many innovative tools such as beating of drums, waving of flags, announcements from temples, community halls etc. to disseminate early warnings. The processes of dissemination have generally been effective when the lead time for such warnings has been adequate to mobilize the administrative machineries to reach out to the people. Close to a million people were evacuated in the coastal districts of Odisha on the onset of cyclone Phailin in 2013, reducing casualties to less than 50 whereas a similar cyclone had claimed more than 10,000 people in 1999. In a contrasting situation,

during the much less severe cyclone Ockhi, nearly 500 people died in Kerala in 2017 as the warnings were not given early enough; due to the unprecedented wavering of the cyclone between the Bay of Bengal and the Arabian Sea.

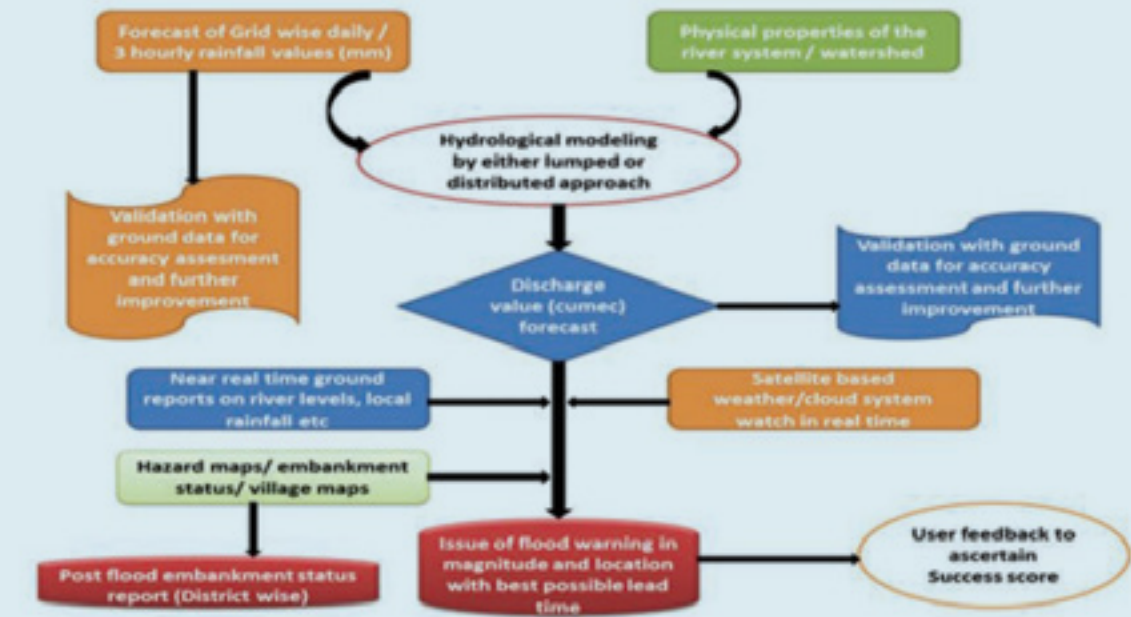
Flood Early Warning System (FLEWS) of Assam

Assam is one of the most flood prone States of India. The two main rivers of the State—Brahmaputra and Barak—and their multiple tributaries cause hazards of flood in more than 40 percent of the geographical area of the State. Nalbari, Morigaon, Darrang, Lakhimpur, Barpeta, Baxa and Dhamaji in the Brahmaputra valley and Cachar, Karimganj and Hailakandi in the Barak valley are the most flood prone districts of the State, each facing floods almost every year; causing enormous loss of lives, livelihoods, assets and infrastructure.

to take pre-emptive measures to evacuate people to safe locations and take other necessary measures to reduce damage and losses due to flood. Assam State Disaster Management Authority (ASDMA) brought in various scientific and technical agencies—India Meteorological Department (IMD), Central Water Commission (CWC), Assam Water Resources Department (AWRD), North East Electrical Power Corporation (NEEPCO), and North East Space Application Centre (NESAC) —to develop Flood Early Warning System (FLEWS).

In the absence of any real time early warning of floods, the State Government was finding it difficult

Flowchart of overall methodology of FLEWS



FLEWS has three main components: meteorological, hydrological and embankment monitoring. Real time data on rainfall at various locations and discharge from main rivers at up-middle-down-stream locations; satellite imageries on topography, land-use-land-cover, human settlement and breach of embankments, if any; and ground level inputs on various other parameters, are all integrated and modelled to generate early warnings of flood in terms of magnitude (intensity), location (state, district and circles) and time (7-24 hour range). A robust mechanism has been developed for dissemination of early warnings to the local administration, down to villages. The warnings have been ground-tested and the margin of error has been reduced to 4.14%. Encouraged by the success of the system, the coverage of FLEWS has been progressively expanded to all flood prone districts of Assam. Various States have shown their interests in replicating FLEWS in their States. Department of Administrative Reforms & Public Grievances has selected FLEWS as a best practice of innovative disaster preparedness.

Dissemination of early warnings has been institutionalized in States like Odisha and Gujarat through SOPs and standing orders, as well as the provision of financial, administrative and logistic arrangements at all levels. Every concerned functionary of the government is well aware of his/ her responsibilities and the time frame within which actions have to be taken, which are closely monitored at the highest level.

Several States have developed their own flood warning systems to supplement rainfall and river discharge forecasts from IMD and CWC. Assam SDMA in collaboration with North Eastern Space Application Centre (NESAC) has developed a Flood Early Warning System (FLEWS) which provides location specific flood alerts within 12-48 hours in advance. Water Resources Department of Government of Bihar has developed flood forecasts and inundation model on the rivers north of Bihar with a lead time of 72 hours, taking the help of telemetry stations for obtaining real time data. Municipal Corporation of Greater Mumbai has installed automated rain gauge stations in 62 different locations in the city to capture the intra-city variations in rainfall that are not available from IMD forecasts. This facilitates ward level action for flood response.

Andhra Pradesh Disaster Mitigation Society (APSDMS) undertakes studies relating to ‘Rainfall, Run-off, Flood Forecasting, Cyclone Modelling for Tracking Wind and Storm Surge Forecast’ to improve the early warning capabilities of the State on natural disasters. Karnataka State Natural Disaster Monitoring Centre (KSNDMC) installed 5,978 automated solar powered GPRS enabled Telemetric Rain Gauges (TRG) at village panchayat level and 747 Telemetric Weather Stations in metropolitan areas, which has enabled real time transmission of rainfall and weather data. The data are analyzed automatically through web-enabled applications and the scientific reports that are subsequently generated are transmitted to the users via SMS, email, helpdesk (Varuna Mitra) and electronic and print media.

Emergency Operation Centres

Most of the State capitals and district headquarters have dedicated Emergency Operation Centres on disaster management. Thirteenth Finance Commission grants on capacity building for disaster management enabled the establishment of such centres. Most of these centres work round the clock, while in some States like Uttar Pradesh these function only during floods. As per responses received from the States, a few States like Chhattisgarh, Goa, Jharkhand, Manipur, Meghalaya, Telangana are yet to set up EOCs. Most of the Union Territories use police control as EOCs for disaster management.

The status of EOCs is summed up in the table below.

Table 46: Status of Emergency Operation Centres

STATES/UNION TERRITORIES	Has State Emergency Operation Centre been set up?	Does it work round-the-clock?	Is SEOC equipped with advanced communication equipment?	Is SEOC linked with Virtual Private Network of ISRO?	Has any SOP Been issued for operation and management of SEOC?	Does SEOC provide space for operation of Emergency Support Functions?	How many districts have District Emergency Operation Centers?
STATES							
Andhra Pradesh	Yes	Yes	Yes	No	Yes	No	None
Arunachal Pradesh	Yes	Yes	Yes	No	No	No	All
Assam	Yes	Yes	Yes	Yes	Yes	Yes	27
Bihar	Yes	Yes	Partly	No	Yes	No	Yes
Chhattisgarh	No	--	--	--	--	--	--
Goa	No	--	--	--	--	--	--
Gujarat	Yes	Yes	Yes	Yes	Yes	Yes	All
Haryana	Yes	Yes	Yes	No	No	No	Partly
Himachal Pradesh	Yes	Yes	Yes	No	Yes	Yes	All
Jammu & Kashmir	Yes	Yes	Partly	No	No	No	None
Jharkhand	No	--	--	--	--	--	--
Karnataka	Yes	Yes	Yes	Yes	No	No	All
Kerala	Yes	Yes	Yes	Yes	Yes	Yes	All
Madhya Pradesh	Yes	Yes	Yes	Yes	No	Partly	All
Maharashtra	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manipur	No	--	--	--	--	--	--
Meghalaya	No	--	--	--	--	--	--
Mizoram	Yes	No	Partly	No	No	No	All
Nagaland	Yes	Yes	Partly	No	No	No	None
Odisha	Yes	Yes	Partly	Yes	No	Partly	All
Punjab	Yes	Yes	Yes	No	No	Partly	All
Rajasthan	Yes	Yes	Yes	No	No	No	Some
Sikkim	Yes	Yes	Yes	Yes	No	No	Yes
Tamil Nadu	Yes	Yes	Yes	Yes	Yes	Partly	Yes
Telangana	No	No	No	No	No	No	None
Tripura	Yes	Yes	Yes	No	Yes	Partly	
Uttar Pradesh	Yes	During flood	Partly	No	No	No	None
Uttarakhand	Yes	Yes	Yes	Yes	No	Partly	Some
West Bengal	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Disaster Communication System

Standards and specifications of basic communication equipment have been taken into consideration, including triple redundancies in communication, as suggested by a Committee of Experts. These have been installed in all functional EOCs. States like Gujarat and Maharashtra have advanced state-of-art communication equipment.

Emergency Medical Preparedness

Emergency medical preparedness means that all hospitals in the State, both in public and private sector, are fully geared to deal with disasters which would cause a sudden influx of people in all age groups, particularly children, women and aged, who would need emergency medical treatment. The nature of treatments required would vary from simple dressing of wounds to complex surgical procedures for fixing bone and joint fractures, cardiac arrests etc. In case of epidemics and pandemics, the challenges would be much more complex as these may affect hospital staff themselves, reducing their effectiveness. Hospital buildings may also be damaged during earthquakes, requiring alternate arrangements such as the setting up of field hospitals. In catastrophic disasters, mass casualties would overwhelm the capacity of hospitals, requiring inter-hospital coordination for sharing burdens, emergency discharge of non-critical patients and emergency processes like triage for prioritizing admission on the basis of age, nature of treatment, expected duration of treatment etc.

All these would require standard protocols and operating procedures to be followed, training of medical and para-medical personnel and regular mock drills for improving operational readiness of the hospitals.

NDMA has issued comprehensive guidelines for emergency medical preparedness and mass casualty management¹³⁶, but barring a few in certain states hospitals in the country are not at all equipped to handle catastrophic disasters. However, efforts are being made to improve the preparedness of the State and district level hospitals to deal with regular and recurring disasters. Jammu & Kashmir is the only State in India to have prepared Health Disaster Management Plans at the district levels and Health Emergency Plans at the State level.

Scenario Building, Simulation and Mock Drills

A test of good disaster preparedness is to anticipate disasters of every type in different contexts and scenarios. Building scenarios of disasters, simulating conditions of disasters and conducting mock drills with these conditions are well-tested methodologies of training for disaster preparedness. Every State conducts mock drills, and some of the States are doing so in hundreds and thousands, involving schools, colleges and NSS volunteers, which is extremely useful in terms of creating awareness among children and youths and providing basic skills for saving lives during disasters.

Most of these are basic mock drills. There is a need for more advanced and disaster specific mock drills of various magnitudes. Factory level mock drills on industrial disasters take place regularly in hazardous industries. Pre-monsoon mock drills based on table top exercises are also regular features in flood prone States. NDMA conducted a few mock drills on mega earthquakes in Delhi, Guwahati and Chandigarh, involving several States. Assam SDMA conducted Emergency Management Exercises (EMEx) in Guwahati, Silchar, Dibrugarh, Barpeta and Nagaon which created a positive impact in enhancing coordination among multiple agencies working for emergency management. There is a need for replication of such exercises in other disaster-prone States.

136 NDMA, Guidelines on Mass Casualty Management

Exercises based on simulators are another cost-effective method of training. Software unfolding complex disasters which require the intervention of multiple agencies can be developed for hands-on exercises in groups of trainees. Such group exercises should be part of all training programmes in disaster response.

Contingency Plans, SOPs, Manuals

Contingency Plans, SOPs and Manuals on various issues of disaster management, such as dissemination of early warnings, evacuation of people to safe places, search and rescue of persons trapped in disasters, emergency medical preparedness, management of relief camps etc are extremely useful for better preparedness for response to disasters. Several States like Assam, Bihar, Gujarat, Himachal Pradesh, Kerala, Maharashtra, Tripura etc have developed a series of such manuals for better disaster preparedness.



Source: UNDP

Community-based Disaster Preparedness

Communities are always the first responders. There is always a time lag between the occurrence of a disaster event and the arrival of response teams like Fire Services, SDRF, NDRF etc. Even the local police and administration will take time to reach the site of a disaster. During these crucial hours, only local communities are available to deal with situations. Many of such situations would completely overwhelm the capacity of communities, but nonetheless they are the people on the spot who can inform the authorities, provide first aid to the injured and evacuate them to the nearest hospitals by all means available. Training the communities with the basics of response, first aid and evacuation and providing them with necessary medical and other kits would help to save

lives in the crucial golden hours of disasters when lives can be saved.

Community Based Disaster Preparedness (CBDP) was one of the major components of UNDP-DRM programmes implemented in 17 States during 2002-09. Several States like Assam, Gujarat, Kerala, Maharashtra, Odisha, Tamil Nadu have continued with the programme in some form to focus the community on disaster preparedness activities.

Awareness Generation

Generation of awareness about disasters among people of various age groups, gender and occupation in towns and villages is an important aspect of disaster preparedness, particularly in a country like India where large sections of people do not have the benefit of formal education. Even those having the benefits of education may not have even a basic knowledge of disasters—causes of disasters, measures to prevent and mitigate disasters, and do’s and don’ts for saving lives and property before, during and after different types of disasters.

Several States are implementing programmes for creating public awareness about disaster management through distribution of IEC materials, advertisements in print, electronic and social media, street plays, road shows, screening of documentaries, painting competitions, celebration of disaster reduction day etc.

Several States are also using social media for creating awareness about disasters and disseminating early warnings of disasters.

Resource Inventory

India Disaster Resource Network (IDRN) was developed under the UNDP-DRM programme for making a detailed inventory of human and material resources available with various public and private sector agencies, as well as individuals in each district who can be used for disaster response and relief. It is the responsibility of every District Magistrate to upload such inventories along with names, addresses and contact details of the persons owning them on the web portal www.idrn.gov.in, and periodically update them. A drop-down menu of list of all possible resources is available on the portal, which has built-in software to track such resources with locations where these are available. This data base is visualized in the National Database on Emergency Management (NDEM), enabling the location of resources on GIS enabled maps. IDRN is a powerful tool to assist disaster managers in an emergency, when resources are not readily available. Effectiveness of the tool depends on maintaining correct and updated inventories on a regular basis. Various States have shown different levels of progress in maintaining this inventory.

Media Partnership

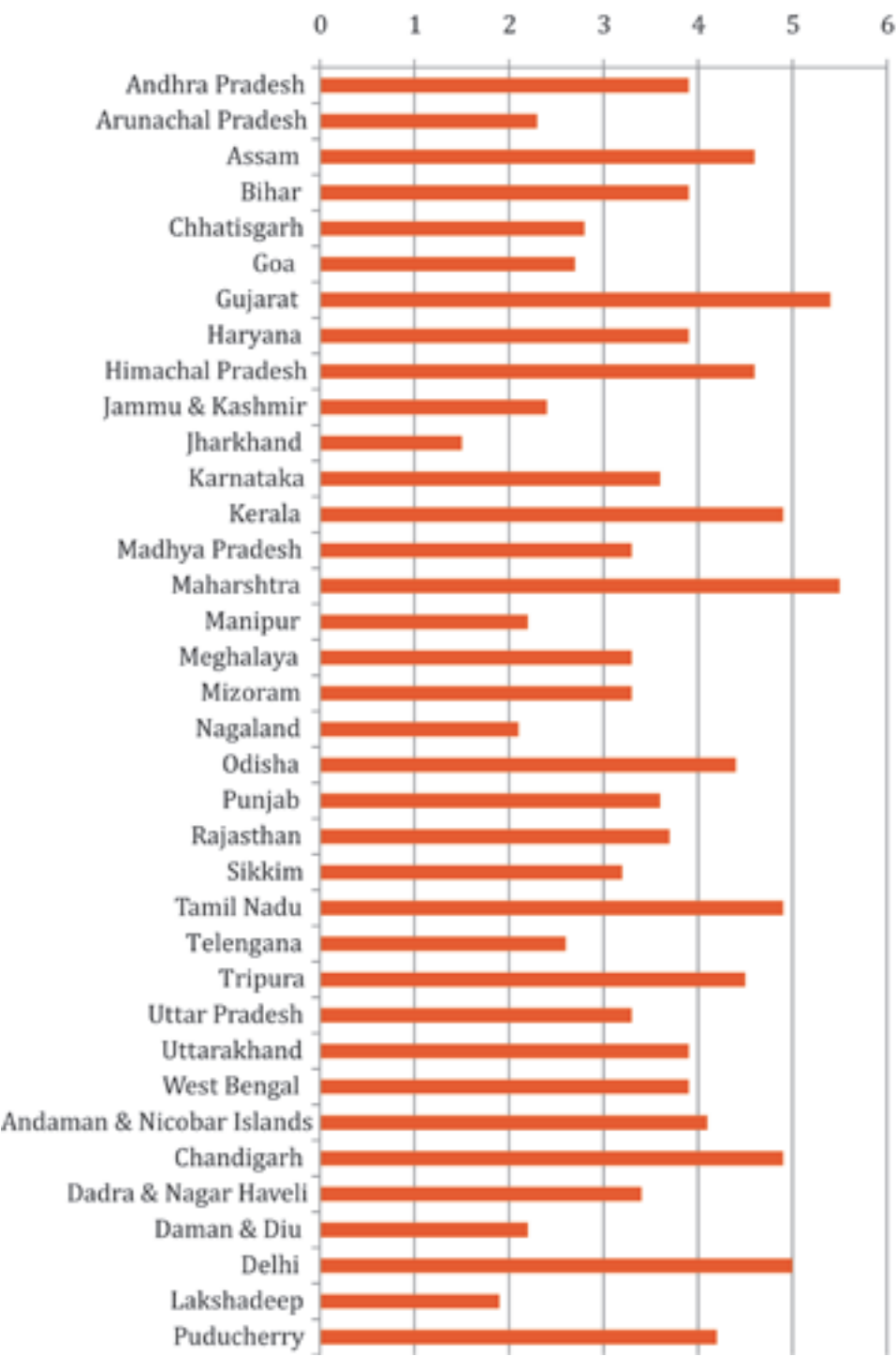
Media can play an important role in the dissemination of information and knowledge about all phases of disaster management. Both the national policy and nation plans have highlighted the critical role of print and electronic media in disaster management. State Governments have been conducting programmes on media sensitization and orientation on various issues of disaster management. Several States have developed kits for media personnel for informed reporting on disaster risk management.

Table 47: Measuring Progress of States/ UTs on Disaster Preparedness

STATES	End-to-End Early Warning System	Emergency Operation Centre	Disaster Communication System	Emergency Medical Preparedness	Scenario Building, Simulation and Mock Drills	Contingency Plans, SOPs, Manuals	Community-based Disaster Preparedness	Awareness Generation	Resource Inventory	Media Partnership	Others	Total
Maximum Values	5	5	5	5	5	5	5	5	3	2	5	50
Andhra Pradesh	2	2	3	2	2.5	2	2	2	1	1	0	19.5
Arunachal Pradesh	1	2	1	0.5	1	1	1	2	2	0	0	11.5
Assam	3	3	2	2	3.5	3	3	2	1	0.5	0	23
Bihar	3	3	2	1.5	2.5	2.5	2	2	1	0	0	19.5
Chhattisgarh	2	2	2	1.5	1.5	1	1	2	1	0		14
Goa	2	1	2	2	1.5	1	1	2	1	0	0	13.5
Gujarat	2.5	3	2.5	3	3.5	3.5	3	3	2	1	0	27
Haryana	2	2	2	2	2	2	1.5	2	2	1	1	19.5
Himachal Pradesh	3	3	2	2	2	3	2	2	2	1	1	23
Jammu & Kashmir	2	1	1	2.5	1	1	1	1	1	0.5	0	12
Jharkhand	1	0	1	1.5	1	0	1	2	0	0	0	7.5
Karnataka	2.5	3	2	2	2	1	2	2	1.5	0	0	18
Kerala	2	3	3	2.5	2	3	3	3	2	1	0	24.5
Madhya Pradesh	1.5	2	2	2	1.5	2	2	2	1.5	0	0	16.5
Maharashtra	3.5	3.5	3	2.5	3	3	3	3	3	0	0	27.5
Manipur	2	2	2	1	1	1	1	1	0	0	0	11
Meghalaya	2	2	2	1	1.5	2	2	2	2	0	0	16.5
Mizoram	2	2	2	1	1.5	2	2	2	2	0	0	16.5
Nagaland	1	1	2	1	1	1	1	2	0.5	0	0	10.5
Odisha	3	2	2	1.5	2	3	3	3	1.5	1	0	22
Punjab	2	2	2	2	2	2	2	3	1	0	0	18
Rajasthan	2.5	2	2	2	2	2	2	2	1	1	0	18.5
Sikkim	1.5	1.5	2	1	1.5	2	2	2	2	0.5	0	16
Tamil Nadu	3.5	3	2	2.5	2.5	2	3	3	2	1	0	24.5
Telangana	1.5	1	1	2	2	1	2	2	0.5	0	0	13
Tripura	3	3	2	1.5	2	3	2	3	2	1	0	22.5
Uttar Pradesh	2	2	2	1.5	1.5	2	1	2	1.5	1	0	16.5
Uttarakhand	2.5	2.5	2	2	1.5	2	2	2	2	1	0	19.5
West Bengal	2	3.5	3	1.5	1	3	2	2	1	0.5	0	19.5
UNION TERRITORIES												
Andaman & Nicobar Islands	2.5	3.5	2	1.5	2	3	2	1	1	1	1	20.5
Chandigarh	3	4	2	3.5	3.5	2	2	2	1.5	1	0	24.5
Dadra and Nagar Haveli	1	2	2	3	1	2	2	2	2	0	0	17
Daman and Diu	1.5	0	1	3	1	1	1.5	1.5	0	0.5	0	11
Delhi	2	4	2	5	4	2	2	2	1.5	0.5	0	25
Lakshadweep	2	0	1	1.5	1	1	2	1	0	0	0	9.5
Puducherry	2.5	3.5	2	3	3	2	1	2	1	1	0	21

The overall progress on a scale of 10 is presented in the following diagram.

Figure 47: Overall progress of States/ UTs on Disaster Preparedness



DISASTER RESPONSE

Disaster response is the coordinated action taken by all concerned agencies of government in collaboration with stakeholders, around the immediate aftermath of disasters, so as to minimize injuries and loss of lives and restore all essential services, recovering normal life and economy at the soonest possible time. UNDRR defined disaster response as ‘actions taken directly before, during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected’.

Therefore, the critical elements of good disaster response are the following: (a) response time must be quick, immediately as the disaster strikes, or even before it strikes, when early warnings of disasters are available; (b) immediate focus of response is to evacuate people in danger to safe place, search or rescue people either trapped in collapsed structures or debris or marooned in submerged areas, and provide emergency medical treatment for the affected people, to save lives; (c) provide necessary humanitarian assistance like food, water and shelter to affected people in need of such assistance; (d) restore essential services like water supply, electricity, tele-communication facilities, transportation networks, supply chains etc.

Disaster response continues till the last survivor is rescued and basic essential services are restored. There are no fixed time limits for response—it may last between less than a day to more than two weeks, depending on the magnitude of the disaster and the efficiency of response. The initial hours of response are known as the ‘golden hours’, importantly: when maximum lives can be saved through prompt action by informed local communities who are the first responders and a quick response by professional team of responders.

Disaster response is distinct from ‘relief and rehabilitation’, which may continue for a longer time and ‘reconstruction’, which may take even longer time. Disaster relief and rehabilitation and disaster reconstruction are discussed separately in next two chapters.

Global Frameworks

None of the three global frameworks for disaster risk reduction—Yokohama, Hyogo and Sendai—have much to say about disaster response, as the focus of these frameworks are clearly on pre-disaster risk reduction rather than on post-disaster response. However, the global frameworks have prioritized actions to be taken towards pre-disaster preparedness for post-disaster response, as discussed in the preceding chapter.

There are several guidelines and good practices which are different aspects of disaster response. UN Office for Coordination for Humanitarian Assistance (UNOCHA) has issued guidelines on coordinated response, including civil-military coordination, mobilization of resources for response etc.¹³⁷ International Search and Rescue Advisory Group (INSARAG) has developed manuals on policy, operations and capacity building on urban search and rescue.¹³⁸ World Health Organization (WHO) has formulated Emergency Response Framework for health emergencies arising out of various natural and human induced disasters.¹³⁹ International Federation of Red Cross (IFRC) has issued guidelines for domestic facilitation for international response.¹⁴⁰The Sphere Project has

137 UNOCHA, Guidelines for Coordinated Among Humanitarian Actors in Disaster Response, 2012
138 INSARAG, Manuals on Policy, Operations and Capacity Building on Urban Search and Rescue, 2015
139 WHO, Emergency Response Framework for Health Emergencies, 2013
140 IFRC, Guidelines for Domestic Facilitation for International Response, 2011

developed a Humanitarian Charter and Minimum Standards for Disaster Response.¹⁴¹

Although most of these global guidelines and best practices are focused on international response, these provide useful insights into the process, standards and checklists to be followed for effective disaster response at the national and local level.

National Vision

Disaster Management Act 2005 has several provisions regarding ‘prompt’, ‘effective’ and ‘coordinated’ response. Section 6(1) of the Act has tasked NDMA to lay down policies, plan and guidelines for ensuring timely and effective response to disaster, but actual responsibilities for coordinating response have been entrusted to NEC, SEC and DDMA at the national, State and district level respectively.

Section 10(2)(k) of the Act has asked NEC to coordinate response in the event of any threatening disaster situation or disaster. Further, under sections 10(2)(l), NEC can give guidelines and directions to concerned Ministries or Departments of Government of India, the State Governments and the State authorities, to take measures to respond to disasters. Also, under section 10(2)(m), NEC can require any agency of the government to make men or material resources available for emergency response.

Under sections 22(2)(g), 22(2)(h), and 22(2)(o). State Executive Committee has similar powers and responsibilities for disaster response within the State. In addition, under section 24 of the Act, SEC has been vested with some special powers of regulation and control for effective and coordinated response.

Section 30(2)(xv) of the Act has mandated DDMA to prepare, review and update a response plan for the district, and under section 30(2)(xvii) DDMA has to ensure that the Departments of State Government at the district level and the local authorities prepare their response plan in accordance with the district plan. Under section 30(2)(xvi), DDMA has to coordinate response to any threatening disaster situation or disaster. Section 34 of the Act has vested special powers of regulation and control in DDMMA for effective and coordinated response.

National Policy on Disaster Management 2009 has laid down the basic national approach to disaster response in the following words:

Prompt and effective response minimises loss of life and property. A caring approach for the special needs of vulnerable sections is also important. The existing and the new institutional arrangements need to ensure an integrated, synergised and proactive approach in dealing with any disaster. This is possible through contemporary forecasting and early warning systems, fail-safe communication and anticipatory deployment of specialised response forces. A well-informed and prepared community can mitigate the impact of disasters.

The National Policy further laid down six elements of national response framework. These are: (a) institutional framework, (b) Standard Operating Procedures, (c) Incident Command System, (d) medical response, (e) animal care, (f) Information and media partnership.

In the institutional framework role of National Executive Committee, NDMA, SDMA and DDMA, as provided in Disaster Management Act, are reiterated. Role of communities as first responders and other key responders like police, SDRF, NDRF, fire and medical services are emphasized. All Central Ministries, State Governments, District Authorities and other stakeholders are asked to prepare their SOPs in consonance with National and State Plans. Similarly, SOPs are prescribed for activities like search and rescue, medical assistance and casualty management, evacuation, restoration of essential services and communication at disaster sites, etc. The existing command structure for disaster response is proposed to be strengthened and professionalized by drawing upon the principles of the Incident Command System, with suitable modifications. Elements of ‘quick and effective’ medical response are laid down and protection of both domestic and wild animals exposed to the effects of natural and man-made disasters are highlighted.

National Plan on Disaster Management 2016 clubbed the issues of preparedness, response and relief together in the same matrix, in order to align the plan with the Sendai Framework. Segregating these issues, the response functions of the Central and State Governments, as outlined in the National Plan, fall under five thematic areas: (a) evacuation of people and animals, (b) search and rescue of people and animals, (c) medical care, (d) disposal of animal carcasses, and (e) media relations. The National Plan has detailed the responsibilities of the Central and State Governments under each of these thematic areas. These are included in Annexure-I on matrix of responsibilities of States/ UTs under national frameworks on disaster management.

Not all activities of disaster response, as prescribed in National Policy and National Plan on disaster management, are covered under the norms of assistance permissible under State Disaster Response Fund (SDRF) and National Disaster Response Fund (NDRF). Based on the recommendations of the Finance Commission, Government of India has restricted the use of SDRF/ NDRF in disaster response for the following activities or disaster response.

Table 48: Norms of Assistance for Disaster Response under NDRF/ SDRF

	ITEMS	NORMS
1.	Search and Rescue Operation a) Cost of search and rescue measures/ evacuation of people affected/ likely to be affected b) Hiring of boats for carrying immediate relief and saving lives	As per actual cost incurred, assessed by SEC and recommended by the Central Team (in case of NDRF).
2.	Clearance of affected areas a) Clearance of debris in public areas b) Draining of flood waters in affected areas c) Disposal of dead bodies/ carcasses	As per actual cost within 30 days from the date of start of work and based on assessment of needs by SEC and recommendations of the Central Team (in case of NDRF)
3.	Procurement of equipment Procurement of essential search, rescue and evacuation equipment including communication equipment, etc. for response to disaster.	Expenditure can be incurred by SDRF only, as assessed by the SEC. The total expenditure on this item shall not exceed 10% of the annual allocation of the SDRF

141 Sphere Project, Humanitarian Charter and Minimum Standards for Disaster Response, 2018

State Initiatives

Complying with the provisions of Disaster Management Act and the prescriptions of the National Policy and the National Plan on Disaster Management, State Governments have taken several initiatives for streamlining the system of disaster response in order to save lives and minimize disruptions of life and economy during and after disasters. The institutional mechanisms for disaster response have been strengthened with the establishment of State Disaster Response Force, modernization of fire and emergency services, and restructuring of the civil defence. Standard Operating Procedures have been developed for evacuation, search and rescue, Incident Command System has been introduced to professionalize response teams, and emergency medical response system has been improved with training, drills and development.

State Disaster Response Force

Section 44 of the DM Act mandates creation of a National Disaster Response Force (NDRF) for the purpose of ‘specialised response to a threatening disaster situation or disaster’. The Act did not prescribe creation of such force at the States, but 24 out of 29 States of India have constituted State Disaster Response Force (SDRF) based on the advisories received from NDMA and Ministry of Home Affairs, to reduce dependence on 12 battalion strong NDRF which were in turn created to reduce dependence on the armed forces. The remaining five States (Goa, Himachal Pradesh, Jharkhand, Karnataka and Telangana) are described as actively considering the establishment of this force.

Odisha was the first to constitute Odisha Disaster Rapid Action Force in 2001, following the aftermath of the super cyclone of 1999, when the absence of specialized teams for evacuation, search and rescue was felt very strongly. All the SDRFs have come up during the past few years. Tripura named their State Disaster Response Team (SDRT), while in West Bengal it is known as Disaster Management Group.

The strength of SDRF has varied from one State to another, ranging from 50 in Tripura to 11 Companies in Gujarat. In most of the States, previously existing units of State Armed Police/ Home Guards have been designated as SDRF while in States like Andhra Pradesh, Gujarat and West Bengal, specialized teams/ squads have been set up with trained rescuers, medical doctors, dog squads etc.

Overall, SDRF has a combined strength of nearly 20 battalions, which supplements the 12 battalion strong NDRF to place India as the country with the largest disaster response force anywhere in the world.

Table 49: State Agencies for Disaster Response

STATES/UNION TERRITORIES	Has the State established State Disaster Response Force?	Year of establishment of SDRF	Status and strength of SDRF.	Has Fire Services been upgraded to acquire multi-hazard rescue capability?	Is Civil Defense reorganized to perform role in disaster response?	Is Incident Response System practiced in the State?	Are there guidelines/ SOPs for State agencies performing ESF?
STATES							
Andhra Pradesh	Yes	2016	6 Coys (12 Teams)	Yes	No	Partly	Yes
Arunachal Pradesh	Yes	2013	64	Yes	No	Partly	No
Assam	Yes	2013	266	Yes	No	Yes	Yes
Bihar	Yes	2010	1 Btn				
(1157)	Yes	Partly	Partly	Yes			
Chhattisgarh	Yes	2016	252	Partly	Partly	No	Yes
Goa	No	--	--	Yes	No	Partly	No
Gujarat	Yes	2016	11 Coys	Yes	Yes	Yes	Yes
Haryana	Yes	2015	1 Coy	Yes	Partly	Partly	No
Himachal Pradesh	No	--	--	Yes	No	No	No
Jammu & Kashmir	Yes	2012	2 Btn	Yes	Partly	Partly	No
Jharkhand	No	--	--	No	No	No	No
Karnataka	No	--	--	Yes	No	No	No
Kerala	Yes	2012	100	No	Partly	Partly	Yes
Madhya Pradesh	Yes	2013	3025	Partly	Partly	Partly	No
Maharashtra	Yes	2017	2 Coys (428)	Yes	Partly	Yes	Yes
Manipur	Yes	2014	104	Yes	No	Partly	No
Meghalaya	Yes	2014	133	Yes	Partly	Partly	No
Mizoram	Yes	2014	724	Yes	Partly	Partly	Yes
Nagaland	Yes	2016	240	Yes	No	No	Partly
Odisha	ODRAF	2001	901	Yes	Partly	Yes	Yes
Punjab	Yes	2015	160	No	Partly	No	No
Rajasthan	Yes	2013	3 Coys	Yes	Partly	Partly	No
Sikkim	Yes	2012	4 Platoons	No	Partly	Partly	Yes
Tamil Nadu	Yes	2012	69	Yes	Partly	Partly	No
Telangana	No	-	-	Yes	No	No	No
Tripura	SDRT	--	50	Yes	Yes	No	Yes
Uttar Pradesh	Yes	2017	Under process	No	No	Partly	No
Uttarakhand	Yes	2014	1 Battalion	Yes	Yes	No	No
West Bengal	DMG	2013	7 squads of 81 each	Yes	Yes	Yes	Yes

Most of the State response forces are still in the process of being trained and equipped to discharge responsibilities effectively. NDRF is playing a key role in training the force.

Ministry of Home Affairs has been implementing a central sector scheme for the modernization of Fire Services throughout the country. State Governments of Goa, Jammu & Kashmir, Maharashtra, West Bengal, Tamil Nadu, Karnataka and Delhi have also invested substantial resources to upgrade the Fire Services to acquire multi-hazard rescue capacity.

Civil Defence Act was amended in 2009 to enable the provisions of the Act to be applied during disasters. This required expansion of the network of civil defence to all districts and reorientation and training of the civil defence volunteers. In most States, the required expansion of civil defence has not taken place.

Incident Response System

Government of India had decided in 2002 to introduce Incident Command System for responding to disaster situations, and trained a large number of administrators of State Government and UT Administration in different aspects of incident management. National Policy on Disaster Management 2009 endorsed the system and National Guidelines on Incident Response System (IRS) was issued in 2010 for adapting the system in the context of our administrative system.¹⁴² Ten years down the line, not much progress seems to have been made in making IRS an integral part of disaster response system in most of the States.

Maximum progress has been achieved in Uttarakhand, where 52 Incident Response Teams have been formed and 40 State level, 720 district level and 2080 sub-divisional level officers have been trained in various modules of IRS. State Disaster Response Manual has been prepared and IRS Apps have been launched for the use of all concerned. Government of Assam, Tamil Nadu and Nagaland have notified State and District Level IR Teams. West Bengal has issued a SOP on IRS.

In the remaining States, progress has been limited to making a mention of the system in the State Plan and conducting sporadic training programmes for the response officers.

Coordination with GOI, NDRF, Armed Forces

Catastrophic or major disasters may overwhelm the capacity of the State government /UT Administration to respond effectively, requiring assistance of Central government and its agencies, like the NDRF and the Armed Force. Quick responses of central agencies are effective if there are institutionalized mechanisms for liaison and coordination, such as a civil-military liaison conference. Several States have regular civil-military liaison conferences, which discuss inter alia issues of preparedness for disaster response. Joint coordination exercises are conducted in many hazard prone border States where the armed forces have a strong presence. Several States conduct pre-monsoon preparation meetings with NDRF, Coast Guard, Army, Navy and Air Force stationed in the State.

¹⁴² NDMA, National Disaster Management Guidelines on Incident Response System, 2010.

Evacuation, Search and Rescue

Disaster mortalities can be reduced considerably if contingency plans are in place regarding quick assessment of evacuation needs, identification of temporary shelters, determination of evacuation routes, mobilization of transportation arrangements, preparation of checklists etc.

Most of the States have prepared detailed contingency plans. Several States like Assam, Bihar, Gujarat, Maharashtra, Tamil Nadu, and West Bengal have pre-identified vulnerable pockets and prepared local level contingency plans to deal with any emergent situations.

Searching and rescuing for people marooned in flooded areas or trapped in collapsed structures or debris is a specialized job, requiring equipment, training, drills etc. Many SDRFs are in the process of acquiring such equipment and training its personnel in handling it. Government of Gujarat has developed Emergency Response Centres (ERC) in five strategic locations of the State (Rajkot, Gandhidham, Gandhinagar, Surat and Vadodara) to respond effectively within the golden hour.

Emergency Medical Response

The immediate impact of disasters is the surge of persons of different age groups inflicted with severe and minor injuries for treatment in hospitals. Many such injuries may require medical attention even before hospitalization. This requires operational readiness of medical response teams, availability of ambulance, heli-ambulance and other logistic arrangements.

Many States have issued guidelines for emergency response, trained doctors and para-medical staff on emergency health management and augmented strength of ambulance services. Several States have introduced 108 Emergency Ambulance Service.

These measures are not adequate for meeting the challenges of emergency medical response after major or catastrophic disasters. States have started gearing up to meet these challenges.

Emergency Support Functions

Disaster response is not the job of responders alone. It requires performance of Emergency Support Functions (ESF) by line departments and agencies, such as restoration of electricity, water supply and sanitation systems, telecommunication, road and transportation networks, supply chains of food and other essential items.

Most of the State DM Plans have prepared checklists of ESF, and have identified primary and secondary agencies and functionaries responsible for the performance of these functions, and outlined the process and timeline to be followed for the same. The plans have also provided for advance procurement of materials required for the performance of such functions.

Not much information is available about how the plans have actually worked or been implemented in disaster situations. None of the States have introduced a system of Lessons Learnt Exercises (LLE), as is being done in countries like Japan after major disasters, to evaluate the performance of the system and make changes to bring the desired improvements. Academic research on such issues have also been extremely limited.

Protection of Women and Children

Vulnerable women and children often become victims of trafficking and sexual abuse after disasters. Several states have put in place a surveillance system for preventing such abuses and protecting them.

Government of West Bengal has established a separate Directorate of Child Rights and Trafficking to prevent child trafficking. A Task Force has also been set up:Rescue-Recovery-Return-Integration (RRRI) of Bangladeshi Children trafficked to West Bengal. Government of Odisha has created a Women and Child Protection Cell in each district under the direct supervision of District Collector. Social Defence Department of Tamil Nadu is focusing surveillance in places where vulnerable women and children become victims of trafficking and child abuse. Kerala has Pink Police to deal with such issues.

Child Protection Committees (CPCs) have been constituted in all vulnerable districts as a community-based, child protection mechanism to safeguard the rights of the children and protect them from trafficking and abuse. Childline India Foundation (CIF) is managing and monitoring the Childline 1098 service, for helping children in distress.

Disposal of dead bodies

In the event of mass casualties in disasters, proper collection, preservation, storage, identification and disposal of dead bodies according to the religious customs and rites of the deceased assume importance as there are serious legal and ethical issues to consider.

NDMA has issued comprehensive guidelines on the subject for the guidance of States¹⁴³, but it is not known yet how such guidelines are actually implemented. A few States like Tripura and Tamil Nadu have issued separate guidelines on the disposal of dead bodies, while States like Assam have laid down the process to be followed in Disaster Management Manual.

Disposal of Animal Carcasses

Proper removal and disposal of animal carcasses at pre-identified sites is important to ensure that no health hazards are created, for the staff as well as the general public. NDMA has also issued guidelines to be followed by the States. A few States like Tripura and Tamil Nadu have issued separate guidelines on the disposal of animal carcasses, while States like Assam have laid down the process to be followed in Disaster Management Manual. Most of the Municipal Corporations have laid down systems and processes for disposal of dead animals.

Disposal of Debris

Major disasters like earthquakes and cyclones may cause widespread destruction of built-up structures like houses and infrastructure, as well as natural assets like trees and plantations. Removal and disposal of construction debris and fallen trees can be problematic in many urban areas, where open sites are not available so easily unless these are pre-identified. Much of these materials can also be recycled.

Municipal Corporations and local authorities have a system of debris disposal which is not geared to handle large debris after disasters. This problem has been addressed in City Disaster Management Plans (CDMP) of many cities. State level instructions for disposal of debris have been issued by Tripura and Tamil Nadu.

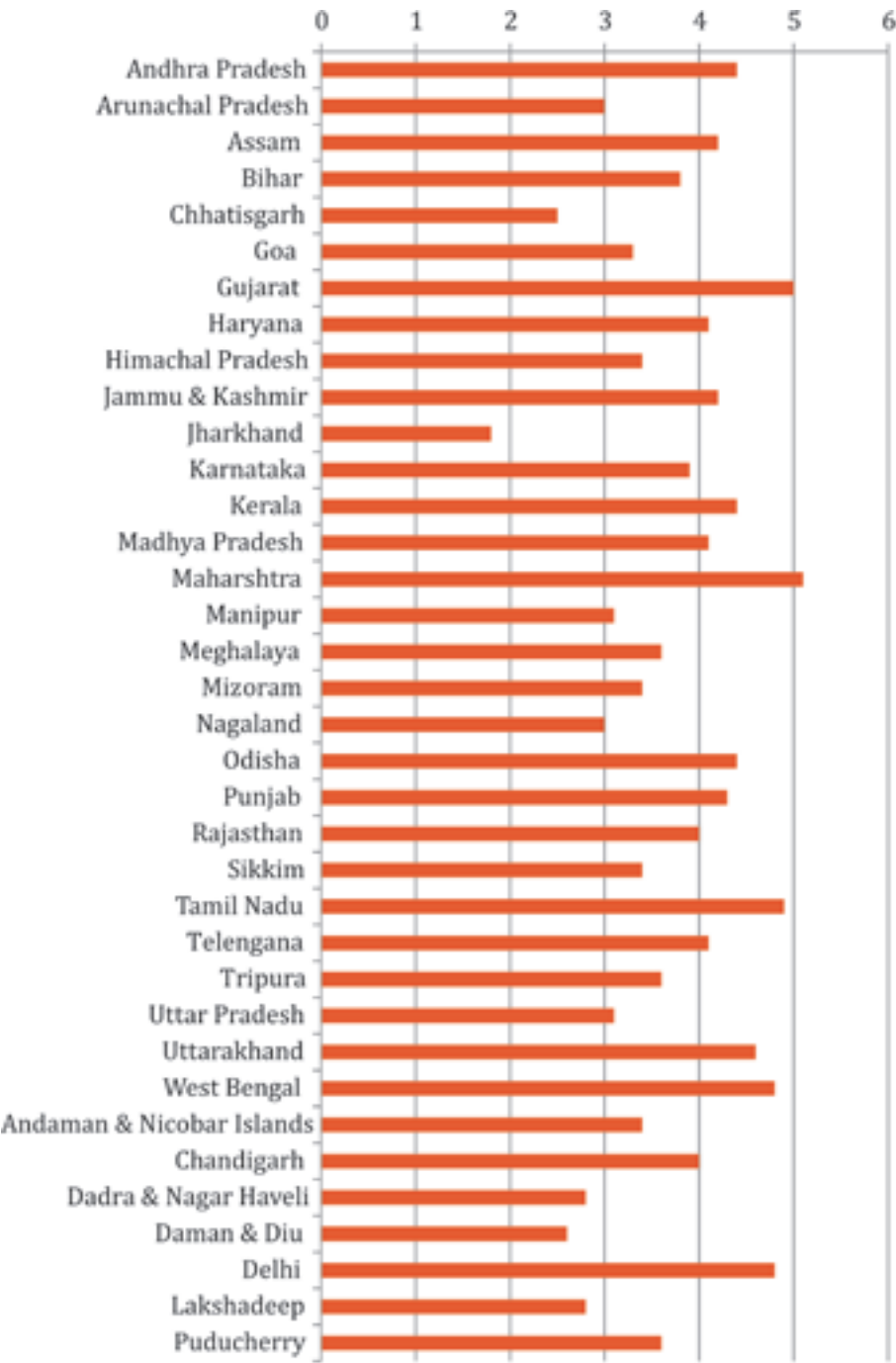
Table 50: Measuring Progress of States/ UTs on Disaster Response

STATES	State Agencies for Disaster Response	Incident Response System	Coordination with GOI, NDRF Armed Forces	Evacuation, Search and Rescue	Emergency Medical Response	Emergency Support Functions	Protection of Women and Children	Disposal of dead bodies	Disposal of Animal Carcasses	Disposal of Debris	Others	Total
Maximum Values	10	4	2	7	5	5	5	3	2	2	5	50
Andhra Pradesh	5.5	1	1	3	2.5	2.5	2.5	2	1	1	0	22
Arunachal Pradesh	3	0.5	1.5	1.5	1	1.5	3	1	1	1	0	15
Assam	5	2	1.5	3	2	2	2	1.5	1	1	0	21
Bihar	6	1	1	3	2	2	2	1	1	0	0	19
Chhattisgarh	3.5	0	1	1.5	1	1.5	2	1	1	0	0	12.5
Goa	1.5	0	1	3	2	2	3.5	2	1	0.5	0	16.5
Gujarat	7	2	1	4	3	3	2	1	1	1	0	25
Haryana	3	2	1	3	2	2	2.5	2	1	1	1	20.5
Himachal Pradesh	2	1	1	3	1	2	3	2	1	1	0	17
Jammu & Kashmir	6.5	0.5	1.5	2	2	2	3	1.5	1	1	0	21
Jharkhand	1	0.5	0	1.5	1	1	2	1	1	0	0	9
Karnataka	3	2	1	3	2	2	2.5	2	1	1	0	19.5
Kerala	4	2	1	3	2.5	3	3.5	2	1	0	0	22
Madhya Pradesh	5.5	2	1	3	2	2	2	2	1	0	0	20.5
Maharashtra	5.5	2	1.5	4	3	3	2.5	2	1	1	0	25.5
Manipur	3	1	1	1.5	2	2	3	1	1	0	0	15.5
Meghalaya	4.5	1	1	1.5	2	2	3	1	1	1	0	18
Mizoram	4.5	1	1	1.5	2	2	3	1	1	0	0	17
Nagaland	2.5	2	1	1.5	1	2	3	1	1	0	0	15
Odisha	6	1.5	1	3.5	2	2	2	1	1	1	1	22
Punjab	4	1.5	1	3.5	2.5	2.5	2.5	2	1	1	0	21.5
Rajasthan	5	1	1	3.5	2	2	2	1.5	1	1	0	20
Sikkim	4	1	1	1.5	1.5	2	3	1	1	1	0	17
Tamil Nadu	4.5	2	1	4	3	3	3	2	1	1	0	24.5
Telangana	3	2	1	3	2.5	2.5	2.5	2	1	1	0	20.5
Tripura	4	1	1	2	2	2	3	1	1	1	0	18
Uttar Pradesh	3	1.5	1	3	1.5	2	2	1.5				15.5
Uttarakhand	6	3	1.5	3	1.5	2	2.5	1.5	1	1	0	23
West Bengal	7	2	1.5	3.5	2	2	3	1	1	1	0	24
UNION TERRITORIES												
Andaman & Nicobar Islands	2	3	1	3	1	2	2	1	1	1	0	17
Chandigarh	4	0	2	3	3	2	3	1	1	1	0	20
Dadra and Nagar Haveli	2	1	1	2	1	2	2	1	1	1	0	14
Daman and Diu	2	0	1	2	2	2	2	1	1	0	0	13
Delhi	2	2	2	4	2.5	2.5	3	2	2	2	0	24
Lakshadweep	2	0	1	2	2	2	3	1	1	0	0	14
Puducherry	3	1	1	3	2	2	2	2	1	1	0	18

143 NDMA, Guidelines on Management of Dead in Aftermath of Disasters

The overall progress, on a scale of 10, is presented in the following diagram.

Figure 48: Overall progress of States/ UTs on Disaster Response



DISASTER RELIEF AND REHABILITATION

Disaster response functions for saving lives and restoring essential services are generally completed within a couple of weeks of disasters, while reconstruction of damaged houses, infrastructure and livelihood may not begin for a few months thereafter, and may continue for a few years depending on the magnitude of damages and destructions. Between these two phases of response and reconstruction, there is a critical phase when people affected by disasters continue to suffer physically, mentally and require support for food, shelter, medical and mental health care, and other humanitarian assistances. These are the functions of disaster relief and rehabilitation. These functions may continue for months and sometimes years, till the affected population are able to return to their homes after repairs and reconstructions.

Disaster management, in most countries, has traditionally focused only on relief and rehabilitation, and therefore there is a strong legacy of management of humanitarian relief through manuals and standard operating procedures. However, with the changing times, characterized by spiralling disasters, increasing complexities and rising aspirations, new standards of relief and rehabilitation have been developed to meet the growing needs of humanitarian assistance. This calls for new approaches, enhanced resources and augmented capacities to deliver relief and rehabilitation assistance to the victims of disasters in a coordinated manner involving multiple government and non-government agencies.

Global Frameworks

Global frameworks of disaster relief and rehabilitation have evolved largely outside the UN system, as UNDRR was concerned more with pre-disaster risk reduction and UNOCHA was involved primarily with post-disaster response. International Federation of Red Cross (IFRC) spearheaded the global movement for humanitarian response, which was joined by many national and international NGOs. Specialized UN agencies like World Health Organization (WHO), World Food Programme (WFP), United Nations International Children’s Emergency Fund (UNICEF) and UN Women etc contributed to the sectors of their specialization. This required a coordinated approach for humanitarian assistance.

The Sphere Project of the Standing Committee for Humanitarian Response (SCHR), which brought together nine of the world’s leading humanitarian organizations (IFRC, ICRC, Save the Children, Oxfam, Caritas, Care, Act Alliance, World Vision, Lutheran World Federation), has developed Humanitarian Charter and Minimum Standards of Disaster Response. Developed initially in 1998, the standards have undergone revisions in 2000, 2004, 2011 and 2018¹⁴⁴, and they are the most accepted and internationally recognized sets of common principles and universal minimum standards of humanitarian relief and rehabilitation. The standards are divided into five parts: (a) Core Standards, (b) Water, Sanitation and Hygiene, (c) Food Security, Nutrition and Food Aid, (d) Shelter and Non-Food Items, and (e) Health Services. These minimum standards have been adapted by many national governments, according to their individual conditions.

144 The Sphere Handbook on Humanitarian Charter and Minimum Standards of Disaster Response, 2018.

National Framework

India’s national framework of disaster relief and rehabilitation is based on the principle of universality and non-discrimination. Section 61 of Disaster Management Act has provided that while providing compensation and relief to the victims of disaster, there shall be no discrimination on the ground of sex, caste, community, descent or religion.

Section 12 of Disaster Management Act 2005 stipulated that NDMA shall recommend guidelines for the minimum standards of relief to be provided to the persons affected by disaster. These minimum standards would include the following: (a) minimum requirements to be provided in the relief camps in relation to shelter, food, drinking water, medical cover and sanitation; (b) special provisions to be made for widows and orphans; (c) ex-gratia assistance on account of loss of life as also assistance on account of damage to houses and for restoration of means of livelihood; and (d) such other relief as may be necessary.

In pursuance of this provision, NDMA issued the guidelines for minimum standards of relief covering six aspects of relief and rehabilitation. These are: (a) shelter in relief camps. (b) food, (c) water, (d) sanitation, (e) medical cover, and (f) relief for widows and orphans.

The National Policy on Disaster Management 2009 has laid down the overarching framework of disaster relief and rehabilitation in the following words:

Relief is no longer perceived only as gratuitous assistance or provision of emergency relief supplies on time. It is on the contrary, viewed as an overarching system of facilitation of assistance to the victims of disaster for their rehabilitation in States and ensuring social safety and security of the affected persons. The relief needs to be prompt, adequate and of approved standards. Guidelines defining minimum standards of relief will be prepared by the NDMA.

Based on this approach the Policy has outlined the five main components of relief and rehabilitation policy to be followed by the Central and State Governments. These are (a) setting up of temporary relief camps; (b) management of relief camps; (c) review of standards of relief as provided in the Act; (d) temporary livelihood options and socio-economic rehabilitation; and (e) provision of intermediate shelters when reconstruction of houses would be a long drawn out process.

Taking into consideration the National Policy and the National Guidelines on Minimum Standards of Relief, the Ministry of Home Affairs has notified the ‘list of items and norms of assistance’ for relief and rehabilitation that can be provided by the State Governments under State Disaster Response Fund (SDRF) and National Disaster Response Fund (NDRF). These norms are revised every five years, synchronizing with the fiscal cycles of the Finance Commission. There are two items related to relief and four to the economic rehabilitation of the victims. The remaining items concern disaster response and reconstruction. The norms have been set in monetary terms, taking into account the recommendations of NDMA, the Finance Commission and the current price index.

Table 51: Norms of Assistance for Relief and Rehabilitation under NDRF/ SDRF

ITEMS	NORMS
Gratuitous Relief a) Ex-Gratia payment to families of deceased c) Ex-Gratia payment for loss of a limb or eyes d) Grievous injury requiring hospitalization e) Clothing and utensils for families whose house has been washed away f) Gratuitous relief for families in dire need of immediate sustenance after a calamity	a) Rs 4 lakhs per deceased b) Rs 2 lakhs/Rs 59,100 per person when disability is more/less than 60% c) Rs 12,700/Rs 4,300 for more/ less than a week d) Rs 1800 for clothing and Rs 2,000 for utensils per family e) Rs 60 per adult and Rs45 per child per day, for maximum period of 90 days
Relief Measures a) Temporary shelter, food, clothing, medical care etc. b) Airdropping of essential supplies c) Emergency supply of drinking water	a) As per assessment of State Executive Committee b) As per actual costs c) As per actual costs
Agriculture a) Assistance to farmers having landholding upto 2 ha i) Reclamation of land ii) Input subsidy b) Input subsidy to farmers having more than 2 ha of landholding	a) Land reclamation: Rs 37500 to Rs. 12200 per ha,depending on nature of land reclamation b) Input subsidy: Rs 18000 to Rs 4800 per ha depending on the nature of crop
Animal husbandry a) Replacement of milch/ draught/animals used for haulage b) Provision of fodder/ feed concentrates/ water	a) Milch animals: Rs 30,000 for cattle, Rs 3000 for sheep/ goats b) Rs 70/ Rs 35 per large/small animal
Fisheries a) For repair of boats and nets b) For replacement of boats and nets	a) Rs 4100/ Rs 2100 b) Rs 9600/Rs 2640
Handicrafts/ Handloom a) Replacement of damaged tools/equipment b) For loss of raw materials/ goods in process/ finished goods	a) Rs 4100 per artisan b) Rs 4100 per artisan

Ex-gratia relief is a token assistance for the family of the deceased and is not connected with minimum standard. State Governments are free to give their own assistance to the victims of disasters over and above these norms.

State Initiatives

Relief and rehabilitation have traditionally been the forte of State Governments. Most of the State Governments have their well-established administrative mechanisms, manuals and procedures for running relief camps and delivering relief and rehabilitation assistance to the victims of natural disasters. The norms of assistance have been standardized as per Government of India norms stated above, but State Governments have applied these norms in their own ways as per the local contexts and situations.

Minimum Standard of Relief

Section 19 of the Act has provided that State Disaster Management Authorities may lay down detailed guidelines for providing standards of relief to persons affected by disaster in the State, but such standards shall in no case be less than the minimum standards in the guidelines laid down by the National Authority. None of the State Authorities has laid down such guidelines, and therefore the norms of assistance for relief and rehabilitation as mentioned in the table above is followed uniformly throughout the country.

Ex-gratia Relief

Most of the States provide ex-gratia relief as per SDRF norms, but a few States provide additional ex-gratia, as provided in State rules. Sometimes additional ex-gratia is also sanctioned under Prime Minister's Relief Fund/ Chief Minister's Relief Fund on a case to basis.

Relief Logistics and Supply Chain Management

Timely procurement, packaging, transportation, storage and distribution of relief materials immediately, as the need arises, are extremely important for efficient management of humanitarian assistance and disaster relief. Relief Manuals/ Relief Codes of the States have laid down detailed guidelines and operating procedures for relief logistics and supply chain management.

Most of the States follow age old manuals amended from time to time, but some States have replaced these with Disaster Management Manuals. Government of Assam, for example, has issued a new DM Manual in 2015 which put in one single manuals all issues and aspects of disaster management including relief and rehabilitation. Bihar has a separate Flood SOP which deals exclusively with flood relief management. Tamil Nadu has a well system of storing buffer stock of essential commodities in inaccessible and vulnerable areas by Tamil Nadu Civil Supplies Corporation.

Food and Essential Supplies

Supply of food including cooked food and other essential items to the affected people is one of the major functions of disaster relief. This involves procurement, storage, transportation and distribution of food in a transparent and accountable manner. It further involves pre-agreements/ MoUs with organizations, trusts and firms for setting up community kitchens in the affected areas.

While Relief Manuals/ Codes deals with these issues in general, separate sets of specific instructions and guidelines are issued every year. Relief and Rehabilitation Department works in close coordination with Food and Supplies Department, which plays a key role in procurement, storage and distribution of grains. Several states have issued instructions that cooked foods shall be distributed in such a way that every child gets minimum calories of 1700 and every adult gets 2400 calories. Standards of hygiene to be maintained in community kitchens have also been prescribed by many States. Several States like Gujarat and Tamil Nadu have issued instructions that milk shall be provided to children and lactating mothers.



Source: UNDP

Drinking Water, Dewatering and Sanitation

As per the minimum standards of relief, the supply of a minimum of three litres of drinking water per person per day has to be provided to inmates of relief camps. Similar quantities of water have to also be ensured to disaster-affected people not staying in camps. This is extremely important to save lives from dehydration and also to prevent water-borne diseases.

This is challenging in situations of severe drought, when sources dry up as well as in acute floods, wherein sources get inundated with contaminated water. States have standardized unusual measures to meet these routine challenges. In chronically drought-affected States like Rajasthan, Gujarat, Maharashtra and Tamil Nadu, water has to be transported from distant sources by trains and trucks and supplied to the affected population as well as cattle. In States with recurrent floods like Assam, Bihar, West Bengal and Odisha, water has to be treated and purified and often supplied in bottles and sachets when saline water ingress in coastal and deltaic regions make all available sources including ground water unfit for human consumption. Areas with high arsenic contents in water create further challenges even in normal situations.

Providing sanitation facilities to men and women, particularly those in relief camps, is another important aspect of public health. Minimum standards of one toilet per 30 persons, separate toilets and bathing area for men and women, 15 litres water for bathing and washing, diapers for children and dignity kits of women with sanitary napkins and disposable paper bags and solid waste management have all been prescribed in the manuals and guidelines of most of several States.

Dewatering of flooded areas in urban pockets that have no outlets is also critical for public health as well as safety of lives and structures. Several cities that have pockets of low-lying areas, such as Kolkata, Mumbai, Srinagar, Guwahati etc. have regular dewatering stations which are augmented with additional pumps during flood season.

Health and Mental Health Care

Health care of disaster affected people is an important aspect of relief and rehabilitation. Minimum standards of health care of pregnant and lactating mothers, neo-natal, aged and those suffering from chronic diseases have been prescribed by many States as these people suffer from double jeopardy during disasters. Mental health care of the affected people suffering from Post Traumatic Stress Disorder (PTSD) is also crucial at the initial stage for diagnosis and treatment.

Several States have issued guidelines/ instructions for health care of disaster-affected people, particularly for those in staying in relief camps. This includes steps to be taken for preventing the spreading of communicable diseases, visits of mobile medical teams to relief camps, supply of essential drugs in camps, transportation of patients to hospitals requiring consultations with specialists, arrangements for safe delivery of pregnant women, counselling of people suffering from trauma and depression etc.

Management of Relief Camp

Provision of basic shelter, food, water and health care does not solve the problems of people in temporary relief camps, as there are many other issues, such as privacy, safety, security, gender based violence etc. that

should also be addressed. These issues can be attended only if there are proper guidelines for management of relief camps.

Several States have issued general and special guidelines in this regard. This includes identification of buildings for being used as a temporary relief camp, construction of pre-fabricated shelters or tents when no suitable buildings are available, provision of minimum of covered area required per person, provision of separate toilets and bathing space for men and women, arrangements for lighting with power back up facilities, special arrangements for differently-abled, old and medically serious patients.

Veterinary Care

Veterinary care for disaster affected livestock and animals, including wild animals and arrangements for their evacuation, shelter, fodder / feed etc. are important for rehabilitation of animals. Several State Governments have developed plans and issued guidelines for animal care during disasters. This includes procurement and supply of adequate stock of fodder, animal shelters and fodder banks in high altitude grazing areas, availability of essential drugs for veterinary care and uninterrupted movements of wild animals through identified corridors in sanctuaries, etc.

Relief Employment

People affected by disasters often lose their livelihood. Relief employment under MNREGA is one of the several avenues for providing alternate source of livelihood to the affected people. States are taking advantage of the scheme to provide wage employment of 100 days to villagers affected by disasters in addition to their normal employment. In some States like in Tamil Nadu and Rajasthan, which face drought for a prolonged period, such benefits have been extended for 150 days.

Temporary and Intermediary Shelters

In the case of devastating disasters, when the period of stay in temporary shelters is likely to be long and uncertain, or where extreme weather conditions can be life-threatening, construction of intermediary shelters shall become necessary.

After devastating earthquakes in Maharashtra, Gujarat and Jammu & Kashmir and tsunamis in the Andaman & Nicobar Islands and Tamil Nadu, temporary shelters had to be set up for the affected people till permanent houses were constructed. Similarly, temporary shelters were constructed in Choglamsar village of Leh district after the mudslide in 2010 and in Malin village of Pune district after the landslide in 2014.

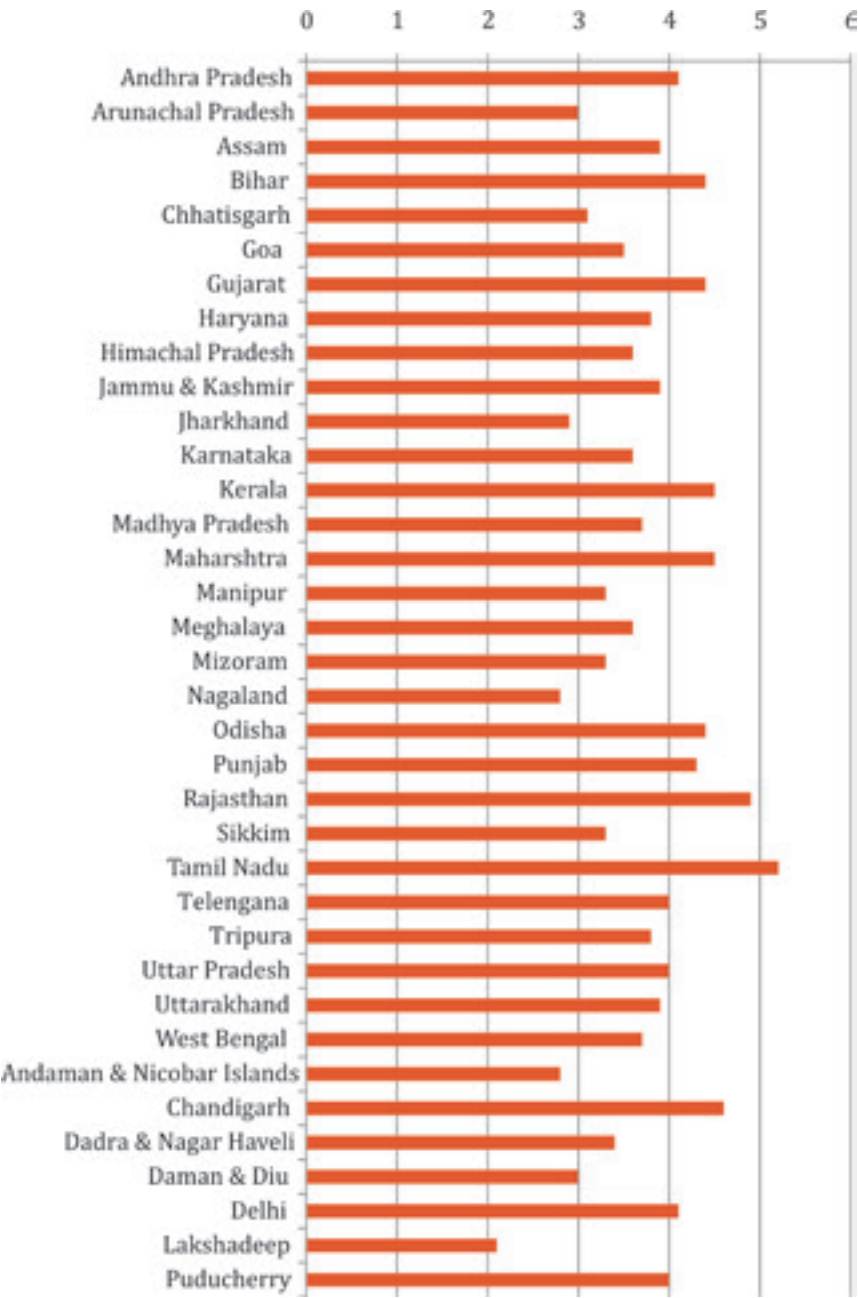
Table 52: Measuring Progress of States/ UTs on Disaster Relief and Rehabilitation

STATES	Minimum Standard of Relief	Ex-gratia Relief	Relief Logistics and Supply Chain Management	Food and Essential Supplies	Drinking Water, Dewatering and Sanitation	Health and Mental Health Care	Management of Relief Camps	Veterinary Care	Relief Employment	Temporary and Intermediary Shelters	Others	Total
Maximum Values	2	1	7	7	7	7	5	3	3	3	5	50
Andhra Pradesh	1	0	2.5	3	4.5	4.5	2	1	1	1	0	20.5
Arunachal Pradesh	1	1	1.5	2.5	3	2.5	2	1	0.5	0	0	15
Assam	1	1	2	3	3.5	3.5	2	1	1	1.5	0	19.5
Bihar	1	0.5	3	3.5	3.5	3.5	3.5	1	1	1.5	0	22
Chhattisgarh	1	0	2	3	3	2.5	1	1	1.5	0.5	0	15.5
Goa	1	0	2.5	3	4.5	3.5	2	1	0	0	0	17.5
Gujarat	1	0.5	2.5	4	4	3	2	2	1	2	0	22
Haryana	1	0	2.5	3	4	3.5	2	1	1	1	0	19
Himachal Pradesh	1	0	2	3	4	3	2	1	1	1	0	18
Jammu & Kashmir	1	0	2	3	4	4	2	1	1	1.5	0	19.5
Jharkhand	1	0	1.5	2.5	2.5	3	1	1	1.5	0.5	0	14.5
Karnataka	1	0	2	3	3	4	2	1	1.5	0.5	0	18
Kerala	1	0	2.5	3	6	4.5	2	2	1	0.5	0	22.5
Madhya Pradesh	1	1	2.5	3	3.5	3	2	1	1	0.5	0	18.5
Maharashtra	1	0	2.5	3.5	5	4.5	2.5	1.5	1.5	0.5	0	22.5
Manipur	1	0	1.5	3	4	2.5	2	1	1	0.5	0	16.5
Meghalaya	1	0	2	3	4	3.5	2	1	1	0.5	0	18
Mizoram	1	0	2	3	4	3	2	1	0	0.5	0	16.5
Nagaland	1	0	1.5	2.5	4	2.5	1	1	0	0.5	0	14
Odisha	1	0.5	3	3.5	4	3.5	2.5	1	1.5	1.5	0	22
Punjab	1	1	2.5	3.5	5	3.5	2	1	1	1	0	21.5
Rajasthan	1	0	4	3.5	4.5	3.5	3	2	2	1	0	24.5
Sikkim	1	0.5	2	2.5	4	2.5	1	1	1	1	0	16.5
Tamil Nadu	1	0	4	4	5	4.5	3	1.5	1.5	1.5	0	26
Telangana	1	0	2	3	5	4	2	1	1	1	0	20
Tripura	1	0.5	3	3	3.5	3	2	1	1	1	0	19
Uttar Pradesh	1	0	4	3	4	3	2	1	1	1	0	20
Uttarakhand	1	0.5	2	3	4	3	2	1	1	1	1	19.5

West Bengal	1	0	2	3	3.5	3	2	1	2	1	0	18.5
UNION TERRITORIES												
Andaman & Nicobar Islands	1	0.5	1	3	2	2.5	2	1	1	0	0	14
Chandigarh	1	0	2	3	7	5	2	2	0	1	0	23
Dadra and Nagar Haveli	1	0	1	3	3	4	3	2	0	0	0	17
Daman and Diu	1	0	1	3	5	2	2	1	0	0	0	15
Delhi	1	0	2	3.5	4.5	3.5	2	2	0	2	0	20.5
Lakshadweep	1	0	1	3	2.5	2	1	0	0	0	0	10.5
Puducherry	1	0	2	3	4	3	3	2	1	1	0	20

The overall progress, on a scale of 10, is presented in the following diagram.

Figure 49: Overall progress of States/ UTs on Disaster Relief & Rehabilitation





Source: UNDP

DISASTER RECONSTRUCTION

Disasters leave in their trails deaths, damage and destruction. Quick and efficient responses can minimize deaths and injuries, rapid and sensitive relief and rehabilitation can reduce human sufferings—but these do not address the issues of reconstruction of damaged houses, infrastructure, livelihoods and environment. Therefore, after the phase of relief and rehabilitation is over, the phase of disaster reconstruction begins, and this may continue from a few months to a few years, depending on the extent of damage and losses in disasters.

UNISDR has defined reconstruction in the following words:

The medium- and long-term rebuilding and sustainable restoration of resilient critical infrastructures, services, housing, facilities and livelihoods required for the full functioning of a community or a society affected by a disaster, aligning with the principles of sustainable development and “build back better”, to avoid or reduce future disaster risk.¹⁴⁵

Usually, reconstruction works after small-scale local disasters are left to the initiatives of the affected families and local communities with small grant assistance from the government or local authorities. Due to the inadequacy of such grants and lack of technical guidance, such reconstructions are not always taken up with the principle of ‘build back better’. Therefore, assets reconstructed after small or even medium scale disasters may not always withstand the shocks of future disasters. However, every catastrophic disaster causing enormous damage and losses of lives, livelihoods, economy and environment are usually followed by systematic efforts and initiatives for reconstruction involving local and national governments, international organizations and multi-lateral financial institutions

Every major post-disaster reconstruction project involves at least six sequential courses of action, as follows:

- a) First, damage and losses in disaster are documented in both physical and financial terms and needs for reconstruction are assessed comprehensively;
- b) Second, plans, designs and estimates for reconstruction projects are prepared;
- c) Third, resources are mobilized for financing the reconstruction projects;
- d) Fourth, mechanisms for implementation of the projects, either through the normal administrative systems or through specialized agencies are decided;
- e) Fifth, actual reconstruction works are taken up in manners that damaged houses, infrastructure and livelihood are ‘built back better’ to prevent risks of repeat disasters;
- f) Finally, impact of implementation of reconstruction projects are monitored and evaluated through ‘output’ and ‘outcome’ indicators.

145 UNISDR Terminology on Disaster Risk Reduction, 2017.

Global Frameworks

Post-disaster reconstruction did not feature as a priority of action in the Hyogo Framework of Action. However, under the Priority 3 on ‘reducing the underlying risk factors’, there was a call to ‘incorporate disaster risk reduction measures into post-disaster recovery and rehabilitation processes, and the opportunities during the recovery phase to develop capacities and reduce disaster risk in the long term, including through the sharing of expertise, knowledge and lessons learned’. The Sendai Framework flagged the issues of disaster reconstruction prominently in Priority-4 on ‘Build Back Better in recovery, rehabilitation and reconstruction’. The following action points have been prescribed at national and local levels:

- a) Promotion of cooperation among diverse institutions, multiple authorities and stakeholders, including affected communities and business, for addressing the complex and costly issues of post -disaster reconstruction;
- b) Incorporation of disaster risk management into post-disaster recovery and rehabilitation processes through the development of land use planning, improvement of structural standards and sharing of expertise, knowledge, and lessons learned;
- c) Building back better through integration of disaster risk reduction measures in reconstruction planning, designs, programmes and projects;
- d) Empowering women and persons with disability to lead and promote gender equitable and universally accessible recovery and reconstruction planning and programmes;
- e) Relocation of public facilities and infrastructures to areas outside the risk range, wherever possible; and
- f) Development of guidelines for enhancing preparedness for disaster reconstruction.

National Framework

Disaster Management Act 2005 has defined reconstruction as ‘construction or restoration of any property after a disaster’ and made the State Government (section 38), its Departments (section 39) and the local authorities (section 41) responsible for carrying out reconstruction activities in the affected areas. Section 36 of the Act has made the Ministries and Departments of Government of India responsible for providing assistance to the State Governments in carrying out reconstruction of the assets damaged in disasters.

The National Policy on Disaster Management 2009 has laid out its own strategic approach for reconstruction in the following words:

The approach to the reconstruction process has to be comprehensive so as to convert adversity into opportunity. Incorporating disaster resilient features to ‘build back better’ will be the guiding principle. This phase requires the most patient and painstaking effort by all concerned. The administration, the stakeholders and the communities need to stay focused on the needs of this phase, as, with the passage of time, the sense of urgency gets diluted. The appropriate choice of technology and project impact assessment needs to be carried out to establish that the projects contemplated do not create any side effects on the physical, socio-cultural or economic environment of the communities in the affected areas or in their neighbourhood. Systems for providing psychosocial support and trauma counselling need to be developed for implementation during the reconstruction and recovery phase.

The National Plan emphasized that the opportunities provided by reconstruction shall be used for plugging the gaps in the social and economic infrastructure through backward and forward linkages with development plans and programmes. In particular, efforts shall be made to support and enhance the viability of livelihood systems, education, healthcare facilities, care of the elderly, women and children, etc. Other aspects warranting attention will be roads, housing, drinking water sources, provision for sanitary facilities, availability of credit, supply of agricultural inputs, upgradation of technologies in the on-farm and off-farm activities, storage, processing, marketing, etc.

The National Plan further emphasized that essential services, social infrastructure and intermediate shelters shall be established in the shortest possible time, and that the permanent reconstruction of houses shall be completed within two to three years thereafter. In order to facilitate speedy reconstruction, contingency plans for reconstruction in highly disaster-prone areas, including architectural and structural type designs, shall be kept in readiness through a participatory process. Owner driven reconstruction of houses, facilitated by technical guidance, financial assistance and market access to building materials, shall be the preferred option. Special emphasis shall be given on restoration of livelihood of the affected people, especially the women headed households, artisans, farmers and people belonging to marginalized and vulnerable sections.

The National Plan on Disaster Management 2016 provided an overarching framework of disaster recovery, which includes reconstruction and rehabilitation. While reconstruction is primarily related to rebuilding of houses and public infrastructure and social services and restoration of jobs and livelihoods damaged by the disaster, rehabilitation includes physical as well as social, economic and psychological rehabilitation. Clearly these two are interrelated as rehabilitation involves reconstruction and vice versa.

National Plan outlined three stages of recovery, in which appropriate policies and programmes have to be planned and implemented, as shown in the following table.

Table 53: Three stages of Recovery

Stages	Duration	Brief Description
Early	3 – 18 Months	Cash for work, resumption of markets, commerce and trade, restoration of social services, transitional and temporary shelters
Mid-Term	Up to 5 Years (concurrent with early recovery)	Recovery plans for assets and livelihoods, reconstruction plans for housing, infrastructure, public buildings and cultural heritage buildings
Long-Term	Within 10 Years	Implemented along with developmental plans: infrastructure strengthening, environmental, urban and regional planning

The National Plan underlined six steps in the process of recovery. These are:

- a) Post-disaster need assessment and credible damage assessment
- b) Developing a vision for Build Back Better (BBB)
- c) Ensuring coherence of BBB with the development programme and goals
- d) Incorporating resilience and BBB is recovery vision
- e) Balancing recovery across sectors
- f) Prioritizing sectors for recovery

The National Plan provided a framework for recovery comprising of eight elements. These are:

- a) **Institutional arrangements:** Ensuring institutional mechanisms at the national, state, district, and local levels that clearly define roles and responsibilities in recovery;
- b) **Coordination:** Effecting inter-agency coordination among multiple stakeholders—government, international agencies, private sector, civil society organizations—in realizing the objectives of recovery
- c) **Public-Private Partnerships:** Facilitating participation of the private sector through innovative Public-Private Partnerships in disaster recovery
- d) **Information and Communication Technology:** Using ICT in recovery programmes, disseminating messages among all stakeholders, and providing information on all aspects of recovery programmes;
- e) **Decision Support System:** Setting up an adequate DSS that includes Management Information System (MIS), databases, deployment of spatial data management technologies;
- f) **Pool of Expertise:** Pooling of professional skills and expertise in diverse areas;
- g) **Community Participation:** Ensuring the pro-active involvement of communities, proper community outreach, empowerment, and gender equity in programme formulation and implementation;
- h) **Monitoring and Evaluation:** Developing a sound M&E system, including technical and social audits, for promoting transparency in the recovery processes.

The National Plan does not provide any matrix of activities to be undertaken by the Central and State Governments on disaster recovery and reconstruction, presumably because the State Governments have the primary responsibility of implementation of such programmes.

However, the SDRF/ NDRF norms have clearly identified the list of activities of reconstruction that can be permitted under these twin funds and further provided a ceiling of expenditure than can be permitted under each item. Please see the following table for a detailed list.

Table 54: Norms of Assistance for Relief and Rehabilitation under NDRF/ SDRF

ITEMS	NORMS
Housing a) Fully damaged/ severely damaged houses b) Partially damaged houses c) Damaged/ destroyed huts d) Cattle shed attached with house	a) Rs 101,900/ Rs 95,100 in hilly/ plain b) Rs 5200/ Rs 3200 per Puce/Kutch c) Rs 4100 per hut d) Rs 2100 per shed
Infrastructure Repair/restoration (of immediate nature) of damaged infrastructure: a) Roads & bridges b) Drinking Water Supply Works c) Irrigation d) Power (only limited to immediate restoration of electricity supply in the affected areas) e) Schools f) Primary Health Centres g) Community assets owned by Panchayat. Sectors such as Telecommunication and Power (except immediate restoration of power supply), which generate their own revenues, and also undertake immediate repair/ restoration works from own funds/ resources, are excluded.	Based on assessment of need, as per States' costs/ rates/ schedules for repair, by SEC and recommendation of the Central Team (in case of NDRF). Due consideration shall be given to the following: a) For repair of roads: Norms for Maintenance of Roads in India, 2001, as amended from time to time (upto 15% of total of Ordinary Repair (OR) and Periodical Repair (PR) in plain areas and upto 20% inhilly areas, b) For repair of Bridges and Irrigation works: as per the schedule of rates notified by concerned States. c) For repair of damaged drinking water schemes: aroundRs 1.5 lakh per damaged structure. d) For repair of damaged primary and secondary schools, primary health centres, anganwadisand community assets owned by the Panchayats: aroundRs 2 lakhs per damaged structure e) For repair of damaged power sector: aroundRs 4000 per pole, Rs 0.50 lakh per km of damaged conductor and Rs 1 lakh per damaged distribution transformer.

SDRF/NDRF norms have provided an illustrative list of activities that are of the nature of immediate restoration. Neither the prescribed lists of activities nor the permissible ceilings of expenditure are meant for reconstruction of the damaged assets, not to speak of ‘building them better’. This is clearly admitted in the Manual for Administration of SDRF/ NDRF:

The objective of State Disaster Response Fund or National Disaster Response is to provide gratuitous assistance as an immediate help to overcome the stress. It is generally understood that no country in the world is in a position to fully compensate the losses incurred due to natural calamities. There have to be other mechanisms in place to address the issues of compensation e.g. insurance coverage.¹⁴⁶

In the absence of any such ‘insurance coverage’ or any other alternate funding arrangement, most of the disasters in India ended up with gratuitous assistance as provided in SDRF/NDRF norms that do not take care of the needs for reconstruction. The only exceptions in recent decades have been a few major and catastrophic disasters that caused so much loss of lives, livelihoods, houses and infrastructure, that Government of India

146 Ministry of Home Affairs, Disaster Management Division, Manual for Administration of SDRF/ NDRF, 2013.

either sanctioned special central assistance to the affected States or sought assistance of multi-lateral financial institutions like the World Bank and the Asian Development Bank for post-disaster reconstruction.

Special central assistances were sanctioned for a few disasters like the Chamoli earthquake reconstruction in Uttarakhand (then Uttar Pradesh), Tsunami reconstruction in Tamil Nadu, Kerala and Puducherry, earthquake reconstruction in Jammu & Kashmir, Aila cyclone reconstruction in West Bengal etc. These reconstruction projects had their own norms, extending beyond the SDRF/NDRF norms. Additionally, special reconstruction programmes were taken up after earthquakes in Sikkim and Manipur, mudslide in Leh and landslide in Malin. These provided limited opportunities for ‘building back better’.

Since 1990, about a dozen disaster recovery and reconstruction projects were implemented, with assistance from the World Bank and the Asian Development Bank. While the World Bank financed 11 of these projects, the Asian Development Bank provided US\$ 200 million for the Tsunami Emergency Assistance Project that covered the two South Indian States of Kerala and Tamil Nadu. All these projects were planned, designed and implemented broadly following the principles of building back better. Six States of India—Andhra Pradesh, Gujarat, Jammu & Kashmir, Kerala, Odisha, Tamil Nadu and Uttarakhand—were beneficiaries of these projects that went through the elaborate process of post-disaster need assessment and a comprehensive approach for addressing some of the critical gaps of disaster risk management in the State, besides undertaking post-disaster reconstruction following the principles of ‘building back better’.

Table 55: World Bank-Assisted Disaster Reconstruction Projects in India

	Name of Project	Year	US \$
1	Andhra Pradesh Disaster Recovery Project	2015	250.0
2	Jhelum and Tawi Flood Recovery Project	2015	250.0
3	Odisha Disaster Recovery Project	2014	153.0
4	Uttarakhand Disaster Recovery Project	2013	250.0
5	Bihar Kosi Flood Recovery Project	2010	220.0
6	Emergency Tsunami Reconstruction Project	2005	465.0
7	Gujarat Emergency Earthquake Reconstruction Project	2002	442.8
8	Orissa Emergency Cyclone Recovery Project	2000	150.0
9	Andhra Pradesh Hazard Mitigation & Emergency Cyclone Recovery Project	1997	150.0
10	Maharashtra Emergency Earthquake Rehabilitation Project	1994	246.0
11	Andhra Pradesh Cyclone Emergency Reconstruction Project	1990	210.0

Source: <http://projects.worldbank.org>

State Initiatives

Experiences of most of the State Governments in post-disaster reconstruction have been rather limited as very States implemented reconstruction projects. Not all the States have learnt from these experiences in equal measures to improve disaster management system in their respective areas. This is evident from the report cards of the States on a set of 10 indicators selected to measure the progress achieved in post-disaster reconstruction.

Damage and Loss Assessment

Post-disaster damages, losses and needs are not assessed systematically in the States. What is assessed is the aggregate number of deaths and injuries, estimation of direct costs of damage of houses, infrastructure and productive assets like crops and livestock, and likely costs of replacement of damages. Indirect or opportunity costs of the damages, particularly on vulnerable sections of community, economy and environment are hardly ever assessed. The focus of CRF/SDRF norms on short term relief and rehabilitation has not encouraged development of comprehensive tools for assessing post disaster damage and losses.

Gujarat was the first and only State of India to have developed a comprehensive methodology for damage and loss which includes rapid assessment of losses, evaluation of damage, detailed assessment of losses in different sectors (productive, social, infrastructure and environment sectors), and assessment of micro-economic effects of losses.¹⁴⁷ The methodology is based on the tools of Damage and Loss Assessment (DALA) developed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). However, the methodology has not been put in practice as the SDRF norms do not permit post disaster reconstruction based on such methodology.

Post-Disaster Need Assessment

However, the methodology has been applied for Post Disaster Need Assessment (PDNA) in all World Bank-assisted reconstruction projects after 2005. Recently, a study has been completed to develop PDNA methodology for India, taking into account the legal administrative and financial contexts of a large federal country like India.¹⁴⁸ The recommendations for the study are yet to be accepted by the government.

Financing Reconstruction

Post disaster reconstruction is not permissible under the norms of SDRF/NDRF. State Governments have hardly financed any reconstruction projects except those taken up under special central assistance or World Bank/ADB assisted projects. However, there are a few exceptions in recent years.

These include post-flood reconstruction in Mumbai 2005, Malin landslide reconstruction 2014, Gustnado reconstruction in Kollam 2016 and flood rehabilitation in Banaskanha and Patan districts in Gujarat 2017. These projects were financed by the State Government from its own resources by debit to the special grants made available either from the State Planning and Finance Department or from Chief Minister’s Relief Fund. Hundreds of such disaster damage and losses are not reconstructed in the absence of any regular financing arrangements. This is one of the major gaps in financing disaster management in India.

¹⁴⁷ GSDMA, Damage and Loss Assessment Methodology for Gujarat, 2006.

¹⁴⁸ NIDM, Post Disaster Need Assessment (PDNA) Study for India, undertaken by Asian Disaster Prepared Centre under National Cyclone Risk Mitigation Project (NCRMP), 2017.

Institutional mechanisms for reconstruction

State Government funded-reconstruction projects were implemented by the concerned departments under the overall supervision of Disaster Management/ Relief & Rehabilitation Department. Reconstruction projects funded under special central assistance followed the same process. However, World Bank/ ADB funded projects had special institutional arrangements for each project according to its specific requirements.

In Maharashtra, a three-tier institutional arrangement was set up for the Latur earthquake reconstruction project. At the first tier was the cabinet sub-committee headed by Chief Minister for taking policy decisions, the second was Central Implementation Review Group (CIRG) headed by Chief Secretary for review and monitoring and the third was Project Management Unit (PMU) for implementation. PMU had officers on deputation from various line departments and was delegated with full powers for implementation of the project based on the decisions taken in the first two tiers.

Gujarat created GSDMA by legislation under the chairmanship of Chief Minister as a single window to deal with reconstruction activities as well as long term disaster risk management in the State, with full powers of the cabinet. The funds received from the World Bank were placed with GSDMA for implementation of the project through the line departments. Therefore, GSDMA was a sleek organization, not burdened with a large establishment like the Latur PMU, and with a long-term vision of holistic management of disasters in the State.

For the tsunami reconstruction project in Tamil Nadu, an advisory committee headed by a cabinet minister was set up to oversee it and an empowered committee headed by the Chief Secretary for periodic monitoring, while reconstruction works were carried out through the office of the Commissioner of the Revenue Administration—also the ex-officio State Relief Commissioner. A PMU, headed by a Project Director, was set up in the office of the State Relief Commissioner to monitor and coordinate the line departments/agencies implementing the project.

Building Back Better

National Policy on Disaster Management had announced that incorporating disaster resilient features to ‘build back better’ will be the guiding principle of reconstruction and the National Plan asked the State Governments to develop a ‘Vision for BBB’, but such principles and visions cannot be followed under the existing regime of SDRF/ NDRF norms do not permit such reconstructions. However, these are followed in all externally funded reconstruction projects. During the past two and a half decades, only 11 externally funded reconstruction projects have been implemented, leaving hundreds of disasters that have to remain satisfied with the norms of SDRF/NDRF that do not permit reconstruction following the principles of BBB. None of the States/ UTs has any programme to support reconstruction following the standards of BBB.

Reconstruction of houses

Houses that are damaged during the normal courses of flood, landslides cyclone and other disasters are reconstructed by owners themselves with the help of local masons with assistance made available by the State Governments under SDRF/ SDRF. However, whenever there is large scale damage of houses, following catastrophic disasters, State Governments develop strategies for reconstruction of houses. After the Latur earthquake, houses were initially reconstructed by the government agencies, but considering the quality, costs and time overrun, the remaining houses were constructed by the owners with the State government helping with technical guidance, material support and financial assistance, and local NGOs facilitating the process.

The model of owner-driven constructions was perfected in Gujarat: reconstruction programmes with add-on features like insurance and joint ownership of husband and wife was one of the most prominent component. This model has become the standard norm and was replicated elsewhere with success.

Reconstruction of infrastructure

Reconstruction of infrastructure after normal disasters follows the norms of SDRF/ NDRF that do not permit additional elements of safety and resilience. None of the State governments provide funds to cover these additional elements that are not permitted under SDRF norms. However, reconstruction of infrastructure funded through external assistance almost invariably follows the norms of building back better, so that these do not suffer further damages during future disasters.

Regeneration of ecology and environment

Disasters have their impacts on environment and ecology over a period of time, which is hardly ever assessed during normal disasters even though long term impacts of such day-today disasters like floods, landslides and cyclones may be very adverse. In large reconstruction projects these issues are studied in detail and appropriate measures are incorporated and implemented for regeneration of ecology and environment that would provide a shield against future disasters. For example, in cyclone reconstruction projects, regeneration of mangroves would be an essential component for providing protection to the coastal communities.

Livelihood Reconstruction

Disasters impact on the livelihood of farmers, artisans, women-headed households, and people belonging to marginalized and vulnerable sections in a very steep manner. SDRF/ NDRF norms provide for financial and other assistance for livelihood recovery and reconstruction. State Governments follow these norms. None of the State Governments has reported additional assistance that are made available by the State Governments over and above these norms.

Learning from reconstruction and recovery

None of the States has systematically documented the rich experiences gained during the process of recovery and reconstruction, even though these have been presented by the functionaries of State Governments in conferences and workshops. GSDMA published a brochure on 2002 earthquake recovery¹⁴⁹, which is more publicity material than serious documentation of the learning from reconstruction and recovery. However, a few academic institutions have documented reconstruction experiences of some of the major earthquakes. Tata Institute of Social Sciences published the proceedings of an international conference on recovery of Latur earthquake.¹⁵⁰ National Institute of Disaster Management published an account of reconstruction after Kutch Earthquake of 2001¹⁵¹. Government of Tamil Nadu published its experiences in response, relief, recovery and reconstruction of Indian Ocean Tsunami of 2004¹⁵²

149 GSDMA, Beyond Reconstruction,

150 Tata Institute of Social Sciences Organization and Administration of Relief and Rehabilitation Following Marathwada Earthquake, 1995.

151 National Institute of Disaster Management, ‘The Kutch Earthquake 2001: Recollections, Lessons and Insights’, Pramod Mishra, 2015.

152 Government of Tamil Nadu, ‘Tiding Over Tsunami, Part I and II’, 2008.

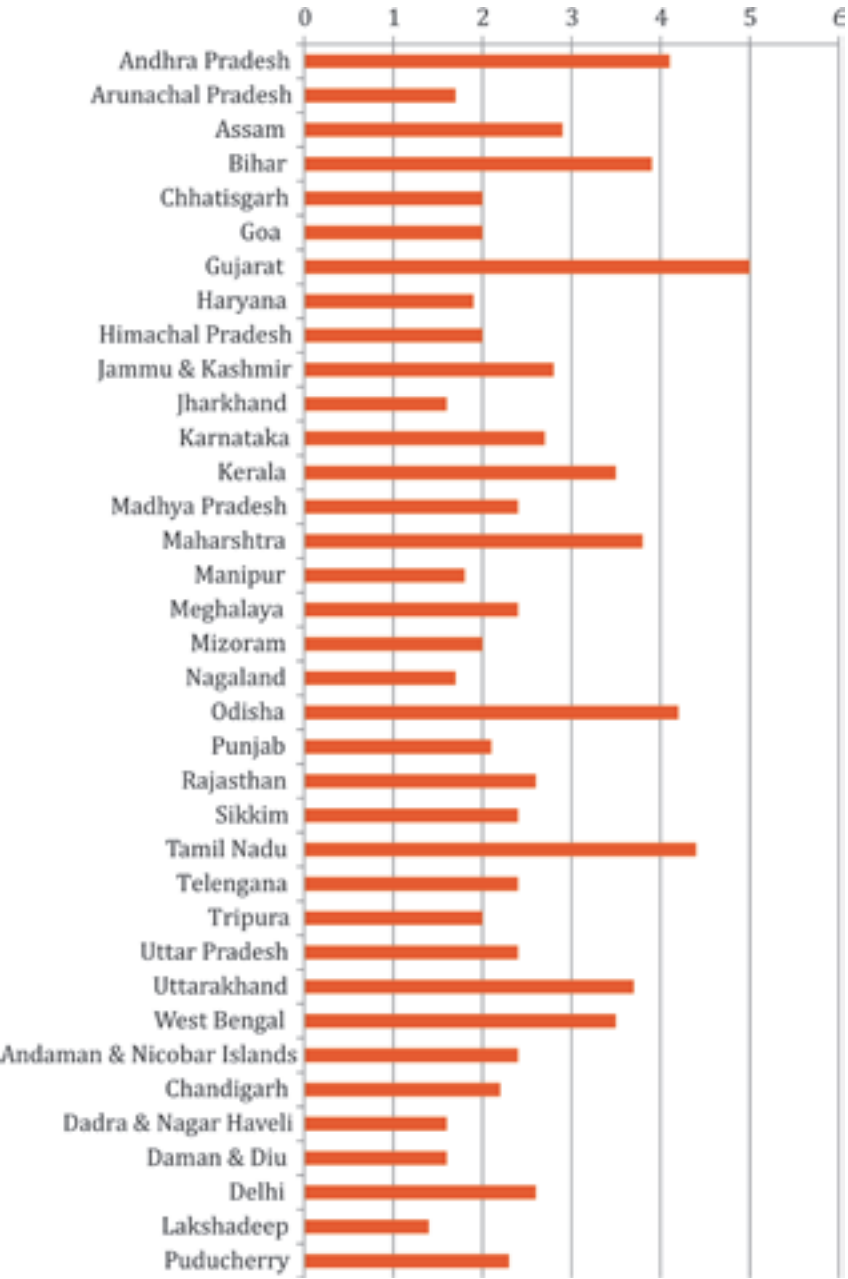
Table 56: Measuring Progress of States/ UTs on Disaster Reconstruction

STATES	Damage and Loss Assessment	Post Disaster Need Assessment	Financing Reconstruction	Institutional mechanisms for reconstruction	Building Back Better	Reconstruction of houses	Reconstruction of infrastructure	Livelihood Reconstruction	Regeneration of ecology and environment	Learning from reconstruction and recovery	Others	Total
Maximum Values	5	5	5	5	5	5	5	5	3	2	5	50
Andhra Pradesh	2.5	1	3	2	2.5	2	3	3	1	0.5	0	20.5
Arunachal Pradesh	2	0.5	1	0.5	1	1.5	1	1	0	0	0	8.5
Assam	2.5	1	2	1	1	1.5	2	2.5	0.5	0.5	0	14.5
Bihar	2.5	1	3	1.5	2.5	2.5	2	2.5	1	1	0	19.5
Chhattisgarh	1.5	0.5	2	0.5	1	1.5	1	2	0	0	0	10
Goa	2	0.5	1	0.5	1	2	2	1	0	0	0	10
Gujarat	3	2	2	2	3	3	3	3	1	2	1	25
Haryana	2	0.5	1	0.5	1	1.5	2	1	0	0	0	9.5
Himachal Pradesh	2	1	1	0.5	1	1.5	2	1	0	0	0	10
Jammu & Kashmir	1.5	0.5	3	2	2	2	1	1	0.5	0.5	0	14
Jharkhand	1.5	0.5	1	0.5	1	1.5	1	1	0	0	0	8
Karnataka	2.5	1	2	0.5	1	1.5	2	2	0	1	0	13.5
Kerala	2.5	1	3	1.5	2	2	2	2	1	0.5	0	17.5
Madhya Pradesh	2	0.5	2	0.5	1.5	1.5	2	2	0	0	0	12
Maharashtra	2.5	1	3	2	2.5	2	3	1	1	1	0	19
Manipur	1.5	0.5	2	0.5	1	1.5	1	1	0	0	0	9
Meghalaya	2	1	1	0.5	1	2.5	2	1	0	1	0	12
Mizoram	2	1	1	0.5	1	1.5	2	1	0	0	0	10
Nagaland	1.5	0.5	1	0.5	1	2	1	1	0	0	0	8.5
Odisha	2.5	1	3	2	2.5	3	2	3	1	1	0	21
Punjab	2	1	1	0.5	1	2	2	1	0	0	0	10.5
Rajasthan	2	1	2	0.5	1	1.5	2	3	0	0	0	13
Sikkim	1.5	0.5	2	1	2.5	1.5	1	1	0.5	0.5	0	12
Tamil Nadu	2.5	1	3	1.5	2.5	3	3	3	1	1.5	0	22
Telangana	2	1	2	0.5	1	1.5	2	2	0	0	0	12
Tripura	2	1	1	0.5	1	1.5	2	1	0	0	0	10
Uttar Pradesh	2	1	2	0.5	1	1.5	2	2	0	0	0	12
Uttarakhand	2	1	3	2	2.5	3	2	2	0.5	0.5	0	18.5

West Bengal	2	1.5	2	2	2	2	2	2	2	0	0	17.5
UNION TERRITORIES												
Andaman & Nicobar I	1	1	0	1	2	2	2	1	1	1	0	12
Chandigarh	1	1	0	2	3	2	2	0	0	0	0	11
Dadra & Nagar Haveli	1	0	0	1	2	2	2	0	0	0	0	8
Daman and Diu	1	0	0	1	2	2	2	0	0	0	0	8
Delhi	2	1	1	2	3	2	2	0	0	0	0	13
Lakshadweep	1	0	0	1	2	2	1	0	0	0	0	7
Puducherry	1	1	1	1	2	2	1	0.5	1	1	0	11.5

States have generally scored very poor on disaster reconstruction, as very few of them have experience in disaster recovery and reconstruction. The overall progress, on a scale of 10, is presented in the following diagram.

Figure 50: Overall progress of States/ UTs on Disaster Reconstruction



DISASTER RESILIENCE INDEX

Disaster Resilience Index is based on the information collected from the States/ UTs on 7x10 indicators through a questionnaire comprised of 172 questions. The Questionnaire was developed through a process of consultation with experts and State Governments. The responses received from the States/ UTs have been reviewed and evaluated on the basis of quantitative norms of evaluation developed in consultation with experts, as explained in the methodology of the study.

Resilience Index is a combination of seven aggregate indicators of disaster resilience. These are: Risk Assessment, Risk Prevention and Mitigation, Risk Governance, Disaster Preparedness, Disaster Response, Disaster Relief & Rehabilitation, and Disaster Reconstruction. Each aggregate indicator has 10 sub-indicators. The performances of the State Governments and UT administration have been evaluated on each aggregate indicator on a scale of 50, as per the norms of evaluation (Annexure IV), on the basis of their response to the Questionnaire (Annexure III), along with supporting documents and resources available in the public domain.

In this report, the focus is on quantitative measurement of progress achieved in building resilience to disasters in States and UTs across various aggregate and sub-indicators. A more qualitative assessment shall be made in the successive report on ‘Disaster Risks and Resilience in States and UTs of India’.

Risk Assessment

Risk assessment is one of the critical areas of disaster management, one that has shown very slow progress—with an average score of 14.1 on a scale of 50. Most of the States have not conducted comprehensive, state specific assessment of hazards, vulnerabilities and exposures of the changing dynamics and complexities of disasters. Risk assessment is based on a very coarse scale, mainly drawing from the Vulnerability Atlas of India, without in-depth study and analysis of multi-hazards and vulnerabilities at the local levels.

Himachal Pradesh is the only State of India that has carried out a comprehensive risk assessment through a professional agency on multiple parameters of hazards, vulnerabilities and exposures, placing the entire assessment report and metadata in the public domain, along with an interactive portal that enables users to access risk information and further generate their own hazard, vulnerability and risk maps at state, district and block levels. Gujarat had a comprehensive risk assessment a decade back but has neither updated the assessment nor made it available in the public domain for the use of stakeholders. Assam and Tripura have made use of the resources and facilities of Space Application Centers.

Table 57: Disaster Resilience Index of States and UTs: Risk Assessment

STATES	Hazard Vulnerability Risk Assessment	Digital Risk Mapping in Public Domain	Real Time Data on Risks and Disasters	Micro Zonation of Earthquake Risks	Flood Risk Assessment	Drought Risk Assessment	Dissemination of Risk Information to People	Assessing Traditional and Local Knowledge	Assessing Patterns of Emerging Risks	Developing Database on Disasters	Others	Total
Values	10	5	5	3	3	5	3	3	3	5	5	50
Andhra Pradesh	5.5	2.5	3	0	2.5	3	1.5	1	1	1	1	22
Arunachal Pradesh	2.5	1	0	0	1.5	0.5	0.5	0	0.5	0.5	0	7
Assam	6	3.5	2.5	2	2.5	2	2	1	1	0.5	2	25
Bihar	5	2	2	0	2.5	1	1	1	1	0.5	1	17
Chhattisgarh	2.5	0	0	0	1.5	2	1	0	0.5	0.5	0	8
Goa	2.5	0	0	0	1.5	1	1	1	1	1	0	9
Gujarat	7.5	2.5	2	2.5	2	3	1.5	0.5	1.5	1	0	24
Haryana	3.5	0	1.5	0	2	1	2	0	1	1	0	12
Himachal Pradesh	8	4	1.5	1	2	2	1.5	1	1	2.5	1	25.5
Jammu & Kashmir	2.5	0	0	0	2	1.5	1	1	0.5	0.5	0	9
Jharkhand	2.5	0	0	0	0	1	1	1	0.5	0.5	0	6.5
Karnataka	4.5	2.5	3	0	2	3.5	1.5	0.5	1	0.5	1	20
Kerala	4.5	1.5	1.5	0.5	2	1.5	2	0.5	1	1	0	16
Madhya Pradesh	2.5	0	0	1	1.5	2	1	0.5	0.5	0.5	0	9.5
Maharashtra	5	0	1	0	2.5	2.5	2	1	1.5	1	0	16.5
Manipur	2.5	0	0	0	2	1.5	1	0	0.5	0.5	0	8
Meghalaya	3.5	0	0	0	0	1.5	1	0.5	1	0.5	1	9
Mizoram	3.5	0	0	0	1.5	0.5	1	0	0.5	1	0	8
Nagaland	2.5	0	0	0.5	0	0.5	1	0.5	0.5	1	0	6.5
Odisha	6	1.5	0	0	2.5	2	2	1.5	1	1.5	0	18
Punjab	2.5	0	0	0	2	1.5	1	0	1	1	0	9
Rajasthan	4	1	2	0	1.5	3	1.5	1	1	2	0	17
Sikkim	4.5	2.5	2	0	1.5	0.5	1.5	1	1	1	0	15.5
Tamil Nadu	4	2	2	1	2	3.5	2	1	2	1.5	1	22
Telangana	4	0	0	0	1.5	2.5	1.5	1	1	1	0	12.5
Tripura	5	2.5	2	1	2	1.5	1	1.5	1.5	1.5	2	21.5
Uttar Pradesh	2.5	1	0.5	0	1	1	1	1	0	1	0	9

Uttarakhand	5.5	2	0	1	2	0.5	1	1	1.5	1	1.5	17
West Bengal	3	1	0	1.5	1	0.5	1	0	1	1.5	0	10.5
UNION TERRITORIES												
Andaman & Nicobar Islands	3.5	0	0	0	0	0	1	1	1	1	1	8.5
Chandigarh	4	1	1	0	0	0	2	0	0	2	0	10
Dadra and Nagar Haveli	3.5	0	0	1	0	1	1	0	0	1	0	7.5
Daman and Diu	3	0	0	0	0.5	1	1	0	0.5	1	0	7
Delhi	4	1	1	3	2	2	2	0	1	1	0	17
Lakshadweep	2.5	0	0	0	1	0	1	0	1	1	0	6.5
Puducherry	2	0	0.5	0	1	1	2	0	1	1	1	9.5

Himachal Pradesh scores highest in risk assessment (25.5 in a scale of 50), followed by Assam (25), Gujarat (24), Tamil Nadu and Andhra Pradesh (22), Tripura (21.5), Karnataka (20), Odisha (18.0), Bihar (17.0), and Kerala (16.0).

Risk Prevention and Mitigation

Risk prevention and mitigation registers least progress, with an average score of 12.2 on a scale of 50. Most of the States have scored poorly on almost every parameter of risk prevention and mitigation.

Only a couple of States have constituted State and District Disaster Mitigation Funds mandated under Disaster Management Act. In most of the States, investments in disaster risk prevention and mitigation have been limited to a few central sector and externally aided schemes. The provision of ‘flexi fund’ in centrally sponsored schemes have not been availed by the States. The statutory mandates for integration and mainstreaming of disaster risk reduction in development have been reiterated in every State and District Disaster Management Plan, but actual implementation of the measures for integration and mainstreaming have hardly ever taken place.

Table 58: Disaster Resilience Index of States and UTs: Risk Prevention and Mitigation

STATES	Disaster Risk Mitigation Projects	Mainstreaming DRR in Development	State and District Disaster Risk Mitigation Fund	Safety standards for construction/ land use plans	Safety audit/ retrofitting of life line structures	Construction of cyclone/ flood shelters	Eco System Approach for DRR	Social Safety Net for Poor and Vulnerable	Mitigating risks of heritage	Integration of climate change adaptation with DRR	Others	Total
Values	8	3	3	7	8	3	3	5	2	3	5	50
Andhra Pradesh	2	1	0	3	0	2	0.5	2.5	0	0.5	0.5	12
Arunachal Pradesh	2	0	0	2	1.5	0	0	2.5	0	0	0	8
Assam	3	1	0	3	3	0	0	2.5	0	1	0	13.5
Bihar	4	2	1.5	4	1.5	1	1	3	0	1	1	20
Chhattisgarh	0	0	0	2	0.5	0	0	3	0	0.5	0	6
Goa	2	0	0	3	1.5	1	1	2	0	0	0	10.5
Gujarat	4.5	1	2	4.5	4	1.5	1	2	1	1	0	22.5
Haryana	2	0	1	4	3	0	0.5	3	0	0	0.5	14
Himachal Pradesh	2	1	0	3	1	0	0	3	0	1	2	13
Jammu & Kashmir	1	0	1.5	3	1	0	0	2.5	0	0	0	9
Jharkhand	0	0	0	2	0	0	0	2.5	0	0	0	4.5
Karnataka	2	1	0	3	0	1	1	2.5	0	0	0	10.5
Kerala	4	1	1	4	2	2	0	2.5	0	1	1.5	19
Madhya Pradesh	1	0	0	3	1	0	0	2.5	0	0.5	1	9
Maharashtra	3	1	1.5	3	2	1	0	2.5	0	1	0.5	15.5
Manipur	0	0	0	2	0	0	0	2.5	0	0	0	4.5
Meghalaya	2	0	0	2	1.5	0	1	2.5	0	1	0	10
Mizoram	2	0	0	3	1.5	0	1	2.5	0	0	0	10
Nagaland	0	0	0	2	0	0	0	2.5	0	0	0	4.5
Odisha	4	1	0	3	0	2	1	2.5	0	1	0	14.5
Punjab	2	0	0	2	0	0.5	0	3.5	0	0.5	0	8.5
Rajasthan	3	0	2	3	0	0	1	3	0	1	1	14
Sikkim	2.5	0	0	2	2	0	1	2.5	1	1	2	14
Tamil Nadu	3	1.5	0	4	1.5	2	2	4	1	2	2.5	23.5
Telangana	2	0	0	3	0	0	0	3	0	0.5	2	10.5
Tripura	2	0	0.5	2	3.5	1	0.5	3	1	1.5	1	16
Uttar Pradesh	2	0	1.5	3	2	1	0	2.5	0	0.5	0	12.5
Uttarakhand	1	0	0	4	3.5	0	0	2.5	0	1	0	12
West Bengal	2.5	0	0	5	1.5	2.5	0	3.5	0	0	0	15
UNION TERRITORIES												
Andaman & Nicobar Islands	0	0	0	3	1	0	0.5	2	0	0	0.5	7
Chandigarh	0	0	0	3.5	1	0	0	3	0	0	0	7.5
Dadra and Nagar Haveli	0	0	0	3	0	0	0	2	0	0	0	5
Daman and Diu	0	0	0	3	0	0	0	2	0	0	0	5
Delhi	1.5	0	0	3	3	0	0	2.5	0.5	0	0	10.5
Lakshadweep	0	0	0	3	0	0	0.5	2	0	0	0	5.5
Puducherry	2	0	0	3	0	0.5	0	2	0	0	0.5	8

Only a handful of States have allocated State budgetary resources for risk prevention and mitigation.

Risk Governance

Among all the seven aggregate indicators of resilience, risk governance registers maximum progress, with an average score of 19.29 on a scale of 50. Most of this progress is seen through setting up institutional mechanisms for risk governance, rather than through the quality of such governance.

Every State has set up the State and Disaster Management Authorities as mandated by the Disaster Management Act now, with the sole exception of Gujarat, which had its SDMA already constituted and fully functional under the Gujarat State DM Act. Odisha also had its OSDMA, registered under Societies Act, which continues to function and remain more active than the statutory SDMA.

In most of the States, SDMAs function more like a committee that meets occasionally than a statutory authority with regular office, establishment and work plan. Almost every State and district in the country has formulated State and District Disaster Management Plans, but very few States revise and update these plans regularly as provided in the Act. Additionally, very few States have developed mechanisms for implementation of the plans with road maps, resource allocation and monitoring systems.

Risk governance has been compartmentalized in most of the States within Revenue and Relief Departments, with very little involvement and participation of other departments and agencies of the State Government and district administration for the holistic management of risks of disasters.

The ‘whole-of-government’ and ‘all-of-society’ approach of disaster risk management, highlighted so prominently in the Sendai Framework, are yet to be institutionalized and practiced in the States. Participation of most of the Departments and agencies of the government in disaster management are typically limited to the phase of post-disaster response and relief. Barring a couple of States, State Government Departments have not been able to develop sectoral disaster management plans and integrate such plans with development plans, despite clear mandates of Disaster Management Act.

Table 59: Disaster Resilience Index of States and UTs: Risk Governance

STATES	Institutional Mechanisms for Risk Governance	Disaster Management Policy and Plans	Disaster Management Manuals and Procedures	Decentralization and Devolution of Functions	Training and Capacity Development	Multi-Stakeholder Platform	Community Involvement and Participation	Enforcement and Compliance	Monitoring and Evaluation System	Transparency and Accountability	Others	Ttoal
Values	6	10	2	2	10	2	5	4	2	2	5	50
Andhra Pradesh	3	3.5	0.5	1	5	0	3	1	0.5	1	0	18.5
Arunachal Pradesh	1.5	4	1	0.5	4	0	1	0	0	0.5	0	12.5
Assam	5.5	5.5	2	1.5	6.5	1	3	0	0	1	1	27
Bihar	5	5.5	1	1	5.5	1.5	2.5	0.5	0.5	1	0	24
Chhattisgarh	2	5	0.5	0.5	3.5	0	2	0	0	0.5	0	14
Goa	2	3	0.5	0.5	2.5	0	2	0	0	1	0	11.5
Gujarat	3.5	6.5	1	1.5	6.5	0.5	3.5	2	0.5	0.5	0	26.5
Haryana	3	6	1	0.5	6.5	0	2	0	0	1	0	20
Himachal Pradesh	4	9	2	0.5	5	2.5	2	0	0	1	0	26
Jammu & Kashmir	2.5	4.5	0	0.5	5	0	1	0	0	0.5	0	14
Jharkhand	1	3	0	0.5	4	0	1	0	0	0.5	0	10
Karnataka	2	6	1	0.5	4.5	0	2	0	0	1	0	17
Kerala	4	5.5	1.5	1.5	3	0	3	1	0.5	1	0	21
Madhya Pradesh	2.5	5	1	1	6.5	0	2	0.5	0.5	1	0	20
Maharashtra	3	7	1	1.5	6.5	1	3	1	0	1	0	25
Manipur	0.5	3	0.5	0.5	3	0	2	0	0.5	0.5	0	10.5
Meghalaya	3.5	6	1	1	4	0	2	0	0	1	0	18.5
Mizoram	4	6	1	1	4	0	2.5	0	0.5	1	0	20
Nagaland	4.5	3	1	1	2	0	2	0	0.5	0.5	0	14.5
Odisha	4	8	2	1	4.5	0	3	2	0.5	1	0	26
Punjab	3	2	2	1	5	0	2	0	0	1	0	16
Rajasthan	5	6	1	1	7	1.5	2	0	0.5	1	0	25
Sikkim	3	4	1	1.5	4.5	1	3	0	0	1	0	19
Tamil Nadu	2	4	1	1	5.5	0.5	3	0	0.5	1	1	19.5
Telangana	3.5	3	1	1	5.5	0	2	0	1	1	0	18
Tripura	3	8.5	2	1	5.5	1	3	2	0	1	0	27
Uttar Pradesh	3.5	4	1	0.5	5	0	2	0	0	0.5	0	16.5
Uttarakhand	3	5	2	1	5.5	0	2	0	0.5	1	0.5	20.5
West Bengal	4.5	5.5	1	1.5	6	0	1	0	0.5	1	0.5	21.5
UNION TERRITORIES												
Andaman & Nicobar Islands	3	4	3	1	2.5	0	2	0	1	0	0	16.5
Chandigarh	1	4	0	0	1.5	0	2	0	1	0	0	9.5
Dadra and Nagar Haveli	1	3	0	0	2	0	1	0	0.5	0	0	7.5
Daman and Diu	1.5	3	1	0	1	0	1	0	0.5	0	0	8
Delhi	1.5	4	1	0.5	4.5	0	1	1	0.5	0.5	0.5	15
Lakshadweep	2	3.5	0	1	1	0	2	1	1	0	0	11.5
Puducherry	2	2	0.5	0	1.5	0	2	0	0.5	0	0	10.5

Disaster Preparedness

Disaster preparedness registers an average score of 19.20 on a scale of 50. Here, again, institutions and systems are being developed but standards and processes are not yet fully in place in most States. Considering the very high level of residual risks of disasters in most States (risks that are neither prevented nor mitigated nor transferred), the level of disaster preparedness requires considerable improvements.

Table 60: Disaster Resilience Index of States and UTs: Disaster Preparedness

STATES	End-to-End Early Warning System	Emergency Operation Centre	Disaster Communication System	Emergency Medical Preparedness	Scenario Building, Simulation and Mock Drills	Contingency Plans, SOPs, Manuals	Community Based Disaster Preparedness	Awareness Generation	Resource Inventory	Media Partnership	Others	Total
Values	5	5	5	5	5	5	5	5	3	2	5	50
Andhra Pradesh	2	2	3	2	2.5	2	2	2	1	1	0	19.5
Arunachal Pradesh	1	2	1	0.5	1	1	1	2	2	0	0	11.5
Assam	3	3	2	2	3.5	3	3	2	1	0.5	0	23
Bihar	3	3	2	1.5	2.5	2.5	2	2	1	0	0	19.5
Chhattisgarh	2	2	2	1.5	1.5	1	1	2	1	0		14
Goa	2	1	2	2	1.5	1	1	2	1	0	0	13.5
Gujarat	2.5	3	2.5	3	3.5	3.5	3	3	2	1	0	27
Haryana	2	2	2	2	2	2	1.5	2	2	1	1	19.5
Himachal Pradesh	3	3	2	2	2	3	2	2	2	1	1	23
Jammu & Kashmir	2	1	1	2.5	1	1	1	1	1	0.5	0	12
Jharkhand	1	0	1	1.5	1	0	1	2	0	0	0	7.5
Karnataka	2.5	3	2	2	2	1	2	2	1.5	0	0	18
Kerala	2	3	3	2.5	2	3	3	3	2	1	0	24.5
Madhya Pradesh	1.5	2	2	2	1.5	2	2	2	1.5	0	0	16.5
Maharashtra	3.5	3.5	3	2.5	3	3	3	3	3	0	0	27.5
Manipur	2	2	2	1	1	1	1	1	0	0	0	11
Meghalaya	2	2	2	1	1.5	2	2	2	2	0	0	16.5
Mizoram	2	2	2	1	1.5	2	2	2	2	0	0	16.5
Nagaland	1	1	2	1	1	1	1	2	0.5	0	0	10.5
Odisha	3	2	2	1.5	2	3	3	3	1.5	1	0	22
Punjab	2	2	2	2	2	2	2	3	1	0	0	18
Rajasthan	2.5	2	2	2	2	2	2	2	1	1	0	18.5
Sikkim	1.5	1.5	2	1	1.5	2	2	2	2	0.5	0	16

Tamil Nadu	3.5	3	2	2.5	2.5	2	3	3	2	1	0	24.5
Telangana	1.5	1	1	2	2	1	2	2	0.5	0	0	13
Tripura	3	3	2	1.5	2	3	2	3	2	1	0	22.5
Uttar Pradesh	2	2	2	1.5	1.5	2	1	2	1.5	1	0	16.5
Uttarakhand	2.5	2.5	2	2	1.5	2	2	2	2	1	0	19.5
West Bengal	2	3.5	3	1.5	1	3	2	2	1	0.5	0	19.5
UNION TERRITORIES												
Andaman & Nicobar Islands	2.5	3.5	2	1.5	2	3	2	1	1	1	1	20.5
Chandigarh	3	4	2	3.5	3.5	2	2	2	1.5	1	0	24.5
Dadra and Nagar Haveli	1	2	2	3	1	2	2	2	2	0	0	17
Daman and Diu	1.5	0	1	3	1	1	1.5	1.5	0	0.5	0	11
Delhi	2	4	2	5	4	2	2	2	1.5	0.5	0	25
Lakshadweep	2	0	1	1.5	1	1	2	1	0	0	0	9.5
Puducherry	2.5	3.5	2	3	3	2	1	2	1	1	0	21

Disaster Response

The average score in disaster response among 29 States is 19.18 on a scale of 50, leaving enormous scope for improvement on almost every aspect of disaster response.

Table 61: Disaster Resilience Index of States and UTs: Disaster Response

STATES	State Agencies for Disaster Response	Incident Response System	Coordination with GOI, NDRF, Armed Forces	Evacuation, Search and Rescue	Emergency Medical Response	Emergency Support Functions	Protection of Women and Children	Disposal of dead bodies	Disposal of Animal Carcasses	Disposal of Debris	Others	Total
Values	10	4	2	7	5	5	5	3	2	2	5	50
Andhra Pradesh	5.5	1	1	3	2.5	2.5	2.5	2	1	1	0	22
Arunachal Pradesh	3	0.5	1.5	1.5	1	1.5	3	1	1	1	0	15
Assam	5	2	1.5	3	2	2	2	1.5	1	1	0	21
Bihar	6	1	1	3	2	2	2	1	1	0	0	19
Chhattisgarh	3.5	0	1	1.5	1	1.5	2	1	1	0	0	12.5
Goa	1.5	0	1	3	2	2	3.5	2	1	0.5	0	16.5
Gujarat	7	2	1	4	3	3	2	1	1	1	0	25
Haryana	3	2	1	3	2	2	2.5	2	1	1	1	20.5
Himachal Pradesh	2	1	1	3	1	2	3	2	1	1	0	17
Jammu & Kashmir	6.5	0.5	1.5	2	2	2	3	1.5	1	1	0	21
Jharkhand	1	0.5	0	1.5	1	1	2	1	1	0	0	9
Karnataka	3	2	1	3	2	2	2.5	2	1	1	0	19.5
Kerala	4	2	1	3	2.5	3	3.5	2	1	0	0	22
Madhya Pradesh	5.5	2	1	3	2	2	2	2	1	0	0	20.5
Maharashtra	5.5	2	1.5	4	3	3	2.5	2	1	1	0	25.5
Manipur	3	1	1	1.5	2	2	3	1	1	0	0	15.5
Meghalaya	4.5	1	1	1.5	2	2	3	1	1	1	0	18
Mizoram	4.5	1	1	1.5	2	2	3	1	1	0	0	17
Nagaland	2.5	2	1	1.5	1	2	3	1	1	0	0	15
Odisha	6	1.5	1	3.5	2	2	2	1	1	1	1	22
Punjab	4	1.5	1	3.5	2.5	2.5	2.5	2	1	1	0	21.5
Rajasthan	5	1	1	3.5	2	2	2	1.5	1	1	0	20
Sikkim	4	1	1	1.5	1.5	2	3	1	1	1	0	17
Tamil Nadu	4.5	2	1	4	3	3	3	2	1	1	0	24.5
Telangana	3	2	1	3	2.5	2.5	2.5	2	1	1	0	20.5
Tripura	4	1	1	2	2	2	3	1	1	1	0	18

Uttar Pradesh	3	1.5	1	3	1.5	2	2	1.5				15.5
Uttarakhand	6	3	1.5	3	1.5	2	2.5	1.5	1	1	0	23
West Bengal	7	2	1.5	3.5	2	2	3	1	1	1	0	24
UNION TERRITORIES												
Andaman & Nicobar Islands	2	3	1	3	1	2	2	1	1	1	0	17
Chandigarh	4	0	2	3	3	2	3	1	1	1	0	20
Dadra and Nagar Haveli	2	1	1	2	1	2	2	1	1	1	0	14
Daman and Diu	2	0	1	2	2	2	2	1	1	0	0	13
Delhi	2	2	2	4	2.5	2.5	3	2	2	2	0	24
Lakshadweep	2	0	1	2	2	2	3	1	1	0	0	14
Puducherry	3	1	1	3	2	2	2	2	1	1	0	18

Almost every State has created a State Disaster Response Force (SDRF) by designating some units of State Armed Force, but in most of the States the Quick Response Teams of this specialized force are yet to be fully equipped and trained. Standard Operating Procedures for evacuation, search and rescue operations are yet to be fully developed in most States. None of the States has operationalized the Incident Response System. The emergency support functions in disaster response and the departments and agencies responsible for the performance of the functions are identified, but the process and timeline to be followed are not laid down properly in most States. Sporadic initiatives have been taken by some States to train medical and para-medical staff in emergency medical response, but no systematic efforts have been made by the States to implement the national guidelines on emergency medical preparedness and mass casualty management.

Relief and Rehabilitation

Every State has a well-established Relief and Rehabilitation Department, which follows the financial norms prescribed by the Government of India under State Disaster Response Fund. Some States provide additional relief on a case-to-case basis. A few States have a well-codified Relief Manual, but in most States operational norms for disbursement of relief and for restoration of critical facilities are not well-defined. Critical issues like relief logistics, supply chain management, management of relief camps, arrangements for temporary and permanent shelters etc, are not addressed systematically.

Table 62: Disaster Resilience Index of States and UTs: Disaster Relief and Rehabilitation

STATES	Minimum Standard of Relief	Ex-gratia Relief	Relief Logistics and Supply Chain Management	Food and Essential Supplies	Drinking Water, Dewatering and Sanitation	Health and Mental Health Care	Management of Relief Camps	Veterinary Care	Relief Employment	Temporary and Intermediary Shelters	Others	Total
Values	2	1	7	7	7	7	5	3	3	3	5	50
Andhra Pradesh	1	0	2.5	3	4.5	4.5	2	1	1	1	0	20.5
Arunachal Pradesh	1	1	1.5	2.5	3	2.5	2	1	0.5	0	0	15
Assam	1	1	2	3	3.5	3.5	2	1	1	1.5	0	19.5
Bihar	1	0.5	3	3.5	3.5	3.5	3.5	1	1	1.5	0	22
Chhattisgarh	1	0	2	3	3	2.5	1	1	1.5	0.5	0	15.5
Goa	1	0	2.5	3	4.5	3.5	2	1	0	0	0	17.5
Gujarat	1	0.5	2.5	4	4	3	2	2	1	2	0	22
Haryana	1	0	2.5	3	4	3.5	2	1	1	1	0	19
Himachal Pradesh	1	0	2	3	4	3	2	1	1	1	0	18
Jammu & Kashmir	1	0	2	3	4	4	2	1	1	1.5	0	19.5
Jharkhand	1	0	1.5	2.5	2.5	3	1	1	1.5	0.5	0	14.5
Karnataka	1	0	2	3	3	4	2	1	1.5	0.5	0	18
Kerala	1	0	2.5	3	6	4.5	2	2	1	0.5	0	22.5
Madhya Pradesh	1.5	1.5	2	3	3	3	2	1	1	0.5	0	18.5
Maharashtra	1	0	2.5	3.5	5	4.5	2.5	1.5	1.5	0.5	0	22.5
Manipur	1	0	1.5	3	4	2.5	2	1	1	0.5	0	16.5
Meghalaya	1	0	2	3	4	3.5	2	1	1	0.5	0	18
Mizoram	1	0	2	3	4	3	2	1	0	0.5	0	16.5
Nagaland	1	0	1.5	2.5	4	2.5	1	1	0	0.5	0	14
Odisha	1	0.5	3	3.5	4	3.5	2.5	1	1.5	1.5	0	22
Punjab	1	1	2.5	3.5	5	3.5	2	1	1	1	0	21.5

Rajasthan	1	0	4	3.5	4.5	3.5	3	2	2	1	0	24.5
Sikkim	1	0.5	2	2.5	4	2.5	1	1	1	1	0	16.5
Tamil Nadu	1	0	4	4	5	4.5	3	1.5	1.5	1.5	0	26
Telangana	1	0	2	3	5	4	2	1	1	1	0	20
Tripura	1	0.5	3	3	3.5	3	2	1	1	1	0	19
Uttar Pradesh	2	0	3	3	4	3	2	1	1	1	0	20
Uttarakhand	1	0.5	2	3	4	3	2	1	1	1	1	19.5
West Bengal	1	0	2	3	3.5	3	2	1	2	1	0	18.5
UNION TERRITORIES												
Andaman & Nicobar Islands	1	0.5	1	3	2	2.5	2	1	1	0	0	14
Chandigarh	1	0	2	3	7	5	2	2	0	1	0	23
Dadra and Nagar Haveli	1	0	1	3	3	4	3	2	0	0	0	17
Daman and Diu	1	0	1	3	5	2	2	1	0	0	0	15
Delhi	1	0	2	3.5	4.5	3.5	2	2	0	2	0	20.5
Lakshadweep	1	0	1	3	2.5	2	1	0	0	0	0	10.5
Puducherry	1	0	2	3	4	3	3	2	1	1	0	20

Reconstruction

Issues of disaster reconstruction and of ‘building back better’ to make the reconstructed assets and livelihoods resistant to disasters are not addressed in any State except after major and catastrophic disasters. Only a few States in India—Andhra Pradesh, Bihar, Gujarat, Jammu & Kashmir, Kerala, Maharashtra, Odisha, Uttarakhand and West Bengal—have had the experience of post-disaster reconstruction, but not every State has done equally well in implementing such reconstruction projects and in learning lessons learnt from the projects.

Table 63: Disaster Resilience Index of States and UTs: Disaster Reconstruction

STATES	Damage and Loss Assessment	Post Disaster Need Assessment	Financing Reconstruction	Institutional mechanisms for reconstruction	Building Back Better	Reconstruction of houses	Reconstruction of infrastructure	Livelihood Reconstruction	Regeneration of ecology and environment	Learning from reconstruction and recovery	Others	Total
Values	5	5	5	5	5	5	5	5	3	2	5	50
Andhra Pradesh	2.5	1	3	2	2.5	2	3	3	1	0.5	0	20.5
Arunachal Pradesh	2	0.5	1	0.5	1	1.5	1	1	0	0	0	8.5
Assam	2.5	1	2	1	1	1.5	2	2.5	0.5	0.5	0	14.5
Bihar	2.5	1	3	1.5	2.5	2.5	2	2.5	1	1	0	19.5
Chhattisgarh	1.5	0.5	2	0.5	1	1.5	1	2	0	0	0	10
Goa	2	0.5	1	0.5	1	2	2	1	0	0	0	10
Gujarat	3	2	2	2	3	3	3	3	1	2	1	25
Haryana	2	0.5	1	0.5	1	1.5	2	1	0	0	0	9.5
Himachal Pradesh	2	1	1	0.5	1	1.5	2	1	0	0	0	10
Jammu & Kashmir	1.5	0.5	3	2	2	2	1	1	0.5	0.5	0	14
Jharkhand	1.5	0.5	1	0.5	1	1.5	1	1	0	0	0	8
Karnataka	2.5	1	2	0.5	1	1.5	2	2	0	1	0	13.5
Kerala	2.5	1	3	1.5	2	2	2	2	1	0.5	0	17.5
Madhya Pradesh	2	0.5	2	0.5	1.5	1.5	2	2	0	0	0	12
Maharashtra	2.5	1	3	2	2.5	2	3	1	1	1	0	19
Manipur	1.5	0.5	2	0.5	1	1.5	1	1	0	0	0	9
Meghalaya	2	1	1	0.5	1	2.5	2	1	0	1	0	12
Mizoram	2	1	1	0.5	1	1.5	2	1	0	0	0	10
Nagaland	1.5	0.5	1	0.5	1	2	1	1	0	0	0	8.5
Odisha	2.5	1	3	2	2.5	3	2	3	1	1	0	21
Punjab	2	1	1	0.5	1	2	2	1	0	0	0	10.5
Rajasthan	2	1	2	0.5	1	1.5	2	3	0	0	0	13

Sikkim	1.5	0.5	2	1	2.5	1.5	1	1	0.5	0.5	0	12
Tamil Nadu	2.5	1	3	1.5	2.5	3	3	3	1	1.5	0	22
Telangana	2	1	2	0.5	1	1.5	2	2	0	0	0	12
Tripura	2	1	1	0.5	1	1.5	2	1	0	0	0	10
Uttar Pradesh	2	1	2	0.5	1	1.5	2	2	0	0	0	12
Uttarakhand	2	1	3	2	2.5	3	2	2	0.5	0.5	0	18.5
West Bengal	2	1.5	2	2	2	2	2	2	2	0	0	17.5
UNION TERRITORIES												
Andaman & Nicobar Islands	1	1	0	1	2	2	2	1	1	1	0	12
Chandigarh	1	1	0	2	3	2	2	0	0	0	0	11
Dadra and Nagar Haveli	1	0	0	1	2	2	2	0	0	0	0	8
Daman and Diu	1	0	0	1	2	2	2	0	0	0	0	8
Delhi	2	1	1	2	3	2	2	0	0	0	0	13
Lakshadweep	1	0	0	1	2	2	1	0	0	0	0	7
Puducherry	1	1	1	1	2	2	1	0.5	1	1	0	11.5

The States and UTs have been assessed on their progress on various aspects of reconstruction post-disasters: small, medium or large. The average all-India score on disaster reconstruction is very low, at 13.77.

It may be observed that Union Territories, despite being administered directly by the Government of India, have not done better than the States on any of the indicators of disaster resilience. Overall performance of the UTs in disaster management have been rather poor. This may be ascribed to several factors: (a) Disaster Management Act has neither prescribed any special institutional mechanisms for the UTs nor made it very specific that the same mechanisms as in the States shall be applicable ipso facto the UTs; (b) Finance Commission allocations under SDRF are not available to the UTs; (c) Most of the UTs are located remotely, which make it difficult for the administration to access technical and other resources available to the mainstream States.

However, despite these limitations, some of the UTs, like Delhi, Puducherry and the Andaman & Nicobar Islands have made significant progress post enactment of Disaster Management Act 2005.

Disaster Resilience Index

The data analysis of the States/ UTs on seven indicators of disaster resilience—risk assessment, risk prevention and mitigation, risk governance, disaster preparedness, disaster response, disaster relief and rehabilitation and disaster reconstruction—have been further aggregated with weights, as explained in the chapter on methodology, to calculate Disaster Resilience Index in a scale of 100 as discussed. The same is presented in the table below.

Table 64: Disaster Resilience Index of States and Union Territories
(Scale of 100)

	STATES / UNION TERRITORIES	Risk Assessment	Risk Prevention & Mitigation	Risk Governance	Disaster Preparedness	Disaster Response	Disaster Relief & Rehabilitation	Disaster Reconstruction	Disaster Resilience Index
1	2	3	4	5	6	7	8	9	10
	States								
1	Andhra Pradesh	44.0	24.0	37.0	39.0	44.0	41.0	41.0	37.0
2	Arunachal Pradesh	14.0	16.0	25.0	23.0	30.0	30.0	17.0	22.6
3	Assam	50.0	27.0	54.0	46.0	42.0	39.0	29.0	41.9
4	Bihar	34.0	40.0	48.0	39.0	38.0	44.0	39.0	41.2
5	Chattisgarh	16.0	12.0	28.0	28.0	25.0	31.0	20.0	23.4
6	Goa	18.0	21.0	23.0	27.0	33.0	35.0	20.0	25.6
7	Gujarat	48.0	45.0	53.0	54.0	50.0	44.0	50.0	49.3
18	Haryana	24.0	28.0	40.0	39.0	41.0	38.0	19.0	34.6
9	Himachal Pradesh	51.0	26.0	52.0	46.0	34.0	36.0	20.0	39.7
10	Jammu & Kashmir	18.0	18.0	28.0	24.0	42.0	39.0	28.0	27.3
11	Jharkhand	13.0	9.0	20.0	15.0	18.0	29.0	16.0	17.1
12	Karnataka	40.0	21.0	34.0	36.0	39.0	36.0	27.0	32.9
13	Kerala	32.0	38.0	42.0	49.0	44.0	45.0	35.0	41.9
14	Madhya Pradesh	19.0	18.0	40.0	33.0	41.0	37.0	24.0	31.0
15	Maharashtra	33.0	31.0	50.0	55.0	51.0	45.0	38.0	44.3
16	Manipur	16.0	9.0	21.0	22.0	31.0	33.0	18.0	21.0
17	Meghalaya	18.0	20.0	37.0	33.0	36.0	36.0	24.0	30.0
18	Mizoram	16.0	20.0	40.0	33.0	34.0	33.0	20.0	29.6
19	Nagaland	13.0	9.0	29.0	21.0	30.0	28.0	17.0	21.2
20	Odisha	36.0	29.0	52.0	44.0	44.0	44.0	42.0	41.7
21	Punjab	18.0	17.0	32.0	36.0	43.0	43.0	21.0	30.6
22	Rajasthan	34.0	28.0	50.0	37.0	40.0	49.0	26.0	39.1
23	Sikkim	31.0	28.0	38.0	32.0	34.0	33.0	24.0	32.3
24	Tamil Nadu	44.0	47.0	39.0	49.0	49.0	52.0	44.0	46.3
25	Telangana	25.0	21.0	36.0	26.0	41.0	40.0	24.0	30.4
26	Tripura	43.0	32.0	54.0	45.0	36.0	38.0	20.0	40.8
27	Uttar Pradesh	18.0	25.0	33.0	33.0	31.0	40.0	24.0	30.3
28	Uttarakhand	34.0	24.0	41.0	39.0	46.0	39.0	37.0	36.5
29	West Bengal	21.0	30.0	43.0	39.0	46.0	37.0	35.0	36.4
	State Average	27.1	24.0	37.0	35.7	38.7	38.6	26.5	33.6

	Union Territories								
1	Andaman & Nicobar Islands	17.0	14.0	33.0	41.0	34.0	28.0	24.0	28.1
2	Chandigarh	20.0	15.0	19.0	49.0	40.0	46.0	22.0	30.6
3	Dadra & Nagar Haveli	15.0	10.0	15.0	34.0	28.0	34.0	16.0	22.0
4	Daman & Diu	14.0	10.0	16.0	22.0	26.0	30.0	16.0	18.9
5	Delhi	34.0	21.0	29.0	50.0	48.0	41.0	26.0	35.7
6	Lakshadweep	13.0	11.0	23.0	19.0	28.0	21.0	14.0	18.6
7	Puducherry	19.0	16.0	21.0	42.0	36.0	40.0	23.0	28.5
	Ut Average	18.8	13.8	22.3	36.7	34.3	34.3	20.1	26.0
	National Average	25.7	21.7	34.6	35.6	37.2	37.4	25.3	32.1

The national average score of disaster resilience is 32.17, with a State average of 33.6 and UT average of 32.1. Thirteen States (Arunachal Pradesh, Chhattisgarh, Goa, Jammu & Kashmir, Jharkhand, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Telangana, and Uttar Pradesh) and six Union Territories (Andaman & Nicobar Islands, Chandigarh, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep, and Puducherry) score less than the national average. None of the States has scored 50% in disaster resilience.

The study shows that the level of resilience to disasters in States and Union Territories is low and requires considerable improvement. Most of the existing level of resilience has been developed during the past decade and a half, and it may be expected that the impacts of these initiatives will be felt in the years ahead.

However, as explained in the section on methodology, this index captures the progress achieved by the State Governments and Union Territory Administrations in the implementation of national and global frameworks for building resilience to disasters. It neither factors in the inherent societal or community resilience nor does it reflect the national capacity for resilience. The national level capacities on disaster management, developed over the years, provide tremendous support to the States/ UTs, particularly during major disasters. These have not been measured in this study.

PART IV: Conclusion

CONCLUSION

Measuring risks and resilience of disasters at a sub-national level in a large diverse multi-hazard country like India with sub-continental dimensions is always a challenging task. The challenges are inherent in the nature of the task itself. Risks of disasters are created through a complex interplay of natural and anthropogenic hazards with social and economic vulnerabilities and built up and natural environments over space and time. This involves an in-depth analysis of hazards, vulnerabilities, exposures and capacities and the ways these interact with each other to create different scenarios of risks of disasters. Measuring resilience to disasters is even more challenging as it is difficult to agree to a common set of indicators that would capture different aspects and dimensions of resilience.

Collecting, compiling, collating and analyzing data on multiple parameters of risks and resilience at sub-national level is a stupendous task for the simple reason that such data sets on a common and uniform format are not available for the entire country. Multiple agencies are working on some specific aspects and most of the agencies keep these data as closely guarded assets and hardly share these in the public domain. Often such data and information are available in raw shapes that are not refined, validated and published at regular intervals. Most of these remain buried in files and records at various levels. Therefore it is not at all surprising that no attempt has ever been made to pull all these together in a common frame and study and analyze the same to measure risks and resilience in a country like India. In fact, there is hardly any country in the world that has ventured the tasks of measuring risks and resilience on a scale that has been undertaken in this study.

The results of the study are presented through 15 separate chapters, structured on the twin themes of risks and resilience. The conclusions of the study are clear and simple: the States of Indian Union have varying degrees of risks and resilience, but the risks are much larger than resilience, thereby leaving open huge layers of unattended and residual risks that would only invite disasters. As the country grows, both economically and demographically, risks would multiply, widening the gaps between the creation of new risks and exacerbation of existing risks and reducing risks and building resilience to disasters. These gaps would pose the most serious threats to sustainable development to the largest democratic country of the world, which is also the fastest-growing major economy, ironically with some of the lowest indices of social and economic development. In fact, it would not at all be an exaggeration to say that reducing risks and building resilience to disasters in India, particularly in its 29 States and 7 Union Territories, would hold the key to the sustainable development of the world.

The findings of the study are spread out throughout its chapters and it is not proposed to summarize these in this concluding chapter. What is intended is to present the main findings and messages that are loud and clear.

First, India has made significant progress during the last decade and a half in building legal and institutional frameworks for disaster risk management and developing policies, plans, regulations, guidelines and standards for holistic management of disasters, but the implementation of these frameworks, particularly at the sub-national levels, have generally remained extremely poor. Barring a few states like Assam, Gujarat, Himachal Pradesh, Maharashtra, Odisha, Tamil Nadu and Tripura, disaster management in the Indian States have largely remained focused on post-disaster relief and rehabilitation and that too for distribution of ex-

gratia humanitarian assistance, which consumes almost the entire funds allocated for disaster management at the sub-national level.

Second, some of the path-breaking initiatives taken at the national level to develop and strengthen early warning of disasters like drought, cyclone and tsunami has significantly strengthened disaster preparedness in the States with visible outcomes in a sharp reduction in mortalities in such disasters. But similar initiatives on early warning of other hydro-meteorological hazards like floods, landslides, hailstorm, cloud bursts, lightning, heat wave etc are not taking place with the same rigor. Floods continue to remain the most recurring disaster in India causing maximum loss of lives and property in most of the States. Floods are no longer confined in some river basins but are spread out to mountains, plateaus and even deserts, and more disturbingly, in every large cities and towns. Predictions of rainfall have improved and discharges from rivers and reservoirs are monitored better, but this has not necessarily improved early warnings of the flood which would depend on the interplay of other factors like topography, vegetation cover, the stability of slopes and soil and human settlements in flood plains etc in local situations. These are all local-level information which can be meaningfully collected and integrated to generate effective flood early warning systems at State and city levels with technical guidance from central agencies like CWC and NDMA.

Third, India has significantly strengthened its capacity for responding to disasters. 12 battalions strong NDRF, supplemented by another 12 battalions of SDRF, give India the distinction of having the largest disaster response force in the world. NDRF has the capacity to respond to complex disaster situations like collapsed structure search and rescue, radiological, chemical and biological disasters etc. NDRF has taken part in search and rescue operations in Nepal earthquake and Fukushima nuclear disasters. Creation of NDRF has not reduced the dependence on the armed forces for responding to major disasters. Similarly, restructuring of the civil defence has not significantly augmented the capacity of communities for disaster preparedness, as intended. Civil Defence Act was amended to make it an integral part of community-based disaster response, particularly in cities, but none of the States has been able to restructure civil defence to play this new role.

Third, States and UTs have lagged in the implementation of national and global frameworks for disaster risk reduction. Most the States of India are larger than many countries, and in fact, thirteen States of India are larger than 74 per cent countries of the world, yet very few of these States have developed high-resolution GIS-based digital risk maps showing layers of hazards, vulnerabilities and exposures, as brought out in this study. Considering the tremendous advances made by India on various frontiers of science and technology there is no reason why such high maps cannot be developed and made available at the public domain at State level in local languages for communicating risks to all stakeholders. Most of the State Governments still depend on the Vulnerability Atlas of BMTPC for risk assessment. The Atlas is confined to only four natural hazards of earthquake, landslide, flood and cyclone and one vulnerability factor of housing. This study has demonstrated that hazards of nature are not confined to the conventional ELFC (earthquake-landslide-flood-cyclone) and vulnerabilities are not limited to BWR (building-walls-roofs), these are much more complex, widespread and multi-faceted. Disaster risk indexes developed in this study can be further improved, mapped and visualized on a GIS-based risk platform and updated on a continuing basis for risk-informed development across all sectors and at all levels. This is doable with a definite time frame within available resources and cannot be further postponed or left to the initiatives of the States and UTs.

Climate change and rapid urbanization are changing the hazards cape and exposure scenarios of the States and its cities at a faster pace than ever before. High and low-temperature regimes are changing, as are patterns of rainfall, with too little and too much of rainfalls in same regions that are witnessing simultaneous drought and flood situations during different months of the same year. Every region – north, east, south and west – are experiencing unprecedented rainfall within a short spell that is beyond the designed carrying capacity of drains, resulting in floods in many cities like Mumbai, Chennai, Srinagar and Bangalore that had never seen floods of such magnitudes. Rapid urbanization triggered by the migration of rural poor to the cities in search of livelihoods is compounding the vulnerabilities of cities. Very few States can assess and analyze such changing dynamics of risks, and much less to design policies, strategies and plans to address the risks

The States/ UTs are also lagging behind in risk investments. In fact, this would not at all be an exaggeration to say that States are not investing at all on disaster risk management, except the funds made available for relief and rehabilitation under State Disaster Response Fund and few centrally sponsored schemes and donor assisted projects, as detailed in chapter 10 of this study. Only a handful of States has constituted a State Disaster Mitigation Fund and District Disaster Mitigation Fund that were mandated under the Disaster Management Act. As of 2019, the Government is yet to constitute the National Disaster Mitigation Fund which is mandated under the Disaster Management Act of 2005. A recent study has shown that central investments on disaster risk management account for less than 1 per cent of its budget and more than 80 per cent of such allocations are spent on disaster response and relief. Surely, there are strong justifications for stepping up such investments and for mainstreaming disaster risk reduction in all development programmes, activities and projects across all sectors and at all levels. ‘Mainstreaming’ is a buzz word routinely mentioned in national policy, plan and guidelines and in every State Disaster Management Plans, but this has hardly been implemented in a structured and systematic manner. This definitely calls for very serious introspection at all levels.

Disaster risk governance in most of the States/ UTs is far from being robust. In almost every State, barring a few, State Disaster Management Authorities function no better than one among several committees of government, without any staff or office, meeting once or twice in a year, barely performing functions mandated under Disaster Management Act. Every State and almost all districts have Disaster Management Plans, thanks to the promptings by NDMA and UNDP with special grants for preparation of such plans, but very few States update the plans and fewer States have sectoral departments preparing such plans as mandated under the law. None of the States has developed mechanisms for monitoring and evaluating the implementation of the plans. In most States disaster management continues to remain as one among many responsibilities of Revenue Department, and States that have either set up a separate department of Disaster Management or changed the nomenclature of existing Relief and Rehabilitation department has not gone much beyond administering issues of relief and rehabilitation. The so-called paradigm shift in disaster management has not taken place on the ground – instead of holistic management of disasters across all sectors of development, as it was intended to be, disaster management is getting compartmentalized into a new sector-in-itself.

Barring a few states of India that have had the experience of implementing externally funded recovery projects, very few states have invested on any post-disaster reconstruction projects for building back better, as mandated under the national policy and plan on disaster management. Surely, States are not to be blamed for this shortcoming. The norms of the National and State Disaster Response Fund are such that these cannot be utilized for the reconstruction of houses and infrastructure that can withstand shocks of future disasters.

SDRF allocation of Rs. 66,000 crores and NDRF grant of almost half of the amount in the five-year fiscal cycle can be used only for disaster response, relief and rehabilitation and not for reconstruction. Therefore damaged houses can be repaired and rebuilt but only within the prescribed financial norms that would not at all permit reconstruction with disaster-resistant features. Similarly damaged infrastructure can be 'restored' to pre-disaster condition but not reconstructed to withstand the shocks of future disasters. If houses and infrastructure have to be built back better then house owners have to arrange additional funds and State Governments have to find resources for the same, which hardly any individual or State does. Therefore SDRF/ NDRF norms are in a way helping to recreate the same unsafe houses and infrastructure and recreate old risks of disasters in new forms, every day and every month around the year. Surely this calls for a complete review by the Finance Commission which allocates funds for SDRF and by the Government of India which stands committed to the implementation of Sendai Framework for Disaster Risk Reduction including its fourth priority of action that calls for 'building back better' in recovery, rehabilitation and reconstruction.

One of the most serious lacunae of the disaster management system of the States as well as that of the Centre is that it has not been able to develop a robust mechanism for monitoring and evaluating the implementation of its policies, plans, guidelines, programmes and projects. None of the national and state plans has a time frame for implementation, none estimates resources required for implementation, none provides an idea about how such resources shall be mobilized, and what is even more important, none sets up targets and indicators for measuring the progress achieved in the implementation of the plans. Some of the initial guidelines of NDMA did set up time frames for implementation, but few of these have been honoured and no study has been made to find out reasons. This calls for review if the plans and guidelines need to ever get translated into action, which alone can make a difference on the grounds in the States and Union Territories and their numerous districts, cities, towns and villages.

Due to the above-mentioned reasons, States/ UTs have generally scored poorly in the indicators on disaster resilience. But these findings are not arbitrary or subjective but are based on the responses received from the States to the Questionnaire that was circulated. The Questionnaire incorporated all the activities recommended to be performed at the sub-national level under the national and global frameworks of disaster management. The responses were evaluated based on standards and norms that were developed through a process of consultations.

Surely the findings of the study would serve its purpose if there are serious reviews and introspections on what has been done, what remains to be done and what can be done with a definite time frame to catch up and close the gaps between promises and action. It would always be wiser to learn from such studies and analysis than being forced to learn from disasters with heavy costs.

PART V: Annexures

Annexure I
National and Local Level Activities Prescribed Under Global Frameworks on Disaster Management

Annexure II
Matrix of activities to be taken up by states/ UTs under various national frameworks

Annexure III
Questionnaire for data collection from States/UTs

Annexure IV
Norms for evaluation

ANNEXURE I

NATIONAL AND LOCAL LEVEL ACTIVITIES PRESCRIBED UNDER GLOBAL FRAMEWORKS ON DISASTER MANAGEMENT

**A. National and local level activities prescribed under the
Priorities of Action of Sendai Framework for Disaster Risk
Reduction 2015-2030**

RITY OF ACTION-I: Understanding Risks

- (a) Promote the collection, analysis, management and use of relevant data and practical information. Ensure its dissemination, taking into account the needs of different categories of users, as appropriate;
- (b) Encourage the use of and strengthening of baseline and periodically assess disaster risks, vulnerability, capacity, exposure, hazard characteristics and their possible sequential effects at the relevant social and spatial scale on ecosystems in line with national circumstances;
- (c) Develop, update periodically and disseminate, as appropriate, location-based disaster risk information, including risk maps, to decisionmakers, the general public and communities at risk to disaster in an appropriate format by using, as applicable, geospatial information technology;
- (d) Systematically evaluate, record, share and publicly account for disaster losses and understand the economic, social, health, education, environmental and cultural heritage impacts, as appropriate, in the context of event -specific hazard-exposure and vulnerability information;
- (e) Make non-sensitive hazard exposure, vulnerability, risk, disasters and loss disaggregated information freely available and accessible, as appropriate;
- (f) 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;
- (g) Build the knowledge of government officials at all levels, civil society, communities and volunteers, as well as the private sector, through sharing experiences, lessons learned, good practices and training and education on disaster risk reduction, including the use of existing training and education mechanisms and peer learning;
- (h) Promote and improve dialogue and cooperation among scientific and technological communities and other relevant stakeholders and policymakers, in order to facilitate a science-policy interface for effective decision -making in disaster risk management;

(i) 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;

(j) Strengthen technical and scientific capacity to capitalize on and consolidate existing knowledge, and to develop and apply methodologies and models to assess disaster risks, vulnerabilities and exposure to all hazards;

(k) Promote investments in innovation and technology development in long-term, multi-hazard and solution-driven research in disaster risk management to address gaps, obstacles, interdependencies and social, economic, educational and environmental challenges and disaster risks;

(l) 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;

(m) 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;

(n) Apply risk information in all its dimensions of vulnerability, capacity and exposure of persons, communities, countries and assets, as well as hazard characteristics, to develop and implement disaster risk reduction policies;

(o) Enhance collaboration among people at the local level to disseminate disaster risk information through the involvement of community-based organizations and non-governmental organizations.

PRIORITY OF ACTION-2: Strengthening disaster risk governance to manage disaster risk

(a) Mainstream and integrate disaster risk reduction within and across all sectors. Review and promote the coherence and further development, as appropriate, of national and local frameworks of laws, regulations and public policies, which, by defining roles and responsibilities, guide the public and private sectors to: (i) address disaster risk in publically owned, managed or regulated services and infrastructures; (ii) promote and provide incentives, as relevant, for actions by persons, households, communities and businesses; (iii) enhance relevant mechanisms and initiatives for disaster risk transparency, which may include financial incentives, public awareness-raising and training initiatives, reporting requirements and legal and administrative measures; and (iv) put in place coordination and organizational structures;

(b) Adopt and implement national and local disaster risk reduction strategies and plans, across different timescales with targets, indicators and time frames, aimed at preventing the creation of risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience;

(c) Carry out an assessment of the technical, financial and administrative disaster risk management capacity to deal with the identified risks at local and national level;

(d) Encourage the establishment of necessary mechanisms and incentives to ensure high levels of compliance with 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;

(e) Develop and strengthen, as appropriate, mechanisms to follow -up, periodically assess and publicly report on progress on national and local plans. Promote public scrutiny and encourage institutional debates, including by parliamentarians and other relevant officials, on progress reports of local and national plans for disaster risk reduction;

(f) Assign, as appropriate, clear roles and tasks to community representatives within disaster risk management institutions and processes and decision-making through relevant legal frameworks. Undertake comprehensive public and community consultations during the development of such laws and regulations to support their implementation;

(g) Establish and strengthen government coordination forums composed of relevant stakeholders at national and local levels, such as national and local platforms for disaster risk reduction, and a designated national focal point, towards implementing the post-2015 framework. It is necessary for such mechanisms to have a strong foundation in national institutional frameworks with clearly assigned responsibilities and authority to, inter alia, identify sectoral and multi-sectoral disaster risk, build awareness and knowledge of disaster risk through sharing and dissemination of non-sensitive disaster risk information and data, contribute to and coordinate reports on local and national disaster risk, coordinate public awareness campaigns on disaster risk, facilitate and support local multi-sectoral cooperation (e.g. among local governments), contribute to the determination of and reporting on national and local disaster risk management plans and all policies relevant for disaster risk management. These responsibilities should be established through laws, regulations, standards and procedures;

(h) Empower local authorities, as appropriate, through regulatory and financial means to work and coordinate with civil society, communities and indigenous peoples and migrants in disaster risk management at the local level;

(i) Encourage parliamentarians to support the implementation of disaster risk reduction through developing new or amending relevant legislation and setting budget allocations;

(j) Promote the development of quality standards, such as certifications and awards for disaster risk management, with the participation of the private sector, civil society, professional associations, scientific organizations and the United Nations;

(k) Formulate public policies, where applicable, aimed at addressing the issues of prevention or relocation, where possible, of human settlements in disaster risk zones, subject to national law and legal systems.

Priority of Action-3: Investing in disaster risk reduction for resilience

(a) 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;

(b) 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;

(c) Strengthen, as appropriate, disaster resilient public and private investments, particularly through: structural, non-structural and functional disaster risk prevention and reduction measures in critical facilities, in particular schools and hospitals and physical infrastructures; building better from the start to withstand hazards through proper design and construction, including the use of the principles of universal design and the standardization of building materials; retrofitting and rebuilding; nurturing a culture of maintenance; and taking into account economic, social, structural, technological and environmental impact assessments;

(d) Protect or support the protection of cultural and collecting institutions and other sites of historical, cultural heritage and religious interest;

(e) Promote the disaster risk resilience of work places through structural and non-structural measures;

(f) 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;

(g) Promote the mainstreaming of disaster risk assessment, mapping and management into rural development planning and management of, inter alia, mountains, rivers, coastal flood plain areas, drylands, wetlands and all other areas prone to droughts and flooding, including through the identification of areas that are safe for human settlement and at the same time preserving ecosystem functions that help reduce risks;

(h) Encourage the revision of existing or the development of new building codes, standards, rehabilitation and reconstruction practices at the national or local levels, as appropriate, with the aim of making them more applicable in the local context, particularly in informal and marginal human settlements, and reinforce the capacity to implement, survey and enforce such codes, through an appropriate approach, with a view to fostering disaster-resistant structures;

(i) Enhance the resilience of national health systems, including by integrating disaster risk management into primary, secondary and tertiary health care, especially at the local level; developing the capacity of health workers in understanding disaster risk and applying and implementing disaster risk reduction approaches in health work; and promoting and enhancing the training capacities in the field of disaster medicine; and supporting and training community health groups in disaster risk reduction approaches in health programmes, in collaboration with other sectors, as well as in the implementation of the International Health Regulations (2005) of the World Health Organization;

(j) Strengthen the design and implementation of inclusive policies and social safety-net mechanisms, including through community involvement, integrated with livelihood enhancement programmes, and access to basic health care services, including maternal, newborn and child health, sexual and reproductive health, food security and nutrition, housing and education, towards the eradication of poverty, to find durable solutions in the post-disaster phase and to empower and assist people disproportionately affected by disasters;

(k) People with life threatening and chronic disease, due to their particular needs, should be included in the design of policies and plans to manage their risks before, during and after disasters, including having access to life -saving services;

(l) Encourage the adoption of policies and programmes addressing disaster-induced human mobility to strengthen the resilience of affected people and that of host communities as per national laws and circumstances;

(m) Promote, as appropriate, the integration of disaster risk reduction considerations and measures in financial and fiscal instruments;

(n) Strengthen the sustainable use and management of ecosystems and implement integrated environmental and natural resource management approaches that incorporate disaster risk reduction;

(o) Increase business resilience and protection of livelihoods and productive assets throughout the supply chains. Ensure continuity of services and integrate disaster risk management into business models and practices;

(p) Strengthen the protection of livelihoods and productive assets, including livestock, working animals, tools and seeds;

(q) Promote and integrate disaster risk management approaches throughout the tourism industry, given the often heavy reliance on tourism as a key economic driver.

Priority of Action-4: Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction

(a) Prepare or review and periodically update disaster preparedness and contingency policies, plans and programmes with the involvement of the relevant institutions, considering climate change scenarios and their impact on disaster risk, and facilitating, as appropriate, the participation of all sectors and relevant stakeholders;

(b) Invest in, develop, maintain and strengthen people-centred multi-hazard, multi-sectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard -monitoring telecommunications systems. Develop such systems through a participatory process. Tailor them to the needs of users, including social and cultural requirements, in particular gender. Promote the application of simple and low-cost early warning equipment and facilities and broaden release channels for natural disaster early warning information;

(c) Promote the resilience of new and existing critical infrastructure, including water, transportation and telecommunications infrastructure, educational facilities, hospitals and other health facilities, to ensure that they remain safe, effective and operational during and after disasters in order to provide life-saving and essential services;

(d) Establish community centres for the promotion of public awareness and the stockpiling of necessary materials to implement rescue and relief activities;

(e) Adopt public policies and actions that support the role of public service workers to establish or strengthen coordination and funding mechanisms and procedures for relief assistance and to plan and prepare for post-disaster recovery and reconstruction;

(f) Train the existing workforce and voluntary workers in disaster response and strengthen technical and logistical capacities to ensure better response in emergencies;

(g) Ensure the continuity of operations and planning, including social and economic recovery, and the provision of basic services in the post-disaster phase;

(h) Promote regular disaster preparedness, response and recovery exercises, including evacuation drills, training and the establishment of area-based support systems, with a view to ensuring rapid and effective response to disasters and related displacement, including access to safe shelter, essential food and non-food relief supplies, as appropriate to local needs;

(i) Promote the cooperation of diverse institutions, multiple authorities and related stakeholders at all levels, including affected communities and business, in view of the complex and costly nature of post-disaster reconstruction, under the coordination of national authorities;

(j) Promote the incorporation of disaster risk management into post-disaster recovery and rehabilitation processes, facilitate the link between relief, rehabilitation and development. Use opportunities during the recovery phase to develop capacities that reduce disaster risk in the short, medium and long term, including through the development of measures such as land use planning, structural standards improvement and the sharing of expertise, knowledge, post-disaster reviews and lessons learned. Integrate post-disaster reconstruction into the economic and social sustainable development of affected areas. This should also apply to temporary settlements for persons displaced by disaster;

(k) Develop guidance for preparedness for disaster reconstruction, such as on land use planning and structural standards improvement, including by learning from the recovery and reconstruction programmes over the decade since the adoption of the Hyogo Framework for Action, and exchanging experiences, knowledge and lessons learned;

(l) Consider the relocation of public facilities and infrastructures to areas outside the risk range, wherever possible, in the post-disaster reconstruction process, in consultation with the people concerned, as appropriate;

(m) Strengthen the capacity of local authorities to evacuate persons living in disaster-prone areas;

(n) Establish a mechanism of case registry and a database of mortality caused by disaster in order to improve the prevention of morbidity and mortality;

(o) Enhance recovery schemes to provide psychosocial support and mental health services for all people in need;

(p) Review and strengthen, as appropriate, national laws and procedures on international cooperation, based on the guidelines for the domestic facilitation and regulation of international disaster relief and initial recovery assistance.

B. Disaster Risk Reduction in Paris Agreement on Climate Change

Article 8 of the Paris Climate Agreement outlined eight specific action areas for enhancing ‘understanding, action and support’ for disaster reduction. These are:

- (a) Early warning systems;
- (b) Emergency preparedness;
- (c) Slow onset events;
- (d) Events that may involve irreversible and permanent loss and damage;
- (e) Comprehensive risk assessment and management;
- (f) Risk insurance facilities, climate risk pooling and other insurance solutions;
- (g) Non-economic losses; and
- (h) Resilience of communities, livelihoods and ecosystems.

C. Sustainable Development Goals and Targets with embedded elements of Disaster risks and resilience

Sustainable Development Goals	Sustainable Development Targets
Goal 1. End poverty in all its forms everywhere.	Target 1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.	Target 2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round. Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.
Goal 3. Ensure healthy lives and promote well-being for all at all ages.	Target 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents Target 3d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.
Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.	Target 4a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.	Target 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.	Target 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons Target 11.5 By 2030, significantly reduce the number of deaths and the number of people affected and decrease by [x] per cent the economic losses relative to gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations. Target 11b By 2020, increase by [x] per cent the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, develop and implement, in line with the forthcoming Hyogo Framework, holistic disaster risk management at all levels
Goal 13. Take urgent action to combat climate change and its impacts.	Target 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. Target 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. Target 13b Promote mechanisms for raising capacities for effective climate change related planning and management, in least development countries, including focusing on women, youth, local and marginalised communities.
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Target 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.
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 15.3 By 2020, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land-degradation-neutral world.

ANNEXURE II

MATRIX OF ACTIVITIES TO BE TAKEN UP BY STATES/ UTS UNDER VARIOUS NATIONAL FRAMEWORKS

A. Disaster Management Act 2005

	State Government	
1.	Establishing State Disaster Management Authority	Section 14
2.	Holding meetings of the State Authority	Section 15
3.	Appointing officers and other employees of State Authority	Section 16
4.	Constituting State Executive Committee	Section 20
5.	Constitute District Disaster Management Authority	Section 25
6.	Appointing officers and other employees of District Authority	Section 29
	State Disaster Management Authority	
1.	Constituting advisory committee of State Authority	Section 17
2.	Laying down State Disaster Management Policy	Section 18 (2)(a)
3.	Approving State Disaster Management Plan	Section 18 (2)(b)
4.	Approving Departmental Disaster Management Plans	Section 18 (2)(c)
5.	Laying down guidelines for integrating DM in development plans and projects	Section 18 (2)(d)
6.	Coordinating implementation of State Plan	Section 18 (2)(e)
7.	Provisioning funds for mitigation and preparedness	Section 18 (2)(f)
8.	Reviewing departmental development plans to ensure that DM is integrated therein	Section 18 (2)(g)
9.	Reviewing measures taken by departments for mitigation, capacity building and preparedness and issuing guidelines as necessary	Section 18 (2)(h)
10.	Laying down guidelines for minimum standard of relief	Section 19
	State Executive Committee	
1.	Constituting sub-committees of State Executive Committee	Section 21
2.	Coordinate and monitor implementation of National Policy, National Plan and State Plan	Section 22 (2)(a)

3.	Examine vulnerability of different parts of the State to different forms of disasters and specify measures to be taken for their prevention or mitigation;	Section 22 (2)(b)
4.	Monitor the implementation of disaster management plans prepared by the departments of the Government of the State and District Authorities;	Section 22 (2)(c)
5.	Monitor the implementation of the guidelines laid down by the State Authority for integrating of measures for prevention of disasters and mitigation by the departments in their development plans and projects;	Section 22 (2)(e)
6.	Evaluate preparedness at all governmental or non-governmental levels to respond to any threatening disaster situation or disaster and give directions, where necessary, for enhancing such preparedness;	Section 22 (2)(f)
7.	Coordinate response in the event of any threatening disaster situation or disaster;	Section 22 (2)(g)
8.	Give directions to any Department of the Government of the State or any other authority or body in the State regarding actions to be taken in response to any threatening disaster situation or disaster;	Section 22 (2)(h)
9.	Promote general education, awareness and community training in regard to the forms of disasters to which different parts of the State are vulnerable and the measures that may be taken by such community to prevent the disaster, mitigate and respond to such disaster	Section 22 (2)(i)
10.	Advise, assist and coordinate activities of the Departments, District Authorities, statutory bodies and other governmental and non-governmental organizations engaged in disaster management;	Section 22 (2)(j)
11.	Provide necessary technical assistance or give advice to District Authorities and local authorities for carrying out their functions effectively;	Section 22 (2)(k)
12.	Advise the State Government regarding all financial matters in relation to disaster management;	Section 22 (2)(l)
13.	Examine the construction, in any local area in the State and, if it is of the opinion that the standards laid for such construction for the prevention of disaster is not being or has not been followed, may direct the District Authority or the local authority, as the case may be, to take such action as may be necessary to secure compliance of such standards;	Section 22 (2)(m)
14.	Provide information to the National Authority relating to different aspects of disaster management;	Section 22 (2)(n)
15.	Lay down, review and update State level response plans and guidelines and ensure that the district level plans are prepared, reviewed and updated;	Section 22 (2)(o)
16.	Ensure that communication systems are in order and the disaster management drills are carried out periodically;	Section 22 (2)(p)
17.	Perform such other functions as may be assigned to it by the State Authority or as it may consider necessary.	Section 22 (2)(q)

	Departments of State Government	
1.	Take measures necessary for prevention of disasters, mitigation, preparedness and capacity-building in accordance with the guidelines laid down by the National Authority and the State Authority;	Section 39 (a)
2.	Integrate into its development plans and projects, the measures for prevention of disaster and mitigation;	Section 39 (b)
3.	Allocate funds for prevention of disaster, mitigation, capacity-building and preparedness;	Section 39 (c)
4.	Respond effectively and promptly to any threatening disaster situation or disaster in accordance with the State Plan, and in accordance with the guidelines or directions of the National Executive Committee and the State Executive Committee;	Section 39 (d)
5.	Review the enactments administered by it, its policies, rules and regulations with a view to incorporate therein the provisions necessary for prevention of disasters, mitigation or preparedness;	Section 39 (e)
6.	Provide assistance, as required, by the National Executive Committee, the State Executive Committee and District Authorities, for- (i) Drawing up mitigation, preparedness and response plans, capacity-building, data collection and identification and training of personnel in relation to disaster management; (ii) Assessing the damage from any disaster; (iii) Carrying out rehabilitation and reconstruction;	Section 39 (f)
7.	Make provision for resources in consultation with the State Authority for the implementation of the District Plan by its authorities at the district level;	Section 39 (g)
8.	Make available its resources to the National Executive Committee or the State Executive Committee or the District Authorities for the purposes of responding promptly and effectively to any disaster in the State, including measures for- (i) Providing emergency communication with a vulnerable or affected area; (ii) Transporting personnel and relief goods to and from the affected area; (iii) Providing evacuation, rescue, temporary shelter or other immediate relief; (iv) Carrying out evacuation of persons or live-stock from an area of any threatening disaster situation or disaster; (v) Setting up temporary bridges, jetties and landing places; (vi) Providing drinking water, essential provisions, healthcare and services in an affected area;	Section 39 (h)
9.	Such other actions as may be necessary for disaster management.	Section 39 (i)

	District Disaster Management Authority	
1.	Constituting advisory and other committees of District Authority	Section 28
2.	Prepare a disaster management plan including district response plan for the district;	Section 30 (2) (i)
3.	Coordinate and monitor the implementation of the National Policy, State Policy, National Plan, State Plan and District Plan;	Section 30 (2) (ii)
4.	Ensure that the areas in the district vulnerable to disasters are identified and measures for the prevention of disasters and the mitigation of its effects are undertaken by the departments of the Government at the district level as well as by the local authorities;	Section 30 (2) (iii)
5.	Ensure that the guidelines for prevention of disasters, mitigation of its effects, preparedness and response measures as laid down by the National Authority and the State Authority are followed by all departments of the Government at the district level and the local authorities in the district;	Section 30 (2) (iv)
6.	Give directions to different authorities at the district level and local authorities to take such other measures for the prevention or mitigation of disasters as may be necessary;	Section 30 (2) (v)
7.	Lay down guidelines for prevention of disaster management plans by the department of the Government at the districts level and local authorities in the district;	Section 30 (2) (vi)
8.	Monitor the implementation of disaster management plans prepared by the Departments of the Government at the district level;	Section 30 (2) (vii)
9.	Lay down guidelines to be followed by the Departments of the Government at the district level for purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provide necessary technical assistance therefor;	Section 30 (2) (viii)
10.	Monitor the implementation of measures referred to in clause (viii);	Section 30 (2) (ix)
11.	Review the state of capabilities for responding to any disaster or threatening disaster situation in the district and give directions to the relevant departments or authorities at the district level for their up gradation as may be necessary;	Section 30 (2) (x)
12.	Review the preparedness measures and give directions to the concerned departments at the district level or other concerned authorities where necessary for bringing the preparedness measures to the levels required for responding effectively to any disaster or threatening disaster situation;	Section 30 (2) (xi)
13.	Organize and coordinate specialized training programmes for different levels of officers, employees and voluntary rescue workers in the district;	Section 30 (2) (xii)
14.	Facilitate community training and awareness programmes for prevention of disaster or mitigation with the support of local authorities, governmental and non-governmental organizations;	Section 30 (2) (xiii)
15.	Set up, maintain, review and upgrade the mechanism for early warnings and dissemination of proper information to public;	Section 30 (2) (xiv)

16.	Prepare, review and update district level response plan and guidelines;	Section 30 (2) (xv)
17.	Coordinate response to any threatening disaster situation or disaster;	Section 30 (2) (xvi)
18.	Ensure that the Departments of the Government at the district level and the local authorities prepare their response plans in accordance with the district response plan;	Section 30 (2) (xvii)
19.	Lay down guidelines for, or give direction to, the concerned Department of the Government at the district level or any other authorities within the local limits of the district to take measures to respond effectively to any threatening disaster situation or disaster;	Section 30 (2) (xviii)
20.	Advise, assist and coordinate the activities of the Departments of the Government at the district level, statutory bodies and other governmental and non-governmental organizations in the district engaged in the disaster management;	Section 30 (2) (xix)
21.	Coordinate with, and give guidelines to, local authorities in the district to ensure that measures for the prevention or mitigation of threatening disaster situation or disaster in the district are carried out promptly and effectively;	Section 30 (2) (xx)
22.	Provide necessary technical assistance or give advice to the local authorities in the district for carrying out their functions;	Section 30 (2) (xxi)
23.	Review development plans prepared by the Departments of the Government at the district level, statutory authorities or local authorities with a view to make necessary provisions therein for prevention of disaster or mitigation;	Section 30 (2) (xxii)
24.	Examine the construction in any area in the district and, if it is of the opinion that the standards for the prevention of disaster or mitigation laid down for such construction is not being or has not been followed, may direct the concerned authority to take such action as may be necessary to secure compliance of such standards;	Section 30 (2) (xxiii)
25.	Identify buildings and places which could, in the event of any threatening disaster situation or disaster, be used as relief centers or camps and make arrangements for water supply and sanitation in such buildings or places;	Section 30 (2) (xxiv)
26.	Establish stockpiles of relief and rescue materials or ensure preparedness to make such materials available at a short notice;	Section 30 (2) (xxv)
27.	Provide information to the State Authority relating to different aspects of disaster management;	Section 30 (2) (xxvi)
28.	Encourage the involvement of non-governmental organizations and voluntary social-welfare institutions working at the grassroots level in the district for disaster management;	Section 30 (2) (xxvii)
29.	Ensure communication systems are in order, and disaster management drills are carried out periodically;	Section 30 (2) (xxviii)
30.	Perform such other functions as the State Government or State Authority may assign to it or as it deems necessary for disaster management in the District.	Section 30 (2) (xxix)

B Matrix of activities to be taken up at State Level under the provisions of

National Policy on Disaster Management, 2009

	Themes	Activities at State level	Para
1.	Institutional and legal arrangements	State Governments: The primary responsibility for disaster management rests with the States. The institutional mechanism put in place at the Centre, State and District levels will help the States manage disasters in an effective manner.	3.3.6
		District Administration: At the District level, DDMA's will act as the District planning, coordinating and implementing body for disaster management and will take all measures for the purposes of disaster management in the District in accordance with the guidelines laid down by NDMA and SDMA.	3.3.8
		Management of Disasters impacting more than one State: At times, the impact of disasters occurring in one State may spread over to the areas of other States. Similarly, preventive measures in respect of certain disasters, such as floods, etc., may be required to be taken in one State, though the impact of their occurrence may affect another. The administrative hierarchy of the country is organized into National, State and District level administrations. This presents some difficulties in respect of disasters impacting more than one State. Management of such situations calls for a coordinated approach, which can respond to a range of issues quite different from those that normally present themselves, before, during and after the event. NDMA will encourage identification of such situations and promote the establishment of mechanisms on the lines of Mutual Aid Agreement for coordinated strategies for dealing with them by the States, Central Ministries and Departments and other agencies concerned.	3.3.9
		State Police Forces and Fire Services: The State Police Forces and the Fire Services are crucial immediate responders to disasters. The Police Forces will be trained and the Fire Services upgraded to acquire multi-hazard rescue capability.	3.4.3
		Civil Defence and Home Guards: The mandate of the Civil Defence and the Home Guards will be redefined to assign an effective role in the field of disaster management. They will be deployed for community preparedness and public awareness. A culture of voluntary reporting to duty stations in the event of any disaster will be promoted.	3.4.4
		State Disaster Response Force: States will be encouraged to create response capabilities from within their existing resources. To start with, each State may aim at equipping and training one battalion equivalent force. They will also include women members for looking after the needs of women and children. NDRF battalions and their training institutions will assist the States/UTs in this effort. The States/UTs will also be encouraged to include DM training in their respective Police Training Colleges and basic and in-service courses, for gazetted and non-gazetted officers.	3.4.5

2.	Financial Arrangements	Mitigation Funds: It shall be the responsibility of the State to constitute the Disaster Mitigation and Response Funds at the State as well as District levels. The modalities for the application of these funds will be worked out in accordance with the provisions of the Act.	4.4.2
		Mitigation Projects: The guidelines on various disasters will form the basis for the formulation of plans for mitigation projects at the National, State and District level. State Governments will identify Mitigation Projects for implementation.	4.4.3
3.	Disaster Prevention and Mitigation	Risk Assessment and Vulnerability Mapping: DM authorities at the State and District levels need to carry out risk and vulnerability assessment of all disaster prone areas. Hazard zonation mapping and vulnerability analysis based on GIS and remote sensing data, needs to mandatorily include a ground check component. Hazard and Consequence Mapping on GIS platforms will be prepared for all chemical accident prone districts	5.1.2
		Increasing Trend of Disasters in Urban Areas: State Governments/UTs concerned should accord priority for improving urban drainage systems with special focus on non-obstruction of natural drainage systems. Urban mapping of infrastructure of spatial resolution will be taken up for development of Decision Support System (DSS) for management of urban risks.	5.1.4
		Critical Infrastructure: It is of utmost importance that critical infrastructure like dams, roads, bridges, flyovers, railway lines, power stations, water storage towers, irrigation canals, delta water distribution networks, river and coastal embankments, ports and other civic utilities are constantly monitored for safety standards in consonance with worldwide safety benchmarks and strengthened where deficient. The building standards for critical infrastructure need to be aligned to the safety norms and Departments/Authorities concerned would ensure the requisite actions and measures to ensure this.	5.1.5
		Environmentally Sustainable Development: Environmental considerations and developmental efforts, need to go hand in hand for ensuring sustainability. Restoration of ecological balance in Himalayan regions and raising coastal shelter belt plantations need to be incorporated wherever necessary in DM plans. Eco systems of forests, islands, coastal areas, rivers; and the agricultural, urban and industrial environment are also to be considered for restoration of ecological balances and sustainable development. Zonal regulations must ensure the preservation of natural habitats.	5.1.6
		Climate Change Adaptation: Synergies in our approach and strategies for climate change adaptation and disaster risk reduction shall be encouraged and promoted.	5.1.7
		Communications and Information Technology Support: Efforts should be made for setting up IT infrastructures consisting of required IT processes, architecture and skills for quick upgradation and updation of data sets from the PRIs or the ULBs.	5.2.5

		Strengthening of the Emergency Operations Centres: The establishment of Emergency Operations Centres at the State, Metro and District level and equipping them with contemporary technologies and communication facilities and their periodic upgradation, will be accorded priority. For last mile connectivity and control of the operations at the disaster hit areas, availability of portable platforms will be catered for. The integration of Ham radios and such other innovative facilities, into the DM communication system, will be advantageous.	5.2.7
		Medical Preparedness and Mass Casualty Management: The surge and casualty handling capacity of all hospitals at the time of disasters, will be worked out and recorded through a consultative process, by all the States/UTs in the pre-disaster phase. The State and District authorities will be encouraged to formulate appropriate procedures for treatment of casualties by private hospitals during disasters. These plans will also address post-disaster disease surveillance systems, networking with hospitals, referral institutions and accessing services and facilities such as availability of ambulances and blood banks.	5.2.8
		Training, Simulations and Mock Drills: State and District authorities will be encouraged to generate a culture of preparedness and quick response. Gradually State Governments will be encouraged to plan a series of exercises for various types of disasters in collaboration with NDMA to enhance the response level of various stakeholders	5.2.10
		Community Based Disaster Preparedness: During any disaster, communities are not only the first to be affected but also the first responders. Community participation ensures local ownership, addresses local needs, and promotes volunteerism and mutual help to prevent and minimize damage. Therefore, the efforts of the States/UTs, in this regard need to be encouraged. Community plans will be dovetailed into the Panchayat, Block and District plans.	5.3.1
		Stakeholders' Participation: The participation of civil society stakeholders will be coordinated by the SDMAs and DDMA's. Civil Defence, NCC, NYKS, NSS and local Non-Governmental Organizations (NGOs) will be encouraged to empower the community and generate awareness through their respective institutional mechanisms. Efforts to promote voluntary involvement will be actively encouraged.	5.3.3
		Corporate Social Responsibility and Public-Private Partnership: SDMAs need to network with the corporate entities to strengthen and formalize their role in the DM process for ensuring safety of the communities.	5.3.4
		Media Partnership: The media plays a critical role in information and knowledge dissemination in all phases of DM. The versatile potential of both electronic and print media needs to be fully utilized. Effective partnership with the media will be worked out in the field of community awareness, early warning and dissemination, and education regarding various disasters.	5.3.5

4.	Techno-Legal Regime	Techno-Legal Regime: The relevant Acts, Rules and Regulations warranting amendments need to be identified and brought in conformity with the DM Act in a phased manner by the State governments and other agencies concerned.	6.1.1
		Revision of Municipal Regulations: Municipal regulations such as development control regulations, building bye-laws and structural safety features will be reviewed periodically to identify safety gaps from seismic, flood, landslide and other disasters and suitable modifications will be made to align them to the revised building codes of the Bureau of Indian Standards (BIS).	6.2.1
		Land Use Planning: A review of master plans and their compliance, on priority, will be essential and regarded as the paramount responsibility of the States/UTs. At the macro-level, there is a need for preparation of land use planning based on the inventory database of various uses. As far as urban settlements are concerned, the future land use is to be assessed keeping in view the anticipated intensity of development.	6.3.1
		Safe Construction Practices: The design and specification of houses being constructed, under the Indira Awas Yojana (IAY) and other government welfare and development schemes, will also be re-examined to ensure hazard safety. Building codes will be updated every five years as a mandatory requirement and also put in the public domain. Observance of the National Building Code should be made mandatory in all the State/ Municipal building bye-laws.	6.4.1
		Enforcement: After having put the techno-legal and compliance system in place, the States/UTs will also ensure their enforcement by establishing an effective mechanism, under the provisions of the Act.	6.6.1
5.	Response	Role of State, District and Local Authorities: It is the primary responsibility of the State Governments/SDMAs to monitor and assess any developing situation and keep the NDMA and NEC apprised of the same. They will also be responsible to constantly evaluate their own capabilities to handle that situation and project the anticipated requirements for the Central resources well in time. Inter-state assistance and cooperation will be encouraged. The States/ UTs will also be responsible to develop their own response potential progressively and complete the process at the earliest. This will comprise training and equipping of State response forces, community preparedness, training and creation of response caches at the District level. District level preparations will provide the cutting edge to all response activities. Local authorities, PRIs and ULBs will play a significant role in the entire process, particularly in response and rescue operations, relief and rehabilitation, awareness generation and disaster preparedness, restoration of livelihood options and coordination with NGOs and civil society.	7.4.1
		Standard Operating Procedures: State Governments, District Authorities and other stakeholders will prepare SOPs in consonance with the National and State Plans. SOPs will be prescribed for activities like search and rescue, medical assistance and casualty management, evacuation, restoration of essential services and communication at disaster sites, etc. The other important activities are provision of food, drinking water, sanitation, clothing and management of relief camps.	7.5.1

		Animal Care: Animals both domestic and wild are exposed to the effects of natural and man-made disasters. It is necessary to devise appropriate measures to protect animals and find means to shelter and feed them during disasters and their aftermath, through a community effort, to the extent possible.	7.10.1
6.	Relief and Rehabilitation	Setting up of Temporary Relief Camps: DDMA's, especially in recurring disaster prone areas, may identify locations for setting up temporary camps. Agencies to supply the necessary stores will be identified in the pre-disaster phase. The use of premises of educational institutions for setting up relief camps needs to be discouraged. The temporary relief camps will have adequate provision of drinking water and bathing, sanitation and essential health care facilities. Wherever feasible, special task forces from amongst the disaster affected families will be set up to explore the possibility of providing food through community kitchens, and provision of education through the restoration of schools and anganwadis. Efficient governance systems like entitlement cards, laminated identification cards etc., will be developed as a part of uniform humanitarian governance practices through the respective DDMA's.	8.2.1
		Management of Relief Supplies: Ensuring minimum standards of relief and speedy management of supplies are important features of relief operations. SOPs will be put in place for ensuring the procurement, packaging, transportation, storage and distribution of relief items, which needs to be carried out in an organized manner. The affected community and local authorities need to work in tandem in managing the relief camps. Guidelines will be evolved to manage the donations received in cash or kind to ensure transparency and accountability.	8.3.1
		Review of Standards of Relief: In most States, existing standards of relief need to be reviewed to address the contemporary needs of communities affected by disasters. The SDMA's may review the Relief Codes/manuals and prepare DM Codes for prescribing the norms, standards and criteria for the provision of relief in conformity with the guidelines of NDMA.	8.4.1
		Temporary Livelihood Options and Socio-Economic Rehabilitation: In the aftermath of any major disaster, generally a demand always arises to generate temporary livelihood options for the affected community and the State Governments should recognize this aspect in their DM planning process. Any such option must ensure that the assets, infrastructure and amenities created are hazard resistant, durable, sustainable, and cost-efficient.	8.5.1
		Provision of Intermediate Shelters: In the case of devastating disasters, where extreme weather conditions can be life-threatening or when the period of stay in temporary shelters is likely to be long and uncertain, construction of intermediate shelters with suitable sanitary facilities will be undertaken to ensure a reasonable quality of life to the affected people. The design of such shelters will be eco-friendly and in consonance with local culture. It would be desirable for SDMA's to plan during periods of normalcy, the layout of intermediate shelters which is cost-effective and as per local needs with multi-use potential.	8.6.1

7.	Reconstruction and Recovery	Speedy Reconstruction: Essential services, social infrastructure and intermediate shelters/camps will be established in the shortest possible time. For permanent reconstruction, ideally, the work including the construction of houses must be completed within two to three years. Central Ministries/ Departments concerned and the State Governments should create dedicated project teams to speed up the reconstruction process.	9.3.1
		Livelihood Restoration: State governments will have to lay emphasis on the restoration of permanent livelihood of those affected by disasters and special attention to the needs of women-headed households, artisans, farmers and people belonging to marginalized and vulnerable sections.	9.5.1
8.	Capacity Development	Institutional Capacity Development: There are a number of renowned institutes in various States, which are imparting training in DM. These will be strengthened with financial assistance and such efforts will be replicated by States/UTs. Also, the DM cells in all Administrative Training Institutes, Police Academies, State Institutes of Rural Development, will contribute most significantly in developing DM related skills. The capacity of existing institutes needs to be upgraded in accordance with Regional and Local requirements.	10.3.1
		Training of Communities: Building the capacity of communities, as they are the first responders to disasters, is a significant part of the capacity development process. It will include awareness, sensitization, orientation and developing skills of communities and community leaders. The overall responsibility to give impetus to leadership and motivation will rest with local authorities, PRIs and ULBs under the overall guidance of State and District authorities.	10.4.1
		DM Education in Schools: State Governments will ensure the inclusion of disaster management curriculum through State School Boards. The education content will inculcate skill based training, psychological resilience and qualities of leadership. The role of the NCC and Boy Scouts may also be included in schools and colleges for disaster management related work.	10.6.1
		Training of Artisans: The upgradation of the skills of artisans is another crucial component of the capacity building process. The States will be encouraged to promote this activity vigorously.	10.7.1
		Training of Other Groups: Other professional groups such as paramedics, social workers, plumbers, sanitary fitters and safety auditors also play a very important role in community based DM. These groups will also be provided training through suitable programmes.	10.8.1
		Licensing and Certification: The State Governments will develop a scheme to ensure that only adequately qualified professionals practice within its territory. The State Governments will also enforce their own registration benchmarks to uphold desirable standards commensurate with their risk profile.	10.9.1

C. Matrix of Responsibilities of State Government under National Plan and Guidelines on Disaster Management

I. Flood Risk Mitigation

	Activities	Responsibility of State Governments	Agencies Responsible
Understanding Disaster Risk			
1.	Observation, Networks, Information Systems, Monitoring and Forecasting	- Support and cooperate with central agencies - Sponsor state-specific efforts; - Support local efforts	Irrigation Dept., WRD, SDMA, DDMA, Panchayats, ULBs
2.	Zoning, Mapping, and classification of flood prone areas	- Support and cooperate with central agencies - Sponsor state-specific efforts; - Support local efforts	Irrigation Dept., WRD, SDMA, DDMA, Panchayats, ULBs
3.	Studies and monitoring of rivers flowing from neighbouring countries	- Support and cooperate with central agencies - Carry out state-specific efforts - Sponsor state-specific efforts; - Support local efforts	Irrigation Dept., WRD, SDMA
4.	Research and Development	- Support and cooperate with central agencies - Sponsor/ carry out state-specific efforts; - Support local efforts	Irrigation Dept., WRD, SDMA, relevant state level technical institutions
5.	Hazard Risk Vulnerability Assessment	Undertake HRVA as part of preparing and periodic revision of DM plans	SDMA, CoR, Irrigation Dept., Revenue Dept.
6.	Monitoring, Forecasting and Warning Systems	Support, cooperation for data collection and updates	SDMA, Irrigation Dept., WRD, relevant state level technical institutions
7.	Dissemination of warnings, data and information	- Inter-state data and information sharing where applicable - Coordination and cooperation with the central agencies - Ensure facilities and infrastructure for the implementation of adequate access to communities at risk - Dissemination of warnings to all, down to the last mile – remote rural or urban; - Regular updates to people in areas at risk - Warnings using all types of options, types of technologies, and media - Monitoring compliance by various network operators and service providers.	SDMA, CoR, Irrigation Dept., Revenue Dept. WRD, DDMA, Panchayats, ULBs

Inter Agency Co-ordination			
1.	Overall disaster governance	Preparation and implementation of DM plans and ensure the functioning of agencies with DM tasks	SDMA, CoR, Revenue Dept., Irrigation Dept., DDMA, Panchayats, ULBs
2.	Response	Organizing the immediate response and seeking assistance of central agencies	SDMA, CoR, Revenue Dept., Irrigation Dept., DDMA, Panchayats, ULBs
3.	Warnings, information, Data	Dissemination of warnings to all, down to the last mile – remote, rural or urban; Regular updates to people in areas at risk	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
4.	Non-structural measures	Adapting the norms/ codes as per State's requirement, enforcement, monitoring	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
Investing in DRR-Structural Measures			
1.	Flood control measures such as construction of embankments and levees	• Identification safe buildings and sites to serve as temporary shelters for people and livestock evacuated from localities at risk • Construction of multi-purpose shelters in Coastal villages/ habitations prone to frequent cyclone • Proper maintenance of drainage systems and flood embankments	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
2.	Social Housing Schemes	Ensure that flood -resistant features are incorporated in the planning and execution of social housing schemes in flood prone areas	State/UT, SDMA, CoR, Revenue Dept., DRD, UDD,PRD, DDMA, Panchayats, ULBs,
3.	Multi-purpose Flood Shelters	Ensure availability of shelters, undertake proper maintenance, and make arrangements to support the people shifted to temporary shelters	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
4.	Waterways and drainage systems for roads highways, and expressways	Coordination and cooperation with the central agencies and ensure proper alignment and design in all state projects	State/UT, SDMA, CoR, Revenue Dept., PWD, DDMA, Panchayats, ULBs
5.	Enhancing the safety of dams and reservoirs	• Carry out measures to increase safety, reduce risks from flooding • Undertake pre- and post-monsoon inspections of dams and reservoirs • Monitor the implementation of safety enhancements in accordance with norms	State/UT, SDMA, CoR, Revenue Dept., Irrigation Dept., WRD

6.	Desilting/ dredging of rivers to improve flow; drainage improvement; floodwater diversion through existing channels	Implementation as per norms	Irrigation Dept., WRD, SDMA, DDMA, Panchayats, ULBs
7.	Hazard resistant construction, strengthening, and retrofitting of all lifeline structures and critical infrastructure	Collaboration with technical agencies and implementation	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, all relevant Departments/ Agencies.
Investing in DRR-Non-Structural Measures			
1.	• Regulation and enforcement of laws, norms, regulations, guidelines • Regulation of Reservoirs Integrated Water Resource Management (IWRM)	• Implementing land-use regulation for low lying areas as per flood control norms • Regulation of inhabitation of low-lying areas along the rivers, nallas and drains • Implementing flood management action plan • Review and modification of operation manuals for all major dams/ reservoirs • Support and cooperate with central agencies; Sponsor state-specific efforts; support local efforts; Cooperate with central efforts • Prevention and removal of encroachment into the waterways and natural drainage systems	Irrigation Dept., WRD, SDMA,CoR, Revenue Dept.
2.	Regulations to promote flood resilient buildings and infrastructure	Revise and implement the relevant rules in flood prone areas	State/UT, SDMA, CoR, Revenue Dept., Local Bodies
3.	• Wetland conservation and restoration • Catchment Area Treatment/ Afforestation	• Discourage reclamation of wetlands, natural depressions • Action plan managing wetlands and natural drainage systems for flood moderation • Implementation of watershed management including catchment area treatment and afforestation programmes	State/UT, SDMA, CoR, Revenue Dept., Local Bodies
4.	Public Private Partnerships	Promote private participation in disaster management facilities	State/UT, SDMA, CoR, Revenue Dept., DDMA
Capacity Development			
1.	Training	Training and orientation programs for state govt. staff, professionals for veterinary care and support to disaster-affected animals Incorporating disaster response, search and rescue in the training programs of youth such as village volunteers, and for protection of disaster-affected animals.	SDMA, ATIs, Engineering Training Institutes, SIRD, Police Training Academies SDMA,SIDM, ATI DDMA, Panchayats, ULBs

2.	Curriculum Development	Update curriculum for undergraduate engineering courses to include topics relevant for flood hazard mitigation Introduction of Crisis Management, emergency medical response/recovery and trauma management at Diploma/UG/PG levels for Health Professionals Improving curriculum periodically using new technologies	Professional Bodies/ Councils Health Department of State Governments/UTs State Boards of Education
3.	Awareness Generation	• Carry out mass media campaigns • Promote culture of disaster risk prevention, mitigation, and better risk management • Promote attitude and behaviour change in the awareness campaigns/ IEC • Promote use of insurance/ risk transfer • Promote Community Radio • Strengthening network of civil society organizations for awareness generation about DRR and DM • Information on care and protection of disaster-affected animals	State/UT, SDMA, CoR, Revenue Dept., WRD, Irrigation Dept., SIDM, SDRF, Fire and Emergency Services, Civil defence, Police, DDMA, Panchayats, ULBs
4.	Mock Drills/ Exercises	Joint planning and execution of emergency drills	State/UT, SDMA, CoR, Revenue Dept., WRD, Irrigation Dept., SDRF, Fire and Emergency Services, Civil defence, Police, DMA, Panchayats, ULBs
5.	Vocational Training and Skill Development	• Conduct training programmes • Develop a team of Trainer-of-Trainers for different trades relevant to flood-resistant construction	State/UT, SDMA, CoR, Revenue Dept., State level skill development agencies
6.	Empowering women, marginalized, and persons with disabilities	Incorporating gender sensitive and equitable approaches in capacity development covering all aspects of disaster management at the state, district, and local levels	State/UT, SDMA, CoR, Revenue Dept., SIDM, ATI, and other state-level institutions, DDMA, Panchayats, ULBs
7.	Community-Based Disaster Management	• Strengthen ability of communities to manage and cope with disasters based on a multi-hazard approach • Strengthen ability of communities to manage and cope with disasters based on a multi-hazard approach • Training for panchayat, SHG, NCC, NSS, Youth, local community organizations	State/UTs, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs

2. Earthquake Risk Mitigation

	Activities	Responsibilities of State Governments	Agencies responsible
Understanding Risk			
1.	• Earthquake Monitoring Services • National Seismological Network • Real Time Seismic Monitoring Network (RTSMN)	Share information widely	State/UT, SDMA, CoR, Revenue Dept.
2.	Earthquake Hazard and Risk Assessment (EHRA)	Share information widely	State/UT, SDMA, CoR, Revenue Dept.
3.	Scientific Seismic Zonation	Ensuring implementation, enforcement, compliance and monitoring; awareness creation	State/UT, SDMA, CoR, Revenue Dept., UDD, PWD, ULB, DDMA
4.	Seismic Micro-zonation	Carry out needs assessment from end-users, conduct micro-zonation studies, prioritize important urban areas for micro-zonation, do professional review before adoption	State/UT, SDMA, CoR, Revenue Dept., Technical organizations/agencies
5.	Hazard Risk Vulnerability Assessment	Undertake HRVA as part of preparing and periodic revision of DM plans	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
Inter-Agency Coordination			
1.	Overall disaster governance	Preparation and implementation of DM plans and ensure the functioning of agencies with DM tasks	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
2.	Response	Organizing the immediate response and seeking assistance of central agencies	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
3.	Non-structural measures	Adapting the norms/ codes as per State's requirement, enforcement, monitoring	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
Investing in DRR-Structural Measures			
1.	Social Housing Schemes	• Ensure that earthquake resistant features are incorporated in planning and execution of social housing schemes • Ensure compliance with relevant building codes	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, DRD, UDD, PRD

2.	Strengthening and seismic retrofitting of prioritized lifeline structures and buildings	Implementation strengthening and seismic retrofitting as per recommendations of safety audits in all govt. departments, agencies, public utilities, schools, colleges, community halls, etc.	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
3.	Hazard resistant construction, strengthening, and retrofitting of all lifeline structures and critical infrastructure	Collaboration with technical agencies and implementation	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, PWD, all relevant Departments/Agencies
Investing in DRR–Non-Structural Measures			
1.	Regulations and model codes for town planning, civil works and public infrastructure	- Adopt suitable byelaws for rural and urban areas, put model codes into practice and ensure proper compliance - Ensure strict compliance with code implementation through relevant Departments and agencies	State/UT, SDMA, CoR, Revenue Dept., UDD, DRD, PWD, All other relevant departments, DDMA, Panchayats, ULBs
2.	Structural safety audit of lifeline structures and buildings; prioritization of lifeline structures and buildings for strengthening and seismic retrofitting	- Carry out safety audit of lifeline buildings and critical infrastructure - Ensure implementation, monitoring, enforcement and proper compliance within state by public, private and individuals	SDMA, CoR, Revenue Dept., UDD, PWD, DDMA, Panchayats, ULBs
3.	Licensing and certification of professionals	Implement licensing of engineers through appropriate legal framework and institutional mechanism	Relevant Departments
4.	Public Private Partnerships	Promote private participation in disaster management facilities	State/UT, SDMA, CoR, Revenue Dept., DDMA
Capacity Development			
1.	Training	Contribute to the national effort to build the requisite number of trained personnel to handle seismic safety in India Trainings in search and rescue	SDMA, CoR, Revenue Dept., Education Dept., ATIs
2.	Capacity Development	DM related aspects to be included in undergraduate and professional courses	SDMA, CoR, Revenue Dept., Health Dept., Education Dept.
3.	Awareness Generation	- Carry out mass media campaigns - Promote culture of disaster risk prevention, mitigation, and better risk management - Promote attitude and behaviour change in the awareness campaigns/ IEC	State/ UT, SDMA, CoR, Revenue Dept., SIDM, ATI Relevant State Govt. Dept., SDRF, Fire and Emergency Services, Civil defence, Police,

		- Promote use of insurance/ risk transfer - Promote Community Radio - Strengthening network of civil society organizations for awareness generation	
4.	Mock Drills/ Exercises	Joint planning and execution of emergency drills	State/ UT, SDMA, CoR, Revenue Dept., SIDM, ATI Relevant State Govt. Dept., SDRF, Fire and Emergency Services, Civil defence, Police, DDMA, Panchayats and ULBs
5.	Documentation and Dissemination	Popularization and distribution of documentation in local languages	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, ATIs
6.	Empowering women, marginalized, and persons with disabilities	Incorporating gender sensitive and equitable approaches in capacity development covering all aspects of disaster management at the state, district, and local levels	State/UT, SDMA, CoR, Revenue Dept., SIDM, ATI, and other state-level institutions, DDMA, Panchayats, ULBs
7.	Community-Based Disaster Management	- Manage and cope with disasters based on a multi-hazard approach - Strengthen ability of communities to manage and cope with disasters based on a multi-hazard approach - Training for panchayat, SHG, NCC, NSS, Youth, local community organizations	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs

3. Landslide and Snow Avalanche Risk Mitigation

	Activities	Responsibilities of State Governments	Agencies responsible
Understanding Risk			
1.	Hazard Zoning, mapping, geological, and geotechnical Investigations in regions prone to landslides and snow avalanches	Support to and cooperation with central agencies	State/UT, SDMA, CoR, Revenue Dept., State DGM, SRSC
2.	Research and Development	Support to and cooperation with central agencies	State/UT, SDMA, CoR, Revenue Dept., State DGM, SRSC
3.	Hazard Risk Vulnerability Assessment	Undertake HRVA as part of preparing and periodic revision of DM plans	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs

4.	Dissemination of warnings	• Ensure facilities and infrastructure for the implementation of adequate access to communities at risk • Dissemination of warnings to all, down to the last mile – remote, rural or urban; Regular updates to people in areas at risk	State/UT, SDMA, CoR, Revenue Dept., PWD, DDMA, Panchayats, ULBs
5.	Monitoring, Warning Systems, and Dissemination	Support and collaboration in implementation	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
Inter-Agency Coordination			
1.	Overall disaster governance	Preparation and implementation of DM plans and ensure the functioning of agencies with DM tasks	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
2.	Response	Organising the immediate response and seeking assistance of central agencies	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
3.	Warnings, Information, Data	Dissemination of warnings to all, down to the last mile – remote, rural or urban; Regular updates to people in areas at risk	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
4.	Non-structural measures	Adapting the norms/ codes as per State's requirement, enforcement, monitoring	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
Investing in DRR–Structural Measures			
1.	Protection of Human Settlements	Improving infrastructure, roads, and land stabilization work	State/UT, SDMA, State DGM, PWD
2.	Protection of Heritage Structures	Support and collaboration	State/UT, SDMA, State DGM, SRSC, DDMA, Panchayats, ULBs
3.	Multi-Hazard Shelters	• Identification of safe buildings and sites to serve as temporary shelters for people and livestock evacuated from localities at risk • Construction of multi-purpose shelters in high risk areas at safe sites away from hazard-prone locations • Proper maintenance of roads in risk-prone areas	State/UT, SDMA, DDMA, Panchayats, ULBs,
Investing in DRR–Non-Structural Measures			
1.	Site selection for Human Settlements in Landslide and Snow Avalanche Prone Areas	• Adopt suitable byelaws for rural and urban areas • Enforce model codes into practice and ensure proper compliance • Ensure proper compliance	State/UT, SDMA, State DGM, DDMA, Local Authorities
2.	Regulations and building Codes	Ensure implementation and adherence to codes and guidelines	State/UT, SDMA, UDD, DDMA, Local Authorities
3.	Licensing and certification of professionals	Implement licensing of engineers through appropriate legal framework and institutional mechanism	Relevant Departments
4.	Public Private Partnerships	Promote private participation in disaster management facilities	State/UT,SDMA, DDMA

Capacity Development			
1.	Training	• Support and collaboration to national agencies • Training and skill upgrades for search and rescue • Conduct regular training programmes for professionals including those for care and protection of disaster affected animals	State/UT, State DGM, SRSC, ATIs, SIDM
2.	Curriculum Development	Include information on landslides and snow avalanches in the curriculum	State/UT, SDMA, Education Dept.
3.	Awareness Generation	• Carry out mass media campaigns • Promote culture of disaster risk prevention, mitigation, and better risk management • Promote attitude and behaviour change in the awareness campaigns/ IEC • Promote use of insurance/ risk transfer • Promote community radio • Inform people about care and protection of disaster-affected animals	State/UT, SDMA,SDRF, Fire and Emergency Services, Information Dept., DDMA, Panchayats, ULBs, Civil Defence, Police
4.	Mock Drills/ Exercises	Joint planning and execution of emergency drills	State/UT, SDMA,SDRF, Fire and Emergency Services, Civil Defence, Police, DDMA, Panchayats, ULBs.
5.	Documentation	Constitute multi-institutional and multi-disciplinary teams for carrying out post landslide field investigations, document the lessons learnt and disseminate	State/UT, SDMA, SIDM, ATI, other academic institutions, DDMA, Panchayats, ULBs.
6.	Empowering women, marginalized, and persons with disabilities	Incorporating gender sensitive and equitable approaches in capacity development covering all aspects of disaster management at the state, district, and local levels	State/UT, SDMA, SIDM, ATI, other academic institutions, DDMA, Panchayats, ULBs.
7.	Community-Based Disaster Management	• Strengthen ability of communities to manage and cope with disasters based on a multi-hazard approach • Training for panchayat, SHG, NCC, NSS, Youth, local community organizations	State , SDMA, DDMA, Panchayats, ULBs

4. Drought Risk Mitigation

	Activities	Responsibilities of State Governments	Agencies responsible
1.	Vulnerability Maps	• Annually, after the end of the South-West monsoon, carry out comprehensive assessment of water availability for drinking and irrigation in all the dryland farming/ drought-prone areas in the state to demarcate blocks and preferably villages • Prepare maps of areas likely to face water deficit before onset of next monsoon (demarcate blocks and preferably villages) • Undertake village-wise assessment of water storage in the vulnerable blocks	State/UT, SDMA, CoR, Revenue Dept., SDMC, SAUs in collaboration with central agencies

2.	Assessment, Monitoring and Early Warning	• Coordinate with central agencies in the compilation, for refining forecast accuracy for the region, and analysis of all the drought, water deficit, and crop related data • Ensure functioning of DMC under control of SDMA/ CoR with requisite facilities and staff • Separately, at the end of SW and NE monsoon, as applicable, prepare and update a robust database of micro-level details on rainfall, reservoir/ lake water levels, surface water/ ground water, soil moisture, sowing/ crop conditions and socio-economic factors • Separately, at the end of SW and NE monsoon, prepare crop advisory for blocks that are likely to face water deficit • Separately, at the end of SW and NE monsoons, prepare comprehensive water conservation, re-distribution, and management plan for the areas in the state that are likely to experience water deficit	State/UT, SDMC,SDMA, CoR, Revenue Dept., Agricultural Dept., Irrigation Dept., Water Supply Dept., SAUs in collaboration with central agencies
3.	Drought Declaration	• Monitor key indicators for drought declaration with the support of relevant Central/ State agencies/ Departments • State Govt. to issue a formal declaration of drought affected areas after which Collector will notify the district and talukas affected and initiate drought response measures	State/UT, SDMA, Revenue Dept., CoR, SDMC, SAU, Agricultural Dept., Irrigation Dept., WRD., Rev. Dep., DDMA, District Collector
4.	Hazard Risk Vulnerability Assessment	• Undertake HRVA as part of preparation/ revision of DM plans including change in vulnerability and risk considering climate change scenarios • Estimate vulnerability of crops to rainfall uncertainties	State/UT, SDMA, DDMA, SAU, Agriculture Dept., Panchayats, ULBs
5.	Research	Conduct research through the university system to cope with water deficit, to manage crops with less water, improve water conservation programs, enhance the productivity of dryland/ rain-fed farming	State/UT, SAUs in collaboration with CRIDA, NRAA
Inter-Agency Coordination			
1.	Overall disaster governance	Preparation and implementation of DM plans and ensure the functioning of agencies with DM tasks	SDMA, CoR, Revenue Dept., Agriculture Dept., DRD, PRD, DDMA, Panchayats, ULBs
2.	Response	Organizing the immediate response and seeking assistance of central agencies	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs
3.	Warnings, Information, Data	Dissemination of warnings to all, down to the last mile – remote, rural or urban; Regular updates to people in areas at risk	SDMC,SDMA, CoR, Agriculture Dept., Irrigation Dept., WRD, DDMA, Panchayats, ULBs
4.	Non-structural measures	Adapting the norms/ codes as per State's requirement, enforcement, monitoring	SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs

Investing in DRR–Structural Measures			
1.	Storage Facilities	• Drinking water storage and distribution facilities • Fodder storage facilities to maintain fodder banks • Rain water harvesting systems – individual and community	State/UT,SDMA, CoR, Revenue Dept., DDMA, Forest Dept., Water Supply Dept., Panchayats, ULBs, WRD, DRD, PRD, Revenue Dept., other relevant departments
2.	Water Conservation Structures	• Water harvesting and storage structures • Check dams, reservoirs with excess capacity • Groundwater recharge augmentation systems	State/UT,SDMA, CoR, Revenue Dept, DDMA, Panchayats,ULBs, WRD, DRD, PRD, AHD, Revenue Dept., Irrigation Dept., other relevant departments.
3.	Social Housing Schemes	Ensure rainwater harvesting and storage in the social housing schemes especially in drought-prone areas	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, WRD, DRD, PRD, AHD, Revenue Dept., Irrigation Dept., other relevant departments.
Investing in DRR–Non-Structural Measures			
1.	Mitigation Measures	• Coordinate the efforts of the central agencies in implementing mitigation measures • Promote private participation in disaster management facilities • Improve the implementation of watershed development programmes • Risk management for dryland/ rain-fed farmers through agricultural extension, and financial institutions based on assessments at the end of monsoon (SW or NE as applicable) • Drought-Proofing	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, WRD, DRD, PRD, AHD, Revenue Dept., Irrigation Dept., SAU, Forest/ Environment Dept., Other relevant departments
2.	Promote water conservation, harvesting, efficient irrigation, afforestation	• Promote water efficient irrigation systems (sprinklers, drip, etc.) • Promote protective irrigation through micro irrigation systems • Provide advice to farmers to cope with drought, crop management under drought conditions, and efficient water management • Training in water and soil moisture conservation • Promote village-level information systems for natural resource management • Afforestation and other options	State/UT, SDMA, COR, Revenue Dept., DDMA, Panchayats, ULBs, WRD, DRD, PRD, AHD, Revenue Dept., Irrigation Dept., SAU, Forest Dept.
3.	Agricultural credits, agricultural inputs, finance, marketing, and crop insurance	• Need-based credit • Promote financial inclusion • Monitor the availability of credit and other financial support from banks and other financial institutions to farmers in drought-prone areas • Ensure the insurance programmes reach the target audiences (especially dryland/ rain-fed farmers) and dependent agricultural labor • Marketing support • Ensuring availability of quality agricultural inputs	State/UT, DMC, Agriculture Dept., State Rural Coop. Banks, Rural Banks, NABARD, SLBC, DDMA

4.	Reducing climate change impact	Implement various water and soil conservation programmes taking into account climate change impacts	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, WRD, DRD, PRD, Revenue Dept., Irrigation Dept., SAU, Forest Dept.
Capacity Development			
1.	Training and Capacity Building	- Formulate and implement national training and capacity building programme for drought management, especially, better water conservation, integrated water management (surface and ground water), and cropping systems - Implement different training programmes for officials at various levels, elected representatives, community leaders, civil society organizations, animal welfare organizations - Ensure availability of qualified and experienced trainers conversant with drought mitigation and management techniques (crop, animal care, integrated water resources – surface and ground water) - Professionals for veterinary care and support to drought-affected animals	State/UT, SDMA, ATI, SIDM, SDMC, DDMA, Panchayats, ULBs
2.	Curriculum Development	Include basic aspects of disaster management including drought in graduate and post-graduate courses in agriculture and veterinary courses offered by state institutions	State/UT, SAU, Education Dept.
		Include drought mitigation in secondary and higher secondary school curriculum	State/UT, SBSE
3.	Awareness Generation	- Carry out mass media campaigns - Promote culture of disaster risk prevention, mitigation, and better risk management covering crop and water management (including conservation of surface and ground water) - Promote attitude and behaviour change in the awareness campaigns/IEC - Promote use of insurance/ risk transfer - Promote community radio - Inform people about care and protection of disaster-affected animals	State/UT, SDMA, CoR, Revenue Dept., all other relevant line departments, DDMA, Panchayats, ULBs, SAU
4.	Empowering women, marginalised, and persons with disabilities	Incorporating gender sensitive and equitable approaches in capacity development covering all aspects of disaster management at the state, district, and local levels	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, Agriculture Dept. AHD, WRD, DRD, PRD, Irrigation Dept., SAU, Forest/ Environment Dept., DSJE, other departments
5.	Drought Management Plans	Ensure development of state, district, block, taluka and village drought management plans	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, Agriculture Dept., AHD, WRD, DRD, PRD, Irrigation Dept., SAU, Forest/ Environment Dept.

6.	Mainstreaming drought management in development plans	All state govt. departments/ agencies will mainstream disaster management efforts in their developmental plans	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, Agriculture Dept., AHD, WRD, DRD, PRD, Irrigation Dept.
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5. Chemical (Industrial) Disasters

	Activities	Responsibilities of State Governments	Agencies responsible
Understanding Risk			
1.	Information Systems and Research	Support and coordination with Central Government	State/UT, SDMA, Industries Dept., SPCB and other relevant departments
2.	Zoning/ Mapping	Industrial zones on basis of hazard potential and effective disaster management for worst case scenarios Carry out the mapping and related studies in collaboration with central agencies, technical organizations.	State/UT, SDMA, Industries Dept., SPCB and other relevant departments
3.	Monitoring	Ensuring implementation, enforcement, compliance and monitoring; awareness creation.	State/UT, SDMA, Industries Dept., SPCB and other relevant departments
4.	Hazard Risk Vulnerability Assessment	Undertake HRVA as part of preparing and periodic revision of DM plans	State/UT, SDMA, DDMA, Panchayats, ULBs and other relevant departments
Inter-Agency Coordination			
1.	Overall disaster governance	Preparation and implementation of DM plans and ensure the functioning of agencies with DM tasks	SDMA, CoR, Revenue Dept., Industries Dept., SPCB, DDMA, Panchayats, ULBs
2.	Response	Organizing the immediate response and seeking assistance of central agencies	SDMA, CoR, Revenue Dept., Industries Dept., SPCB, DDMA, Panchayats, ULBs
3.	Warnings, Information, Data	Dissemination of warnings to all, down to the last mile – remote, rural or urban; Regular updates to people in areas at risk	SDMA, CoR, Revenue Dept., Industries Dept., SPCB, DDMA, Panchayats, ULBs
4.	Non-structural measures	Adapting the norms/ codes as per State's requirement, enforcement, monitoring	SDMA, CoR, Revenue Dept., Industries Dept., SPCB, DDMA, Panchayats, ULBs

Investing in DRR–Structural Measures			
1.	- Shelters, evacuation, and support facilities - Multiple routes for reliable access and escape - Decontamination facilities	- Identification of shelters with basic facilities like drinking water and first aid for chemical exposure - Ensuring water storage facilities and sources for water for accident containment and fire-fighting operations - Providing wide roads and multiple routes in the industrial area to allow quick access by first responders and to ensure escape pathways - Establish decontamination facilities for off-site emergencies of MAH units	State/UT, SDMA, Industries Dept., DDMA, Panchayats, ULBs, Industries, Industrial Associations
Investing in DRR–Non-Structural Measures			
1.	- Laws, Regulations, Techno-Legal regimes - Enforcement, Compliance and Monitoring - Institutional Arrangements	- Formulate rules, norms, and laws such as factories rules consistent with that of ensuring greater safety in hazardous industries and to reduce likelihood of disasters - Empower factory inspectorates to take legal actions for noncompliance of MSIHC Rules - Review rules to grant compensation to chemical accident victims to improve them in favour of victims - Amend land use norms to ensure greater safety and to ensure buffer zones without human settlements in close proximity of hazardous industries - Strengthen the conduct of safety audits and enforcement of disaster prevention norms.	State/UT, SDMA, DDMA, SPCB, Forest/ Environment Dept. Industries Dept., Other relevant depts, Panchayats, ULBs, Industries Associations
2.	Public Private Partnerships	Promote private participation in off-site disaster management facilities Provide legal support for Mutual Assistance Groups among industries within clusters Encourage private participation in enhancing off-site disaster response and mitigation	State/UT, SDMA, DDMA, Industries Associations
Capacity Development			
1.	Training	Training and orientation programs for state govt. staff, and other direct stakeholders	SDMA, State ATIs, SPCB, Industries Dept., DDMA, Panchayats, ULBs, Industries, Associations
2.	Curriculum Development	Incorporating disaster response, search and rescue in the training programs of youth such as village volunteers, civil society, village/ward level leaders	SDMA, SIDM, ATI DDMA, Panchayats, ULBs

		Add more specializations and electives on HAZCHEM and chemical disaster management Professional Bodies and Councils in States Implement the recommendations of reviews in all educational institutions in the state/UT Implement the recommendations of reviews in all educational institutions in the state/UT	State/UT, Health Dept.
		Implement the recommendations of reviews in all educational institutions in the state/UT”	State/UT, Health Dept. (in authorities)
		Introducing basic DM concepts and precautions related to HAZCHEM	State Education Boards
3.	Awareness Generation	- Carry out mass media campaigns - Promote culture of disaster risk prevention, mitigation, and better risk management - Promote attitude and behaviour change in the awareness campaigns/ IEC - Promote use of insurance/ risk transfer - Strengthening network of civil society organizations for awareness generation about DRR and DM - Focus on safety and compliance with SOP at workplace for workers - Information on safety, care and protection of disaster-affected animals	State/UT, SDMA, SDRF, Fire and Emergency Services, Industries Dept., Civil Defence, Police, DDMA, Panchayats, ULBs
4.	Mock Drills/ Exercises	Joint planning and execution of emergency drills	State, SDMA, Industries Dept., SDRF, Fire and Emergency Services, Civil Defence, Police, DDMA, Panchayats, ULBs, Industries Associations
5.	Empowering women, marginalized, and persons with disabilities	Incorporating gender sensitive and equitable approaches in capacity development covering all aspects of disaster management at the state, district, and local levels	State, SDMA, SIDM, ATI, and other state-level institutions, DDMA, Panchayats, ULBs
6.	Community-Based Disaster Management	- Strengthen ability of communities to manage and cope with disasters based on a multi-hazard approach - Training for panchayat, SHG, NCC, NSS, Youth, local community organizations	States/UTs, SDMA, DDMA, Panchayats, ULBs

6. Preparedness and Response

	Activities	Responsibilities of State Governments	Agencies responsible
1.	Early Warning, Maps, Satellite inputs, Information Dissemination	- To disseminate early warning signals to the district administration, local authorities, and the public at large in the areas likely to be affected by a disaster so as to reduce loss of life and property - Dissemination of warnings and information up to the last mile - Ensure appropriate compilation/ analysis of received data - Use of satellite imageries and other scientific methods for risk assessment and forecasting	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, all other relevant Departments/ Agencies
2.	Evacuation of People and Animals	- Quick assessment of evacuation needs such as the number of people and animals to be evacuated and mode of evacuation - Mobilize transport and resources for evacuation - Identify and prepare sites for temporary relocation of affected people and animals - Identify requirements of resources for evacuation such as helicopters, aircrafts, high speed boats and ships to be provided to the affected state government - Request for central resources, if needed - Coordinate with central agencies to mobilise required resources - Monitor the situation - Earmark resources/ units/ battalions of SDRF for quick deployment - Prepare handbook/manuals and SOP for evacuation of people and animals - Undertake review and revise DMPs and SOPs after each major incident - Prepare evacuation plan taking into account local conditions and periodically update it - Undertake mock/simulation drills - Prepare operational checklists - Prepare list of agencies/ organizations who could assist in evacuation - Web-based resource inventory and its regular updates	State/UT, SDMA, Revenue Dept., CoR, SEOC, FES, DDMA, all other relevant Departments/ Agencies, SDRF, Civil Defence
3.	Search and Rescue of People and Animals	- Various positions of IRTs (State, District, Sub-division and Tehsil) are trained and activated for response at their respective administrative jurisdiction - SDRF teams are trained, equipped and ready to move at a short notice to the affected areas - Strategic stationing of state of the art equipment for search, rescue and response with dedicated trained manpower	State/UT, SDMA, Revenue Dept., CoR, SEOC, SDRF, FES, DDMA, all other relevant Departments/ Agencies, Civil Defence

		- MoU is in place with suppliers for blankets, tarpaulins, tents, boats, inflatable lights, torches, ropes, etc. with a condition that they will be supplied quickly at short notice (usually within 24 hours) - Nodal officer selected for coordination is in regular touch with MHA/NDMA for additional requirements (including help from other Central Ministries)	
4.	Medical Care	- Health and Family Welfare Dept. Works with the logistic section of the state level IRT to provide effective services (Medical Unit) to the field level IRTs for response. - District wise repository of hospitals (both Government and Private), availability of beds, doctors, paramedics and other trained staff available along with other infrastructure details and update it on a regular basis - Include the hospital wise information in the DM Plans at local levels - Tie-up with the companies for easy availability of common medicines during the emergency situations - Hygienic conditions are prevalent at all times in various facilities established as well as hospitals to curb the spread of Diseases - Establishment of sound protocols for coordination between state's health Dept. and the central agencies - Ensure strict compliance with minimum standards of relief as per Section 12 of DM Act 2005	State/UT, SDMA, Revenue Dept., CoR, SEOC, SDRF, FES, DDMA, Health Dept., all other relevant departments, Civil Defence
5.	Drinking Water/ Dewatering Pumps/ Sanitation Facilities/ Public Health	- Ensure strict compliance with minimum standards of relief as per Section 12 of DM Act 2005 - Provide disaster-affected areas with clean drinking water and to prevent the spread of water borne diseases - Provide emergency water supplies when there is scarcity of potable water - Respond to the public health needs so as to prevent and mitigate a sudden outbreak of epidemic, water and food contamination as well as other public health-related problems in the aftermath of a disaster - Dept. of Water Resources and Drinking Water and Sanitation works with the logistic section of the state level IRT to provide effective services to the field level IRTs - Necessary arrangements are made for supplying drinking water through tankers - Necessary arrangements are made for supplying chlorine tablets - MoU is in place with vehicle manufacturers for vehicle mounted RO Systems with integrated power source and pouch facility with a condition that system should be in place usually within 6 hours of placing order	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, WRD, Water Supply and Sanitation Dept., Health Dept. all other relevant Departments/ Agencies, Civil Defence

		• MoU is in place with companies for providing vehicle mounted heavy duty dewatering pumps with a condition to make them available usually within 6 hours of request • Availability of hygienic portable toilets and bleaching powder through pre- disaster agreements/ contracts with suppliers	
6.	Food& Essential Supplies	• Dept. of Food and Civil Supply works with the logistic section of the state level IRT to provide effective services to the field level IRTs for response • Agreements/MoUs with organizations, trusts, and firms for setting up community kitchens in the affected areas • Depending upon the requirement, coordinate with the relevant Central Ministry to make sure that the supplies reach the site on time • Deploy a dedicated team at the local level to receive the supplies, maintain log (manual or computerized), and distribute them at required locations • Food godowns have sufficient food materials and not situated at vulnerable location	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Food and Civil Supply Dept., all other relevant Departments, Civil Defence
7.	Communication	• Failsafe communication plan is prepared with all early warning agencies • Logistic section of the state level IRT coordinates with central agencies to provide effective communication support to the field level IRTs for response. • State and district EOCs are equipped with satellite phones/ VHF/ HF as a backup to the landline • All communication equipment, especially the satellite phones are in good working condition 24x7 on all days through regular testing • Plans for communication including telephone and HAM is prepared for smooth coordination with the field level IRTs • Establish protocols and responsibilities for coordinating with central agencies and various service providers • Prepare, update and maintain a District wise list of HAM Operators who could be contacted and deployed at the site of emergency • Have binding agreements with telecom service providers to restore damaged facilities and set up temporary facilities on emergency basis • Ensure Inter-Operability among different telecom service providers	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Information Dept., all other relevant departments

8.	Housing and Temporary Shelters	• Ensure strict compliance with minimum standards of relief as per Section 12 of DM Act 2005 • Logistic section of the state level IRT must coordinate with Railways to provide effective services to the field level IRTs for response • Alternate places for the establishment of facilities as mentioned in the IRS guidelines such as relief camp, base, camp etc. are identified in advance and included in the local DM Plan • Identify shelter suppliers for supply of tents/ shelters up to the village level and enter into an MoU for supply at short notice (usually less than 24 hours) as per requirement • Stockpile tents, tarpaulins and temporary shelter material in regional warehouses/ stores/ ERCs • Depending upon the requirement, coordinate with the relevant Central Ministry to make sure that the tents/ shelters reach the site on time • Deploy a dedicated team at the local level to receive the tents/ shelters • Maintain logs (manual or computerized) of all material movements and details of distribution to required locations	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, UDD., all other relevant Departments
9.	Power	• Electricity Board and Power Distribution Companies work with the logistic section of the state level IRT to provide effective services to the field level IRTs for response • Pre-disaster arrangements for quick restoration of power supply with alternate mechanisms to critical facilities usually within 6 to 12 hours of placement of order • Pre-disaster agreements with central and neighbouring state governments for technical support in restoration of power supply and infrastructure • Mobile power supply units or other arrangements with power generation companies for quick deployment at the site during emergency	State/UT, SDMA, Revenue Dept, CoR, SEOC, DDMA, Electricity Board, Power Distribution Companies, all other relevant Departments
10.	Fuel	• Logistic section of the state level IRT to coordinate with the relevant departments/ agencies to provide effective services (Ground Support Unit) to the field level IRTs for response • Assess and indicate clear requirement of fuel to the Central Ministry and coordinate the delivery of fuel through local arrangements. • Ensure sufficient availability of tankers/ other vehicles for local transportation through the relevant Dept. • Establish mechanism for stocking the fuel at strategic locations with relevant agencies	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Civil Supply Dept., all other relevant Departments

11.	Transportation	• Dept. of Transport works with the logistic section of the state level IRT to provide effective services (Ground Support Unit) to the field level IRTs for response • Requirement of transport for the sending the relief material, responders are arranged • Need of the transport of various activated section of the IRT as per Incident Action Plan is fulfilled • Indian Railway works with the logistic section of the state level IRT to provide effective services (Ground Support Unit) • Restoration of railway tracks and functioning of railway at the earliest • Coordinate with Central Govt. For transportation of relief materials • Within and near Airports: AAI works with the logistic section of the state level IRT to provide effective services (Ground Support Unit) and also provide Nodal Officer for coordination of the relief operations • Restoration of Airport at the earliest involving specialized response force of the central government • Coordination with state and district administration to provide air support • Cater to the needs of transporting affected people if required	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Transport Dept., Forest/ Environment Dept., PWD, Railways, Airport Officer, all other relevant Departments
12.	Relief Logistics and Supply Chain Management	• Establish a mobilization centre at the airport/railway station for the movement of relief supplies within the state • Deploy special transport mechanism for the movement of relief supplies within the state • Make arrangements to receive and distribute relief and emergency supplies received from different parts of the country • Coordinate transportation (air, rail, road, water) with Central ministries/ departments/ agencies • Arrange alternative means of transportation to send relief supplies to the affected locations if normal transport cannot reach	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, all other relevant Departments/ Agencies
13.	Disposal of animal carcasses	• Equip and train the staff in carcass removal/ disposal at pre-identified sites to ensure that no other health hazard is created both for the staff as well as general public	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Forest/ Environment Dept., Agriculture Dept., AHD, Animal Welfare Organizations

14.	Fodder for livestock in scarcity-hit areas	• Mobilize fodder and cattle feed to meet shortages, as in drought or scarcity conditions • Transport fodder from storage facilities or collection centres to the scarcity-hit areas • Organize collection centres for fodder and cattle feed • Enlist PSUs and private agencies for providing fodder and other support	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Forest/ Environment Dept., Agriculture Dept., AHD, Animal Welfare Organizations
15.	Rehabilitation and Ensuring Safety of Livestock and Other Animals, Veterinary Care	• Include provisions for evacuation, safety, and rehabilitation of animals in SDMP • Set up of livestock camps/ shelters for animals in distress due to disasters, including drought • Organize proper care of animals in the camps/ shelters • Ensure proper management and running of livestock camps/ shelters • Proper rehabilitation of animals • Provide veterinary care to disaster-affected livestock, including in drought-hit areas	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Forest/ Environment Dept., Agriculture Dept., AHD, Animal Welfare Organizations
16.	Data Collection and Management	• Representative of SDMA works with the planning section at state level for making of IAP and dissemination of information. • Creation of a cell at the District level (preferably as part of DEOC) and place dedicated resources to collect/ update data on all essential services (as per the template given in the IRS guidelines) which will help during the response phase for effective reporting and compilation.	State/UT, Revenue Dept./ SEOC/ CoR, SDMA, DDMA, Bureau of Economics and Statistics, all other relevant Departments
17.	Relief Employment	• Provide opportunities for unskilled work in public works for people seeking work in drought affected areas as a relief measure • Ensure quick and prompt payment of wages • Carry out health check-up of those seeking work • Draw from various funds including Disaster Response Fund to implement the employment schemes	State/UT, Revenue Dept./ CoR, SDMA, DDMA
18.	Media Relations	• Dept. of Information and Public Relations works with the Command staff as Information and media officer of the state level IRT to provide effective services • Ethical guidelines for coverage of disaster is prepared and shared with all media agencies • Plan is prepared for providing/ broadcasting warnings, do's and don'ts etc. to media and ensure its dissemination	State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Information Dept., all other relevant Departments

7. Risk Governance

	Activities	Responsibilities of State Governments	Agencies responsible
1.	• Mainstream and integrate disaster risk reduction within and across all sectors • Institutional Strengthening	• Promote the coherence and development of relevant laws, regulations, and public policies • Adopt and implement disaster risk reduction strategies and plans, across different levels and timescale • Carry out assessment of the technical, financial and administrative capacity for disaster risk management at all levels within the state • Make institutions efficient and responsive • Improve work culture • Develop mechanisms, and processes to ensure transparency and accountability • Enhance relevant mechanisms and initiatives for transparency • Strengthen/ establish coordination and convergence mechanisms at state, district, and local levels • Carry out assessment of the technical, financial and administrative disaster risk management capacity at state, district, and local levels • Promote necessary mechanisms and incentives to ensure high levels of compliance with the safety-enhancing provisions • Make institutions efficient and responsive; • Improve work culture • Develop mechanisms, and processes to ensure transparency and accountability	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, all departments involved in disaster management
2.	Capacity Development	• Implementation in state ministries, departments, and agencies • Involving communities, panchayats, municipalities, urban local bodies, etc., elected representatives, civil society organizations, private sector, and educational institutions; • Develop capabilities at state, district, block, and local levels to understand disaster risk, develop DM plans, implement relevant policies, laws, and ensure compliance with risk reduction safety standards	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, All departments involved in disaster management

3.	Promote Participatory Approaches	• Empower local authorities • Implement participatory approaches in disaster management based on a multi-hazard approach, with emphasis on hazards more frequent in the region/ location • Establish and strengthen government coordination forums composed of relevant stakeholders • Promote for participation of individuals, households, communities, and businesses in all aspects of disaster management	State/UT,SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, All departments involved in disaster management, especially DRD and UDD
4.	Work with elected representatives	• Sensitize the political leadership • Involve the political leadership at state, district, block, and local levels in discussions on disaster management	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, All departments involved in disaster management, especially DRD and UDD
5.	Grievance redress mechanism	Ensuring the functioning of a sound grievance redress mechanism in all the ministries/ agencies involved in disaster response	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs, all departments involved in disaster response
6.	Promote quality standards, such as certifications and awards for disaster risk management	• Ensure implementation of standards • Develop suitable bye-laws specifically for urban and rural areas • Monitor compliance	State/UT, SDMA, CoR, Revenue Dept., DDMA, Panchayats, ULBs

ANNEXURE III

Questionnaire for data collection from states/UTs

PART-1: Risk Assessment

[Mandates: DM Act: Sections 22 (2)(b), 23 (4)(a), 30 (2)(iii), 31 (3)(a); National DM Policy: Para 5.1.2; National DM Plan: Para 3.2.1, 3.3.1, 3.4.1, 3.5.1, 3.6.1, 3.7.1, 3.8.1, 3.10.1, 3.11.1, Sendai Framework: Priority-1: Understanding Risks, Para 24]

1.1 Hazard Vulnerability Risk Assessment

1. Has the State Government undertaken Hazard Vulnerability Risk Assessment (HVRA) of the State as part of preparation of State, District and Departmental Disaster Management Plans? Yes/ No
2. If yes, name the agency that prepared the HRVA study and the year when the study was undertaken.
3. Is the HRVA available online in public domain? Yes/ No
4. If yes, mention the URL.

1.2 Digital Risk Mapping in Public Domain

5. Are hazard-wise district-wise risk maps of the State available online in digital format? Yes/ No
6. If yes, mention the URL.
7. What is the resolution of the maps? What is the lowest administrative unit for which the map is available?

1.3 Real Time Data on Risks and Disasters

8. Is disaster risk related data such as earthquake, tsunami, flood cyclone etc available to the stakeholders on a real time basis? Yes/ No
9. If yes, please provide a link to the database.

1.4 Micro Zonation of Earthquake Risks

10. How many cities and towns of the State/ UT have micro-zonation of earthquake? Give details. (Give URL if the study report is available online).
11. If it is not available online, give a brief resume mentioning inter alia the names of the cities, year the study was undertaken and the agency that did the study.

1.5 Flood Risk Assessment

12. Has the State/ UT undertaken any study for assessing risks of flood, particularly for urban flood? Yes/No.
13. If yes, give the URL if the study report is available online.
14. If it is not available online, give a brief resume mentioning inter alia the year the study was undertaken and the agency that did it.

1.6 Drought Risk Assessment

15. Have the State/ UT undertaken any special study for assessing the risks of drought? Yes/No.
16. If yes, give the URL if the study report is available online.
17. If it is not available online, give a brief resume mentioning inter alia the year the study was undertaken and the agency that did it.
18. What are the key indicators monitored by the State/ UT for declaring drought? How are data on the indicators collected?

1.7 Dissemination of Risk Information to People

19. Give a brief resume of the steps taken by the State/ UT for the dissemination of risk assessment to the general public, particularly at the community level.

1.8 Assessing Traditional and Local Knowledge

20. Does the State make use of traditional, indigenous and local knowledge for risk assessment? Yes/No.
21. If yes explain the process for using such knowledge, such as documentation, analysis and integration of such knowledge with scientific knowledge of risk assessment.

1.9 Assessing Patterns of Emerging Risks

22. What are the emerging risks of disasters (such as climate change, urban risks, technological risks? Have these risks been assessed in the State. Give details.
23. Has the State/ UT developed any database on any aspect of disasters, such as risks or events of disasters or damage and loss due to disasters or impacts thereof?

1.10 Developing Database on Disasters

24. If yes, enclose a copy of the same or give the URL if it is available online.

Others

25. If the State/ UT has undertaken any other initiative for risk assessment that are not covered by the questions above, give a brief resume of the same.

PART-2: Risk Prevention and Mitigation

[Mandates: DM Act: Sections 18 (2)(d),(f),(g),(h), 22 (2)(e), 23 (4)(b),(c), 30 (2) (iv),(v),(vi),(viii),(xx),(xxii), 31 (3)(b); National DM Policy: Para 4.4.2, 4.4.3, 5.1.4 to 5.1.7, 6.1.1 to 6.4.1; National DM Plan: Para 3.2.3, 3.2.4, 3.3.3, 3.3.4, 3.4.3, 3.4.4, 3.5.3, 3.5.4, 3.6.3, 3.6.4, 3.7.3, 3.7.4, 3.8.3, 3.8.4, 3.10.3, 3.10.4, 3.11.3, 3.11.4, 3.12, Sendai Framework: Priority-3: Investing in disaster risk reduction for resilience, Para 29]

2.1 Disaster Risk Mitigation Projects

1. Has the State Govt/UT Adm. implemented any State/UT specific disaster risk mitigation project after 2005? Yes/No.
2. If yes, provide complete details as per Schedule-A attached with the questionnaire.

2.2 Mainstreaming DRR in Development

3. Has the SDMA/ State Govt/UT Adm. issued any general or sector-specific guidelines for integration and mainstreaming of disaster risk reduction in development? Yes/ No.
4. If yes, attach copies of these guidelines

2.3 State and Disaster Risk Mitigation Fund

5. Has the State Government constituted the State Disaster Mitigation Fund and District Mitigation Fund as mandated by the DM Act? Yes/No.
6. If yes, provide complete details as per Schedule-B attached with the questionnaire.
7. Has the State/ UT made use of flexi-funds under centrally sponsored programmes for disaster risk management? If so, give details.

2.4 Safety standards for constructions and land use

8. Has the State Govt/ UT Adm./ Municipal Bodies incorporated the BIS standards/ National Building Codes regarding earthquake and other hazard resistant construction of houses and infrastructures in relevant codes and bye laws? Yes/No.
9. If yes, provide details as per Schedule-C attached with the questionnaire.
10. Has the State Govt/ UT Adm. amended the Town Planning / Urban Development Acts and Regulations to conform to ecologically sensitive and disaster reducing land use standards? Yes/No.
11. If yes, provide details as per Schedule-C attached with the questionnaire.

2.5 Safety audit/ retrofitting of life line infrastructure/ buildings

12. Has the State Govt./UT Adm. conducted safety audit of life line structures/ critical infrastructures? Yes/No.
13. If yes, give total number of such buildings audited as per use of the buildings.
14. Are earthquake/ other hazard resistant designs and specifications incorporated in the type design of school buildings, dispensaries and social housing schemes for economically weaker sections? Yes/ No.
15. If yes, enclose copies of relevant notifications.
16. Has the State Govt./UT Adm. retrofitted/ strengthened some of these structures? Yes/No.
17. If yes, provide details as per Schedule-D attached with the questionnaire.

2.6 Construction of cyclone/ flood shelters

18. What are the assessed needs of cyclone/ flood shelters in the State/UT? How many such shelters have been constructed so far?

2.7 Eco System Approach for Disaster Risk reduction

19. Do the State Govt/ UT Adm. have any plan/guideline/scheme for eco systems approach (integrated environmental and natural resource management) for disaster risk reduction? Yes/No.
20. If yes, enclose copy of relevant plan/guideline/scheme.
21. What is the total length of coastline in the State/UT? What is the length of coastline that had natural protection of bio-shield like mangroves? Assess the extent of damage, restoration, and regeneration of such bio-shields in the State/UT (Please refer to the sources on the basis of which such assessments are made).

2.8 Social Safety Net for Poor and Vulnerable

22. What social safety nets are available in the State/UT for protecting vulnerable groups of people like children, aged, disabled, destitute etc from the adverse impacts of disasters?
23. Give a brief resume of the plan/schemes/programmes implemented by the State/ UT to protect the poor, particularly for the restoration of their livelihood during or after disasters.
24. Do the State Govt/ UT Adm. have any plan/guideline/scheme for protecting the animals and livestock from the risks of disasters? Yes/No.
25. If yes, enclose copy of plan/guideline/scheme.

2.9 Mitigation of risks of heritage

- 26. Do the State Govt/ UT Adm. have any plan/guideline/scheme for protecting the monuments, heritage buildings, museums etc. from disasters? Yes/No.
- 27. If yes, enclose copy of plan/guideline/scheme.

2.10 Integration of climate change adaptation with DRR

- 28. Have the State Govt./UT Adm. taken any steps or measures for integrating disaster risk reduction with climate change adaptation? Yes/No.
- 29. If yes, give a brief narrative of such integration.

Others

- 30. What has been the overall impact of disaster risk reduction initiatives in the State in terms of number of deaths, affected and economic losses in disasters? Please provide details as per Schedule-E attached with the questionnaire.
- 31. Is the State Govt./UT Adm. promoting mechanisms for risk transfer such insurance/ micro-insurance etc. If so, give details.
- 32. If the State/ UT Adm. have implemented any other measures for risk prevention and mitigation (other than those already mentioned in the response to the questionnaire), please provide details. (Use separate sheet if required).

PART-3: Risk Governance

[Mandates: DM Act: Sections 14-18, 20-34, 38, 41, 48; National DM Policy: Para 3.3.6 to 3.3.8, 3.4.3 to 3.4.6, 5.3.1 to 5.3.5; National DM Plan: Para 5.1 to 5.3; Sendai Framework: Priority-2: Strengthening Disaster Risk Governance, Para 26, 27]

3.1 Institutional mechanisms for risk governance

- 1. Mention date-month-year of constitution of SDMA, SEC and DDMA's
 - Year
 - No. of Meetings
 - Year
 - No. of Meetings
- 3. Has the SDMA constituted its Advisory Committee? Yes/ No
- 4. Does SDMA have its dedicated staff? Yes/ No
- 5. If yes, give details.
- 6. How many times the SEC has met year-wise since its constitution?
 - Year

No. of Meetings

Year

No. of Meetings

- 7. Has the SEC constituted its Sub-Committees? Yes/ No

3.2 Disaster Management Policy and Plans

- 8. Has the SDMA laid down State Disaster Management Policy? Yes/No
- 9. If yes, attach a copy of the Policy document.
- 10. How many guidelines have been laid down by the SDMA? Give details along with copies or URL if these are available on line.
- 11. Does the State/UT have a State Disaster Management Plan? Yes/ No
- 12. If yes, when was the Plan prepared and revised/ updated? Give URL of the plan.
- 13. How many Departments are there in the State Government?
- 14. How many Departments have prepared Departmental Disaster Management Plan?
 - Name of Department
 - Year of Preparation of First Plan
 - Year of Revision
- 15. How many districts are there in the State/ UT? How many districts have prepared District Disaster Management Plans? Give details.
 - Name of District
 - Year of Preparation of First Plan
 - Year of Revision

3.3 Disaster Management Manuals and Procedures

- 16. Has the State/ UT developed Manuals and Standard Operating Procedures, such as Relief Manual, SOP for Disaster Response, SOP for Emergency Operating Procedures etc? Give complete details of all the Manuals and SOPs along with URL.

3.4 Decentralisation and Devolution of Functions

- 17. How are the Municipalities and Panchayats involved with disaster risk management in the State/UT? Has the State Govt./UT Adm. devolved any functions or resources to these self-governing institutions for disaster management? If so, give details.

3.5 Training and Capacity Development

- 18. Has the State/UT set up any Institute/Centre/Cell for training and capacity development of the functionaries of the government, its agencies and other stakeholders? Provide details as per Schedule-F.

19. Is disaster management included in the entry/induction level training curriculum of State Administrative Services and in sectoral training programmes of all relevant development departments? If so, give details.
20. Has the State Govt./UT Adm. introduced Disaster Management in the curriculum of school education in the schools? Yes/No.
21. If yes, give the year of introduction of the curriculum, the class/level where such curriculum has been introduced. Further mention if text books have been developed in local language has been developed for this purpose.
22. Is disaster risk management included in the curriculum of higher education in the State/UT? If so, give details of the streams/subjects of higher/ technical education where such inclusions have taken place.

3.6 Multi-Stakeholder Platform

23. Does the State/UT have multi-stakeholder coordination forum like State Platform for Disaster Risk Reduction? If so, give details, such as composition of the forum, date of constitution, and number of meetings it had so far.
24. Is there any mechanism for private sector engagement for disaster risk management in the State/ UT? If so, give details.

3.7 Community Involvement and Participation

25. Has the State/ UT developed any mechanism for the involvement and participation of the communities, civil society, NGOs, volunteers etc in disaster management? If so, give details.

3.8 Enforcement and Compliance

26. Has the State/UT or its agencies devised any mechanisms or incentives to ensure high levels of compliance with the safety-enhancing codes and regulations, such as building codes and zoning regulations? Yes/No.
27. If yes, give details of such incentives.
28. Has the State/UT evaluated the effectiveness of enforcement of the safety-enhancing codes and regulations, such as building codes and zoning regulations? Yes/No.
29. If yes, enclose a copy of the evaluation report.

3.9 Monitoring and Evaluation

30. Has the CAG or Parliamentary Committee conducted any Performance Audit/ Review of the functioning of disaster management system of the State? Yes/No.
31. If yes, what were the main findings? Give citations of the report such as name of Committee, title of the report, year of publication etc. Provide link to the URL if it is available online.

3.10 Transparency and Accountability

32. What are the mechanisms, and processes developed by the State/UT to ensure transparency and accountability in the delivery of relief and other disaster management services to the people affected by disasters? Give details.

Others

33. Mention any other initiative taken by the State Govt./UT Adm. for improving the system of risk governance.

PART-4: Disaster Preparedness

[Mandates: DM Act: Sections 18(2)(f)(h), 22(2)(f)(p), 23(4)(d), 30(2)(xi)(xii)(xiii) (xxv)(xxviii), 31(3)(c), 38(2)(h)(i); National DM Policy: Para 5.2.5 to 5.3.2, 3.4.3 to 3.4.6, 5.2.5-5.3.5; National DM Plan: Para 4.9, 7.1 to 7.7; Sendai Framework: Priority-4: Enhancing Disaster Preparedness for Effective Response, Para 32,33]

4.1 End-to-End Early Warning Systems

1. While central agencies like IMD, CWC, GSI, INCOIS etc are responsible for early warning of most of the major hazards, it is the responsibility of the State Govt./UT Adm. to ensure that such warnings are communicated to the people, down to the last mile in urban and rural areas by every possible means. Give a brief resume of the technical, administrative and logistic arrangements made by the State government for dissemination of early warning of various types of hazards in the State.
2. Has any general or specific guideline or SOP been issued for dissemination of early warnings of various types of hazards to the people in the State? Yes/No.
3. If yes, enclose a copy of the guidelines.

4.2 Emergency Operation Centres

4. Has the State Govt./UT Adm. set up Emergency Operation Centres at the State, Metro and District levels equipped with modern communication and other facilities? If so give details of these facilities as per Schedule G.
5. Has any Standard Operating Procedure been developed for the operation and management of Emergency Operation Centres? Yes/No.
6. If yes, enclose a copy of the same.

4.3 Disaster Communication System

7. Information and Communication Technology (ICT) plays important role in disaster risk management – before, during and after disasters. Give a brief resume on the initiatives taken by the State/ UT for the application of ICT for disaster management.

4.4 Emergency Medical Preparedness

8. How many government hospitals are in operation at the state and district level in the State/UT? How many of them have developed Emergency Medical Preparedness as per the guidelines of NDMA? Provide URL for accessing the plans.
9. What steps have been taken for training and capacity building of the medical and para-medical staff of the hospitals for emergency medical preparedness, including trauma management and triage? Give details.
10. Has the State developed any post-disaster disease surveillance system? If so, give details.

4.5 Scenario Building, Simulation and Mock Drills

11. Have the State/ UT developed worst case scenarios/ simulations of various possible disasters in the State? Yes/No.
12. If yes, give the type of hazards for which scenarios have been developed. Enclose copies of the same if these are available.
13. How many mock drills have been conducted by the SDMA/ DDMA in the State annually since 2006? Give details.

4.6 Contingency Plans, SOPs, Manuals

14. Give a complete list of Contingency Plans, Standard Operating Procedures and Manuals on various aspects of disaster management developed by the State Government/ SDMA.

4.7 Community Based Disaster Preparedness

15. What measures have been taken for strengthening community based disaster preparedness in the State? Give details.

4.8 Awareness Generation

16. What measures have been taken for raising awareness of the common people about the measures to be taken for disaster preparedness? Give details.

4.9 Resource Inventory

17. Has the State prepared inventory of material and human resources available with various public and private entities that can be made use for managing disasters? Yes/ No.
18. Are these inventories registered with India Disaster Resource Network (IDRN)? Give the district-wise dates of last updates of IDRN.

4.10 Media Partnership

19. Media can play important role in dissemination of information and knowledge in

all phases of disaster management. Both the national policy and nation plan have highlighted the critical role of print and electronic media in disaster management. Has the State Govt./District Adm. developed any guidelines or strategy for media partnership? Give details.

Others

20. Mention any other initiative taken by the State Govt./UT Adm. for strengthening disaster preparedness in the State.

PART-5: Disaster Response

[Mandates: DM Act: Sections: 22(2)(g)(h)(o), 23(4)(f), 24(e)(f)(g)(k), 30(2)(xi)(xv) (xvi)(xvii) (xviii), 31(3)(d), 34, 36(c)(f)(g), 38(2)(j); National DM Policy: Para 7.4.1 to 7.11.1; National DM Plan: Para 4.9; Sendai Framework: Priority-4: Enhancing Disaster Preparedness for Effective Response, Para 32,33]

5.1 State Agencies for Disaster Response

1. Has the State constituted a specialized State Disaster Response Force? Yes/No.
2. If yes, give details such as year of constitution, strength of the force, equipments provided and arrangements made for training.
3. Is disaster management included in the training curriculum of State Police at all levels? Yes/No.
4. If so, give details
5. Has the Fire Services been upgraded to acquire multi-hazard rescue capability? Yes/No.
6. If so, give details.
7. Civil Defence Act was amended in 2009 to enable the provisions of the Act to be applied during disasters. This requires expansion of the network of civil defence to all districts and reorientation and training of the civil defence volunteers. What actions have been taken in the State to reorient the civil defence for this new role?

5.2 Incident Response System

8. Govt. of India had decided in 2002 to introduce Incident Command System for responding to disaster situations and trained a large number of administrators of State Govt./UT Adm. on different facets of incident management. National Policy on Disaster Management 2009 endorsed the system and National Guidelines on Incident Response System was issued in 2010 for adapting the system in the context of our administrative system. What steps have been taken by the State Govt./UT Adm. to introduce the system in the State? What is the current status of implementation of the guidelines in terms of training and actual practice during emergency situations?

5.3 Coordination with GOI, NDRF, Armed Forces

9. Catastrophic or major disasters may overwhelm the capacity of the State Govt./UT Adm. to respond effectively, requiring assistance of Central Govt. and its agencies like the NDRF and the Armed Force. Quick responses of central agencies are effective if there are institutionalised mechanisms for liaison and coordination, such as civil-military liaison conference. Has any such mechanism been established in the State/UT? If so, give details.

5.4 Evacuation, Search and Rescue

10. Disaster mortalities can be reduced considerably if contingency plans are in place regarding quick assessment of evacuation needs, identification of temporary shelters, determination of evacuation routes, mobilization of transportation arrangements, preparation of checklists etc. Is such contingency plan for evacuation available? Yes/No.
11. If yes, enclose copy of the Contingency Plan.
12. Searching and rescuing people marooned in flooded areas or trapped in collapsed structures or debris is a specialized job requiring equipments, training, drills etc. To what extent are the concerned agencies of the State equipped and trained to handle such operations? Give details.

5.5 Emergency Medical Response

13. Immediate impact of disasters is the surge of persons of different age group inflicted with severe and minor injuries for treatment in hospitals. Many such injuries may require medical attention even before hospitalization. This requires operational readiness of medical response teams, availability of ambulance, heli-ambulance and other logistic arrangements. What is the status of such operational readiness of medical response? Give an account of the achievements and challenges.

5.6 Emergency Support Functions

14. Disaster response is not the job of responders alone. It requires performance of Emergency Support Functions (ESF) by the line departments and agencies, such as restoration of electricity, water supply and sanitation system, telecommunication, road and transportation network, supply chain of food and other essential items etc. Has the State Govt./UT Adm. prepared check lists of ESF, identified primary and secondary agencies and functionaries for the performance of these functions, outlined the process and timeline to be followed and provided resources for the same? Have the agencies made pre-arrangements for advance procurement of materials needed for such functions? Give details.

5.7 Protection of vulnerable women and children

15. Vulnerable women and children often become victims of trafficking and sexual abuse after disasters. Is a surveillance system in place in the State/ UT for preventing such

abuses and protecting the vulnerable? If so give details.

5.8 Disposal of dead bodies

16. In the event of mass casualties in disasters proper collection, preservation, storage, identification and disposal of dead bodies according to the religious customs and rites of the deceased are ethical as well as legal issues. Has the State Govt./UT Adm. issued any guidelines to be followed in this regard? Yes/No.
17. If yes, enclose a copy of the guidelines.

5.9 Disposal of Animal Carcasses

18. Proper removal and disposal of animal carcasses at pre-identified sites is important to ensure that no health hazards are created to the staff as well as general public. Has the State Govt./UT Adm. issued any guidelines to be followed in this regard? Yes/No.
19. If yes, enclose a copy of the guidelines.

5.10 Disposal of Debris

20. Major disasters like earthquakes and cyclones may cause widespread destruction of built up structures like houses and infrastructure as well as natural assets like trees and plantations. Removal and disposal of construction debris and fallen trees can be problematic in many urban areas where open sites are not available so easily unless these are pre-identified. Much of these materials can be also be recycled. Does the State Govt./UT Adm. or the municipal authorities have any plan for management of the debris? Yes/No.
21. If yes, enclose a copy of the guidelines.

Others

22. Mention any other initiative taken by the State Govt./UT Adm. for effective response to disasters in the State.

PART-6: Disaster Relief and Rehabilitation

[Mandates: DM Act: Sections 19, 24(d)(f), 30(2)(xxiv), 38(2)(j), 41(d); National DM Policy: Para 8.2.1 to 8.6.1; National DM Plan: Para 6.1 to 6.4, 6.7; Sendai Framework: Priority-4: Build Back Better in Recovery and Rehabilitation, Para 32,33]

6.1 Minimum Standard of Relief

1. Has the State Disaster Management Authority laid down guidelines for providing standards of relief to persons affected by disasters in the State, as provided in section 19 of Disaster Management Act? Yes/No.
2. If yes, enclose a copy of the guidelines.

6.2 Ex-gratia Relief

3. Government of India has fixed norms of ex-gratia relief under State Disaster Response Fund and National Disaster Response Fund. Do the State Government/ UT Adm. provide additional ex-gratia relief over and above such norms? If so give details.

6.3 Relief Logistics and Supply Chain Management

4. Timely procurement, packaging, transportation, storage and distribution of relief materials immediately as the need arises make it imperative that there are well laid down operating procedures and manuals on relief logistics and supply chain management. Do the State Govt./UT Adm. have such SOP/ Manuals. Yes/No.
5. If yes, enclose a copy of SOP/Manual or give link to the online resource.
6. Major disasters attract humanitarian assistance, often in kind, from all over the world, Receiving, sorting, transporting and distributing these materials to the neediest in a transparent manner is quite challenging. Has the State Govt./UT Adm. evolved any guidelines to deal with such situations? Yes/No.
7. If yes, enclose a copy of the guidelines.

6.4 Food and Essential Supplies

8. Supply of food including cooked food and other essential items to the affected people is one of the major functions of disaster relief. This involves procurement, storage, transportation and distribution of food in a transparent and accountable manner. This further involves pre-agreements/ MoUs with organisations, trusts and firms for setting up community kitchens in the affected areas. Describe the policies and practices followed in this regard, with special reference to any innovative practice introduced for better delivery of services.

6.5 Drinking Water, Dewatering and Sanitation

9. Supply of clean drinking water to disaster affected areas is extremely important to prevent water borne diseases. Every State/ UT faces its own challenge. Describe the minimum standards of the State for supply of drinking water to people affected by disasters and assess the compliance of the standards.
10. Providing sanitation facilities to men and women, particularly those in relief camps, is another important aspect of public health. Describe the minimum standards adopted by the State for providing sanitation services to people affected by disasters and assess the compliance of the standards.
11. Dewatering of flooded areas in urban pockets that have no outlets can be critical for public health as well as safety of lives and structures. Do the State/ UT face such situations? How does it address the problem?

6.6 Health and Mental Health Care

12. Health care of disaster affected pregnant and lactating mothers, neo-natal, aged and

those suffering from chronic diseases should receive priority in health care as they suffer from double jeopardy. Do the State Govt./UT Adm. provide special dispensation for such people? If so give details.

13. Mental health care of the affected people suffering from Post Traumatic Stress Disorder (PTSD) is crucial at the initial stage for diagnosis and treatment. Have the State Govt./ UT Adm. made arrangements for expert psycho-social counselling of such people? If so give details.

6.7 Management of Relief Camps

14. Provision of basic shelter, food, water and health care does not solve the problems of people in temporary relief camps, as there are many other issues, such as privacy, safety, security, gender based violence etc. that should also be addressed. These issues can be attended only if there are proper guidelines for management of relief camps. Have the State Govt./UT Adm. developed such guidelines? Yes/No.
15. If yes, enclose a copy of the guidelines on the management of the relief camps.

6.8 Veterinary Care

16. Veterinary care for disaster affected livestock and animals, including wild animals and arrangements for their evacuation, shelter, fodder / feed etc. are important for rehabilitation of animals. Do the State Govt./UT Adm. have any plan or guidelines for animal care during disasters. Yes/ No.
17. If yes, enclose a copy of the plan/guidelines.

6.9 Relief Employment

18. People affected by disasters often lose their livelihood. Relief employment under MNREGA is one of the several avenues for providing alternate source of livelihood to the affected people. What are the alternative avenues developed by the State Govt./ UT Adm. for providing relief employment to the people? How many man days of relief employment have been provided in the State since 2006 under different schemes/ programmes? Give details.

6.10 Temporary and Intermediary Shelters

19. In case of devastating disasters when the period of stay in temporary shelters is likely to be long and uncertain, or where extreme weather conditions can be life-threatening, construction of intermediary shelters shall become necessary. Did the State Govt./UT Adm. have to construct such intermediary shelters anytime in the past? Give year-wise details from 2006 onwards. Based on the experiences gained, has any general or specific guidelines been issued for future? If so give details.

Others

20. Mention any other initiative taken by the State Govt./UT Adm. for relief and rehabilitation of people affected by disasters in the State.

PART-7: Disaster Reconstruction

[Mandates: DM Act: 38(2)(k), 39(f)(iii), 41(d); National DM Policy: Para 9.1.1.to 9.5.1; National DM Plan: Para 6.5 to 6.6; Sendai Framework: Priority-4: Build Back Better in Reconstruction, Para 32,33]

7.1 Damage and Loss Assessment

1. How are the damage and losses in disasters assessed in the State/ UT?
2. Are there any guidelines or manual for damage and loss assessment in disasters? Yes/ No.
3. If yes, enclose a copy of the guidelines.

7.2 Post Disaster Need Assessment

4. How are the needs for post disaster recovery and reconstruction assessed in the State/ UT?
5. Are there any guidelines or manual for such Post Disaster Need Assessment? Yes/No.
6. If yes, so enclose a copy of the guidelines.
7. Do the State/ UT have a policy or framework for post-disaster recovery and reconstruction? Yes/No.
8. If yes, enclose a copy of the framework.

7.3 Financing Reconstruction

9. Post disaster reconstruction is not permissible under the norms of SDRF/NDRF. How such reconstructions are financed in the State/ UT? How many such reconstruction projects have been implemented in the State since 2006? Give details stating inter alia the costs incurred on each reconstruction project, period of implementation of the projects and the sources for mobilization of the fund.

7.4 Institutional Mechanisms for Reconstruction

10. How is reconstruction projects implemented in the State/UT? Give a brief description of the institutional mechanism(s) adopted in the State for the implementation of such projects.

7.5 Building Back Better

11. Do the State/ UT consistently follow the principle 'Build Back Better' in post-disaster construction projects? Give examples of practical application of the principles in past reconstruction projects.
12. How have the reconstructed towns and villages behaved in repeat occurrences of disasters? Give examples from the reconstruction experiences of the past.

7.6 Reconstruction of Houses

13. What strategies are followed for reconstruction of damaged houses? Are the houses reconstructed by the agencies of the government or by the owners themselves? How it is ensured that owners reconstruct their houses as per disaster resistant designs and technology?
14. What material and financial supports are provided by the government to facilitate reconstruction of houses damaged in disasters?
15. Are the reconstructed houses insured? Are these registered jointly in the name of present owner and spouse?

7.7 Reconstruction of Infrastructure

16. What is the strategic approach of the State Govt./UT Adm. for reconstruction of damaged physical and social infrastructure? Are these reconstructed as per original plan and design or redesigned to provide additional elements of safety and resilience? Give examples from the reconstruction experiences of the past..

7.8 Livelihood Reconstruction

17. Disasters impact on the livelihood of people such as farmers, artisans, women headed households, and people belonging to marginalised and vulnerable sections. What strategic approach is followed for reconstruction of damaged livelihoods? Give examples from the reconstruction experiences of the past.

7.9 Regeneration of Ecology and Environment

18. Disasters cause considerable damages to ecology and environment. How such damaged environment have been restored during past 10 years. Give examples.

7.10 Learning from Reconstruction and Recovery

19. What are the main lessons learnt from the experiences of reconstruction in the past? Have these been documented? Have these lessons been incorporated in the policies or guidelines? If so give details.

Others

20. Mention any other initiative/ good practice of the State Govt./UT Adm. for disaster recovery and reconstruction.

Schedule A

Details of Disaster Risk Mitigation Projects
Implemented by the State Government/ UT
Administration since 2006

(Risks shall include all natural and human induced risks of disasters, such as earthquake, cyclone, flood, landslide, drought, tsunami, industrial and chemical disasters etc.)

No.	Name of project	Date of start	Date of com- pletion	Total in- vestment	Source of funding	Executing Deptt/ Agency	Specific Risks for mitigation	Structural Measures	Non- structural measures	Areas/ popu- lation cov- ered (%)	Expected outcome	Results achieved	Overall impact
1.													
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9.													
10.													
11.													
12.													
13.													
14.													
15.													
16.													
17.													
18.													

Schedule B

Details of State Disaster Mitigation Fund and District Disaster Mitigation Fund

(Use additional sheets as required)

State Disaster Mitigation Fund				
Date of Notification	Year wise deposits	Source of fund	Year-wise expenditure	Risk-wise expenditure
	2006-2007		2006-2007	Earthquake
	2007-2008		2007-2008	Flood
	2008-2009		2008-2009	Cyclone
	2009-2010		2009-2010	Landslide
	2010-2011		2010-2011	Drought
	2011-2012		2011-2012	Tsunami
	2012-2013		2012-2013	Industrial
	2013-2014		2013-2014	Chemical
	2014-2015		2014-2015	Others
	2015-2016		2015-2016	Others
	2016-2017		2016-2017	Others
District Disaster Mitigation Fund				
Date of Notification	Year wise deposits (ALL DISTRICTS)	Source of fund	Year-wise expenditure (ALL DISTRICTS)	Risk-wise expenditure (ALL DISTRICTS)
	2006-2007		2006-2007	Earthquake
	2007-2008		2007-2008	Flood
	2008-2009		2008-2009	Cyclone
	2009-2010		2009-2010	Landslide
	2010-2011		2010-2011	Drought
	2011-2012		2011-2012	Tsunami
	2012-2013		2012-2013	Industrial
	2013-2014		2013-2014	Chemical
	2014-2015		2014-2015	Others
	2015-2016		2015-2016	Others
	2016-2017		2016-2017	Others

Schedule C

Status of Risk Resistant land Use and Construction Practices

Risk Resistant land Use Regulations
Has the State/UT Town Planning Act/ Regulations been amended to conform to risk reducing land use standards? Give details.
Has the State/UT Urban Development Act been amended to conform to conform to risk reducing land use standards? Give details.
Give an overview of the status of implementation/ enforcement of these laws/ regulations in major cities and towns. (Use separate sheet if required).
Risk Resistant Construction Practices
Has the State Municipal Laws/Bye Laws of the Municipal bodies been amended to conform to BIS/NBC standards of construction? Give details.
Give an overview of the status of implementation/ enforcement of these laws/ regulations in major cities and towns. (Use separate sheet if required).

Schedule D

Safety Audit and Retrofitting of Lifeline Structures/ Critical Infrastructures

	Lifeline structures/ critical infra-structures	Safety Audit conducted (No. of structures)	Rapid Visual Screening conducted (No. of structures)	Seismic retrofitting completed (No. of structures)	Other types of strengthening/ ret-rofitting completed (No. of structures)
1.	State Hospitals				
2.	District Hospitals				
3.	Primary health Centres				
4.	State Emergency Operation Centres				
5.	State Secretariat				
6.	State Police Headquarter				
7.	Office of District Magistrate				
8.	District Emergency Operation Centre				
9.	District Police Headquarter				
10.	Schools				
11.	Community Halls				
12.	Cinema Halls/ Theatres				
13.	Bridges				
14.	Dams/ reservoirs				
15.	Power Transmission Towers				
16.	Hydro-electric power stations				
17.	Other lifeline structures				

Schedule E

Trends of Disaster Damage and Losses in States/UTs

	People killed	People with major injuries	People with minor injuries	Houses fully damaged	Houses partly damaged	Animals perished	Crop lost ₹ Crores	Loss of infrastructure (₹ Crores)				Industry and trade ₹ Crores	Total Loss ₹ Crores
Year								Roads	Power	PHE	Others		
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
2001													
2002													
2003													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013													
2014													
2015													
2016													

Schedule F

Training and Capacity Development on Disaster Management

- 1. Name of the Institute/ Centre –
- 2. Year it was set up -
- 3. Number of faculty members (as on 1-1-2017) -
- 4. Number of supporting staff (as on 1-1-2017) –
- 5. Number of Training Modules developed –
- 6. Details of financial/physical progress – (to be furnished in the table given below)
- 7. Any other details -

Year	Number of training pro-grammes conducted	Number of persons trained	Funds allocated by MHA/NIDM ₹ Lakhs	MHA/NIDM Funds utilised ₹ Lakhs	Funds allocated by Thirteenth Finance Commission	TFC Funds utilized ₹ Lakhs
2005						
2006						
2007						
2008						
2009						
2010						
2011						
2012						
2013						
2014						
2015						
2016						

Schedule G

Emergency Operation Centres in the State/ Union Territory

No.	Type of EOC (State/Metro/Dist.)	Controlling Department (Revenue/DM/Police)	Does it operate 24x7? (Yes/ No)	Total Floor Area (Sq. ft.)	Details of Communication Systems/ Equipments (Take separate sheet, if needed)	Details of Staff Deployed	Does it have space for ESF agencies?
1.	State EOC						
2.	Metro EOC						
3.	Metro EOC						
4.	Metro EOC						
5.	Metro EOC						
6.	District EOC						
7.	District EOC						
8.	District EOC						
9.	District EOC						
10.	District EOC						
11.	District EOC						
12.	District EOC						
13.	District EOC						
14.	District EOC						
15.	District EOC						
16.	District EOC						
17.	District EOC						
18.	District EOC						
19.	District EOC						
20.	District EOC						
21.	District EOC						

Metro EOC is an EOC set up at a metro city with population of more than 10 lakhs each. Mention separately for each metro city.

Mention separately for each district of the State/ UT.

ANNEXURE IV

Norms For Evaluation

1. Risk Assessment (Weights 10%)

	Indicators/ Questions	Aggre- gate Points	Criteria for evaluation	Points to be allocated
	1.1 Hazard Vulnerability Risk Assessment	10		
1	Has the State Government undertaken Hazard Vulnerability Risk Assessment (HVRA) of the State as part of preparation of State, District and Departmental Disaster Management Plans? Yes/ No	1	1. Yes 2. No [Note: If response is NO, scores for remaining questions are also 0]	1 0
2	If yes, name the agency that prepared the HRVA study and the year when the study was undertaken.	2	1a. When no specialized agency is engaged 1b. When specialized agency is engaged but they do not have capability for multi-hazard risk assessment 1c. When specialized agency has proven capacity for multi-hazard risk assessment 2. When risk assessment has been periodically updated/ revised 3 When risk assessment has been done one time	0 0.5 1 1 0.5
3	Is the HRVA available online in public domain? Yes/ No	1	1. Yes 2. No	1 0
4	If yes, mention the URL. (Evaluation of quality of risk assessment)	6	Evaluation of assessment: 1a. When risk assessment has been made on the basis of comprehensive analysis of State specific hazards, vulnerabilities, exposures and capacities 1b. When risk assessment is not comprehensive 2. When risks of different districts and regions are quantified on the basis of available data 3. When Average Annual Loss (AAL) and Probable Maximum Loss (PML) is quantified	2 to 4 0.5 to 1.5 1 1

	Indicators/ Questions	Aggre- gate Points	Criteria for evaluation	Points to be allocated
	1.2 Digital Risk Mapping in Public Domain	5		
5	Are hazard-wise district-wise risk maps of the State available online in digital format? Yes/ No	2	1. When online digital risk maps are not available 2. When such maps are available for all hazards and districts 2. When such maps are available partially	0 2 0.5 to 1.5
6	If yes, mention the URL.			
7	What is the resolution of the maps? What is the lowest administrative unit for which the map is available?	3	1. Resolution is 10,000 or below for entire State/UT 2. Resolution is in different scales not exceeding 50,000 2. Resolution exceeds 50,000 or higher scale	3 2 1
	1.3 Real Time Data on Risks and Disasters	5		
8	Is disaster risk related data such as earthquake, tsunami, flood cyclone etc available to the stakeholders on a real time basis? Yes/ No	1	1. Yes 2. No	1 0
9	If yes, please provide a link to the database. (Assessment of quality of database)	4	1. When real time data base has been set up by the State/UT through its own initiative, depending on number of hazards covered 2. When real time database is hyper-linked to national database, depending on number of hazards covered	2 to 4 0.5 to 1.5
	1.4 Micro Zonation of Earth-quake Risks	3		

10	How many cities and towns of the State/ UT have micro-zonation of earthquake? Give details. (Give URL if the study report is available online).	3	1. When seismic micro-zonation has been completed for all million+ and capital cities in hazard zone V, IV and III. 2. When such micro-zonation has been completed only partially 3. When no such micro-zonation has been done	3 0.5 to 2.5 0
11	If it is not available online, give a brief resume mentioning inter alia the names of the cities, year the study was undertaken and the agency that did the study.			
	1.5 Flood Risk Assessment	3		
12	Has the State/ UT undertaken any study for assessing risks of flood, particularly for urban flood? Yes/No.	1	1. Yes 2. No	1 0
13	If yes, give the URL if the study report is available online.	2	1. When comprehensive flood risk assessment has been made for the entire State/UT taking into account hazards, vulnerabilities, exposures and capacities 2. When flood risks of major flood prone cities/ towns have been undertaken 3. When no such flood risk assessments have been done	1 0.5 to 1 0
14	If it is not available online, give a brief resume mentioning inter alia the year the study was undertaken and the agency that did it.			
	1.6 Drought Risk Assessment	5		
15	Have the State/ UT undertaken any special study for assessing the risks of drought? Yes/No.	1	1. Yes 2. No	1 0
16	If yes, give the URL of the study report if it is available online.	2	1. When comprehensive drought risk assessment has been made for the State/UT 2. When risk assessment is further downscaled for the districts and blocks 3. When no such drought risk assessment has been done	1 0.5 to 1 0
17	If it is not available online, give a brief resume mentioning inter alia the year the study was undertaken and the agency that did it.			

18	What are the key indicators monitored by the State/ UT for declaring drought? How are data on the indicators collected?	2	1. When State/ UT has developed policy framework for declaration of drought 2. When the policy framework for drought declaration has incorporated guidelines of National Drought Manual 3. When droughts are declared on the basis of traditional method of gird-wari (crop inspection)	1 1 0.5
	1.7 Dissemination of Risk Information to People	3		
19	Give a brief resume of the steps taken by the State/ UT for the dissemination of risk assessment to the general public, particularly at the community level.	3	1. When risk communication is based entirely on public announcements through conventional means including radio and television 2. When modern means of communication, such as ham radio, VSAT, internet, mobile telephony, Satellite Phones etc. are employed for last mile communication	0.5 to 1.5 0.5 to 1.5
	1.8 Assessing Traditional and Local Knowledge	3		
20	Does the State make use of traditional, indigenous and local knowledge for risk assessment? Yes/No.	3	1. When traditional and local knowledge of risks of disasters in the State have been documented. 2. When efforts have been made to integrate traditional knowledge with modern scientific knowledge. 3. When institutional mechanism has been developed for using traditional and local knowledge for risk assessment	0.5 to 1 0.5 to 1 0.5 to 1
21	If yes explain the process for using such knowledge, such as documentation, analysis and integration of such knowledge with scientific knowledge of risk assessment.			
	1.9 Assessing Patterns of Emerging Risks	3		

22	What are the emerging risks of disasters (such as climate change, urban risks, technological risks etc.)? Have these risks been assessed in the State. Give details.	3	1a. When special study has been undertaken to assess pattern of emerging risks of disasters in the State 1b. When such study has been made as part of Hazard Vulnerability Risk Assessment (HRVA). 1c. When no such study has been undertaken. 2a. When such assessments are comprehensive covering all emerging risks, such as climate change, urban, environmental and technological risks. 2b. When such assessments are not so comprehensive	1 0.5 0 1.5 to 2 0.5 to 1
	1.10 Developing Database on Disasters	5		
23	Has the State/ UT developed any database on any aspect of disasters, such as risks or events of disasters or damage and loss due to disasters or impacts thereof?	5	1. When the State/ UT developed database on disasters, which is regularly updated. 2. When disaster database covers both historical and current disasters, both large and small 3. When disaster database provides disaggregated information (hazard-wise, district-wise) on damages to human life, animals, crops, houses, infrastructure, environment etc. 4. When economic losses due to disasters are quantified and its impact on macro-economic situation are assessed.	0.5 to 1 0.5 to 1 0.5 to 2 0.5 to 1
24	If yes, enclose a copy of the same or give the URL if it is available online.			
	Others	5		
25	If the State/ UT has undertaken any other initiative for risk assessment that are not covered by the questions above, give a brief resume of the same.	5	1. All other measures adopted (or not adopted) by the State for risk assessment that are not covered by the 24 questions above shall be assessed on a scale of 0-5	0 to 5

2. Risk Prevention & Mitigation (Weights 20%)

	Indicators/ Questions	Aggregate Points	Criteria for evaluation	Points to be allocated
	2.1 Disaster Risk Mitigation Projects	8		
1	Has the State Govt/UT Adm. implemented any State/UT specific disaster risk mitigation project after 2005? Yes/ No.	8	1. No 2. Yes. If it is Central Sector Scheme (funded 100% by Government of India) 3. Yes. If it is Centrally Sponsored Scheme (funded on sharing basis) 4. Yes. If it is State Sector scheme (funded out of State Government/ UT budget) a. Number of such schemes b. Total investment on such schemes (Note: Based on responses received scores shall be normalised in a scale of 0.5 to 3)	0 1 1 0.5 to 3 0.5 to 3
2	If yes, provide complete details as per Schedule-A attached with the questionnaire.			
	2.2 Mainstreaming DRR in Development	3		
3	Has the SDMA/ State Govt/ UT Adm. issued any general or sector-specific guidelines for integration and mainstreaming of disaster risk reduction in development? Yes/ No.	3	1. When no such guidelines have been issued 2. When guidelines are general 3. When guidelines are sector specific (Note: Based on responses received scores shall be normalised in a scale of 0.5 to 2)	0 1 0.5 to 2
4	If yes, attach copies of these guidelines			
	2.3 State and Disaster Risk Mitigation Fund	3		
5	Has the State Government constituted the State Disaster Mitigation Fund and District Mitigation Fund as mandated by the DM Act? Yes/No.	1	1. When no such fund has been constituted 2. When both State and District Mitigation Funds have been constituted 3. When only State Fund has been constituted 4. When only District Fund has been constituted	0 1 0.5 0.5

6	If yes, provide complete details as per Schedule-B attached with the questionnaire.	1	1. Quantum of such funds allocated during 2006 and 2015 a. State Fund b. District Fund	0.5 to 1 0.5 to 1
7	Has the State/ UT made use of flexi-funds under centrally sponsored programmes for disaster risk management? If so, give details.	1	1. If no 2. If yes, depending on the responses received	0 0.5 to 1
	2.4 Safety standards for constructions and land use	7		
8	Has the State Govt/ UT Adm./ Municipal Bodies incorporated the BIS standards/ National Building Codes regarding earthquake and other hazard resistant construction of houses and infrastructures in relevant codes and bye laws? Yes/No.	5	1. If neither BIS nor NBC standards incorporated in Building Bye Laws 2. If both BIS and NBC standards are incorporated in Building Bye Laws of all municipal and other local bodies throughout the State 3. If these are incorporated partially depending on the extent to which these are incorporated	0 5 0.5 to 4.5
9	If yes, provide details as per Schedule-C attached with the questionnaire.			
10	Has the State Govt/ UT Adm. amended the Town Planning / Urban Development Acts and Regulations to conform to ecologically sensitive and disaster reducing land use standards? Yes/No.	2	1. If neither Town Planning nor Development Act has been amended. 2. If Town Planning Act has been amended, depending on nature of amendments 3. If Development Act has been amended, depending on nature of such amendments	0 0.5 to 1 0.5 to 1
11	If yes, provide details as per Schedule-C attached with the questionnaire.			
	2.5 Safety audit/ retrofitting of life line infrastructure/ buildings	8		
12	Has the State Govt./UT Adm. conducted safety audit of life line structures/ critical infrastructures? Yes/No.	2	1. If no such audit has been conducted. 2. If such audits have been conducted, depending on number of buildings audited	0 0.5 to 2
13	If yes, give total number of such buildings audited as per use of the buildings.			

14	Are earthquake/ other hazard resistant designs and specifications incorporated in the type design of school buildings, dispensaries and social housing schemes for economically weaker sections? Yes/ No.	3	1. If no such hazard resistant type designs developed 2. If hazard resistant type designs developed for schools 3. If hazard resistant type designs developed for dispensaries 4. If n hazard resistant type designs developed for social housing schemes	0 1 1 1
15	If yes, enclose copies of relevant notifications.			
16	Has the State Govt./UT Adm. retrofitted/ strengthened some of these structures? Yes/ No.	3	1. If no such retrofitting has been done 2. If such retrofitting works have been conducted, depending on the number of such buildings retrofitted	0 0.5 to 3
17	If yes, provide details as per Schedule-D attached with the questionnaire.			
	2.6 Construction of cyclone/ flood shelters	3		
18	What are the assessed needs of cyclone/ flood shelters in the State/UT? How many such shelters have been constructed so far?	3	1. Has there been any study to assess the needs for such shelters. If no. 2. Has there been any study to assess the needs for such shelters. If yes. 3. Extent to which such needs have been met (Note: for non-coastal States/ UTs assessment shall be made for flood shelters only)	0 1 0.5 to 2
	2.7 Eco System Approach for Disaster Risk reduction	3		
19	Do the State Govt/ UT Adm. have any plan/guideline/ scheme for eco systems approach (integrated environmental and natural resource management) for disaster risk reduction? Yes/No.	2	1. If no such plan/guideline/schemes have been developed 2. If such plan/guideline/scheme have been developed, depending on the nature of such plan/guideline/ scheme (Note: for non coastal States this will be evaluated on the basis of total score of 3)	0 0.5 to 1.5
20	If yes, enclose copy of relevant plan/guideline/scheme.			

21	What is the total length of coastline in the State/UT? What is the length of coastline that had natural protection of bio-shield like mangroves? Assess the extent of damage, restoration, and regeneration of such bio-shields in the State/UT (Please refer to the sources on the basis of which such assessments are made).	1	1. Depending on the extent of restoration/ regeneration of bio-shield	0.5 to 1
	2.8 Social Safety Net for Poor and Vulnerable	5		
22	What social safety nets are available in the State/UT for protecting vulnerable groups of people like children, aged, disabled, destitute etc from the adverse impacts of disasters?	4	1. When State/ UT is using existing schemes for protecting vulnerable groups, depending on how such schemes are being used. 2. When State/ UT have developed special schemes for protecting vulnerable groups in disasters, depending on how such schemes are being used.	0.5 to 2 0.5 to 2
23	Give a brief resume of the plan/schemes/programmes implemented by the State/ UT to protect the poor, particularly for the restoration of their livelihood during or after disasters.			
24	Do the State Govt/ UT Adm. have any plan/guideline/ scheme for protecting the animals and livestock from the risks of disasters? Yes/No.	1	1. If no such plan/guidelines/scheme is available 2. If such plan/guidelines/scheme is available, depending on its nature	0 0.5 to 1
25	If yes, enclose copy of plan/ guideline/scheme.			
	2.9 Mitigation of risks of heritage	2		
26	Do the State Govt/ UT Adm. have any plan/guideline/ scheme for protecting the monuments, heritage buildings, museums etc. from disasters? Yes/No.	2	1. If no such plan/guidelines/scheme is available 2. If such plan/guidelines/scheme is available, depending on its nature	0 0.5 to 2
27	If yes, enclose copy of plan/ guideline/scheme.			
	2.10 Integration of climate change adaptation with DRR	3		

28	Have the State Govt./UT Adm. taken any steps or measures for integrating disaster risk reduction with climate change adaptation? Yes/No.	3	1.If no such steps/measures have been taken 2. If such steps/ measures have been taken, depending on its nature	0 0.5 to 3
29	If yes, give a brief narrative of such integration.			
	Others	5		
30	What has been the overall impact of disaster risk reduction initiatives in the State in terms of number of deaths, affected and economic losses in disasters? Please provide details as per Schedule-E attached with the questionnaire.	1	1. Overall impact in reducing risks of disasters, based on data provided for past 25 years	0 to 1
31	Is the State Govt./UT Adm. promoting mechanisms for risk transfer such insurance/ micro-insurance etc. If so, give details.	2	1. If no such mechanisms are promoted. 2. If such mechanisms are promoted, depending on the nature and coverage of the mechanisms	0 0.5 to 2
32	If the State/ UT Adm. have implemented any other measures for risk prevention and mitigation (other than those already mentioned in the response to the questionnaire), please provide details. (Use separate sheet if required).	2	1. All other measures for risk prevention and mitigation that are not covered by the questions above	0.5 to 2

3. Risk Governance (Weights 20%)

	Indicators/ Questions	Aggre- gate Points	Criteria for evaluation	Points to be allocated
	3.1 Institutional mecha- nisms for risk governance	6		
1	Mention date-month-year of constitution of SDMA, SEC and DDMA's	1	1. If these bodies have not been consti- tuted 2. If constituted within 6 months of the coming into force of the DM Act 3. If constituted after 6 months of the coming into force of the DM Act	0 1 0.5
2	How many times SDMA has met year-wise since its consti- tution?	1	1. If it has never met 2. If it has met at least once in a year on an average 3. If it has met less than once in a year on an average	0 1 0.5
	Year No. of Meetings Year No. of Meetings			
3	Has the SDMA constituted its Advisory Committee? Yes/ No	0.5	1. No 2. Yes	0 0.5
4	Does SDMA have its dedicated staff? Yes/ No	2	1. If SDMA does not have any dedicated staff of its own 2. When SDMA has its dedicated staff, depending on the strength of such staff	0 0.5 to 2
5	If yes, give details.			
6	How many times the SEC has met year-wise since its consti- tution?	1	4. If it has never met 5. If it has met at least once in a year on an average 6. If it has met less than once in a year on an average	0 1 0.5
	Year No. of Meetings Year No. of Meetings			
7	Has the SEC constituted its Sub-Committees? Yes/ No	0.5	3. No 4. Yes	0 0.5
	3.2 Disaster Management Policy and Plans	10		

8	Has the SDMA laid down State Disaster Management Policy? Yes/No	1	1. When no such policy has been laid down 2. When such State Policy on Disaster Management has been developed, de- pending on the type and status of such Policy	0 0.5 to 1
9	If yes, attach a copy of the Policy document.			
10	How many guidelines have been laid down by the SDMA? Give details along with copies or URL if these are available on line.	1	1. When no such guidelines have been laid down 2. When such guidelines have been developed, depending on the number and nature of such guidelines	0 0.5 to 1
11	Does the State/UT have a State Disaster Management Plan? Yes/ No	2	1. If the State/ UT does not have a DM Plan 2. If the State has a DM Plan 3. If the State DM Plan has been revised depending on the number of times the Plan has been revised a. Once b. More than once	0 1 0.5 to 1
12	If yes, when was the Plan pre- pared and revised/ updated? Give URL of the plan.			
13	How many Departments are there in the State Govern- ment?	3	1. When none of the Departments has prepared their DM Plans 2. When less than one third of the Departments have prepared their DM Plans 3. When more than one third of the Departments have prepared their DM Plans 4. When all the Departments have pre- pared their DM Plans 5. When none of the Departments has revised their DM Plans 6. When less than half of the Depart- ments have revised their DM Plans 7. When more than half of the Depart- ments have prepared their DM Plans	0 0.5 1 2 0 0.5 1
14	How many Departments have prepared Departmental Disas- ter Management Plan?			
	Name of Department Year of Preparation of First Plan Year of Revision			

15	How many districts are there in the State/ UT? How many districts have prepared District Disaster Management Plans? Give details.	13	1. When none of the Districts has prepared their DM Plans 2. When less than one third of the Districts have prepared their DM Plans 3. When more than one third but less than 100% of the Districts have prepared their DM Plans 4. When all the districts have prepared their DM Plans 8. When none of the districts has revised their DM Plans 9. When less than half of the Districts have revised their DM Plans 10. When more than half of the Districts have prepared their DM Plans	0 0.5 1 2 0 0.5 1
	3.3 Disaster Management Manuals and Procedures	2		
16	Has the State/ UT developed Manuals and Standard Operating Procedures, such as Relief Manual, SOP for Disaster Response, SOP for Emergency Operating Procedures etc? Give complete details of all the Manuals and SOPs along with URL.	2	1. If not a single Manual/ SOP has been developed 2. If such Manuals/ SOPs have been developed, depending on the number and nature of such Manuals/ SOPs	0 0.5 to 2
	3.4 Decentralisation and Devolution of Functions	2		
17	How are the Municipalities and Panchayats involved with disaster risk management in the State/UT? Has the State Govt./UT Adm. devolved any functions or resources to these self-governing institutions for disaster management? If so, give details.	2	1. When the State/UT has not devolved any function or resources to the urban and rural local bodies for disaster management 2. When the State/UT has devolved only some functions of disaster management 3. When the State/UT has devolved both functions and resources for disaster management	
	3.5 Training and Capacity Development	10		

18	Has the State/UT set up any Institute/Centre/Cell for training and capacity development of the functionaries of the government, its agencies and other stakeholders? Provide details as per Schedule-F.	5	1. If no such facility for training and capacity development of government functionaries are available 2. When such facilities are available, works done during 2005-15 a. No. of training programmes conducted b. No. of persons trained c. % of MHA/NIDM/TFC funds utilized for training d. Number of training faculty engaged	0 0.5 to 1.5 0.5 to 1.5 0.5 to 1 0.5 to 1
19	Is disaster management included in the entry/induction level training curriculum of State Administrative Services and in sectoral training programmes of all relevant development departments? If so, give details.	2	1. If disaster management is not included in the training curriculum 2. If it is included in both induction and in service training programmes of administrative service personnel 3. If it is included in training programmes of sectoral officers, depending on the number of sectors covered in such programmes.	0 0.5 to 1 0.5 to 1
20	Has the State Govt./UT Adm. introduced Disaster Management in the curriculum of school education in the schools? Yes/No.	1.5	1. If it is not included in the curriculum of school education 2. If included actual progress, depending on a. year of introduction, b. level of curriculum, and c. development of text books in local language	0 0.5 to 1.5
21	If yes, give the year of introduction of the curriculum, the class/level where such curriculum has been introduced. Further mention if text books have been developed in local language for this purpose.			
22	Is disaster risk management included in the curriculum of higher education in the State/ UT? If so, give details of the streams/subjects of higher/ technical education where such inclusions have taken place.	1.5	1. If it is not included in the curriculum of higher education 2. If it is included in general stream of graduate education 3. If it is included in engineering education 4. If it is included in medical education	0 0.5 0.5 0.5

	3.6 Multi-Stakeholder Platform	2		
23	Does the State/UT have multi-stakeholder coordination forum like State Platform for Disaster Risk Reduction? If so, give details, such as composition of the forum, date of constitution, and number of meetings it had so far.	1	1. If no such multi-stakeholder platform has been set up 2. If such platform has been set, depending on its activities	0 0.5 to 1
24	Is there any mechanism for private sector engagement for disaster risk management in the State/ UT? If so, give details.	1	1. If no such mechanism is available 2. If such mechanism is available, depending on its effectiveness	0 0.5 to 1
	3.7 Community Involvement and Participation	5		
25	Has the State/ UT developed any mechanism for the involvement and participation of the communities, civil society, NGOs, volunteers etc in disaster management? If so, give details.	5	1. Mechanism for preparation of Community Based Disaster Management Plans and its effectiveness a. Are local level DM plans prepared? b. Are local level DM plans funded and implemented? c. Are local level DM Plans monitored? 2. System for involvement of civil society/ NGOs in disaster management a. Are there guidelines for NGO involvements b. Is GO-NGO coordination mechanism available? 3. System for involvement of volunteers in disaster management a. Are there guidelines for involving volunteers in disaster management? b. How are such involvements coordinated?	0 to 3 0 to 1 0 to 1
	3.8 Enforcement and Compliance	4		

26	Has the State/UT or its agencies devised any mechanisms or incentives to ensure high levels of compliance with the safety-enhancing codes and regulations, such as building codes and zoning regulations? Yes/No.	2	1. If no such incentives are available 2. Nature of such incentives a. Rewards such as property tax concessions b. Punishments, such as penalties, demolitions etc 3. Effectiveness of such incentives	0 0.5 to 1 0.5 to 1
27	If yes, give details of such incentives.			
28	Has the State/UT evaluated the effectiveness of enforcement of the safety-enhancing codes and regulations, such as building codes and zoning regulations? Yes/No.	2	1. If no such evaluation has been conducted 2. When evaluations of both building codes and zoning regulations have been conducted 3. When findings of evaluations have been considered for improving the system	0 0.5 to 1 0.5 to 1
29	If yes, enclose a copy of the evaluation report.			
	3.9 Monitoring and Evaluation	2		
30	Has the CAG or Parliamentary Committee conducted any Performance Audit/ Review of the functioning of disaster management system of the State? Yes/No.	2	1. When no such monitoring and evaluation system of disaster management is in place 2. When such system is in place, results of performance appraisal	0 0.5 to 2
31	If yes, what were the main findings? Give citations of the report such as name of Committee, title of the report, year of publication etc. Provide link to the URL if it is available online.			
	3.10 Transparency and Accountability	2		
32	What are the mechanisms, and processes developed by the State/UT to ensure transparency and accountability in the delivery of relief and other disaster management services to the people affected by disasters? Give details.	2	1. Is any system in place for ensuring transparency and accountability of disaster management 2. Effectiveness of the system, as borne out from the response from the State	0.5 to 1 0.5 to 1

	Others	5		
33	Mention any other initiative taken by the State Govt/UT Adm. for improving the system of risk governance.	5	1. Assessment of the innovation and effectiveness of the initiatives.	

4. Disaster Preparedness (Weights 20%)

	Indicators/ Questions	Aggregate Points	Criteria for evaluation	Points to be allocated
	4.1 End-to-End Early Warning Systems	5		
1	While central agencies like IMD, CWC, GSI, INCOIS etc are responsible for early warning of most of the major hazards, it is the responsibility of the State Govt./UT Adm. to ensure that such warnings are communicated to the people, down to the last mile in urban and rural areas by every possible means. Give a brief resume of the technical, administrative and logistic arrangements made by the State government for dissemination of early warning of various types of hazards in the State.	4	1. Arrangement for dissemination of Early Warning of disasters to the last mile a. Technical arrangements b. Logistic arrangements c. Administrative arrangements	0 to 2 0 to 1 0 to 1
2	Has any general or specific guideline or SOP been issued for dissemination of early warnings of various types of hazards to the people in the State? Yes/No.	1	1. When no such guidelines have been issued 2. When guidelines have been issued, depending on the comprehensiveness of the guidelines	0 0.5 to 1
3	If yes, enclose a copy of the guidelines.			
	4.2 Emergency Operation Centres	5		

4	Has the State Govt./UT Adm. set up Emergency Operation Centre at the State, Metro and District levels equipped with modern communication and other facilities? If so, give details of these facilities as per Schedule G.	4	1. When EOCs have not been set up 2. When EOC has been set up only at the State Level 3. When EOCs have been set up at State, District and Metro levels 4. When EOCs are equipped with modern and communication facilities, depending on the nature of these facilities.	0 1 1 to 3 0.5 to 2
5	Has any Standard Operating Procedure been developed for the operation and management of Emergency Operation Centres? Yes/No.		1. When no such guidelines have been issued 2. When guidelines have been issued, depending on the comprehensiveness of the guidelines	0 0.5 to 1
6	If yes, enclose a copy of the same.			
	4.3 Disaster Communication System	5		
7	Information and Communication Technology (ICT) plays important role in disaster risk management – before, during and after disasters. Give a brief resume on the initiatives taken by the State/ UT for the application of ICT for disaster management.	5	1. When there are no such initiatives 2. ICT initiatives pre disaster, depending on the nature of such initiatives 3. ICT initiatives during disasters, depending on the nature of such initiatives 4. ICT initiatives post disasters, depending on the nature of such initiatives	0 0.5 to 2 0.5 to 2 0.5 to 1
	4.4 Emergency Medical Preparedness	5		
8	How many government hospitals are in operation at the state and district level in the State/UT? How many of them have developed Emergency Medical Preparedness as per the guidelines of NDMA? Provide URL for accessing the plans.	2	1. When none of the hospitals has disaster medical preparedness plan developed 2. When some of the hospitals have such plans, depending on the number of hospitals having disaster medical preparedness plan and comprehensiveness of such plans	0 0.5 to 2

9	What steps have been taken for training and capacity building of the medical and para-medical staff of the hospitals for emergency medical preparedness, including trauma management and triage? Give details.	2	1. When no such steps have been taken 2. When some steps have been taken for training medical and para-medical staff, depending on the nature, duration and coverage of such training	0 0.5 to 2
10	Has the State developed any post-disaster disease surveillance system? If so, give details.	1	1. If no 2. If yes, depending on the scope of such system	0 0.5 to 1
	4.5 Scenario Building, Simulation and Mock Drills	5		
11	Have the State/ UT developed worst case scenarios/ simulations of various possible disasters in the State? Yes/No.	2	1. If no such scenarios/ simulations of probable disasters have been developed 2. If such scenarios/simulations have been developed, depending on the nature and scope of such exercises	0 0.5 to 2
12	If yes, give the type of hazards for which scenarios have been developed. Enclose copies of the same if these are available.			
13	How many mock drills have been conducted by the SDMA/ DDMA in the State annually since 2006? Give details.	3	1. Number of such mock drills conducted in the state since 2006. (Note: Annual average normalised according to area and population of the State)	0.5 To 3
	4.6 Contingency Plans, SOPs, Manuals			
14	Give a complete list of Contingency Plans, Standard Operating Procedures and Manuals on various aspects of disaster management developed by the State Government/ SDMA.	5	1. If not a single Manual/ SOP has been developed 2. If such Contingency Plans/Manuals/ SOPs have been developed, depending on the number and nature of such Contingency Plans/Manuals/ SOPs	0 0.5 to 5
	4.7 Community Based Disaster Preparedness	5		

15	What measures have been taken for strengthening community based disaster preparedness in the State? Give details.	5	1. When no mechanism is in place for preparation of Community Based Disaster Preparedness Plan 2. When mechanism for CBDP exists: a. Are there guidelines for CBDP? b. Is this institutionalised? c. Is this funded? d. Does it cover the entire State? e. Are local level DM drills organised?	0 0.5 to 5
	4.8 Awareness Generation	5		
16	What measures have been taken for raising awareness of the common people about the measures to be taken for disaster preparedness? Give details.	5	1. Is there any policy or plan for raising awareness of common people on disaster preparedness? 2. What are the strategic interventions for awareness generation? a. Campaigns b. Drills c. Observation of DRR day d. Other measures	1 0.5 to 4
	4.9 Resource Inventory	3		
17	Has the State prepared inventory of material and human resources available with various public and private entities that can be made use for managing disasters? Yes/No.	3	1. When no such inventory has been made 2. % of districts registered with IDRN 3. Status of updating of inventories	0 0.5 to 1 0.5 to 2
18	Are these inventories registered with India Disaster Resource Network (IDRN)? Give the district-wise dates of last updates of IDRN.			

	4.10 Media Partnership	2		
19	Media can play important role in dissemination of information and knowledge in all phases of disaster management. Both the national policy and nation plan have highlighted the critical role of print and electronic media in disaster management. Has the State Govt./District Adm. developed any guidelines or strategy for media partnership? Give details.	2	1. When no such guidelines or strategy is in place. 2. When there are strategies for media partnership, its effectiveness in terms of a. Communicating risks for pre-disaster mitigation and preparedness b. Communicating correct information about disaster loss and response c. Raising awareness for mobilization of resources for humanitarian response	0 0.5 to 2
	Others	5		
20	Mention any other initiative taken by the State Govt./UT Adm. for strengthening disaster preparedness in the State.	5	1. Any innovative measures taken by the State Govt./UT Adm. for strengthening disaster preparedness in the State, depending on the effectiveness of such innovation	0.5 to 5

5. Disaster Response (Weights 10%)

	Indicators/ Questions	Aggre- gate Points	Criteria for evaluation	Points to be allocated
	5.1 State Agencies for Disaster Response	10		
1	Has the State constituted a specialized State Disaster Response Force? Yes/No.	4	1. When no such specialized State Disaster Response Force has been constituted. 2. When SDRF has been constituted, its profile in terms of a. Year of constitution b. Strength c. Equipment d. Training	0 0.5 to 4
2	If yes, give details such as year of constitution, strength of the force, equipments provided and arrangements made for training.			
3	Is disaster management included in the training curriculum of State Police at all levels? Yes/No.	2	1. When disaster management is not included in the training curriculum of State Police 2. When disaster management is included in the training curriculum: a. Type: (induction, in service) b. Level: (higher, middle, lower)	0 0.5 to 2
4	If so, give details			
5	Has the Fire Services been upgraded to acquire multi-hazard rescue capability? Yes/No.	2	1. When no such upgrading has taken place 2. When fire services has been upgraded as multi-hazard rescue team, whether a. Fire fighters have been trained/ retrained b. Fire services have been equipped to discharge new role	0 0.5 to 2
6	If so, give details.			

7	Civil Defence Act was amended in 2009 to enable the provisions of the Act to be applied during disasters. This requires expansion of the network of civil defence to all districts and reorientation and training of the civil defence volunteers. What actions have been taken in the State to reorient the civil defence for this new role?	2	1. Has the Civil Defence expanded to every district? 2. Has Civil Defence been trained to discharge new role	0.5 to 1 0.5 to 1
	5.2 Incident Response System	4		
8	Govt. of India had decided in 2002 to introduce Incident Command System for responding to disaster situations and trained a large number of administrators of State Govt./UT Adm. on different facets of incident management. National Policy on Disaster Management 2009 endorsed the system and National Guidelines on Incident Response System was issued in 2010 for adapting the system in the context of our administrative system. What steps have been taken by the State Govt./UT Adm. to introduce the system in the State? What is the current status of implementation of the guidelines in terms of training and actual practice during emergency situations?	4	1. When IRS is not introduced/ practised in the State 2. When IRS has been introduced, the current status in terms: a. Notifications/ Guidelines issued for introduction of IRS b. Number of trained IRS teams available in the State. c. Number of districts where IRS teams are available d. Number of occasions IRS has been practised for dealing with emergency situations	0 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1

	5.3 Coordination with GOI, NDRF Armed, Forces	2		
9	Catastrophic or major disasters may overwhelm the capacity of the State Govt./UT Adm. to respond effectively, requiring assistance of Central Govt. and its agencies like the NDRF and the Armed Force.	2	1. When no such institutionalised mechanisms for liaison and coordination has been set up 2. When mechanisms have been set up, its effectiveness in terms of a. Regular meetings b. Actual operations	0 0.5 to 2
	5.4 Evacuation, Search and Rescue	7		
10	Disaster mortalities can be reduced considerably if contingency plans are in place regarding quick assessment of evacuation needs, identification of temporary shelters, determination of evacuation routes, mobilization of transportation arrangements; preparation of check lists etc Is such contingency plan for evacuation available? Yes/No.	4	1. When no such contingency plan is in place 2. When contingency plan is available, whether the plan takes into account the following: a. Needs of evacuation in different disaster situations b. Evacuation routes c. Identification of temporary shelters d. Other check list of activities	0 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1
11	If yes, enclose copy of the Contingency Plan.			
12	Searching and rescuing people marooned in flooded areas or trapped in collapsed structures or debris is a specialized jobs requiring equipments, training, drills etc. To what extent are the concerned agencies of the State equipped and trained to handle such operations? Give details.	3	The extent to which SDRF and/or other agencies responsible for search and rescue have capacity to handle such operations in terms a. Personnel b. Training c. Equipments	0.5 to 1 0.5 to 1 0.5 to 1
	5.5 Emergency Medical Response	5		

13	Immediate impact of disasters is the surge of persons of different age group inflicted with severe and minor injuries for treatment in hospitals. Many such injuries may require medical attention even before hospitalization. This requires operational readiness of medical response teams, availability of ambulance, heli-ambulance and other logistic arrangements. What is the status of such operational readiness of medical response? Give an account of the achievements and challenges.	5	Effectiveness of emergency medical response in terms of: a. Emergency medical response plan of State/district/hospitals b. Availability of trained doctors and para-medical staff c. Well equipped trauma centres d. Ambulance/ heli-ambulance e. Other logistic arrangements	0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1
	5.6 Emergency Support Functions	5		
14	Disaster response is not the job of responders alone. It requires performance of Emergency Support Functions (ESF) by the line departments and agencies, such as restoration of electricity, water supply and sanitation system, telecommunication, road and transportation network, supply chain of food and other essential items etc. Has the State Govt./UT Adm. prepared check lists of ESF, identified primary and secondary agencies and functionaries for the performance of these functions, outlined the process and timeline to be followed and provided resources for the same? Have the agencies made pre-arrangements for advance procurement of materials needed for such functions? Give details.	5	Pre-arrangements for the performance of Emergency Support Functions post-disasters: a. Preparation of check lists of activities of Emergency Support Functions b. Identification of primary and secondary agencies responsible for performance of these functions c. Process to be followed for performance of these functions d. Timeline for performance of these functions e. Operational agencies of the agencies for performance of these functions	0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1

	5.7 Protection of vulnerable women and children	5		
15	Vulnerable women and children often become victims of trafficking and sexual abuse after disasters. Is a surveillance system in place in the State/ UT for preventing such abuses and protecting the vulnerable? If so give details.	5	1. When no such surveillance system is in place 2. When there is a surveillance system, how effective is this system in terms of: a. Whether institutional arrangements are available for surveillance b. Whether system is in place for identification of vulnerable women and children who need protection post disasters c. Whether there is system for rescuing trafficked women and children d. Whether there are arrangements for rehabilitation of trafficked women and children. e. How many vulnerable women and children have been protected from trafficking post disasters in the State.	0 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1
	5.8 Disposal of dead bodies	3		
16	In the event of mass casualties in disasters proper collection, preservation, storage, identification and disposal of dead bodies according to the religious customs and rites of the deceased are ethical as well as legal issues. Has the State Govt./UT Adm. issued any guidelines to be followed in this regard? Yes/No.	3	1. When there are no such guidelines 2. When the guidelines are there, do these cover issues like: a. Identification of dead bodies b. Preservation of DNA of unclaimed bodies c. Mass funeral, following religious rites	0 0.5 to 1 0.5 to 1 0.5 to 1
17	If yes, enclose a copy of the guidelines.			
	5.9 Disposal of Animal Carcasses	2		

18	Proper removal and disposal of animal carcasses at pre-identified sites is important to ensure that no health hazards are created to the staff as well as general public. Has the State Govt./UT Adm. issued any guidelines to be followed in this regard? Yes/No.	2	1. When no such guidelines have been issued. 2. When the guidelines are there, do these cover issues like: a. There are pre-identified sites for disposal of animal carcasses b. There are arrangements for protecting	0 0.5 to 1 0.5 to 1
19	If yes, enclose a copy of the guidelines.			
	5.10 Disposal of Debris	2		
20	Major disasters like earthquakes and cyclones may cause widespread destruction of built up structures like houses and infrastructure as well as natural assets like trees and plantations. Removal and disposal of construction debris and fallen trees can be problematic in many urban areas where open sites are not available so easily unless these are pre-identified. Much of these materials can be also be recycled. Does the State Govt./UT Adm. or the municipal authorities have any plan for management of the debris? Yes/No.	2	1. When there is no such plan 3. When there are plans, does this cover issues like: a. There are pre-identified sites for disposal of debris b. There are arrangements for recycling debris	0 0.5 to 1 0.5 to 1
21	If yes, enclose a copy of the guidelines.			
	Others	5		
22.	Mention any other initiative taken by the State Govt./UT Adm. for effective response to disasters in the State.	5	1. Any innovative measures taken by the State Govt./UT Adm. for strengthening disaster response in the State, depending on the effectiveness of such innovation.	0.5 to 5

6. Disaster Relief & Rehabilitation (Weights 15%)

	Indicators/ Questions	Aggregate Points	Criteria for evaluation	Points to be allocated
	6.1 Minimum Standard of Relief	2		
1	Has the State Disaster Management Authority laid down guidelines for providing standards of relief to persons affected by disasters in the State, as provided in section 19 of Disaster Management Act? Yes/No.	2	1. When no such guidelines have been issued 2. When guideline endorses norms prescribed by NDMA/SDRF/NDRF 3. When guideline prescribes higher standards of relief	0 1 2
2	If yes, enclose a copy of the guidelines.			
	6.2 Ex-gratia Relief	1		
3	Government of India has fixed norms of ex-gratia relief under State Disaster Response Fund and National Disaster Response Fund. Do the State Government/ UT Adm. provide additional ex-gratia relief over and above such norms? If so give details.	1	1. When State Government/ UT Adm. provide additional ex-gratia relief over and above SDRF/NDRF norms.	1
	6.3 Relief Logistics and Supply Chain Management	7		
4	Timely procurement, packaging, transportation, storage and distribution of relief materials immediately as the need arises make it imperative that there are well laid down operating procedures and manuals on relief logistics and supply chain management. Do the State Govt./UT Adm. have such SOP/ Manuals. Yes/No.	4	1. When no such Manual/ SOP is available 2. When Manual/SOP is in place 3. Whether Manual/SOP covers issues like a. Stockpiling of essential relief materials b. Pre-tendering for supply of essential relief materials c. Packaging of relief materials for easy distribution d. Decentralised storage/ transportation of relief materials e. Procedure for distribution of relief materials	0 1 0.5 0.5 0.5 0.5 0.5

5	If yes, enclose a copy of SOP/ Manual or give link to the online resource.			
6	Major disasters attract humanitarian assistance, often in kind, from all over the world, Receiving, sorting, transporting and distributing these materials to the neediest in a transparent manner is quite challenging. Has the State Govt./UT Adm. evolved any guidelines to deal with such situations? Yes/No.	3	1. When no such guidelines have been developed 2. When guidelines are available, whether it covers issues like a. Receiving/ sorting/ repackaging relief materials b. Norms for fair distribution of relief materials c. Transparency in distribution of relief materials d. Involvement of NGOs in such operations	0 1 0.5 0.5 0.5 0.5
7	If yes, enclose a copy of the guidelines.			
	6.4 Food and Essential Supplies	7		
8	Supply of food including cooked food and other essential items to the affected people is one of the major functions of disaster relief. This involves procurement, storage, transportation and distribution of food in a transparent and accountable manner. This further involves pre-agreements/ MoUs with organisations, trusts and firms for setting up community kitchens in the affected areas. Describe the policies and practices followed in this regard, with special reference to any innovative practice introduced for better delivery of services.	7	1. Whether Relief Manual/ SOP/ practices of the State/ UT covers issues like the following: a. Minimum standards of food/ cooked food to be provided to the victims b. Special needs of children, pregnant and lactating mothers c. Special needs of old, sick etc. d. Pre-agreements/ MOUs etc with NGOs for setting up community kitchens e. Arrangements for dry food when cooked food cannot be served f. Involvement of the victims for deciding choice of foods g. System for feedback and monitoring for continuous improvement	0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1

	6.5 Drinking Water, Dewatering and Sanitation	7		
9	Supply of clean drinking water to disaster affected areas is extremely important to prevent water borne diseases. Every State/ UT faces its own challenge. Describe the minimum standards of the State for supply of drinking water to people affected by disasters and assess the compliance of the standards.	3	1. Alternate arrangements for supply of drinking water when normal arrangements are disrupted in disaster a. Water trains b. Water tankers c. Packaged water d. Other innovative measures 2. Mechanisms to ensure that water is free from impurities and safe to drink a. Mechanical/ electrical water purifiers b. Chlorination c. Other innovative measures	0.5 to 1.5 0.5 to 1.5
10	Providing sanitation facilities to men and women, particularly those in relief camps, is another important aspect of public health. Describe the minimum standards adopted by the State for providing sanitation services to people affected by disasters and assess the compliance of the standards.	3	1. Minimum standards of sanitation in relief camps a. Adequate number of toilets b. Separate toilets for men and women c. Provision of water d. Arrangements for regular cleanliness e. Provision for sanitary napkins for girls/women f. Arrangements for solid waste management	0.5 0.5 0.5 0.5 0.5 0.5
11	Dewatering of flooded areas in urban pockets that have no outlets can be critical for public health as well as safety of lives and structures. Do the State/ UT face such situations? How does it address the problem?	1	1. Mechanisms for dewatering of flooded areas, particularly in cities	0.5 to 1

	6.6 Health and Mental Health Care	7		
12	Health care of disaster affected pregnant and lactating mothers, neo-natal, aged and those suffering from chronic diseases should receive priority in health care as they suffer from double jeopardy. Do the State Govt./UT Adm. provide special dispensation for such people? If so give details.	5	1. Health care arrangements for disaster affected people, particularly for a. Pregnant and lactating mothers b. Neo-natal children c. Senior and very senior citizens d. Persons suffering from chronic diseases	0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1
13	Mental health care of the affected people suffering from Post Traumatic Stress Disorder (PTSD) is crucial at the initial stage for diagnosis and treatment. Have the State Govt./UT Adm. made arrangements for expert psycho-social counselling of such people? If so give details.	2	1. Availability of facilities for psycho-social counselling for PTSD: a. Are these facilities available to disaster affected as part of relief and rehabilitation measures? b. Is there regular tie up with mental hospitals in the State and outside?	0.5 to 1 0.5 to 1
	6.7 Management of Relief Camps	5		
14	Provision of basic shelter, food, water and health care does not solve the problems of people in temporary relief camps, as there are many other issues, such as privacy, safety, security, gender based violence etc. that should also be addressed. These issues can be attended only if there are proper guidelines for management of relief camps. Have the State Govt./UT Adm. developed such guidelines? Yes/No.	5	1. When there are no such guidelines 2. When guidelines have been issued, whether the following issues are covered? a. Safety and security of camp dwellers b. Privacy of dwellers, particularly women dwellers c. Mechanism for redressing grievances d. Participatory management of camps e. Supervision and monitoring arrangements	0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1
15	If yes, enclose a copy of the guidelines on the management of the relief camps.			

	6.8 Veterinary Care	3		
16	Veterinary care for disaster affected livestock and animals, including wild animals and arrangements for their evacuation, shelter, fodder / feed etc. are important for rehabilitation of animals. Do the State Govt./UT Adm. have any plan or guidelines for animal care during disasters. Yes/ No.	3	1. When no such guidelines are available 2. When guidelines are available, whether the following aspects are covered a. Evacuation and rescue of domestic animals and pets b. Arrangements for fodder and feeds c. Rescue, rehabilitation and safe passage of wild animals	0.5 to 1 0.5 to 1 0.5 to 1
17	If yes, enclose a copy of the plan/guidelines.			
	6.9 Relief Employment	3		
18	People affected by disasters often lose their livelihood. Relief employment under MN-REGA is one of the several avenues for providing alternate source of livelihood to the affected people. What are the alternative avenues developed by the State Govt./UT Adm. for providing relief employment to the people? How many man days of relief employment have been provided in the State since 2006 under different schemes/ programmes? Give details.	3	1. Alternate livelihood arrangements for disaster affected people a. MNREGA b. Other schemes 2. Man days of relief employment generated	0.5 to 2 0.5 to 1
	6.10 Temporary and Intermediary Shelters	3		

19	In case of devastating disasters when the period of stay in temporary shelters is likely to be long and uncertain, or where extreme weather conditions can be life-threatening, construction of intermediary shelters shall become necessary. Did the State Govt./UT Adm. have to construct such intermediary shelters anytime in the past? Give year-wise details from 2006 onwards. Based on the experiences gained, has any general or specific guidelines been issued for future? If so give details.	3	1. Guidelines on temporary or intermediary shelters issued, if any 2. Experiences and practices 3. Innovations carried out, if any	0.5 to 1 0.5 to 1 0.5 to 1
	Others	5		
20	Mention any other initiative taken by the State Govt./UT Adm. for relief and rehabilitation of people affected by disasters in the State.	5	2. Any innovative measures taken by the State Govt./UT Adm. for strengthening disaster relief and rehabilitation in the State, depending on the effectiveness of such innovation.	0.5 - 5

7. Disaster Reconstruction (Weights 5%)

	Indicators/ Questions	Aggregate Points	Criteria for evaluation	Points to be allocated
	7.1 Damage and Loss Assessment	5		
1	How are the damage and losses in disasters assessed in the State/ UT?		1. When structured guidelines for assessment of are available, depending on the comprehensiveness of the guidelines	0.5 to 1
2	Are there any guidelines or manual for damage and loss assessment in disasters? Yes/ No.		2. How assessments are made of damages and losses of the following due to disasters: a. Human and animal lives b. Houses and infrastructure c. Production and services d. Livelihood e. Environmental assets f. Cultural assets g. Macro-economic losses h. Other socio-economic losses	0.5 to 4
3	If yes, enclose a copy of the guidelines.			
	7.2 Post Disaster Need Assessment	5		
4	How are the needs for post disaster recovery and reconstruction assessed in the State/ UT?	3	1. When structured guidelines for assessing needs of post-disaster recovery and reconstruction are available, depending on the comprehensiveness of the guidelines.	0.5 to 1
5	Are there any guidelines or manual for such Post Disaster Need Assessment? Yes/No.		2. When no such guidelines are available, how are such assessments made, depending on the quality of such assessments.	0.5 to 2
6	If yes, so enclose a copy of the guidelines.			
7	Do the State/ UT have a policy or framework for post-disaster recovery and reconstruction? Yes/No.	2	1. When no such framework is available	0
8	If yes, enclose a copy of the framework.		2. When a framework is available depending on the comprehensiveness of the framework	0.5 to 2

	7.3 Financing Reconstruction	5		
9	Post disaster reconstruction is not permissible under the norms of SDRF/NDRF. How such reconstructions are financed in the State/ UT? How many such reconstruction projects have been implemented in the State since 2006? Give details stating inter alia the costs incurred on each reconstruction project, period of implementation of the projects and the sources for mobilization of the fund.	5	1. Methods adopted for financing post-disaster reconstruction: a. State budgetary allocation b. Central assistance c. Institutional finance d. Support of World Bank/ ADB e. CSR support f. Other sources 2. Experiences with post-disaster reconstruction a. Financing b. Implementation	0.5 to 3 0.5 to 2
	7.4 Institutional Mechanisms for Reconstruction	5		
10	How is reconstruction projects implemented in the State/UT? Give a brief description of the institutional mechanism(s) adopted in the State for the implementation of such projects.	5	1. Effectiveness of institutional mechanisms for post-disaster reconstruction a. When dedicated institution has been created for planning, coordination and monitoring of reconstruction b. When dedicated institution has been created for implementation as well c. When reconstruction is got done through line departments d. When no such mechanism is available	0.5 to 5
	7.5 Building Back Better	5		

11	Do the State/ UT consistently follow the principle 'Build Back Better' in post-disaster construction projects? Give examples of practical application of the principles in past reconstruction projects.	3	1. When principle of build back better is followed consistently in all reconstruction projects and across all sectors as a matter of State Policy. 2. When it is followed only in major projects of reconstruction 3. When it is not followed at all	1.5 to 3 0.5 to 1 0
12	How have the reconstructed towns and villages behaved in repeat occurrences of disasters? Give examples from the reconstruction experiences of the past.	2	1. Evaluation of reconstruction projects of the State, based on the materials made available by the State Govt./ UT Adm.	0 to 2
	7.6 Reconstruction of Houses	5		
13	What strategies are followed for reconstruction of damaged houses? Are the houses reconstructed by the agencies of the government or by the owners themselves? How it is ensured that owners reconstruct their houses as per disaster resistant designs and technology?	2	1. When there are no strategies for reconstruction of damaged houses. 2. When well defined strategies for reconstruction of damaged houses are available. 3. When such strategies are followed: a. In all reconstruction projects. b. In some reconstruction projects	0 0.5 to 1 0.5 to 1
14	What material and financial supports are provided by the government to facilitate reconstruction of houses damaged in disasters?	2	1. When support is provided by the government for reconstruction of damaged houses only as per SDRF norms 2. When additional support is provided by government in terms of a. Finance b. Materials c. Technical standards of design and specification	0.5 0.5 to 2
15	Are the reconstructed houses insured? Are these registered jointly in the name of present owner and spouse?	1	1. When there is no such insurance 2. When houses are insured only in major reconstruction projects 3. When houses are insured only in major reconstruction projects	0 0.5 1

	7.7 Reconstruction of Infrastructure	5		
16	What is the strategic approach of the State Govt./ UT Adm. for reconstruction of damaged physical and social infrastructure? Are these reconstructed as per original plan and design or redesigned to provide additional elements of safety and resilience? Give examples from the reconstruction experiences of the past..	5	1. When there are no strategies for reconstruction of damaged infrastructure 2. When well defined strategies for reconstruction of damaged infrastructure are available. a. What are the additional elements of safety and resilience that are built in reconstruction projects? b. What are the demonstrated effectiveness of such projects?	0 0.5 to 1 0.5 to 3 0.5 to 2
	7.8 Livelihood Reconstruction	5		
17	Disasters impact on the livelihood of people such as farmers, artisans, women headed households, and people belonging to marginalised and vulnerable sections. What strategic approach is followed for reconstruction of damaged livelihoods? Give examples from the reconstruction experiences of the past.	5	1. When there are no strategies for reconstruction of livelihoods of affected people and communities. 2. When strategic approach has been developed, the effectiveness of the approach in reconstructing livelihoods of affected people in terms of: a. Reviving damaged livelihoods b. Creating alternate livelihoods c. Developing skills for alternate livelihoods d. Providing input and marketing support e. Providing credit support	0 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1 0.5 to 1

	7.9 Regeneration of Ecology and Environment	3		
18	Disasters cause considerable damages to ecology and environment. How such damaged environment have been restored during past 10 years. Give examples.	3	1. When there has not been any effort to repair and restore ecology and environment damaged due to disasters during past 10 years? 2. When there have been efforts in this direction, effectiveness of the initiatives in terms of a. Restoration of damaged forests and mangroves b. Restoration of soil c. Restoration of dried/ contaminated water bodies	0.5 to 1 0.5 to 1 0.5 to 1
	7.10 Learning from Reconstruction and Recovery	2		
19	What are the main lessons learnt from the experiences of reconstruction in the past? Have these been documented? Have these lessons been incorporated in the policies or guidelines? If so give details.	2	1. Have the lessons learnt from recovery and reconstruction projects been documented systematically? 2. Have these lessons been incorporated in the policies or guidelines?	0.5 to 1 0.5 to 1
	Others	5		
20	Mention any other initiative/ good practice of the State Govt./UT Adm. for disaster recovery and reconstruction.	5	3. Any innovative measures taken by the State Govt./UT Adm. for post-disaster recovery and reconstruction in the State, depending on the effectiveness of such innovation.	0.5 to 5

Statistical note on methodology

Statistical Note on Methodology

The complex methodology for working out the hazard, vulnerability and exposure indexes and composite risk and resilience index has been given practical shape through the application of various statistical tools and techniques.

Hazard Index

A - Earthquake (Table-H.1)

Earthquake Hazard Index has been calculated as the weighted average of the prescribed values of the seismic hazard zones, where the weights are the percentage of area falling within a particular zone. Here $X_1 = 0$, $X_2 = 4$, $X_3 = 6$, $X_4 = 8$, $X_5 = 10$ is the intensity of the i -th hazard zone, w_i 's are percentage of area of district in the i -th hazard zone, $i = 1, \dots, 5$.

$$I = \frac{\sum_{i=1}^5 w_i \times X_i}{\sum w_i}$$

B - Landslide (Table-H.2)

Landslide Hazard Index has been calculated as the weighted average of the prescribed values of the landslide hazard zones, where the weights are the percentage of area falling within a particular zone. Here $X_1 = 0$, $X_2 = 4$, $X_3 = 6$, $X_4 = 8$, $X_5 = 10$ is the intensity of the i -th hazard zone, w_i 's are percentage of area of district in the i -th hazard zone.

$$I = \frac{\sum_{i=1}^5 w_i \times X_i}{\sum w_i}$$

C - Flood (Table-H.3)

The index has been calculated as the weighted average of the three prescribed indicators which are the values of the percentage of flood prone are according to the mapping by BMTPC(2006), standardized by formula (I) and NRSC(2017), standardized by formula (II) where w 's denote the percentage of flood area in the risk zone and Y 's denote the pre-specified score of the zones, as well as total number of Flood prone cities in the district with population greater than 1 Million and 10 Million, standardized by formula (III), where the weights had been pre-specified as 60%, 20% and 20%.

$$\begin{aligned} X_1^* &= (X_1)/(10) \dots \dots \dots (I) \\ X_2^* &= \frac{\sum_{i=1}^5 w_i \times Y_i}{\sum w_i} \dots \dots \dots (II) \\ X_3^* &= 10 * (X_3)/(max(X_3)) \dots \dots \dots (III) \\ I &= \frac{\sum_{i=1}^3 w_i \times X_i^*}{\sum w_i} \end{aligned}$$

D - Drought (Table-H.4)

Drought Hazard Index has been calculated as the average of the normalised scores of the parameters. For (a), Negative of the moisture index has been normalised to a range of 0 to 10 according to formula (I) such that the higher the value of this normalised value, the more intense the hazard. For (b) the percentages have been divided by 100 to normalise from 0 to 10. (c) and (d) has been normalised through dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of all these parameters had been taken since equal weights had been pre-specified.

$$\begin{aligned} X_1^* &= 10 * (max(X_1) - X_1)/(max(X_1) - min(X_1)) \dots \dots \dots (I) \\ X_2^* &= (X_2)/(100) \dots \dots \dots (II) \\ X_3^* &= 10 * (X_3)/(max(X_3)) \dots \dots \dots (III) \\ X_4^* &= 10 * (X_4)/(max(X_4)) \dots \dots \dots (IV) \\ I &= mean(X_i^*) \end{aligned}$$

E - Cyclone (Table-H.5)

For calculating Cyclone Hazard Index parameters (a), (b), (c), (d), (e), as shown in the table have been normalized by dividing by the maximum value and multiplying by 10 to get on scale of 0 to 10 according to formula (I). For (f) an ad hoc score has been developed which follows the following properties: (i) Score (yes) > Score (no) (ii) The mean of all scores = $(0+10)/2 = 5$. Out of several possible choices, the middle point has been chosen which gives the values: Score (yes) = 5.85, Score (no) = 2.49. The score has been assigned corresponding to the responses Yes and No. Then a weighted average of all these parameters had been taken where the weights had been pre specified.

$$X_i^* = 10 * (X_i) / (\max(X_i)) \dots \dots \dots (I)$$
$$X_6^* = \begin{cases} 5.85 & \text{if } X_6 = \text{yes} \\ 2.49 & \text{if } X_6 = \text{no} \end{cases}$$
$$I = \text{mean}(X_i^*)$$

F - Tsunami (Table-H.6)

For Tsunami Hazard Index 3 parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to formula (I). Then a weighted average of all these parameters had been taken where the weights had been pre specified.

$$X_i^* = 10 * (X_i) / (\max(X_i)) \dots \dots \dots (I)$$
$$I = \frac{\sum_{i=1}^3 w_i \times X_i^*}{\sum w_i}$$

G - Avalanche (Table-H.7)

Avalanche Hazard Index has been calculated as the weighted average of the prescribed values of the seismic hazard zones, where the weights are the percentage of area falling within a particular zone. Here $X_1 = 0$, $X_2 = 4$, $X_3 = 6$, $X_4 = 8$, $X_5 = 10$ is the intensity of the i-th hazard zone, w_i 's are percentage of area of district in the i-th hazard zone.

$$I = \frac{\sum_{i=1}^5 w_i \times X_i}{\sum w_i}$$

H - Heat Wave (Table-H.8)

The first 3 parameters (annual average of the number of hot days, number of heat waves and length of longest heat wave) have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to formula (I). The average heat index during the heat waves is normalised according to formula (II). Then a simple average of all these parameters had been taken to get the index since equal weights had been pre specified. Since there were extensive cases of missing data for several districts due to non existence of weather stations etc, the missing values have been imputed with data from the geographically closest district in order to compute the index.

$$X_i^* = 10 * (X_i) / (\max(X_i)) \dots \dots \dots (I)$$
$$X_4^* = 10 * (X_4 - 54) / (\max(X_4) - 54) \dots \dots \dots (II)$$
$$I = \text{mean}(X_i^*)$$

I - Cold Wave (Table-H.9)

All 3 parameters (the proportion out of total days in the three zones on basis of severity of cold day) have been normalized by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of all these parameters had been taken to get the index since equal weights had been pre specified. Since there were extensive cases of missing data for several districts due to non-existence of weather stations etc., the missing values have been imputed with data from the geographically closest district in order to compute the index.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$I = \text{mean}(X_i^*)$$

J - Coastal Erosion (Table-H.10)

For Coastal Erosion Hazard Index 3 parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of all these parameters had been taken since equal weights had been pre specified.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$I = \text{mean}(X_i^*)$$

K - Lightning (Table-H.11)

The average annual deaths has been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Since, the data has been compiled at the state level, an assumption has been made that the incidence is equally likely across all districts, hence the districts with more population would be at a higher risk.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$I = \text{mean}(X_i^*)$$

L - Forest Fire (Table-H.12)

We obtain a multiplier which has been defined as the weighted average of proportions of “very dense”, “dense” and “open” forest cover in the district (area of forest category in district divided by total forest cover in district) where the weights had been pre specified. The multiplier is strictly between 0 and 1. Then this multiplier is multiplied to the pre-assigned score associated with the risk category of the district to get the hazard index.

M - Fire (Table-H.13)

All 3 parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of all these parameters had been taken since equal weights had been pre specified. Since, the data has been compiled at the state level, an assumption has been made that the incidence is equally likely across all districts, hence the districts with more population would be at a higher risk.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$I = \text{mean}(X_i^*)$$

N - Industrial Hazards (Table-2.14)

The first 2 parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. The CEPI has been rescaled on a scale of 10, which is 10 for CEPI>80, 8 for CEPI>70, 60 for CEPI>60, 4 for CEPI>50, 2 for CEPI<50. Then a weighted average of all these parameters had been taken where the weights had been pre specified as 50%:25%:25%.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$

$$I = \frac{\sum_i^3 w_i \times X_i^*}{\sum w_i}$$

Vulnerability Index

A - Buildings-Walls(Table-V.1)

In order to capture the effect each particular hazard has on each particular type of roof, the following coding has been used: X:{VH = 10, H = 8, M = 6, L = 4, VL = 2} and each hazard index has been categorized according to 5 risk zones A weighted average of these has been taken where the weights are proportion of a particular roof type in all houses of the district.

B - Buildings-Roofs(Table-V.2)

In order to capture the effect each particular hazard has on each particular type of wall, the following coding has been used: X:{VH = 10, H = 8, M = 6, L = 4, VL = 2} and each hazard index has been categorized according to 5 risk zones A weighted average of these has been taken where the weights are proportion of a particular wall type in all houses of the district.

C - Agriculture and Livestock (Table-V.3 and V.4)

For agriculture, the net non-irrigated cropped area (total cropped area-irrigated area) and irrigated area has been normalized by dividing by the total area of the district and multiplying by 10 to put on scale of 0 to 10. Then a weighted average of all these parameters had been taken where the weights had been pre specified as 80% on former and 20% on latter. (Xc : Cropped area, Xi : Irrigated area, Xt : Total area)

$$I_a = 0.8 * (X_c - X_i) / X_t + 0.2 * X_i / X_t$$

For livestock, the number of bovine animals and other animals has been normalized by dividing by the total number of the district and multiplying by 10 to put on scale of 0 to 10. Then a weighted average of all these parameters had been taken where the weights had been pre specified as 75% on former and 25% on latter. (Xb : No. of bovine animals, Xo : No. of other animals, Xt : Total No. of animals)

$$I_l = 0.75 * (X_b) / X_t + 0.25 * (X_o) / X_t$$

D - Industries(Table-V.5)

The total number of industries, industrial clusters and SEZs have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a weighted average of all these parameters had been taken where the weights had been pre specified as 40%:40%:20%.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$I = \frac{\sum_i^3 w_i \times X_i^*}{\sum w_i}$$

E - Physical Infrastructure(Table-V.6)

All parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of groups of these parameters (Road & Rail Connectivity, Sea and Air Connectivity, Dams & Reservoirs and Power Plants) had been taken since equal weights had been pre specified. Within each group, simple average of each of the parameter in the group has been taken.

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$Y_j = \text{mean} (X_i : X_i \in j - \text{th group})$$
$$I = \text{mean} (Y_j)$$

F - Social Infrastructure(Table-V.7)

All parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of groups of sub-groups of these parameters (Educational Institutions and Health Institutions) had been taken since equal weights had been pre specified. Within each group, simple average of each of the sub-group of parameters in the group has been taken. Within each sub-group, simple average of each of the parameter in the sub-group has been taken.

$$Y_j = \text{mean} (X_i : X_i \in j - \text{th subgroup})$$
$$Z_j = \text{mean} (Y_i : Y_i \in j - \text{th group})$$
$$I = \text{mean} (Z_j)$$

G - Poverty(Table-V.8)

All parameters (rural and urban BPL and Homeless population) have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10. Then a simple average of all these parameters had been taken, since equal weights had been pre specified

$$X_i^* = 10 * (X_i) / (\max(X_i))$$
$$I = \text{mean} (X_i^*)$$

H - Women(Table-V.9)

All parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (I). Then a simple average of all these parameters had been taken, since equal weights had been pre specified

$$X_i^* = 10 * (X_i - \min(X_i)) / (\max(X_i) - \min(X_i)) \dots \dots \dots (I)$$
$$I = \text{mean} (X_i^*)$$

I - Children(Table-V.10)

All parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (I). Then a simple average of groups of these parameters had been taken since equal weights had been pre specified. Within each group, weighted average of each of the parameter in the group has been taken where the weights had been pre specified. This has been done twice, once using absolute numbers and once using percentages. Then a geometric mean of both these indexes have been taken to obtain final index

$$X_i^* = 10 * (X_i - \min(X_i)) / (\max(X_i) - \min(X_i)) \dots \dots \dots (I)$$
$$I_1 = \text{mean} (X_i^*)$$
$$I_2 = \text{mean} (X_i^*)$$
$$I = \text{geomean} (I_1, I_2)$$

J - Disability(Table-V.11)

All parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (I). Then a simple average of all these parameters had been taken since equal weights had been pre specified. This has been done twice, once using absolute numbers and once using percentages. Then a geometric mean of both these indexes have been taken to represent final index.

$$\begin{aligned} X_i^* &= 10 * (X_i - \min(X_i)) / (\max(X_i) - \min(X_i)) \dots \dots \dots (I) \\ I_1 &= \text{mean}(X_i^*) \\ I_2 &= \text{mean}(X_i^*) \\ I &= \text{geomean}(I_1, I_2) \end{aligned}$$

K - Elderly(Table-V.12)

All parameters have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (I). Then a simple average of all these parameters had been taken since equal weights had been pre specified. This has been done twice, once using absolute numbers and once using percentages. Then a geometric mean of both these indexes has been taken to represent final index.

$$\begin{aligned} X_i^* &= 10 * (X_i - \min(X_i)) / (\max(X_i) - \min(X_i)) \dots \dots \dots (I) \\ I_1 &= \text{mean}(X_i^*) \\ I_2 &= \text{mean}(X_i^*) \\ I &= \text{geomean}(I_1, I_2) \end{aligned}$$

I - Depleting Forest Cover(Table-V.13)

All parameters of change (dense & open) have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (I). Then a simple average of all these parameters had been taken, since equal weights had been pre specified.

$$\begin{aligned} X_i^* &= 10 * (X_i - \min(X_i)) / (\max(X_i) - \min(X_i)) \dots \dots \dots (I) \\ I &= \text{mean}(X_i^*) \end{aligned}$$

M - Depleting Mangroves(Table-V.14)

All parameters of change (dense & open) have been normalised by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (I). Then a simple average of all these parameters had been taken, since equal weights had been pre specified.

$$\begin{aligned} X_i^* &= 10 * (X_i - \min(X_i)) / (\max(X_i) - \min(X_i)) \dots \dots \dots (I) \\ I &= \text{mean}(X_i^*) \end{aligned}$$

N - Water Stress (Table-V.15)

All parameters of change have been on scale of 0 to 10 according to Formula (I), (II) and (III). Then a simple average of all these parameters had been taken, since equal weights had been pre specified.

$$\begin{aligned} X_1^* &= 10 * (\max(X_1) - X_1) / (\max(X_1) - \min(X_1)) \dots \dots \dots (I) \\ X_2^* &= (100 - X_2) / (100) \dots \dots \dots (II) \\ X_3^* &= \frac{\sum_i^3 w_i \times X_i}{\sum w_i} \dots \dots \dots (III) \\ I &= \text{mean}(X_i^*) \end{aligned}$$

Exposure Index

Two parameters are considered for calculating Exposure Index These are: (a) population density (=Population/(Area in sq.km)), and (b) per capita GDP (=(GDP in Cr.Rs.)/Population) of a district. Both have been normalized by dividing by the maximum value and multiplying by 10 to put on scale of 0 to 10 according to Formula (IE) below. Then a simple average of these parameters had been taken, since equal weights have been given on both the parameters.

$$\begin{aligned} X_i^* &= 10 * (X_i) / (\max(X_i)) \\ I_E &= \text{mean}(X_i^*) \end{aligned} \tag{IE}$$

Disaster Risk Index

Disaster Risk Index is calculated in two stages: (a) calculating the multiplier of hazards, vulnerabilities and risks; and (b) discounting the multiplier with capacities.

A - Calculating H*V*E

The calculation has been done as (H*V)*E since hazard specific vulnerabilities have to be first calculated before the parameters of exposures are added. (H*V) has been computed using the formula (IHV) where w_j^h is the weight of the j-th hazard, h_j is the index of the j-th hazard, w_i^v is the weight of the i-th vulnerability, v_i is the index of the i-th vulnerability and $I(i \in h_j)$ is the indicator function which returns 1 if the i-th indicator is relevant to the j-th hazard and returns 0 otherwise. All the weights used in the formula had been pre-specified for all hazards and all vulnerabilities.

$$I_{H \cdot V} = \frac{1}{10} \sum_j w_j^h h_j^{\alpha_1} \left\{ \frac{\sum_i w_i^v I(i \in h_j) v_i^{\alpha_2}}{\sum_i w_i^v I(i \in h_j)} \right\} \quad (IHV)$$

$I_{(H \cdot V \cdot E)}$ is calculated as the geometric mean of the $I_{(H \cdot V)}$ so obtained and $I_E^{\alpha_3}$.

Here $\alpha_1, \alpha_2, \alpha_3$ are relative importance parameters of the Hazards, Vulnerabilities, and Exposures in the ratio of 4:2:1 to best reflect the relative contribution of h, v and e for creating risks of disasters. Accordingly the values adopted are $\alpha_1=4, \alpha_2=2, \alpha_3=1$.

Statistical appendices

Table-H.1: Earthquake Hazard Index

	State/UTs	TOTAL AREA	Area falling in Earthquake Hazard Zones								Earthquake Hazard Index	
			ZONE V		ZONE IV		ZONE III		ZONE II			
		(Sq. Km)	Area	%	Area	%	Area	%	Area	%		
	1	2	3	4	5	6	7	8	9	10	11	
	STATES											
1	Andhra Pradesh	160205	0.00	0.00	0.00		0.00	53924.43	33.66	106280.57	66.34	2.67
2	Arunachal Pradesh	83743	83743.00	100.00	0.00	0.00		0.00	0.00	0.00	0.00	10.00
3	Assam	78438	78438.00	100.00	0.00		0.00	0.00	0.00	0.00	0.00	10.00
4	Bihar	94163	14537.09	15.44	61314.78	65.12		18311.13	19.45	0.00	0.00	6.23
5	Chhattisgarh	135192	0.00	0.00	0.00		0.00	20670.61	15.29	114521.39	84.71	2.31
6	Goa	3702	0.00	0.00	0.00	0.00		3702.00	100.00	0.00	0.00	4.00
7	Gujarat	196244	36962.81	18.84	30234.86		15.41	127551.95	65.00	1494.37	0.76	5.42
8	Haryana	44212	0.00	0.00	16386.32	37.06		23844.01	53.93	3981.46	9.01	4.56
9	Himachal Pradesh	55673	19598.72	35.20	36074.28		64.80	0.00	0.00	0.00	0.00	7.41
10	Jammu &Kashmir	101387	9838.89	9.70	91548.11	90.30		0.00	0.00	0.00	0.00	6.39
11	Jharkhand	79716	0.00	0.00	3030.71		3.80	41718.94	52.33	34966.35	43.86	3.20
12	Karnataka	191791	0.00	0.00	0.00	0.00		25472.81	13.28	166318.19	86.72	2.27
13	Kerala	38852	0.00	0.00	0.00		0.00	38070.02	97.99	781.98	2.01	3.96
14	Madhya Pradesh	308252	0.00	0.00	0.00	0.00		111292.77	36.10	196959.23	63.90	2.72
15	Maharashtra	307713	0.00	0.00	14784.01		4.80	156957.34	51.01	135971.65	44.19	3.21
16	Manipur	22327	22327.00	100.00	0.00	0.00		0.00	0.00	0.00	0.00	10.00
17	Meghalaya	22429	22429.00	100.00	0.00		0.00	0.00	0.00	0.00	0.00	10.00
18	Mizoram	21081	21081.00	100.00	0.00	0.00		0.00	0.00	0.00	0.00	10.00
19	Nagaland	16579	16579.00	100.00	0.00		0.00	0.00	0.00	0.00	0.00	10.00
20	Odisha	155707	0.00	0.00	0.00	0.00		21757.43	13.97	133949.57	86.03	2.28
21	Punjab	50362	460.27	0.91	25581.11		50.79	23013.96	45.70	1306.62	2.59	5.02
22	Rajasthan	342239	0.00	0.00	12486.96	3.65		92862.49	27.13	236889.12	69.22	2.69
23	Sikkim	7096	0.00	0.00	7096.00		100.00	0.00	0.00	0.00	0.00	6.00
24	Tamil Nadu	130060	0.00	0.00	0.00	0.00		36380.64	27.97	93679.36	72.03	2.56
25	Telangana	114840	0.00	0.00	0.00		0.00	33649.57	29.30	81192.32	70.70	2.59
26	Tripura	10486	10486.00	100.00	0.00	0.00		0.00	0.00	0.00	0.00	10.00
27	Uttar Pradesh	240928	0.00	0.00	74065.88		30.74	116406.91	48.32	50455.21	20.94	4.20
28	Uttarakhand	53483	21928.77	41.00	31554.23	59.00		0.00	0.00	0.00	0.00	7.64
29	West Bengal	88752	2563.15	2.89	27784.99		31.31	49908.88	56.23	8494.98	9.57	4.61
	UNION TERRITORIES											
1	Andaman &Nicobar	8249	8249.00	100.00	0.00		0.00	0.00	0.00	0.00	0.00	10.00
2	Chandigarh	114	0.00	0.00	114.00	100.00		0.00	0.00	0.00	0.00	6.00

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

3	Dadra and Nagar Haveli	491	0.00	0.00	0.00		0.00	491.00	100.00	0.00	0.00	4.00
4	Daman and Diu	111	0.00	0.00	0.00		0.00	111.00	100.00	0.00	0.00	4.00
5	Delhi	1483	0.00	0.00	1483.00		100.00	0.00	0.00	0.00	0.00	6.00
6	Lakshadweep	30	0.00	0.00	0.00		0.00	30.00	100.00	0.00	0.00	4.00
7	Puducherry	490	0.00	0.00	0.00		0.00	39.00	7.96	451.00	92.04	2.16
	TOTAL	3166620	369221.71	11.66	433539.24		13.69	996166.87	31.46	1367693.39	43.19	

Table-H.2: Landslide Hazard Index

	States/Uts	Area (Sq. Km.) in Landslide Hazard Zones						Landslides Hazard Index
		Total Area	Zone-I		Zone-II	Zone-III	Zone-IV	
			(Unlikely)		Moderate	(High)	(Very High)	
		1	2	3	4	5	6	7
	STATES							
1	Andhra Pradesh	160205	98008		58255	3942	0	1.65
2	Arunachal Pradesh	83743	12487		3591	65160	2505	6.70
3	Assam	78438	59009		13475	5947	6	1.29
4	Bihar	94163	89277		4886	0	0	0.21
5	Chhattisgarh	135192	55217		79927	48	0	2.37
6	Goa	3702	1195		2203	303	0	3.04
7	Gujarat	196244	176080		20094	70	0	0.41
8	Haryana	44212	41487		2658	67	0	0.25
9	Himachal Pradesh	55673	1477		7285	38961	7949	7.55
10	Jammu and Kashmir	101387	15492		40162	40129	5604	5.30
11	Jharkhand	79716	41941		37774	1	0	1.90
12	Karnataka	191791	128303		56807	6681	0	1.46
13	Kerala	38852	7401		22050	9046	355	4.22
14	Madhya Pradesh	308252	232996		75051	205	0	0.98
15	Maharashtra	307713	193706		101073	12933	0	1.65
16	Manipur	22327	1527		2781	11186	6833	7.57
17	Meghalaya	22429	3524		9269	9380	256	5.11
18	Mizoram	21081	48		1537	14695	4801	8.15
19	Nagaland	16579	582		3114	9253	3631	7.41
20	Odisha	155707	79856		75414	437	0	1.96
21	Punjab	50362	48696		1341	325	0	0.16
22	Rajasthan	342239	298271		43968	0	0	0.51
23	Sikkim	7096	1		477	6453	166	7.78
24	Tamil Nadu	130060	112509		13560	3433	557	0.67
25	Telengana	114840	80944		33326	571	0	1.20

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

26	Tripura	10486	3757	4168	2562	0	3.54
27	Uttar Pradesh	240928	234005	6552	371	0	0.12
28	Uttarakhand	53483	3071	7146	23677	19588	7.74
29	West Bengal	88752	85265	2030	1369	88	0.22
	UNION TERRITORY						
1	Andaman and Nicobar	8249	0	0	0	0	0.00
2	Chandigarh	114	114	0	0	0	0.00
3	Dadra and Nagar Haveli	491	251	240	0	0	1.95
4	Daman and Diu	111	111	0	0	0	0.00
5	Delhi	1483	1483	0	0	0	0.00
6	Lakshadweep	30	0	0	0	0	0.00
7	Puducherry	490	486	4	0	0	0.04
	Total	3166620	2108577	730218	267205	52340	

Table-H.3 : Flood Hazard Index

	State Union Territory	Total Area (Sq. Km)	Flood Affected Area in Sq. Km (1953-2016)						Flood Hazard Index
			Average Annual Flooding		Maximum Annual Flooding	Year of Maximum Flooding	Average Flooded Area (%)	Maximum Flooded Area (%)	
	1	2	3		4	5	6	7	8
	STATE								
1	Andhra Pradesh	160205	5280		90400	2005	3.30	56.43	3.27
2	Arunachal Pradesh	83743	640		3100	2010	0.00	3.70	1.30
3	Assam	78438	8320		38200	1988	10.61	48.70	5.67
4	Bihar	94163	13116		42600	1971	13.93	45.24	5.19
5	Chhattisgarh	135192	130		890	2001	0.10	0.66	1.48
6	Goa	3702	0		0	-	0.00	0.00	1.70
7	Gujarat	196244	3550		20500	1988	1.81	10.45	3.07
8	Haryana	44212	1960		10000	1977	4.43	22.62	4.12
9	Himachal Pradesh	55673	3560		8700	1999	6.39	15.63	1.00
10	Jammu & Kashmir	101387	380		5140	1987	0.37	5.07	1.33
11	Jharkhand	79716	50		410	2012	0.06	0.51	1.58
12	Karnataka	191791	1600		23900	2009	0.87	12.46	1.45
13	Kerala	38852	1670		14700	1989	4.30	37.84	3.24
14	Madhya Pradesh	308252	540		3770	1994	0.18	1.22	1.86
15	Maharashtra	307713	550		3910	2002	0.18	1.27	1.79
16	Manipur	22327	540		1160	2002	2.42	5.20	1.00

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

17	Meghalaya	22429	90	950	1987	0.40	4.24	1.49
18	Mizoram	21081	340	5410	1993	1.61	25.66	1.22
19	Nagaland	16579	10	90	1993	0.06	0.54	0.55
20	Odisha	155707	5500	39700	2014	3.53	25.50	2.51
21	Punjab	50362	3540	27900	1988	7.03	55.40	7.19
22	Rajasthan	342239	3100	32600	1977	0.91	9.53	1.36
23	Sikkim	7096	530	1170	2000	7.47	16.49	1.28
24	Tamil Nadu	130060	1600	14660	2010	1.23	11.27	1.55
25	Telangana	114840	NA	NA	-	0.00	0.00	1.74
26	Tripura	10486	320	3300	1963	3.05	31.47	1.52
27	Uttar Pradesh	240928	16670	73400	1978	6.92	30.47	4.54
28	Uttarakhand	53483	0	20	2001	0.00	0.04	1.14
29	West Bengal	88752	7910	30800	1978	8.91	34.70	6.76
	UNION TERRITORIES							
1	A & N Islands	8249	10	300	1988	0.12	3.64	0.0
2	Chandigarh	114	0	0	-	0.00	0.00	1.53
3	Dadra & Nagar Haveli	491	0	0	-	0.00	0.00	0.89
4	Daman & Diu	111	0	0	-	0.00	0.00	1.32
5	Delhi	1483	230	458	1997	15.51	30.88	1.92
6	Lakshadweep	30	0	0	-	0.00	0.00	0.00
7	Puducherry	490	20	50	1977	4.08	10.20	0.84
	TOTAL	3166620	71110	518188	-	2.25	16.36	

Table-H.4: Drought Hazard Index

	STATE/ UNION TERRITORY	Total Geographical Area (sq. km)	Drought Prone Area	Total Cropped Area		Gross Irrigated Area	Drought Years (2000-16)	Drought Hazard Index
	1	2	3		4	5	6	7
	STATES							
1	Andhra Pradesh	160205	32617		7690	3886	13	6.80
2	Arunachal Pradesh	83743	0		299	56	0	1.82
3	Assam	78438	0		4083	374	2	3.03
4	Bihar	94163	9533		7673	5268	5	4.05
5	Chhattisgarh	135192	21801		5728	1787	4	4.56
6	Goa	3702	0		158	39	0	2.29
7	Gujarat	196244	43938		12773	6014	4	4.63
8	Haryana	44212	0		6536	5824	2	2.77
9	Himachal Pradesh	55673	3319		918	193	4	3.80
10	Jammu & Kashmir	101387	14705		1178	504	2	2.77
11	Jharkhand	79716	34843		1554	221	7	5.98
12	Karnataka	191791	84332		12247	4186	12	7.05
13	Kerala	38852	0		2625	470	5	3.96
14	Madhya Pradesh	308252	89101		23810	10301	7	5.30
15	Maharashtra	307713	194473		23474	4282	10	7.23
16	Manipur	22327	0		383	69	1	3.09
17	Meghalaya	22429	0		343	128	0	1.30
18	Mizoram	21081	0		145	21	0	2.49
19	Nagaland	16579	0		500	106	1	2.92
20	Odisha	155707	28178		5173	1485	5	4.34
21	Punjab	50362	0		7857	7757	1	1.95
22	Rajasthan	342239	31963		24235	10171	12	6.67
23	Sikkim	7096	0		136	12	0	1.88
24	Tamil Nadu	130060	29143		5995	3394	3	5.66
25	Telangana	114840	66601		5315	2529	7	5.85
26	Tripura	10486	0		483	116	0	3.16
27	Uttar Pradesh	240928	35698		26147	20965	6	3.83
28	Uttarakhand	53483	15796		1097	542	7	5.74
29	West Bengal	88752	115914		9690	5700	2	3.10
	UNION TERRITORIES							
1	Andaman& Nicobar Islands	8249	0		24	0	0	2.85
2	Chandigarh	114	0		2	0	0	1.52
3	Dadra & Nagar Haveli	491	0		23	8	0	2.71
4	Daman & Diu	111	0		3	0	0	4.35
5	Delhi	1483	0		35	29	0	1.60
6	Lakshadweep	30	0		3	0	0	2.86
7	Puducherry	490	0		27	22	0	2.35
	TOTAL	3166620	745914		198360	96457		

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-H.5: Cyclone Hazard Index

	States/ UTs	No. of Cyclones	No. of Severe Cyclones	Maximum Storm Surge (meter)		Maximum Wind Speed (kmph)	Maximum Precipitation (cm)	Cyclone Hazard Index
	1	2	3		4	5	6	7
	East Coast – Bay of Bengal							
1.	Andhra Pradesh	19	8		7.5	127	60	6.34
2.	Odisha	28	6		11	140	60	6.87
3.	Tamil Nadu	10	8		10	95	68	5.77
4.	West Bengal	29	16		13	115	56	8.88
5.	Andaman & Nicobar	8	1		4.25	90	58	3.06
6.	Puducherry	17	4		4.5	125	68	4.08
	West Coast – Arabian Sea							
1.	Goa	0	0		4.5	55	64	2.37
2.	Gujarat	9	4		4.5	90	104	4.90
3.	Karnataka	0	0		4.5	45	92	2.72
4.	Kerala	3	2		4.5	55	60	2.54
5.	Maharashtra	2	2		5	55	95	3.22
6.	Daman & Diu	9	4		5	90	80	3.45
7.	Lakshadweep	9	5		4.25	90	22.03	2.36

Table-H.6: Tsunami Hazard Index

	States/ UTs	No. of coastal districts	Total Length of Coastline (Km)	Population living within ½ Km of Shoreline		Average Height of Tsunami Wave (M)	Tsunami Hazard Index
	1	2	3		4	5	6
	East Coast – Bay of Bengal						
1.	Andhra Pradesh	9	971.27		189874	3.57	5.29
2.	Odisha	6	435.57		119856	2.56	3.49
3.	Tamil Nadu	13	786.91		451271	3.12	5.45
4.	West Bengal	3	282.20		161628	1.14	1.98
5.	Andaman & Nicobar	3	2499.65		53520	4.78	7.67
6.	Puducherry	4	62.81		79600	3.52	3.99
	West Coast – Arabian Sea						
1.	Goa	2	155.39		30342	0.88	1.18
2.	Gujarat	12	1482.13		226522	0.56	2.78
3.	Karnataka	3	298.08		36401	1.24	1.71
4.	Kerala	9	585.77		325667	1.81	3.49
5.	Maharashtra	6	742.29		8082.30	0.63	3.90
6.	Daman & Diu	2	55.5		59822	0.70	0.98
7.	Lakshadweep	1	136.28		146433	0.73	1.35

Table-H.7: Coastal Erosion Index

	STATES/ UNION TERRITORIES	Coastline (km)	Coastline Changes (km)				Coastal Area Changes (sq. km)			Coastal Erosion Index
			Erosion	Accretion		Net gain/loss	Erosion	Accretion	Net gain/Loss	
	1	2	3	4		5	6	7	8	9
1.	Andhra Pradesh	971.27	443.88	186.94		-256.94	46.89	25.14	-21.75	3.68
2.	Goa	155.39	27.03	46.98		19.95	0.771	1.53	0.759	0.29
3.	Gujarat	1482.13	486.43	297.99		-188.44	27.3	43.46	16.16	3.88
4.	Karnataka	298.08	106.12	118.65		12.53	5.16	6.26	1.1	0.79
5.	Kerala	585.77	218.04	294.13		76.09	5.31	9.54	4.23	1.43
6.	Maharashtra	742.29	449.55	244.42		-205.13	7.83	5.08	-2.75	2.25
7.	Odisha	435.57	198.79	204.61		5.82	13.79	13.34	-0.45	1.44
8.	Tamil Nadu	786.91	267.86	490.32		222.46	16.06	41.53	25.47	2.13
9.	West Bengal	282.2	115.07	19.46		-95.61	11.64	1.53	-10.11	0.98
10.	Andaman & Nicobar	2499.65	1430.43	1013.17		-417.26	112.64	27.83	-84.81	9.91
11.	Daman & Diu	55.5	6.41	7.9		1.49	0.12	0.11	-0.01	0.09
12.	Lakshadweep	136.28	72.03	63.24		-8.79	1.7	0.83	-0.87	0.40
13.	Puducherry	62.81	16.5	26.3		9.8	1.24	1.21	-0.03	0.16
	Total	8493.85	3838.14	3014.11		-824.03	250.451	177.39	-73.061	

Table-H.8: Avalanche Hazard Index

	STATES/ UNION TERRITORIES	Total Area (Sq. Km)	Area (Sq. Km) in Avalanche Hazard Zones						
			Very High Risk	High Risk		Moderate Risk	Low Risk	No Risk	Avalanche Hazard Index
	1	2	3	4		5	6	7	8
1	Himachal Pradesh	37398	6271.5	1072.1		1039.7	1725.6	27289.1	2.26
2	Jammu and Kashmir	98141	12140.1	1236.5		1346.9	2289.7	81127.8	1.51
3	Uttarakhand	31003	3720.9	714.8		771.2	1976.9	23819.2	1.79
11.	Daman & Diu	55.5	6.41	7.9		1.49	0.12	0.11	-0.01

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-H.9: Heat Wave Index

	2001-2016					
	States/ UTs	Heat Waves				Heat Wave Index
		No of days with Heat In- dex above 54 (annual av.)	Number of Heat Waves (5 days +)	Longest Heat Wave (No of Days)	Average Index of Heat Waves	
	1	2	3	4	5	6
	STATES					
1	Andhra Pradesh	30.35	41	22.15	62.26	5.77
2	Arunachal Pradesh	6.53	1	3.75	58.49	1.65
3	Assam	25.87	7	7.52	60.52	2.96
4	Bihar	57.87	12	9.29	64.55	4.64
5	Chhattisgarh	18.08	9	6.44	65.63	3.20
6	Goa	0.28	0	3.00	60.12	1.52
7	Gujarat	18.58	6	7.85	64.06	3.07
8	Haryana	27.58	8	7.76	65.62	3.56
9	Himachal Pradesh	6.68	4	3.50	52.23	1.15
10	Jammu and Kashmir	4.52	2	2.36	39.39	-0.31
11	Jharkhand	47.28	15	11.67	67.16	4.89
12	Karnataka	12.00	5	5.83	59.23	2.21
13	Kerala	9.84	5	11.71	59.33	2.64
14	Madhya Pradesh	41.99	10	7.60	64.93	3.99
15	Maharashtra	31.32	21	8.97	63.56	4.07
16	Manipur	0.49	0	2.00	59.13	1.34
17	Meghalaya	14.13	11	8.43	48.89	1.73
18	Mizoram	5.79	7	5.25	63.42	2.45
19	Nagaland	14.41	4	9.27	49.80	1.63
20	Odisha	50.63	62	17.13	64.32	6.95
21	Punjab	36.87	11	9.90	66.67	4.23
22	Rajasthan	26.12	11	6.15	65.21	3.46
23	Sikkim	5.94	6	10.25	50.95	1.64
24	Tamil Nadu	58.59	51	12.84	61.29	6.13
25	Telengana	9.44	9	10.90	64.13	3.17
26	Tripura	4.78	1	5.00	60.76	1.92
27	Uttar Pradesh	88.42	26	11.99	62.95	6.16
28	Uttarakhand	8.28	7	6.00	60.23	2.28
29	West Bengal	39.54	27	22.16	61.32	5.43
	UNION TERRITORIES					
1	Andaman and Nicobar	2.11	3	10.33	61.20	2.40
2	Chandigarh	0.38	0	1.00	61.13	1.45
3	Dadra and Nagar Haveli	0.47	2	12.00	59.52	2.29
4	Daman and Diu	1.58	1	6.00	59.56	1.79
5	Delhi	14.02	6	8.22	65.79	3.13
6	Lakshadweep	0.37	1	7.00	57.13	1.60
7	Puducherry	11.52	43	26.00	62.83	5.66

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-H.10: Cold Wave Index

		Percentage of days with cold wave conditions (Nov-Feb) 2001-2016						Cold Wave Index	
	STATES/ UNION TERRITORIES	Plain Areas (temperature <4 C)				Hilly Areas (temperature <-4 C)			
		4 to 3	2.9 to 1	.9 to 0		<-4 to <-7	<-7.1 to <-10	<-10.1	
	1	2	3	4		5	6	7	8
	STATES								
1	Andhra Pradesh	0	0	0		0	0	0	0.00
2	Arunachal Pradesh	0	0	0		2.43	0.98	0	0.32
3	Assam	1.63	1.72			0	0	0	0.31
4	Bihar	3.20	2.73	1.36		0	0	0	0.68
5	Chhattisgarh	2.35	1.38	1.27		0	0	0	0.47
6	Goa	0	0	0		0	0	0	0.00
7	Gujarat	1.84	1.79	0.72		0	0	0	0.40
8	Haryana	5.32	4.81	1.92		0	0	0	1.12
9	Himachal Pradesh	0	0	0		31.34	12.48	9.9	5.00
10	Jammu and Kashmir	10.34	3.54	0.69		39.47	14.04	8.45	7.12
11	Jharkhand	1.98	1.58	1.00		0	0	0	0.42
12	Karnataka	0	0	0		0	0	0	0.00
13	Kerala	0	0	0		0	0	0	0.00
14	Madhya Pradesh	9.15	5.22	1.41		0	0	0	1.47
15	Maharashtra	1.52	1.39	1.11		0	0	0	0.37
16	Manipur	0	0	0		7.17	5.97	0.41	1.26
17	Meghalaya	0	0	0		8.89	9.71	3.16	2.02
18	Mizoram	0	0	0		1.25	1.46	1.50	0.39
19	Nagaland	0	0	0		1.17	1.12	0.53	0.26
20	Odisha	2.24	2.08	1.63		0	0	0	0.55
21	Punjab	20.76	8.86	1.41		0	0	0	2.89
22	Rajasthan	6.24	5.64	1.59		0	0	0	1.25
23	Sikkim	0	0	0		1.26	1.23	1.36	0.36
24	Tamil Nadu	0	0	0		0	0	0	0.00
25	Telengana	0	0	0		0	0	0	0.00
26	Tripura	0	0	0		1.49	2.56	0.57	0.43
27	Uttar Pradesh	3.27	2.41	0.69		0	0	0	0.59
28	Uttarakhand	0	0	0		7.26	9.36	3.84	4.04
29	West Bengal	0	0	0		1.1	0.21	0	0.12

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

	UNION TERRITORIES								0.00
1	Andaman and Nicobar	0	0	0		0	0	0	0.00
2	Chandigarh	4.35	3.57	1.17		0	0	0	0.85
3	Dadra & Nagar Haveli	0	0	0		0	0	0	0.00
4	Daman and Diu	0.58	0	0		0	0	0	0.05
5	Delhi	2.35	1.68	1.23		0	0	0	0.49
6	Lakshadweep	0	0	0		0	0	0	0.00
7	Puducherry	0	0	0		0	0	0	0.00

Table-H.11: Lightning Hazard Index

	STATES/ UNION TERRITORIES	Total Lightning Mortalities	Lightning Mortalities Average Annual	Lightning Hazard Index
	1	2	3	4
	STATES			
1	Andhra Pradesh	1573	104.87	2.96
2	Arunachal Pradesh	6	0.40	0.01
3	Assam	392	26.13	0.74
4	Bihar	1642	109.47	3.09
5	Chhattisgarh	3250	216.67	4.11
6	Goa	4	0.27	0.01
7	Gujarat	901	60.07	1.69
8	Haryana	122	8.13	0.23
9	Himachal Pradesh	57	3.80	0.11
10	Jammu and Kashmir	50	3.33	0.09
11	Jharkhand	1773	118.20	5.33
12	Karnataka	1677	111.80	3.15
13	Kerala	551	36.73	1.04
14	Madhya Pradesh	5268	351.20	6.90
15	Maharashtra	4546	303.07	5.55
16	Manipur	3	0.20	0.01
17	Meghalaya	50	3.33	0.09
18	Mizoram	5	0.33	0.01
19	Nagaland	5	0.33	0.01
20	Odisha	4211	280.73	7.92

21	Punjab	1005	67.00	1.89
22	Rajasthan	1005	67.00	1.89
23	Sikkim	22	1.47	0.04
24	Tamil Nadu	1312	87.47	2.47
25	Telengana	1525	101.67	2.87
26	Tripura	120	8.00	0.23
27	Uttar Pradesh	2934	195.60	5.52
28	Uttarakhand	52	3.47	0.10
29	West Bengal	2135	142.33	4.01
	UNION TERRITORIES			
1	Andaman and Nicobar Islands	5	0.33	0.01
2	Chandigarh	2	0.13	0.00
3	Dadra and Nagar Haveli	7	0.47	0.01
4	Daman and Diu	2	0.13	0.00
5	Delhi	9	0.60	0.02
6	Lakshadweep	0	0.00	0.00
7	Puducherry	3	0.20	0.01

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-H.12: Forest Fire Hazard Index

	STATES/ UNION TERRITORIES	Total area	Forest area (Square Km)							Forest Fire Index
			Very Dense	Dense		Open	Total	%	Risk Zonation	
	1	2	3	4		5	6	7	8	9
	STATES									
1	Andhra Pradesh	160205	375	13093		10956	24424	15.25	8.08	4.17
2	Arunachal Pradesh	83743	20804	31301		15143	67248	80.30	8.69	5.90
3	Assam	78438	1441	11268		14914	27623	35.22	7.85	4.03
4	Bihar	94163	248	3376		3664	7288	7.74	1.82	0.93
5	Chhattisgarh	135192	4152	34846		16588	55586	41.12	8.33	4.75
6	Goa	3702	542	580		1102	2224	60.08	2.00	1.20
7	Gujarat	196244	376	5220		9064	14660	7.47	2.54	1.24
8	Haryana	44212	27	452		1105	1584	3.58	0.33	0.16
9	Himachal Pradesh	55673	3224	6381		5091	14696	26.40	2.50	1.55
10	Jammu and Kashmir	101387	2716	6187		7101	16004	15.79	0.91	0.53
11	Jharkhand	79716	2588	9663		11227	23478	29.45	5.33	2.93
12	Karnataka	191791	1781	20063		14577	36421	18.99	3.83	2.07
13	Kerala	38852	1523	9301		8415	19239	49.52	2.64	1.44
14	Madhya Pradesh	308252	6629	34902		35931	77462	25.13	6.70	3.63
15	Maharashtra	307713	8712	20747		21169	50628	16.45	4.77	2.79
16	Manipur	22327	727	5925		10342	16994	76.11	8.56	4.24
17	Meghalaya	22429	449	9584		7184	17217	76.76	10.00	5.27
18	Mizoram	21081	138	5858		12752	18748	88.93	10.00	4.67
19	Nagaland	16579	1296	4695		6975	12966	78.21	10.00	5.32
20	Odisha	155707	7023	21470		21861	50354	32.34	3.57	2.03
21	Punjab	50362	0	735		1036	1771	3.52	1.15	0.56
22	Rajasthan	342239	76	4426		11669	16171	4.73	0.39	0.18
23	Sikkim	7096	500	2160		697	3357	47.31	0.50	0.31
24	Tamil Nadu	130060	2993	10469		12883	26345	20.26	1.41	0.77
25	Telengana	114840	513	12712		8366	21591	18.80	4.80	2.55
26	Tripura	10486	113	4609		3089	7811	74.49	10.00	5.27
27	Uttar Pradesh	240928	2195	4060		8206	14461	6.00	1.55	0.85
28	Uttarakhand	53483	4754	13602		5884	24240	45.32	6.08	3.83
29	West Bengal	88752	2948	4172		9708	16828	18.96	1.63	0.91

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

	UNION TERRITORIES									
1	Andaman and Nicobar	8249	5686	685		380	6751	81.84	2.00	1.85
2	Chandigarh	114	1.36	14.09		6.58	22.03	19.32	2.00	1.13
3	Dadra and Nagar Haveli	491	0	80		126	206	41.96	2.00	0.96
4	Daman and Diu	111	1.4	5.82		12.39	19.61	17.67	2.00	1.00
5	Delhi	1483	6.94	57.15		124.68	188.77	12.73	0.00	0.00
6	Lakshadweep	30	0	17.22		9.84	27.06	90.20	2.00	1.05
7	Puducherry	490	0	29.68		25.7	55.38	11.30	2.00	1.01
		3166620	84558.7	312746		297384.2	694688.9	21.94		

Table-H.13: Lightning Hazard Index

	STATES/ UNION TERRITORIES	Accidents of Fire (2001-2015)			Fire Haz- ard Index
		Cases	Deaths	Injured	
	1	2	3	4	5
	STATES				
1	Andhra Pradesh	23612	1170	24266	2.41
2	Arunachal Pradesh	107	1	135	0.01
3	Assam	1739	49	1879	0.18
4	Bihar	6065	1133	6402	0.73
5	Chhattisgarh	10660	234	11645	1.10
6	Goa	655	4	639	0.06
7	Gujarat	34249	1660	35376	3.51
8	Haryana	4784	13	5163	0.48
9	Himachal Pradesh	869	58	930	0.09
10	Jammu and Kashmir	542	93	461	0.06
11	Jharkhand	3604	342	3746	0.39
12	Karnataka	19920	334	21583	2.03
13	Kerala	3846	141	4160	0.40
14	Madhya Pradesh	35787	1057	37675	3.63
15	Maharashtra	89765	20347	75107	6.57
16	Manipur	33	6	38	0.00
17	Meghalaya	177	14	193	0.02
18	Mizoram	43	1	61	0.01
19	Nagaland	23	0	30	0.00
20	Odisha	5567	364	6310	0.62

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

21	Punjab	4566	131	4861	0.47
22	Rajasthan	11261	283	12366	1.17
23	Sikkim	86	9	90	0.01
24	Tamil Nadu	24834	1559	28987	2.81
25	Telengana	23572	1150	24185	2.41
26	Tripura	293	0	336	0.03
27	Uttar Pradesh	15193	2678	16312	1.84
28	Uttarakhand	1233	155	1270	0.14
29	West Bengal	9957	3089	9795	1.31
	UNION TERRITORIES				
1	Andaman and Nicobar Islands	250	0	269	0.02
2	Chandigarh	291	0	305	0.03
3	Dadra and Nagar Haveli	135	0	141	0.01
4	Daman and Diu	126	7	144	0.01
5	Delhi	5004	825	5306	0.59
6	Lakshadweep	6	0	6	0.00
7	Puducherry	517	19	528	0.05

Table-H.14: Industrial Hazard Index

	STATES/ UNION TERRITORIES	Indicators of Industrial Hazards			Industrial Hazard Index
		Maximum Hazard Industries	Maximum Polluting Industries	Average CEPI of major Industrial Clusters	
	1	2	3	4	5
	1	2	3	4	5
	STATES				
1	Andhra Pradesh	79	148	65.695	3.31
2	Arunachal Pradesh	0	0	0	0.50
3	Assam	24	44	44.55	1.04
4	Bihar	13	25	55.12	1.30
5	Chhattisgarh	21	77	66.34	2.17
6	Goa	14	12	0	0.75
7	Gujarat	372	270	83.95667	6.86
8	Haryana	58	116	74.49	3.37
9	Himachal Pradesh	8	20	67.22333	1.71
10	Jammu and KashmiOr	14	37	0	0.88
11	Jharkhand	17	177	67.93	2.62
12	Karnataka	71	228	69.366	3.61
13	Kerala	46	54	75.08	2.89
14	Madhya Pradesh	76	81	68.025	2.93
15	Maharashtra	363	495	74.50833	6.97
16	Manipur	2	0	0	0.53
17	Meghalaya	1	17	46.26	0.60
18	Mizoram	0	1	0	0.51
19	Nagaland	2	0	0	0.53
20	Odisha	23	88	75.11667	2.75
21	Punjab	64	86	72.5775	3.29
22	Rajasthan	92	99	74.6625	3.74
23	Sikkim	0	4	0	0.52
24	Tamil Nadu	126	161	73.88333	4.51
25	Telangana	69	317	70.07	4.53
26	Tripura	2	15	0	0.60
27	Uttar Pradesh	106	389	68.37545	4.89
28	Uttarakhand	40	48	57.69	1.78
29	West Bengal	102	119	73.49	3.97

	UNION TERRITORIES				
1	Andaman and Nicobar	2	0	0	0.53
2	Chandigarh	0	0	0	0.50
3	Dadra and Nagar Haveli	0	0	0	0.50
4	Daman and Diu	0	0	0	0.50
5	Delhi	17	2	79.54	2.24
6	Lakshadweep	0	0	0	0.50
7	Puducherry	3	7	0	0.58

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Table-H.15: Composite Hazard Index

	STATES/ UNION TERRITORIES	Earth- quake	Land- slide	Flood	Drought	Cyclone	Tsunami	Avalanche	Heat Wave	Cold Wave	Coastal Erosion	Light- ening	Forest Fire	Fire	Industrial Hazard	Composite Hazard Index
	Weights (%) >	15%	7%	15%	15%	15%	3%	3%	6%	3%	3%	6%	3%	3%	3%	100%
1	Andhra Pradesh	2.67	1.65	3.27	6.80	6.34	5.29	-	5.77	0.00	3.68	2.96	4.17	2.41	3.31	4.07
2	Arunachal Pradesh	10.00	6.70	1.30	1.82	-	-	-	1.65	0.32	-	0.01	5.90	0.01	0.50	2.74
3	Assam	10.00	1.29	2.93	3.03	-	-	-	2.96	0.31	-	0.74	4.03	0.18	1.04	2.87
4	Bihar	6.23	0.21	5.19	4.05	-	-	-	4.64	0.68	-	3.09	0.93	0.73	1.30	2.91
5	Chattisgarh	2.31	2.37	1.48	4.56	-	-	-	3.20	0.47	-	6.11	4.75	1.10	2.17	2.23
6	Goa	4.00	3.04	1.70	2.29	2.37	1.18	-	1.52	0.00	0.29	0.01	1.20	0.06	0.75	1.96
7	Gujarat	5.42	0.41	3.07	4.63	4.90	2.78	-	3.07	0.40	3.88	1.69	1.24	3.51	8.86	3.64
8	Haryana	4.56	0.25	4.12	2.77	-	-	-	3.56	1.12	-	0.23	0.16	0.48	3.37	2.12
9	Himachal Pradesh	7.41	7.55	1.00	3.80	-	-	2.26	1.15	5.00	-	0.11	1.55	0.09	1.71	2.75
10	Jammu &Kashmir	6.39	5.30	1.33	2.77	-	-	1.51	0.31	7.12	-	0.09	0.53	0.06	0.88	2.27
11	Jharkhand	3.20	1.90	1.58	5.98	-	-	-	4.89	0.42	-	3.33	2.93	0.39	2.62	2.43
12	Karnataka	2.27	1.46	1.45	7.05	2.72	1.71	-	2.21	0.00	0.79	3.15	2.07	2.03	3.61	2.75
13	Kerala	3.96	4.22	3.24	3.96	2.54	3.49	-	2.64	0.00	1.43	1.04	1.44	0.40	2.89	2.86
14	Madhya Pradesh	2.72	0.98	1.86	5.30	-	-	-	3.99	1.47	-	9.90	3.63	3.63	2.93	2.73
15	Maharashtra	3.21	1.65	1.79	7.23	3.22	3.90	-	4.07	0.37	2.25	8.55	2.79	9.99	9.38	4.05
16	Manipur	10.00	7.57	1.00	3.09	-	-	-	1.34	1.26	-	0.01	4.24	0.02	0.53	2.91
17	Meghalaya	10.00	5.11	1.49	1.30	-	-	-	1.73	2.02	-	0.09	5.27	0.02	0.60	2.62
18	Mizoram	10.00	8.15	1.22	2.49	-	-	-	2.45	0.39	-	0.01	4.67	0.01	0.51	2.94
19	Nagaland	10.00	7.41	0.55	2.92	-	-	-	1.63	0.26	-	0.01	5.32	0.02	0.53	2.82
20	Odisha	2.28	1.96	2.51	4.34	6.87	3.49	-	6.95	0.55	1.44	7.92	2.03	0.62	2.75	3.76
21	Punjab	5.02	0.16	7.19	1.95	-	-	-	4.23	2.89	-	1.89	0.56	0.47	3.29	2.72
22	Rajasthan	2.69	0.51	1.36	6.67	-	-	-	3.46	1.25	-	1.89	0.18	1.17	3.74	2.15
23	Sikkim	6.00	7.78	1.28	1.88	-	-	-	1.64	0.36	-	0.04	0.31	0.01	0.52	2.06
24	Tamil Nadu	2.56	0.67	1.55	3.66	5.77	5.45	-	6.13	0.00	2.13	2.47	0.77	2.81	4.51	3.06
25	Telangana	2.59	1.20	1.74	5.85	-	-	-	3.17	0.00	-	2.87	2.55	2.41	4.53	2.26
26	Tripura	10.00	3.54	1.52	3.16	-	-	-	1.92	0.43	-	0.23	5.27	0.03	0.60	2.77
27	Uttar Pradesh	4.20	0.12	4.54	3.83	-	-	-	6.16	0.59	-	5.52	0.85	1.84	4.89	2.84
28	Uttarakhand	7.64	7.74	1.14	5.74	-	-	1.79	2.28	4.04	-	0.10	3.83	0.14	1.78	3.21
29	West Bengal	4.61	0.22	6.76	3.10	8.88	1.98	-	5.43	0.12	0.98	4.01	0.91	1.31	3.97	4.36
	UNION TERRITORIES															
1	Andaman & Nicobar Islands	10.00	0.00	0.0	2.85	3.06	7.67	-	2.40	0.00	9.91	0.01	1.85	0.02	0.53	3.13
2	Chandigarh	6.00	0.00	1.53	1.52	-	-	-	1.45	0.85	-	0.00	1.13	0.03	0.50	1.52
3	Dadra & Nagar Haveli	4.00	1.95	0.89	2.71	2.58	-	-	2.29	0.00	-	0.01	0.96	0.01	0.50	1.85
4	Daman & Diu	4.00	0.00	1.32	4.35	3.45	0.98	-	1.79	0.05	0.09	0.00	1.00	0.01	0.50	2.15
5	Delhi	6.00	0.00	1.92	1.60	-	-	-	3.13	0.49	-	0.02	0.00	0.59	2.24	1.72
6	Lakshadeep	4.00	0.00	0.00	2.86	2.36	1.35	-	1.60	0.00	0.40	0.00	1.05	0.01	0.50	1.58
7	Pondicherry	2.16	0.04	0.84	2.35	4.08	3.99	-	5.66	0.00	0.16	0.01	1.01	0.05	0.58	1.93

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.1: Vulnerability of Built Environment: Building Walls

	STATES/ UNION TERRITORIES	Grass, Thatch, Bamboo	Plastic Poluthene	Mud Unburnt bricks	Wood	Stone packed with mortar	Stone not packed with mortar		GI, Metal Asbestos	Burnt Bricks	Concrete	Any other material	Total	Vulnerability Index of Walls
	1	2	3	4	5	6	7		8	9	10	11	12	13
	STATES													
1	Andhra Pradesh	915987	38379	1647077	123642	625275	3704664		31763	6746907	240997	146561	14221252	3.04
2	Arunachal Pradesh	201697	5039	6387	34558	9009	7849		3171	23274	32874	15965	339823	4.68
3	Assam	5775808	58346	270296	154807	63421	131039		120323	1814422	266437	101808	8756707	3.91
4	Bihar	6943736	118304	4065590	99857	197898	264905		31865	10812874	177883	70155	22783067	2.34
5	Chhatisgarh	81779	12201	3919827	37598	125595	93614		6919	2023295	52488	7795	6361111	2.57
6	Goa	9930	2092	43105	4986	49975	276673		5247	7664	40310	3171	443153	3.15
7	Gujarat	690904	43276	2434894	104496	409966	1226490		67523	9502855	579187	23705	15083296	2.60
8	Haryana	44865	12698	267545	7986	99055	247785		9320	5621521	115542	8769	6435086	2.01
9	Himachal Pradesh	19437	5109	531484	40656	280591	652383		13193	1007568	22319	3207	2575947	5.84
10	Jammu & Kashmir	21913	9462	538908	161261	494503	262227		42205	1653064	68012	24390	3275945	4.78
11	Jharkhand	137142	17074	4033883	20064	73969	93961		15796	2859861	65268	6730	7323748	2.44
12	Karnataka	696773	43683	3274960	141307	1978189	3209975		104371	5495385	1143830	53361	16141834	2.33
13	Kerala	157032	52775	1024165	104081	942652	4767577		25698	2471449	286062	103664	9935155	3.31
14	Madhya Pradesh	632171	54504	8114024	144224	487510	855669		48065	6861129	179219	50954	17427469	2.02
15	Maharshtra	1682119	136434	5788328	324494	980560	2881094		752643	13682038	3194187	174209	29596106	2.37
16	Manipur	136703	4653	326182	79593	4862	3623		3797	80343	6915	4220	650891	6.11
17	Meghalaya	264927	9744	42726	125935	12061	26527		19144	72940	96354	10239	680597	5.02
18	Mizoram	69398	2224	661	7915	527	735		118587	22882	30981	3123	257033	5.79
19	Nagaland	233850	6354	14736	106911	2497	2725		13512	76788	31399	3598	492370	5.21
20	Odisha	884749	43403	5217153	327462	183461	684835		33145	4401213	206192	37076	12018689	2.65
21	Punjab	48021	12629	315961	6794	62876	66761		6368	6247049	358715	14593	7139767	2.00
22	Rajasthan	424345	24471	3269015	83283	1125928	6226520		25769	4841930	64370	67203	16152834	2.03
23	Sikkim	20220	1651	14626	34896	7011	4380		2679	41033	23173	2103	151772	3.22
24	Tamil Nadu	974920	25620	4182268	58236	645176	3641135		55006	9796314	1866134	153313	21398122	2.33
25	Telengana	460594	39058	1731353	110926	458160	1649154		33897	4614003	244917	72618	9414680	2.11
26	Tripura	304869	4764	451457	3464	4996	6940		74214	162793	5985	2097	1021579	5.33
27	Uttar Pradesh	2578261	139934	8229316	83054	509543	846910		47845	28913573	261853	987660	42597949	1.81
28	Uttarakhand	69056	5875	129801	29536	416194	811205		16083	1495657	50588	6004	3029999	5.31
29	West Bengal	4391018	154175	6452373	202162	134298	179257		581896	11081877	973611	87055	24237722	2.40
	UNION TERRITORIES													
1	Andaman & Nicobar Islands	29174	544	1113	24106	723	1927		8252	6869	47295	1537	121540	5.91
2	Chandigarh	699	1001	7492	514	1378	2364		3128	245601	14309	572	277058	2.02
3	Dadra & Nagar Haveli	19977	320	7286	438	286	288		690	56966	3287	114	89652	3.08
4	Daman & Diu	596	295	841	284	966	14208		462	54748	2612	96	75108	2.73
5	Delhi	14161	11614	85842	7463	45213	153631		9170	3495442	223494	7346	4053376	2.05
6	Lakshadeep	1467	76	40	218	1549	5697		183	8121	146	120	17617	2.69
7	Puducherry	23130	464	23056	957	5436	37219		776	248916	7680	1214	348848	2.70
	TOTAL	28961428	1098245	66463771	2798164	10441309	33041946		2332705	146548364	10984625	2256345	304927001	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.2: Vulnerability of Built Environment: Building Roofs

	STATES/ UNION TERRITORIES	Grass, Thatch, Bam- boo, wood, mud	Plastic Poluthene	Hand made tiles	Machine Made tiles	Burnt Bricks	Stone Slates		GI, Metal Asbestos	Concrete	Any Other Materials	Total	Vulnerability Index of Roofs
	1	2	5	6	7	8		9	10	11	12	13	14
	STATES												
1	Andhra Pradesh	2926342	28044	559279	1110832	41305		771883	1406470	7303076	74021	14221252	2.67
2	Arunachal Pradesh	145239	1521	1249	463	861		3419	165637	17877	3557	339823	4.27
3	Assam	1752172	238424	61659	21488	13320		74502	6298932	277445	18765	8756707	3.42
4	Bihar	7656471	283575	4031787	210681	1615410		1236476	2412593	5234365	101709	22783067	2.43
5	Chhattisgarh	477736	41536	4061040	78335	21949		109346	272590	1288698	9881	6361111	1.80
6	Goa	10551	2787	14279	201684	2866		9007	40709	159492	1778	443153	2.42
7	Gujarat	225930	66159	1187275	3139055	86279		480620	2885551	6990721	21706	15083296	2.16
8	Haryana	1345198	23768	295707	78148	904973		1465165	216953	2081551	23623	6435086	1.98
9	Himachal Pradesh	155522	8460	6482	4089	18422		1041373	364872	972713	4014	2575947	3.64
10	Jammu and Kashmir	845849	12309	30493	6267	12604		36987	1565270	729625	36541	3275945	3.86
11	Jharkhand	826109	27045	3436617	259121	62854		90746	567264	2036004	17988	7323748	1.81
12	Karnataka	1731360	78473	1445086	3937576	77889		1358323	2638598	4818546	55983	16141834	1.92
13	Kerala	251286	71707	332763	3313560	30437		90128	958712	4866989	19573	9935155	2.72
14	Madhya Pradesh	1547405	179207	6872862	1225392	140054		2238892	1819607	3344067	59983	17427469	1.48
15	Maharashtra	1766597	189289	2003442	3937750	196292		883768	10941907	9437703	239358	29596106	2.13
16	Manipur	110419	1481	4349	1528	2847		12705	485576	31117	869	650891	4.22
17	Meghalaya	111780	7305	2043	2882	2935		11935	457782	79493	4442	680597	4.01
18	Mizoram	41002	1289	175	320	350		2531	170508	40509	349	257033	4.39
19	Nagaland	93701	2004	1119	1098	1230		7968	347933	35751	1566	492370	4.39
20	Orissa	4203272	50095	2517420	559941	29850		139331	1660563	2833289	24928	12018689	2.61
21	Punjab	565370	22889	867072	117770	1750008		81086	173140	3525752	36680	7139767	2.39
22	Rajasthan	2182197	56908	1730515	329312	708094		8178323	999639	1884448	83398	16152834	1.44
23	Sikkim	8176	1420	351	126	645		1781	99761	39339	173	151772	3.67
24	Tamil Nadu	3320518	31372	1837224	4135387	278621		286576	1774153	9649601	84670	21398122	1.93
25	Telengana	804092	51131	882025	1403155	32732		418859	1528519	4253790	40377	9414680	1.69
26	Tripura	112563	6375	3415	1614	8274		8755	825309	54475	1866	1022646	3.93
27	Uttar Pradesh	10313269	198268	3417279	293264	1.3E+07		5817251	1554894	7453987	232247	42602359	1.95
28	Uttarakhand	175927	22939	23216	7949	556476		745408	271140	1221027	5835	3029917	3.36
29	West Bengal	3155403	330754	4621407	1965314	155173		427656	7028204	6468481	85737	24238129	3.12
	UNION TERRITORIES												
1	Andaman and Nicobar	8269	411	92	94	54		599	95843	15395	783	121540	3.38
2	Chandigarh	6674	2325	1190	594	4984		2248	27716	230483	844	277058	1.64

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3	Dadra & Nagar Haveli	1049	804	4286	22841	172		1138	33431	25896	35	89652	3.14
4	Daman and Diu	336	240	1527	6318	219		1491	33778	31120	79	75108	2.36
5	Delhi	47899	31823	12390	25067	171662		942754	230111	2583893	7777	4053376	1.58
6	Lakshadweep	1623	59	36	6452	20		98	2428	6827	74	17617	1.47
7	Puducherry	65157	1310	9878	19799	3215		2991	23428	221451	1619	348848	1.82
	Total	46992463	2073506	4E+07	26425266	2E+07		2.7E+07	50379521	90244996	1302828	304932704	

Table-V.3: Vulnerability of Built Environment: Physical Infrastructure

	STATES/ UNION TERRITORIES	Road Length	Road Length	Sea port		Air Port			Dams & Reservoirs		Power Plants			Physical Infrastructure Index
		Km	Km	Major	Minor	Int.+Dom.		Domestic	100m+	15-100m	Thermal	Hydro	Nuclear	
		2	3	4	5	6		7	8	9	10	11	12	
	STATES													
1	Andhra Pradesh	105820.18	4189.77	1	12	1		5	3	167	26	4		5.27
2	Arunachal Pradesh	7267.94	0					3		4		3		0.54
3	Assam	51818.60	2760.22			1		6		4	3	3		2.23
4	Bihar	102880.11	3892.37					5		26	6	3		2.58
5	Chhattisgarh	64029.90	1550.67					2	1	258	10	1		2.04
6	Goa	7188.91	192.35	1	5	1				5	1			0.76
7	Gujarat	129063.70	5948.13	1	46	1		10	4	632	25	3	1	8.31
8	Haryana	82335.96	1730.32							1	6	2	1	2.06
9	Himachal Pradesh	23754.23	310.28					3	4	20	1	22		2.74
10	Jammu and Kashmir	34264.41	406.78			1		2	3	15	4	8		2.17
11	Jharkhand	50275.84	2986.63					3	3	79	7	3		2.52
12	Karnataka	193549.26	3942.87	1	9	2		3	10	231	8	10	1	7.49
13	Kerala	133469.35	2242.18	1	17	3			5	62	3	11		4.86
14	Madhya Pradesh	145083.82	5716.47					8	3	906	6	7		5.37
15	Maharashtra	241347.16	6818.99			2		8	5	1,845	16	16		9.44
16	Manipur	9150.27	12.84					1		4	1	2		0.35
17	Meghalaya	5148.75	0			1		1		8		4		0.72
18	Mizoram	4977.38	1.47					1		1				0.14
19	Nagaland	10763.09	9.42					1		1		1		0.24
20	Odisha	77298.18	2863.92	2	26	1		1	4	300	9	7		4.51
21	Punjab	101363.17	2154.29			1		3	1	15	2	3		2.32
22	Rajasthan	204077.74	6197.03			1		6	3	211	10	2		5.18
23	Sikkim	2623.57	0							6	2	2		0.25

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

24	Tamil Nadu	222785.77	4668.32	6	32	3		5	2	116	19	11	2	9.29
25	Telengana	94275.15	1948.01			1		1	2	182	6	5		2.73
26	Tripura	7650.54	158.32					4		1	2			0.59
27	Uttar Pradesh	279499.42	9371.38			1		7	3	130	12	5		6.69
28	Uttarakhand	36083.65	363.85					2	3	15		14		2.00
29	West Bengal	101522.12	4770.46	1	1	1		6	1	33	16	3		4.10
	UNION TERRITORIES													
1	Andaman and Nicobar	2304.30	0		23	1				2	1			0.90
2	Chandigarh	1514.08	19.74					1						0.12
3	Dadra and Nagar Haveli	832.30	0											0.01
4	Daman and Diu	430.00	0		2			1						0.15
5	Delhi	18745.00	720.57			1		1						0.72
6	Lakshadweep	27.39	0		10			1						0.32
7	Puducherry	1807.26	79.83		6						1			0.21
		2555028.49	76027.48	14	189	24		101	60	5,280	203	155		

Table-V.4: Vulnerability of Built Environment: Social Infrastructure

		Number of Educational Institutions								Number of Health Institutions					Social Infrastructure Index
		School Education			Higher Education					Primary Healthcare					
	STATES/ UNION TERRITORIES	Primary	Middle	secondary	College	universi- ties	Engineer- ing	Medical	Polytech- niques	Dispen- saries	FW Centres	Health Cen- tres	Hospitals / Med. Schools		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	STATES														
1	Andhra Pradesh	49608	16403	11562	1197	10	353	27	101	423	109	7207	213	2.27	
2	Arunachal Pradesh	2502	1062	358	39	0	0	1	1	45	43	606	56	0.12	
3	Assam	41363	20414	8178	1171	3	13	7	11	527	520	4358	532	1.56	
4	Bihar	58252	28662	9752	1162	16	16	24	35	1632	5299	9736	220	3.27	
5	Chhattisgarh	33602	15245	6505	403	2	39	37	13	1364	1260	5322	748	1.80	
6	Goa	962	351	375	34	1	4	2	3	80	126	79	39	0.10	
7	Gujarat	37856	0	9957	1015	39	70	102	90	663	1205	7925	572	2.54	
8	Haryana	13928	9892	10231	186	7	38	112	42	685	754	2638	327	1.34	
9	Himachal Pradesh	13231	6325	5166	139	6	24	9	15	2223	411	1520	263	1.19	

10	Jammu and Kashmir	14924	8550	3424	164	1	3	6	4	1204	368	1749	239	0.84
11	Jharkhand	32471	14492	4270	205	10	12	13	10	1698	1786	5161	1541	2.12
12	Karnataka	55670	34677	18915	2309	23	159	125	278	1505	4089	9834	1203	4.49
13	Kerala	11083	5815	5549	922	7	150	56	65	2301	1764	2122	464	1.92
14	Madhya Pradesh	86908	37527	14733	1256	22	204	81	44	1393	2041	7225	938	3.51
15	Maharashtra	84810	47009	29945	2068	43	257	143	484	4399	3032	12559	2635	6.78
16	Manipur	2988	1434	913	96	1	2	3	1	111	56	415	28	0.16
17	Meghalaya	7215	2775	1099	96	5	2	0	3	25	190	506	15	0.26
18	Mizoram	1671	1155	615	59	2	2	3	0	143	76	381	55	0.17
19	Nagaland	2072	822	434	57	20	0	0	2	116	16	391	59	0.40
20	Odisha	53899	23992	13237	1510	7	202	45	38	1303	816	6106	824	2.61
21	Punjab	18203	9501	8670	1285	4	78	15	36	2360	1593	2883	1022	2.11
22	Rajasthan	68524	44427	33556	1715	35	195	27	109	2573	6729	17277	4298	6.78
23	Sikkim	1013	394	234	8	6	2	1	0	154	75	166	8	0.17
24	Tamil Nadu	42286	18613	14885	977	41	555	79	175	2269	4357	10488	1533	4.79
25	Telengana	28392	12511	9354	742	3	277	18	58	174	71	4398	445	1.54
26	Tripura	2670	1325	909	25	0	0	0	1	311	98	492	97	0.21
27	Uttar Pradesh	122672	63900	33187	3475	9	556	395	87	1991	8542	4804	2936	6.96
28	Uttarakhand	14777	6016	4937	350	9	29	49	25	362	816	3249	855	1.25
29	West Bengal	62741	14072	14540	491	4	204	142	8	5190	3506	12356	1509	4.46
	UNION TERRITORIES													
1	Andaman and Nicobar	364	148	121	1	0	2	0	0	24	17	129	8	0.03
2	Chandigarh	222	201	239	22	1	4	7	2	52	109	6	7	0.07
3	Dadra and Nagar Haveli	289	0	34	1	0	0	0	0	12	11	43	3	0.01
4	Daman and Diu	65	42	41	1	0	0	0	0	10	9	16	7	0.01
5	Delhi	727	383	438	13	0	11	0	8	111	51	17	25	0.08
6	Lakshadweep	64	19	25	3	0	0	0	0	17	0	8	3	0.01
7	Puducherry	695	402	391	45	1	14	11	5	67	159	76	109	0.15
	Total	968719	448556	276779	23242	338	3477	1540	1754	37517	50104	142248	23836	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.5: Vulnerability of Productive Systems: Agriculture

	States and Union Territories	Total area hectares	Area Under Agriculture (hectare)					Corp Vulnerability Index
			Cropped Area		Irrigated Area			
			Area	%	Area	%		
	1	2	3		4	5	6	7
	STATES							
1	Andhra Pradesh	16020500	6236050		38.93	2829687	45.38	2.51
2	Arunachal Pradesh	8374300	225000		2.69	58242.5	25.89	0.16
3	Assam	7843800	2827324		36.05	193078	6.83	2.40
4	Bihar	9416300	5278316		56.06	2986842	56.59	2.71
5	Chhattisgarh	13391230	4964448.5		37.07	1339370	26.98	2.51
6	Goa	370200	129243		34.91	38800	30.02	1.54
7	Gujarat	19624400	9923950		50.57	4097650	41.29	3.65
8	Haryana	4421200	3521751		79.66	2973571	84.43	2.24
9	Himachal Pradesh	5567300	541509.5		9.73	106324	19.63	0.56
10	Jammu and Kashmir	10138700	781067		7.70	325085	41.62	0.43
11	Jharkhand	7971600	1384515		17.37	150670.5	10.88	1.13
12	Karnataka	19179100	9360148		48.80	3093388	33.05	3.66
13	Kerala	3885200	2042881		52.58	388176	19.00	2.87
14	Madhya Pradesh	30825200	15201955		49.32	7171914	47.18	4.39
15	Maharashtra	30771300	17208900		55.93	2220300	12.90	5.78
16	Manipur	2232700	219787		9.84	50790	23.11	0.49
17	Meghalaya	2242900	259731.5		11.58	59737	23.00	0.58
18	Mizoram	2108100	144701		6.86	10256.5	7.09	0.39
19	Nagaland	1657900	383851		23.15	96850	25.23	1.12
20	Odisha	15570700	4474000		28.73	2117121	47.32	1.80
21	Punjab	5036200	4118857		81.79	4118018	99.98	1.85
22	Rajasthan	34223900	17521496		51.20	6484574	37.01	5.07
23	Sikkim	709600	49582		6.99	14438	29.12	0.31
24	Tamil Nadu	13006000	4819018		37.05	2725641	56.56	2.02
25	Telengana	11484000	4376540		38.11	1687608	38.56	2.27
26	Tripura	1048600	153825		14.67	58183	37.82	0.61
27	Uttar Pradesh	24092800	16513780		68.54	13311231	80.61	4.35
28	Uttarakhand	5348300	700171		13.09	329964	47.13	0.59
29	West Bengal	8875200	5395844		60.80	3279156	60.77	2.78

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

	UNION TERRITORIES						
1	Andaman and Nicobar	824900	14710		1.78	93	0.63
2	Chandigarh	11400	0		0.00	0	0.00
3	Dadra and Nagar Haveli	49100	20131		41.00	5903	29.32
4	Daman and Diu	11100	3153		28.41	283	8.98
5	Delhi	148300			0.00		0.00
6	Lakshadweep	3000	2345		78.17	776	33.09
7	Puducherry	49000	15846		32.34	13355	84.28
	Total	316534030	138814427		43.85	62337074	44.91

Table-V.6: Vulnerability of Productive Systems: Livestock

	STATES/ UNION TERRITORIES	Livestock (numbers)			Livestock Vulnerability Index
		Bovine Animals	Other Animals	Total Animals	
	1	2	3	4	
	STATES				
1	Andhra Pradesh	11040114	18112670	29152784	3.41
2	Arunachal Pradesh	732789	1412666	2145455	2.12
3	Assam	10742869	19082171	29825040	3.39
4	Bihar	19555140.4	32712496.8	52267637.2	4.41
5	Chhattisgarh	11205449	15043943	26249392	3.43
6	Goa	89278	145853	235131	2.15
7	Gujarat	20369527	27128200	47497727	4.37
8	Haryana	7893428	8819518	16712946	3.15
9	Himachal Pradesh	2869114	4844431	7713545	2.45
10	Jammu and Kashmir	3591865	9200842	12792707	2.40
11	Jharkhand	9916025	18052746	27968771	3.29
12	Karnataka	12986989	27701896	40688885	3.74
13	Kerala	1430896	2735162	4166058	2.21
14	Madhya Pradesh	27790355	35808046	63598401	5.10
15	Maharashtra	21078599	32488652	53567251	4.53
16	Manipur	340343	695772	1036115	2.03
17	Meghalaya	918059	1957627	2875686	2.08
18	Mizoram	43034	311856	354890	1.38
19	Nagaland	302565	911162	1213727	1.80

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

20	Odisha	11621272	20732498	32353770	3.50
21	Punjab	7587448	8117101	15704549	3.14
22	Rajasthan	26300557	57732204	84032761	5.62
23	Sikkim	145206	291626	436832	2.02
24	Tamil Nadu	9594473	22722984	32317457	3.31
25	Telengana	9178618	26946623	36125241	3.35
26	Tripura	492271	1042584	1534855	2.03
27	Uttar Pradesh	48059590	66035896	114095486	7.26
28	Uttarakhand	2993890	4794730	7788620	2.49
29	West Bengal	17112707	30348280	47460987	4.16
	UNION TERRITORIES				
1	Andaman and Nicobar Islands	53488	154750	208238	1.78
2	Chandigarh	22996	24197	47193	2.46
3	Dadra and Nagar Haveli	45932	50239	96171	2.44
4	Daman and Diu	2526	4627	7153	2.06
5	Delhi	248575	360397	608972	2.25
6	Lakshadweep	3099	49596	52695	1.18
7	Puducherry	62005	119614	181619	2.03
	Total	296421091	496693655.8	793114747	

Table-V.7: Vulnerability of Productive Systems: Industries

	STATES/ UNION TERRITORIES	MSME Indus- tries (Nos)	Industrial Clus- ters (nos.)	Special Eco- nomic Zones (nos.)	Industrial Vul- nerability Index
	1	2	3	4	5
	STATES				
1	Andhra Pradesh	22128	25	29	2.64
2	Arunachal Pradesh	483	0	0	0.00
3	Assam	13864	4	0	0.35
4	Bihar	27135	3	0	0.38
5	Chhattisgarh	11392	6	2	0.53
6	Goa	862	1	7	0.28
7	Gujarat	321785	50	28	6.28
8	Haryana	31701	24	23	2.46
9	Himachal Pradesh	6395	5	0	0.37
10	Jammu and Kashmir	8395	3	0	0.25
11	Jharkhand	15885	6	1	0.53
12	Karnataka	165093	24	62	4.56
13	Kerala	102868	10	29	2.23
14	Madhya Pradesh	145165	10	10	1.94
15	Maharashtra	136878	59	55	6.41
16	Manipur	1074	0	1	0.04
17	Meghalaya	4503	0	0	0.03
18	Mizoram	2146	0	0	0.01
19	Nagaland	5624	0	1	0.07
20	Odisha	15966	13	7	1.16
21	Punjab	17531	30	5	2.21
22	Rajasthan	123393	20	9	2.41
23	Sikkim	199	0	0	0.00
24	Tamil Nadu	582931	37	49	7.87
25	Telengana	40728	10	63	2.83
26	Tripura	1515	0	0	0.01
27	Uttar Pradesh	289503	41	24	5.36
28	Uttarakhand	16240	3	0	0.30
29	West Bengal	103276	24	7	2.47

	UNION TERRITORIES				
1	Andaman and Nicobar	653	0	0	0.00
2	Chandigarh	1365	0	2	0.01
3	Dadra and Nagar Haveli	943	0	0	0.01
4	Daman and Diu	923	0	0	0.00
5	Delhi	2310	19	2	1.09
6	Lakshadweep	99	9	0	0.00
7	Puducherry	1122	17	49	3.61
	Total	2222073	444	465	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.8: Vulnerable Socio-Economic Conditions: Poverty

	STATES/ UNION TERRITORIES	BPL Population (Lakhs)			Homeless Population			Poverty Vulnerability Index
		Rural	Urban	Total	Rural	Urban	Total	
		2	3	4	5	6	7	
1	Andhra Pradesh	38.11492	8.488648	46.60357	34111	27131	61242	0.68
2	Arunachal Pradesh	4.151332	0.645211	4.796543	1289	345	1634	2.39
3	Assam	90.84904	9.012613	99.86165	10392	2527	12919	2.19
4	Bihar	314.5149	36.72028	351.2352	32993	12591	45584	2.63
5	Chhattisgarh	87.47111	14.69466	102.1658	17681	6533	24214	2.79
6	Goa	0.375729	0.370887	0.746616	1358	1693	3051	0.45
7	Gujarat	74.73219	26.10551	100.8377	59484	84822	144306	1.29
8	Haryana	19.21689	9.089682	28.30658	28082	23789	51871	0.90
9	Himachal Pradesh	5.23729	0.298143	5.535433	3226	872	4098	0.54
10	Jammu and Kashmir	10.5107	2.471934	12.98264	8199	10848	19047	0.77
11	Jharkhand	102.3249	19.69779	122.0227	16424	6967	23391	2.64
12	Karnataka	91.91228	36.02959	127.9419	41262	35473	76735	1.60
13	Kerala	15.96862	7.919658	23.88828	4092	7761	11853	0.57
14	Madhya Pradesh	187.8402	42.14575	229.9859	80380	66055	146435	2.30
15	Maharashtra	149.0888	46.34625	195.4351	99535	111373	210908	1.35
16	Manipur	7.843963	2.718508	10.56247	1881	1331	3212	2.87
17	Meghalaya	2.971413	0.551387	3.5228	1064	177	1241	0.88
18	Mizoram	1.861616	0.363646	2.225263	51	110	161	1.67
19	Nagaland	2.805219	0.940952	3.746171	557	349	906	1.46
20	Odisha	124.8099	12.10932	136.9193	20008	14053	34061	2.14
21	Punjab	13.28565	9.608811	22.89446	28340	18374	46714	0.69
22	Rajasthan	82.65806	18.2244	100.8825	108308	73236	181544	1.11
23	Sikkim	0.450144	0.05621	0.506354	245	32	277	0.55
24	Tamil Nadu	58.93444	22.83601	81.77045	13812	37117	50929	0.90
25	Telangana	23.6575	7.906634	31.56414	35243	48726	83969	0.68
26	Tripura	4.483703	0.713398	5.197101	1873	1352	3225	0.97
27	Uttar Pradesh	472.1645	115.9541	588.1187	148196	180929	329125	2.26
28	Uttarakhand	8.176941	3.195706	11.37265	6268	5556	11824	1.30
29	West Bengal	140.0364	42.65034	182.6867	29073	104967	134040	1.51
	UNION TERRITORIES							
1	Andaman and Nicobar	0.037224	0	0.037224	30	65	95	0.97
2	Chandigarh	0.004755	2.29003	2.294785	6	4133	4139	3.14
3	Dadra and Nagar Haveli	1.146111	0.246995	1.393106	723	281	1004	0.52
4	Daman and Diu	0	0.200481	0.200481	146	591	737	0.92
5	Delhi	0.541402	16.107	16.6484	352	46724	47076	0.14
6	Lakshadweep	0	0.017314	0.017314	0	0	0	0.94
7	Puducherry	0.674211	0.537234	1.211446	82	1508	1590	0.68
	Total	2138.852	517.2651	2656.117	834766	938391	1773157	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.9: Vulnerable Socio-Economic Conditions: Children

	STATES/ UNION TERRITORIES	Age Group of Children						IMR*	Not Going to School		Working Children		Child Vulnerability Index
		0-18 (Numbers)	0-6 (%)	0-6 (Numbers)	7-18 (%)		7-18 (Numbers)		(%)	Numbers	(%)	Numbers	Health Centres
	1	2	3	4	5		6	7	8	9	10	11	12
	STATES												
1	Andhra Pradesh	16192987	32.2509	5222384	67.7491		10970603	37	21.46069	3475126	7.108108	1151015	3.83
2	Arunachal Pradesh	623609	34.02581	212188	65.97419		411421	30	21.66101	135080	3.370702	21020	2.36
3	Assam	12768623	36.32443	4638130	63.67557		8130493	47	26.97607	3444473	3.543499	452456	4.03
4	Bihar	49797077	38.42387	19133964	61.57613		30663113	42	27.51297	13700655	2.313067	1151840	5.35
5	Chhattisgarh	10335064	35.42977	3661689	64.57023		6673375	41	22.34717	2309594	4.433054	458159	3.52
6	Goa	406973	35.53332	144611	64.46668		262362	9	15.09609	61437	2.895524	11784	1.13
7	Gujarat	22214012	35.01061	7777262	64.98939		14436750	33	24.97422	5547777	5.922041	1315523	4.01
8	Haryana	9727500	34.75426	3380721	65.24574		6346779	36	18.22074	1772422	2.768738	269329	2.99
9	Himachal Pradesh	2290517	33.96168	777898	66.03832		1512619	28	13.71123	314058	2.53851	58145	2.14
10	Jammu and Kashmir	5272578	38.29066	2018905	61.70934		3253673	26	19.7438	1041007	1.386475	73103	2.30
11	Jharkhand	14600419	36.91329	5389495	63.08671		9210924	32	23.35675	3410184	2.282565	333264	3.14
12	Karnataka	20729561	34.54503	7161033	65.45497		13568528	28	22.80745	4727884	6.507205	1348915	3.66
13	Kerala	9932755	34.96467	3472955	65.03533		6459800	12	10.98277	1090892	1.204852	119675	1.48
14	Madhya Pradesh	30501760	35.43859	10809395	64.56141		19692365	50	23.0635	7034773	4.633493	1413297	5.06
15	Maharashtra	38488509	34.62466	13326517	65.37534		25161992	21	18.76204	7221229	5.131399	1974999	3.87
16	Manipur	1098379	34.17372	375357	65.82628		723022	9	17.73878	194839	3.249425	35691	1.21
17	Meghalaya	1447331	39.28168	568536	60.71832		878795	42	21.95103	317704	4.364309	63166	3.10
18	Mizoram	445066	37.86652	168531	62.13348		276535	32	16.94423	75413	4.76244	21196	2.42
19	Nagaland	869237	33.4858	291071	66.5142		578166	12	20.54514	178586	4.776373	41518	1.43
20	Odisha	15319522	34.4214	5273194	65.5786		10046328	46	27.18969	4165330	3.204199	490868	4.06
21	Punjab	9371374	32.8257	3076219	67.1743		6295155	23	21.18258	1985099	4.45512	417506	2.50
22	Rajasthan	29894376	35.62377	10649504	64.37623		19244872	43	25.7748	7705215	4.625984	1382909	4.79
23	Sikkim	220086	29.12998	64111	70.87002		155975	18	15.79246	34757	4.845833	10665	1.59
24	Tamil Nadu	21987083	33.76452	7423832	66.23548		14563251	19	15.34909	3374817	4.469679	982752	2.75
25	Telangana	12169519	32.21506	3920418	67.78494		8249101	34	18.68684	2274099	5.871333	714513	3.24
26	Tripura	1305542	35.08229	458014	64.91771		847528	20	19.77003	258106	2.587431	33780	1.83
27	Uttar Pradesh	90929225	33.86296	30791331	66.13704		60137894	46	26.6588	24240641	3.005703	2733062	7.28
28	Uttarakhand	4054494	33.43978	1355814	66.56022		2698680	34	18.18148	737167	3.024224	122617	2.64
29	West Bengal	32120577	32.94295	10581466	67.05705		21539111	26	25.99591	8350035	3.909864	1255871	3.90
	UNION TERRITORIES												
1	Andaman and Nicobar	119179	34.29967	40878	65.70033		78301	20	14.87259	17725	2.236132	2665	1.66
2	Chandigarh	348780	34.24336	119434	65.75664		229346	21	15.88021	55387	4.456678	15544	1.79
3	Dadra and Nagar Haveli	133283	38.18567	50895	61.81433		82388	21	23.11698	30811	7.784939	10376	2.01
4	Daman and Diu	74521	36.14283	26934	63.85717		47587	18	31.39786	23398	16.8731	12574	2.10
5	Delhi	5921350	33.98641	2012454	66.01359		3908896	18	16.87524	999242	2.834303	167829	1.88
6	Lakshadweep	21041	34.4803	7255	65.5197		13786	20	11.35402	2389	0.251889	53	1.55
7	Puducherry	379568	35.00242	132858	64.99758		246710	11	11.10815	42163	2.028622	7700	1.14
	Total	472111477	34.8467	164515253	65.1533		307596224		23.37361	110349514	3.955714	18675379	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.10: Vulnerable Socio-Economic Conditions: Women

	State/ Union Territory	Total Female Population	Sex Ratio	Illiteracy (%)	WHH* (%)	MMR **	CAW ***		Dependent %	Gender Vulnerability Index
	1	2	3	4	5	6		7	8	9
	STATES									
1	Andhra Pradesh	24648731	996	40.41	15.08	110		91	64.86	5.38
2	Arunachal Pradesh	669815	938	40.43	12.98	126		30	64.56	4.46
3	Assam	15266133	958	32.73	13.32	323		67	77.54	6.29
4	Bihar	49821295	918	46.67	10.44	219		18	80.93	6.56
5	Chhattisgarh	12712303	991	39.41	13.00	230		34	60.3	4.80
6	Goa	719405	973	18.16	23.16	126		26	78.08	3.51
7	Gujarat	28948432	919	29.27	10.08	122		27	76.62	5.46
8	Haryana	11856728	879	33.23	11.65	146		48	82.21	5.83
9	Himachal Pradesh	3382729	972	23.4	20.58	126		30	55.18	3.50
10	Jammu and Kashmir	5900640	889	41.99	9.61	126		44	80.89	5.55
11	Jharkhand	16057819	948	43.79	10.9	219		23	70.9	5.38
12	Karnataka	30128640	973	31.87	16.98	144		28	68.13	4.93
13	Kerala	17378649	1084	8.02	25.24	66		48	81.77	2.95
14	Madhya Pradesh	35014503	931	39.98	9.96	230		49	67.36	7.12
15	Maharashtra	54131277	929	24.52	12.84	155		31	68.94	6.28
16	Manipur	1417208	985	26.83	14.94	126		15	61.44	3.52
17	Meghalaya	1475057	989	26.22	23.14	126		14	67.33	3.46
18	Mizoram	541867	976	10.6	16.63	126		29	63.84	3.18
19	Nagaland	953853	931	23.11	13.49	126		5	55.26	3.88
20	Odisha	20762082	979	35.64	12.47	235		43	72.84	5.57
21	Punjab	13103873	895	28.66	14.94	155		23	86.09	5.28
22	Rajasthan	32997440	928	47.34	9.26	255		54	64.88	7.48
23	Sikkim	287507	890	23.57	12.94	126		19	60.43	4.48
24	Tamil Nadu	36009055	996	26.14	16	90		21	68.2	4.25
25	Telengana	17489900	988	42.47	14.57	110		84	60.67	4.99
26	Tripura	1799541	960	16.85	14.1	126		63	76.43	3.85
27	Uttar Pradesh	95331831	912	40.74	11.98	292		24	83.25	8.39
28	Uttarakhand	4948519	963	29.3	19.09	292		22	73.32	4.63
29	West Bengal	44467088	950	29.84	12.83	117		46	81.92	6.73
	UNION TERRITORIES									
1	Andaman and Nicobar Islands	177710	876	18.16	13.76	126		35	82.19	3.57
2	Chandigarh	474787	818	18.62	9.96	126		50	84	4.07
3	Dadra and Nagar Haveli	149949	774	34.07	5.61	126		14	74.75	4.02
4	Daman and Diu	92946	618	20.41	12.23	126		14	85.11	5.97
5	Delhi	7800615	868	19.07	11.49	126		81	89.42	5.29
6	Lakshadweep	31350	946	11.75	38.41	126		8	89.04	1.87
7	Puducherry	635442	1037	18.78	15.06	126		18	82.37	2.83
	Total	587584719	943	34.54	17.07	178		36	74.49	

* Women Headed Household which is an indicator of strength and vulnerability

** Maternal Mortality Rate per 100,000 child births

*** Crime Against Women.. The figure is based on average number of cases registered in police stations during 2001-2015, per 100,000 women

Note: % of women is based on census 2011 data on Work Participation Rate of women. Woen not working is considered as dependent

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.11: Vulnerable Socio-Economic Conditions: Disability

			Disabled Population		Visual			Physical		Mental		Disability Vulnerable Index
	State/ Union Terri- tory	Total Population	Number	%	Number		%	Number	%	Number	%	
	1	2	3	4	5		6	7	8	9	10	11
	STATES											
1	Andhra Pradesh	49386799	1219785	2.47	203167		16.66	312782	25.64	102166	8.38	1.67
2	Arunachal Pradesh	1383727	26734	1.93	5652		21.14	3235	12.10	1895	7.09	1.33
3	Assam	31205576	480065	1.54	80553		16.78	76007	15.83	45193	9.41	1.39
4	Bihar	104099452	2331009	2.24	549080		23.56	369577	15.85	126772	5.44	1.48
5	Chhattisgarh	25545198	624937	2.45	111169		17.79	190328	30.46	54003	8.64	1.88
6	Goa	1458545	33012	2.26	4964		15.04	5578	16.90	3492	10.58	1.40
7	Gujarat	60439692	1092302	1.81	214150		19.61	245879	22.51	108430	9.93	1.72
8	Haryana	25351462	546374	2.16	82702		15.14	116026	21.24	46261	8.47	1.48
9	Himachal Pradesh	6864602	155316	2.26	26076		16.79	32550	20.96	14152	9.11	1.55
10	Jammu and Kashmir	12541302	361153	2.88	66448		18.40	58137	16.10	32393	8.97	1.43
11	Jharkhand	32988134	769980	2.33	180721		23.47	147892	19.21	57615	7.48	1.66
12	Karnataka	61095297	1324205	2.17	264170		19.95	271982	20.54	114887	8.68	1.62
13	Kerala	33406061	761843	2.28	115513		15.16	171630	22.53	132624	17.41	1.82
14	Madhya Pradesh	72626809	1551931	2.14	270751		17.45	404738	26.08	117316	7.56	1.69
15	Maharashtra	112374333	2963392	2.64	574052		19.37	548418	18.51	218962	7.39	1.49
16	Manipur	2855794	54110	1.89	18226		33.68	5093	9.41	5911	10.92	1.78
17	Meghalaya	2966889	44317	1.49	6980		15.75	5312	11.99	4672	10.54	1.26
18	Mizoram	1097206	15160	1.38	2035		13.42	1976	13.03	2635	17.38	1.45
19	Nagaland	1978502	29631	1.50	4150		14.01	3828	12.92	2245	7.58	1.14
20	Odisha	41974218	1244402	2.96	263799		21.20	259899	20.89	115236	9.26	1.69
21	Punjab	27743338	654063	2.36	82199		12.57	130044	19.88	66995	10.24	1.41
22	Rajasthan	68548437	1563694	2.28	314618		20.12	427364	27.33	122436	7.83	1.82
23	Sikkim	610577	18187	2.98	2772		15.24	2067	11.37	1029	5.66	1.07
24	Tamil Nadu	72147030	1179963	1.64	127405		10.80	287241	24.34	133811	11.34	1.53
25	Telengana	35193978	1046822	2.97	194977		18.63	226152	21.60	73383	7.01	1.56
26	Tripura	3673917	64346	1.75	10828		16.83	11707	18.19	7216	11.21	1.53
27	Uttar Pradesh	199812341	4157514	2.08	763988		18.38	677713	16.30	257945	6.20	1.35
28	Uttarakhand	10086292	185272	1.84	29107		15.71	36996	19.97	17893	9.66	1.50
29	West Bengal	91276115	2017406	2.21	424473		21.04	322945	16.01	208038	10.31	1.56
	UNION TERRITORIES											1.65
1	Andaman and Nicobar Islands	380581	6660	1.75	1084		16.28	1593	23.92	658	9.88	1.66
2	Chandigarh	1055450	14796	1.40	1774		11.99	3815	25.78	1846	12.48	1.41
3	Dadra and Nagar Haveli	343709	3294	0.96	429		13.02	682	20.70	295	8.96	1.90
4	Daman and Diu	243247	2196	0.90	382		17.40	620	28.23	265	12.07	1.74
5	Delhi	16787941	234882	1.40	30124		12.83	67383	28.69	26384	11.23	1.85
6	Lakshadweep	64473	1615	2.50	337		20.87	361	22.35	208	12.88	1.73
7	Puducherry	1247953	30189	2.42	3608		11.95	9054	29.99	3188	10.56	1.67
	Total	1210854977	26810557	2.21	5032463		18.77	5436604	20.28	2228450	8.31	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.12: Vulnerable Socio-Economic Conditions: Elderly People

			Disabled Population		60 -79 Age Group			80+ Age Group		Dependency Ratio	Elderly Vulnerability Index
	State/ Union Territory	Total Population	Number	%		Number	%	Number	%		
	1	2	3	4	5		6	7	8	9	10
	STATES										
1	Andhra Pradesh	49386799	5008662	10.14	4593221		91.71	415441	8.29	15.90	3.40
2	Arunachal Pradesh	1383727	63639	4.60		56200	88.31	7439	11.69	8.13	1.31
3	Assam	31205576	2078544	6.66	1848969		88.96	229575	11.04	10.88	2.20
4	Bihar	104099452	7707145	7.40		7027797	91.19	679348	8.81	14.24	3.53
5	Chhattisgarh	25545198	2003909	7.84	1817130		90.68	186779	9.32	12.33	2.50
6	Goa	1458545	163495	11.21		147714	90.35	15781	9.65	16.73	2.75
7	Gujarat	60439692	4786559	7.92	4237497		88.53	549062	11.47	13.04	2.97
8	Haryana	25351462	2193755	8.65		1919166	87.48	274589	12.52	14.26	2.76
9	Himachal Pradesh	6864602	703009	10.24	596272		84.82	106737	15.18	15.78	2.78
10	Jammu and Kashmir	12541302	922656	7.36		795786	86.25	126870	13.75	12.35	2.22
11	Jharkhand	32988134	2356678	7.14	2167941		91.99	188737	8.01	12.92	2.46
12	Karnataka	61095297	5791032	9.48		5165722	89.20	625310	10.80	15.48	3.50
13	Kerala	33406061	4193393	12.55	3651544		87.08	541849	12.92	19.86	4.10
14	Madhya Pradesh	72626809	5713316	7.87		5045247	88.31	668069	11.69	13.38	3.24
15	Maharashtra	112374333	11106935	9.88	9926741		89.37	1180194	10.63	17.17	4.43
16	Manipur	2855794	200020	7.00		174226	87.10	25794	12.90	10.98	1.82
17	Meghalaya	2966889	138902	4.68	123025		88.57	15877	11.43	8.39	1.36
18	Mizoram	1097206	68628	6.25		60454	88.09	8174	11.91	10.17	1.65
19	Nagaland	1978502	102726	5.19	88920		86.56	13806	13.44	8.85	1.44
20	Odisha	41974218	3984448	9.49		3586456	90.01	397992	9.99	15.51	2.47
21	Punjab	27743338	2865817	10.33	2486316		86.76	379501	13.24	16.60	3.26
22	Rajasthan	68548437	5112138	7.46		4525085	88.52	587053	11.48	13.13	3.06
23	Sikkim	610577	40752	6.67	36110		88.61	4642	11.39	10.01	1.63
24	Tamil Nadu	72147030	7509758	10.41		6767748	90.12	742010	9.88	16.13	3.92
25	Telengana	35193978	3269579	9.29	2930817		89.64	338762	10.36	15.09	3.09
26	Tripura	3673917	289544	7.88		250019	86.35	39525	13.65	12.05	2.02
27	Uttar Pradesh	199812341	15439904	7.73	13627420		88.26	1812484	11.74	14.06	4.62
28	Uttarakhand	10086292	900809	8.93		795904	88.35	104905	11.65	16.64	2.59
29	West Bengal	91276115	7742382	8.48	6858821		88.59	883561	11.41	12.98	3.54
	UNION TERRITORIES										
1	Andaman and Nicobar Islands	380581	25424	6.68	22951		90.27	2473	9.73	10.55	1.70
2	Chandigarh	1055450	67078	6.36		59447	88.62	7631	11.38	9.30	1.53
3	Dadra and Nagar Haveli	343709	13892	4.04	12814		92.24	1078	7.76	6.27	1.01
4	Daman and Diu	243247	11361	4.67		10231	90.05	1130	9.95	8.55	1.36
5	Delhi	16787941	1147445	6.83	1034414		90.15	113031	9.85	10.11	1.93
6	Lakshadweep	64473	5270	8.17		4789	90.87	481	9.13	12.36	2.00
7	Puducherry	1247953	120436	9.65	107121		88.94	13315	11.06	15.17	3.26
	Total	1210854977	103849040	8.58		92560035	89.13	11289005	10.87	13.85	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.13: Environmental Vulnerability Index: Depletion of Mangrove Cover

	Change in Mangrove Cover (Sq. Km) 2000-15				
	STATES	Dense	Open	Total	Depletion of Mangrove Cover Index
1	Andhra Pradesh	115	-81	34	0.86
2	Goa	15	6	21	0.00
3	Gujarat	-10	204	197	0.08
4	Karnataka	1	0	1	0.00
5	Kerala	5	4	9	0.00
6	Maharashtra	-11	115	104	0.09
7	Odisha	-17	29	12	0.42
8	Tamil Nadu	6	18	24	0.00
9	West Bengal	39	-14	25	0.89
	UNION TERRITORIES				
1	Andaman and Nicobar Islands	-142	-30	-172	3.81
2	Daman and Diu	0	3	3	0.00
3	Lakshadweep				0.00
4	Puducherry	0	-1	-1	1.20

Table-V-14: Environmental Vulnerability Index: Depletion of Forest Cover

			Change in Forest Cover (2000 - 15)			
	State/ Union Territory	Total Area	Dense	Open	Total	Forest Cover Depletion index
	1	2	3	4	5	6
	STATES					
1	Andhra Pradesh	160205	1541	633	2174	0.00
2	Arunachal Pradesh	83743	-1643	959	-684	2.39
3	Assam	78438	-3158	3016	-91	1.80
4	Bihar	94163	252	1316	1568	0.00
5	Chhattisgarh	135192	1190	-1908	5484	0.73
6	Goa	3702	-663	792	129	0.00
7	Gujarat	196244	-3077	2525	-552	1.46
8	Haryana	44212	-660	490	-170	1.69
9	Himachal Pradesh	55673	-824	1160	336	1.13
10	Jammu and Kashmir	101387	877	1643	2520	0.00
11	Jharkhand	79716	-670	-805	-1475	1.48
12	Karnataka	191791	-4347	3653	-694	1.72
13	Kerala	38852	-948	4627	3679	0.00
14	Madhya Pradesh	308252	-2853	3050	197	0.76
15	Maharashtra	307713	-1435	4581	3146	0.74
16	Manipur	22327	942	-874	68	0.34
17	Meghalaya	22429	4352	-2719	1633	0.62
18	Mizoram	21081	-2940	4194	1254	0.16
19	Nagaland	16579	598	-977	-379	2.31
20	Odisha	155707	521	995	1516	0.00
21	Punjab	50362	-824	137	-687	2.49
22	Rajasthan	342239	-1820	1624	-196	2.16
23	Sikkim	7096	269	-105	164	0.00
24	Tamil Nadu	130060	963	3900	4863	0.00
25	Telengana	114840	-675	-121	-796	2.37
26	Tripura	10486	1259	-513	746	0.89
27	Uttar Pradesh	240928	-2710	3425	715	0.40
28	Uttarakhand	53483	-667	969	302	0.42
29	West Bengal	88752	774	5361	6135	0.00
	UNION TERRITORIES					
1	Andaman and Nicobar	8249	-222	43	-179	2.64
2	Chandigarh	114	10.66	2.81	13.47	0.00
3	Dadra and Nagar Haveli	491	-71	58	-13	2.58
4	Daman and Diu	111	5.48	7.94	13.42	0.00
5	Delhi	1483	26.16	51.37	77.53	0.00
6	Lakshadweep	30	-10.27	9.84	-0.43	2.67
7	Puducherry	490	-4.88	24.46	19.58	0.00

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.15: Environmental Vulnerability Index: Water Stress

	State/ Union Territory	Surface Water			Terrestrial		Sub Surface Water				Water Stress Index
		Total Area (Sq. Km)	Sq. km	%		Moisture Index	Over Exploited	Critical	Sub Critical	Safe	
	1	2	3	4	5		6	7	8	9	10
	STATES										
1	Andhra Pradesh	160205	85437.75	53.33026		-43.41	11.28	4.39	11.40	72.92	5.29
2	Arunachal Pradesh	83743	59978.49	71.6221		156.33	0.00	0.00	0.00	100.00	3.03
3	Assam	78438	73921.14	94.24149		122.21	0.00	0.00	0.00	100.00	4.19
4	Bihar	94163	41110.2	43.65855		-15.63	0.00	0.00	2.17	97.83	4.20
5	Chhattisgarh	135192	103142.8	76.29354		-16.62	0.00	1.34	15.65	83.01	5.47
6	Goa	3702	2599.993	70.23213		87.50	0.00	0.00	0.00	100.00	3.82
7	Gujarat	196244	124824	63.60652		-50.94	11.16	8.12	10.62	70.09	5.82
8	Haryana	44212	6691.214	15.13439		-56.52	54.74	11.88	8.85	24.53	4.95
9	Himachal Pradesh	55673	32270.99	57.96524		9.84	0.00	24.51	29.39	46.10	4.93
10	Jammu and Kashmir	101387	27993.48	27.61053		7.40	0.00	0.00	0.00	100.00	3.37
11	Jharkhand	79716	65529.05	82.20313		-9.70	1.38	0.57	3.35	94.71	5.48
12	Karnataka	191791	123585.8	64.43773		-26.60	20.98	7.29	15.19	56.55	5.80
13	Kerala	38852	31150.39	80.17706		69.05	0.89	1.74	12.56	84.81	4.53
14	Madhya Pradesh	308252	162944.8	52.86091		-38.55	7.09	0.76	18.98	73.16	5.13
15	Maharashtra	307713	265396.9	86.2482		-24.10	2.83	0.28	6.02	90.87	5.86
16	Manipur	22327	19336.86	86.6075		59.12	0.00	0.00	0.00	100.00	4.71
17	Meghalaya	22429	16201.57	72.23491		208.80	0.00	0.00	0.00	100.00	2.17
18	Mizoram	21081	19824.63	94.04029		124.75	0.00	0.00	0.00	100.00	4.16
19	Nagaland	16579	12876.97	77.67039		58.39	0.00	0.00	0.00	100.00	4.42
20	Odisha	155707	84391.43	54.19887		-8.37	0.00	0.00	0.00	100.00	4.45
21	Punjab	50362	10.67	0.021187		-47.35	76.40	3.81	1.92	17.87	4.04
22	Rajasthan	342239	219402.2	64.10788		-65.14	67.34	5.95	8.29	18.42	7.50
23	Sikkim	7096	5290.183	74.55161		155.27	0.00	0.00	100.00	0.00	3.76
24	Tamil Nadu	130060	57289.81	44.04875		-45.13	33.35	10.73	19.48	36.43	5.64
25	Telengana	114840	72853.45	63.43909		-44.93	9.32	2.80	15.97	71.91	5.65
26	Tripura	10486	6840.093	65.23072		108.66	0.00	0.00	0.00	100.00	3.39
27	Uttar Pradesh	240928	50384.16	20.91254		-34.65	12.81	6.72	4.61	75.86	4.00
28	Uttarakhand	53483	40143.78	75.05896		13.65	0.00	0.68	9.48	89.84	4.98
29	West Bengal	88752	39494.84	44.50023		41.76	0.00	0.20	19.24	80.56	3.65
	UNION TERRITORIES	342239	265396.9			208.80					
1	Andaman and Nicobar	8249	8207.615	99.49831		90.64	0.00	0.00	0.00	100.00	4.75
2	Chandigarh	114	114	100		-21.92	0.00	0.00	0.00	100.00	7.37
3	Dadra and Nagar Haveli	491	347.0388	70.68		30.87	0.00	0.00	0.00	100.00	4.52
4	Daman and Diu	111	101.0445	91.03108		-38.56	0.00	35.14	0.00	64.86	7.89
5	Delhi	1483	1483	100		-34.12	54.83	0.00	37.26	7.91	9.74
6	Lakshadweep	30	20.073	66.91			0.00	0.00	33.00	67.00	5.09
7	Puducherry	490	74.1507	15.1328		-35.00	60.00	0.00	0.00	40.00	4.51

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.16: Composite Vulnerability Index

		Built Environment				Productive System			Socio Economic Conditions						Natural Enviornments			Composite Vulnerability Index
	STATES/ UNION TERRITORIES	Buildings: Walls	Build- ings: Roofs	Physical Infra- structure	Social In- frastruc- ture	Agricul- ture	Live- stock	Indus- tries		Poverty	Women	Children	Disability	Elderly People	Depletion of Forest Cover	Depletion of Mangrove	Water Stress	
	Weights (%) >	15%	5%	5%	10%	6%	6%	10%		8%	8%	6%	6%	5%	5%	5%	100%	
1	Andhra Pradesh	3.04	2.67	5.27	2.27	2.51	3.41	2.64		0.68	5.38	3.83	1.67	3.40	0.00	0.86	5.29	2.84
2	Arunachal Pradesh	4.68	4.27	0.54	0.12	0.16	2.12	0.00		2.39	4.46	2.36	1.33	1.31	2.39	-	3.03	2.06
3	Assam	3.91	3.42	2.23	1.56	2.40	3.39	0.35		2.19	6.29	4.03	1.39	2.20	1.80	-	4.19	2.76
4	Bihar	2.34	2.43	2.58	3.27	2.71	4.41	0.38		2.63	6.56	5.35	1.48	3.53	0.00	-	4.20	2.94
5	Chattisgarh	2.57	1.80	2.04	1.80	2.51	3.43	0.53		2.79	4.80	3.52	1.88	2.50	0.73	-	5.47	2.53
6	Goa	3.15	2.42	0.76	0.10	1.54	2.15	0.28		0.45	3.51	1.13	1.4	2.75	0.00	0.00	3.82	1.62
7	Gujarat	2.60	2.16	8.31	2.54	3.65	4.37	6.28		1.29	5.46	4.01	1.72	2.97	1.46	0.08	5.82	3.44
8	Haryana	2.01	1.98	2.06	1.34	2.24	3.15	2.46		0.9	5.83	2.99	1.48	2.76	1.69	-	4.95	2.41
9	Himachal Pradesh	5.84	3.64	2.74	1.19	0.56	2.45	0.37		0.54	3.50	2.14	1.55	2.78	1.13	-	4.93	2.20
10	Jammu &Kashmir	4.78	3.86	2.17	0.84	0.43	2.40	0.25		0.77	5.55	2.30	1.43	2.22	0.00	-	3.37	2.09
11	Jharkhand	2.44	1.81	2.52	2.12	1.13	3.29	0.53		2.64	5.38	3.14	1.66	2.46	1.48	-	5.48	2.43
12	Karnataka	2.33	1.92	7.49	4.49	3.66	3.74	4.56		1.6	4.93	3.66	1.62	3.50	1.72	0.00	5.80	3.31
13	Kerala	3.31	2.72	4.86	1.92	2.87	2.21	2.23		0.57	2.95	1.48	1.82	4.10	0.00	0.00	4.53	2.34
14	Madhya Pradesh	2.02	1.48	5.37	3.51	4.39	5.10	1.94		2.3	7.12	5.06	1.69	3.24	0.76	-	5.13	3.36
15	Maharashtra	2.37	2.13	9.44	6.78	5.78	4.53	6.41		1.35	6.28	3.87	1.49	4.43	0.74	0.09	5.86	4.02
16	Manipur	6.11	4.22	0.35	0.16	0.49	2.03	0.04		2.87	3.52	1.21	1.78	1.82	0.34	-	4.71	2.11
17	Meghalaya	5.02	4.01	0.72	0.26	0.58	2.08	0.03		0.88	3.46	3.10	1.26	1.36	0.62	-	2.17	1.82
18	Mizoram	5.79	4.39	0.14	0.17	0.39	1.38	0.01		1.67	3.18	2.42	1.45	1.65	0.16	-	4.16	1.92
19	Nagaland	5.21	4.39	0.24	0.40	1.12	1.80	0.07		1.46	3.88	1.43	1.14	1.44	2.31	-	4.42	2.04
20	Odisha	2.65	2.61	4.51	2.61	1.80	3.50	1.16		2.14	5.57	4.06	1.69	3.26	0.00	0.42	4.45	2.74
21	Punjab	2.00	2.39	2.32	2.11	1.85	3.14	2.21		0.69	5.28	2.50	1.41	3.26	2.49	-	4.04	2.35
22	Rajasthan	2.03	1.44	5.18	6.78	5.07	5.62	2.41		1.11	7.48	4.79	1.82	3.06	2.16	-	7.50	3.72
23	Sikkim	3.22	3.67	0.25	0.17	0.31	2.02	0.00		0.55	4.48	1.59	1.07	1.63	0.00	-	3.76	1.58
24	Tamil Nadu	2.33	1.93	9.29	4.79	2.02	3.31	7.87		0.9	4.25	2.75	1.53	3.92	0.00	0.00	5.64	3.16
25	Telangana	2.11	1.69	2.73	1.54	2.27	3.35	2.83		0.68	4.99	3.24	1.56	3.09	2.37	-	5.65	2.50
26	Tripura	5.33	3.93	0.59	0.21	0.61	2.03	0.01		0.97	3.85	1.83	1.53	2.02	0.89	-	3.39	1.90
27	Uttar Pradesh	1.81	1.95	6.69	6.96	4.35	7.26	5.36		2.26	8.39	7.28	1.35	4.62	0.40	-	4.00	4.21
28	Uttarakhand	5.31	3.36	2.00	1.25	0.59	2.49	0.30		1.3	4.63	2.64	1.5	2.59	0.42	-	4.98	2.27
29	West Bengal	2.40	3.12	4.10	4.46	2.78	4.16	2.47		1.51	6.73	3.90	1.56	3.54	0.00	0.89	3.65	3.05
	Union Territories												1.65					0.10
1	Andaman & Nicobar Islands	5.91	3.38	0.90	0.03	0.10	1.78	0.00		0.97	3.57	1.66	1.66	1.70	2.64	3.81	4.75	2.14
2	Chandigarh	2.02	1.64	0.12	0.07	0.00	2.46	0.01		3.14	4.07	1.79	1.41	1.53	0.00	-	7.37	1.76
3	Dadra & Nagar Haveli	3.08	3.14	0.01	0.01	1.79	2.44	0.01		0.52	4.02	2.01	1.9	1.01	2.58	-	4.52	1.86
4	Daman & Diu	2.73	2.36	0.15	0.01	1.48	2.06	0.00		0.92	5.97	2.10	1.74	1.36	0.00	0.00	7.89	1.98
5	Delhi	2.05	1.58	0.72	0.08	0.00	2.25	1.09		0.14	5.29	1.88	1.85	1.93	0.00	-	9.74	1.81
6	Lakshadeep	2.69	1.47	0.32	0.01	3.29	1.18	0.00		0.94	1.87	1.55	1.73	2.00	2.67	-	5.09	1.71
7	Pondicherry	2.70	1.82	0.21	0.15	0.67	2.03	3.61		0.68	2.83	1.14	1.67	3.26	0.00	1.20	4.51	1.73

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-V.17: Hazard Specific Vulnerability Index

	STATES/ UNION TERRITORIES	Earth- quake	Landslide	Flood	Drought	Cyclone	Tsunami	Avalanche	Heat Wave	Cold Wave	Coastal Erosion	Lightening	Forest Fire	Fire	Industrial Hazard
1	Andhra Pradesh	2.53	2.53	2.84	1.99	2.84	2.84	0.00	1.11	0.00	2.21	1.11	1.84	2.07	1.53
2	Arunachal Pradesh	1.79	1.91	2.06	1.36	0.00	0.00	0.00	1.06	0.94	0.00	0.94	1.89	1.77	1.09
3	Assam	2.46	2.55	2.76	2.02	0.00	0.00	0.00	1.35	1.26	0.00	1.26	2.11	2.12	1.49
4	Bihar	2.73	2.73	2.94	2.28	0.00	0.00	0.00	1.52	1.52	0.00	1.52	2.08	2.27	1.75
5	Chattisgarh	2.22	2.25	2.53	2.01	0.00	0.00	0.00	1.24	1.21	0.00	1.21	1.85	1.93	1.51
6	Goa	1.43	1.43	1.62	1.16	1.62	1.62	0.00	0.67	0.00	1.28	0.67	1.27	1.30	0.87
7	Gujarat	3.07	3.14	3.44	2.54	3.44	3.44	0.00	1.24	1.17	2.44	1.17	1.89	2.32	1.84
8	Haryana	2.08	2.16	2.41	1.94	0.00	0.00	0.00	1.13	1.05	0.00	1.05	1.68	1.81	1.45
9	Himachal Pradesh	1.90	1.95	2.20	1.29	0.00	0.00	1.66	0.82	0.77	0.00	0.77	1.78	1.80	1.03
10	Jammu &Kashmir	1.92	1.92	2.09	1.29	0.00	0.00	1.70	0.92	0.92	0.00	0.92	1.74	1.80	1.11
11	Jharkhand	2.09	2.16	2.43	1.88	0.00	0.00	0.00	1.27	1.19	0.00	1.19	1.86	1.92	1.50
12	Karnataka	2.94	3.02	3.31	2.39	3.31	3.31	0.00	1.24	0.00	2.44	1.15	1.85	2.26	1.72
13	Kerala	2.11	2.11	2.34	1.55	2.34	2.34	0.00	0.77	0.00	1.84	0.77	1.45	1.68	1.13
14	Madhya Pradesh	3.07	3.11	3.36	2.66	0.00	0.00	0.00	1.54	1.50	0.00	1.50	2.06	2.31	1.87
15	Maharashtra	3.69	3.72	4.02	2.87	4.02	4.02	0.00	1.34	1.30	3.03	1.30	1.97	2.66	1.98
16	Manipur	1.85	1.87	2.11	1.31	0.00	0.00	0.00	0.90	0.88	0.00	0.88	1.91	1.90	1.12
17	Meghalaya	1.68	1.71	1.82	1.09	0.00	0.00	0.00	0.80	0.77	0.00	0.77	1.59	1.57	0.88
18	Mizoram	1.70	1.71	1.92	1.14	0.00	0.00	0.00	0.81	0.80	0.00	0.80	1.78	1.78	1.01
19	Nagaland	1.70	1.82	2.04	1.29	0.00	0.00	0.00	0.84	0.73	0.00	0.73	1.78	1.69	0.95
20	Odisha	2.49	2.49	2.74	1.96	2.74	2.74	0.00	1.28	1.28	2.23	1.28	1.92	2.10	1.57
21	Punjab	2.03	2.15	2.35	1.80	0.00	0.00	0.00	1.10	0.97	0.00	0.97	1.63	1.74	1.31
22	Rajasthan	3.23	3.34	3.72	2.86	0.00	0.00	0.00	1.49	1.39	0.00	1.39	2.13	2.50	1.91
23	Sikkim	1.39	1.39	1.58	1.04	0.00	0.00	0.00	0.70	0.70	0.00	0.70	1.41	1.42	0.89
24	Tamil Nadu	2.87	2.87	3.16	2.13	3.16	3.16	0.00	0.98	0.00	2.20	0.98	1.58	2.29	1.73
25	Telangana	2.10	2.22	2.50	2.00	0.00	0.00	0.00	1.12	0.00	0.00	1.01	1.69	1.82	1.46
26	Tripura	1.68	1.73	1.90	1.16	0.00	0.00	0.00	0.81	0.76	0.00	0.76	1.67	1.64	0.93
27	Uttar Pradesh	3.99	4.01	4.21	3.25	0.00	0.00	0.00	1.86	1.84	0.00	1.84	2.34	2.99	2.36
28	Uttarakhand	2.00	2.02	2.27	1.45	0.00	0.00	1.68	0.98	0.96	0.00	0.96	1.88	1.94	1.22
29	West Bengal	2.83	2.83	3.05	2.17	3.05	3.05	0.00	1.31	1.31	2.47	1.31	1.95	2.28	1.64
	Union Territories														
1	Andaman & Nicobar Islands	1.58	1.71	2.14	1.20	2.14	2.14	0.00	0.85	0.00	1.66	0.72	1.97	1.65	0.95
2	Chandigarh	1.39	1.39	1.76	1.48	0.00	0.00	0.00	0.96	0.96	0.00	0.96	1.60	1.61	1.33
3	Dadra & Nagar Haveli	1.50	1.63	1.86	1.39	1.86	1.86	0.00	0.84	0.00	0.00	0.71	1.53	1.40	0.94
4	Daman & Diu	1.58	1.58	1.98	1.59	1.98	1.98	0.00	0.92	0.92	1.46	0.92	1.70	1.70	1.32
5	Delhi	1.33	1.33	1.81	1.50	0.00	0.00	0.00	0.81	0.81	0.00	0.81	1.57	1.64	1.37
6	Lakshadeep	1.32	1.45	1.71	1.38	1.71	1.71	0.00	0.72	0.00	1.25	0.59	1.29	1.16	0.85
7	Pondicherry	1.44	1.44	1.73	1.31	1.73	1.73	0.00	0.68	0.00	1.17	0.68	1.31	1.47	1.12

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-E.1: Average Exposure Intensity Index

	STATES/ UNION TERRITORIES	Area	Population		State GDP (2015-16)		Average Expo- sure Index
		(Sq. Km)	Total	Density	Total (Rs. Cr.)	Per capita (Rs.)	
	STATES						
1	Andhra Pradesh	160205	49386799	308	609934	123501	2.90
2	Arunachal Pradesh	83743	1383727	17	20294	146662	0.51
3	Assam	78438	31205576	398	226276	72511	1.86
4	Bihar	94163	104099452	1106	381501	36648	2.67
5	Chhattisgarh	135192	25545198	189	260776	102084	1.89
6	Goa	3702	1458545	394	54275	372117	1.00
7	Gujarat	196244	60439692	308	1033791	171045	3.73
8	Haryana	44212	25351462	573	485184	191383	2.72
9	Himachal Pradesh	55673	6864602	123	112852	164397	1.24
10	Jammu and Kashmir	101387	12541302	124	119093	94961	1.27
11	Jharkhand	79716	32988134	414	231294	70114	1.88
12	Karnataka	191791	61095297	319	1016910	166447	3.70
13	Kerala	38852	33406061	860	556616	166621	3.02
14	Madhya Pradesh	308252	72626809	236	508937	70076	2.63
15	Maharashtra	307713	112374333	365	2001223	178085	5.16
16	Manipur	22327	2855794	128	19233	67347	0.55
17	Meghalaya	22429	2966889	132	25767	86849	0.63
18	Mizoram	21081	1097206	52	15339	139801	0.46
19	Nagaland	16579	1978502	119	19816	100157	0.55
20	Odisha	155707	41974218	270	341887	81452	2.19
21	Punjab	50362	27743338	551	391543	141130	2.45
22	Rajasthan	342239	68548437	200	672707	98136	2.99
23	Sikkim	7096	610577	86	16954	277672	0.50
24	Tamil Nadu	130060	72147030	555	1161963	161055	4.05
25	Telengana	114840	35193978	306	567588	161274	2.80
26	Tripura	10486	3673917	350	34184	93045	0.81
27	Uttar Pradesh	240928	199812341	829	1120836	56094	4.11
28	Uttarakhand	53483	10086292	189	176171	174664	1.57
29	West Bengal	88752	91276115	1028	1039924	113932	4.06

	UNION TERRITORIES						
1	Andaman and Nicobar	8249	380581	46	5932	155867	0.29
2	Chandigarh	114	1055450	9258	29049	275226	4.69
3	Dadra and Nagar Haveli	491	343709	700	2440	70990	0.48
4	Daman and Diu	111	243247	2191	1059	43536	1.08
5	Delhi	1483	16787941	11320	551963	328785	7.63
6	Lakshadweep	30	64473	2149	407	63127	1.02
7	Puducherry	490	1247953	2547	24701	197932	1.68
	Total	3166620		382	13838419	114286	

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-E.2: Hazard Specific Exposure Index - I

			Depth of Exposure							Hazard Specific Exposure Index							
	STATES/ UNION TERRITORIES	Intensity of Exposure	Earth- quake	Land- slide	Flood	Drought	Cyclone		Tsunami	Coastal Erosion	Earth- quake	Landslide	Flood	Drought	Cy- clone	Tsunami	Coastal Erosion
	STATES	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15
1	Andhra Pradesh	2.90	2.67	1.65	3.27	6.8	6.34		5.29	3.68	2.78	2.27	3.08	4.85	4.62	4.09	3.29
2	Arunachal Pradesh	0.51	10	6.7	1.3	1.82	0		0	0	5.26	3.61	0.91	1.17	0.00	0.00	0.00
3	Assam	1.86	10	1.29	2.93	3.03	0		0	0	5.93	1.57	2.39	2.44	0.00	0.00	0.00
4	Bihar	2.67	6.23	0.21	5.19	4.05	0		0	0	4.45	1.44	3.93	3.36	0.00	0.00	0.00
5	Chattisgarh	1.89	2.31	2.37	1.48	4.56	0		0	0	2.10	2.13	1.68	3.22	0.00	0.00	0.00
6	Goa	1.00	4	3.04	1.7	2.29	2.37		1.18	0.29	2.50	2.02	1.35	1.64	1.68	1.09	0.64
7	Gujarat	3.73	5.42	0.41	3.07	4.63	4.9		2.78	3.88	4.57	2.07	3.40	4.18	4.31	3.25	3.80
8	Haryana	2.72	4.56	0.25	4.12	2.77	0		0	0	3.64	1.48	3.42	2.74	0.00	0.00	0.00
9	Himachal Pradesh	1.24	7.41	7.55	1	3.8	0		0	0	4.33	4.40	1.12	2.52	0.00	0.00	0.00
10	Jammu &Kashmir	1.27	6.39	5.3	1.33	2.77	0		0	0	3.83	3.29	1.30	2.02	0.00	0.00	0.00
11	Jharkhand	1.88	3.2	1.9	1.58	5.98	0		0	0	2.54	1.89	1.73	3.93	0.00	0.00	0.00
12	Karnataka	3.70	2.27	1.46	1.45	7.05	2.72		1.71	0.79	2.99	2.58	2.58	5.38	3.21	2.71	2.25
13	Kerala	3.02	3.96	4.22	3.24	3.96	2.54		3.49	1.43	3.49	3.62	3.13	3.49	2.78	3.25	2.22
14	Madhya Pradesh	2.63	2.72	0.98	1.86	5.3	0		0	0	2.67	1.80	2.24	3.96	0.00	0.00	0.00
15	Maharashtra	5.16	3.21	1.65	1.79	7.23	3.22		3.9	2.25	4.19	3.41	3.48	6.20	4.19	4.53	3.71
16	Manipur	0.55	10	7.57	1	3.09	0		0	0	5.27	4.06	0.77	1.82	0.00	0.00	0.00
17	Meghalaya	0.63	10	5.11	1.49	1.3	0		0	0	5.31	2.87	1.06	0.96	0.00	0.00	0.00
18	Mizoram	0.46	10	8.15	1.22	2.49	0		0	0	5.23	4.31	0.84	1.48	0.00	0.00	0.00
19	Nagaland	0.55	10	7.41	0.55	2.92	0		0	0	5.28	3.98	0.55	1.74	0.00	0.00	0.00
20	Odisha	2.19	2.28	1.96	2.51	4.34	6.87		3.49	1.44	2.23	2.07	2.35	3.26	4.53	2.84	1.81
21	Punjab	2.45	5.02	0.16	7.19	1.95	0		0	0	3.74	1.31	4.82	2.20	0.00	0.00	0.00
22	Rajasthan	2.99	2.69	0.51	1.36	6.67	0		0	0	2.84	1.75	2.17	4.83	0.00	0.00	0.00
23	Sikkim	0.50	6	7.78	1.28	1.88	0		0	0	3.25	4.14	0.89	1.19	0.00	0.00	0.00
24	Tamil Nadu	4.05	2.56	0.67	1.55	3.66	5.77		5.45	2.13	3.31	2.36	2.80	3.86	4.91	4.75	3.09
25	Telangana	2.80	2.59	1.2	1.74	5.85	0		0	0	2.69	2.00	2.27	4.32	0.00	0.00	0.00
26	Tripura	0.81	10	3.54	1.52	3.16	0		0	0	5.40	2.17	1.16	1.98	0.00	0.00	0.00
27	Uttar Pradesh	4.11	4.2	0.12	4.54	3.83	0		0	0	4.15	2.11	4.32	3.97	0.00	0.00	0.00
28	Uttarakhand	1.57	7.64	7.74	1.14	5.74	0		0	0	4.60	4.65	1.35	3.65	0.00	0.00	0.00
29	West Bengal	4.06	4.61	0.22	6.76	3.1	8.88		1.98	0.98	4.33	2.14	5.41	3.58	6.47	3.02	2.52
	UNION TERRITORIES																
1	Andaman & Nicobar Islands	0.29	10	0	0	2.85	3.06		7.67	9.91	5.15	0.15	0.15	1.57	1.68	3.98	5.10
2	Chandigarh	4.69	6	0	1.53	1.52	0		0	0	5.35	2.35	3.11	3.11	0.00	0.00	0.00
3	Dadra & Nagar Haveli	0.48	4	1.95	0.89	2.71	2.58		0	0	2.24	1.22	0.69	1.60	0.00	0.00	0.00
4	Daman & Diu	1.08	4	0	1.32	4.35	3.45		0.98	0.09	2.54	0.54	1.20	2.72	2.27	1.03	0.59
5	Delhi	7.63	6	0	1.92	1.6	0		0	0	6.81	3.81	4.77	4.61	0.00	0.00	0.00
6	Lakshadeep	1.02	4	0	0	2.86	2.36		1.35	0.4	2.51	0.51	0.51	1.94	1.69	1.19	0.71
7	Pondicherry	1.68	2.16	0.04	0.84	2.35	4.08		3.99	0.16	1.92	0.86	1.26	2.02	2.88	2.84	0.92

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-E.3: Hazard Specific Exposure Index - II

			Depth of Exposure							Hazard Specific Exposure Index							
	STATES/ UNION TERRITORIES	Intensity of Expo- sure	ava- lanche	Heat Wave	Cold Wave	Lightening	Fire		Forest Fire	Industri- al Haz- ard	Ava- lanche	Heat Wave	Cold Wave	Lighten- ing	Fire	Forest Fire	Industrial Hazard
	STATES	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15
1	Andhra Pradesh	2.90	0	5.77	0	2.96	4.17		2.41	3.31	0.00	4.33	0.00	2.93	3.53	2.65	3.10
2	Arunachal Pradesh	0.51	0	1.65	0.32	0.01	5.9		0.01	0.5	0.00	1.08	0.42	0.26	3.21	0.26	0.51
3	Assam	1.86	0	2.96	0.31	0.74	4.03		0.18	1.04	0.00	2.41	1.08	1.30	2.94	1.02	1.45
4	Bihar	2.67	0	4.64	0.68	3.09	0.93		0.73	1.3	0.00	3.66	1.68	2.88	1.80	1.70	1.99
5	Chattisgarh	1.89	0	3.2	0.47	6.11	4.75		1.1	2.17	0.00	2.54	1.18	4.00	3.32	1.49	2.03
6	Goa	1.00	0	1.52	0	0.01	1.2		0.06	0.75	0.00	1.26	0.00	0.50	1.10	0.53	0.87
7	Gujarat	3.73	0	3.07	0.4	1.69	1.24		3.51	8.86	0.00	3.40	2.06	2.71	2.48	3.62	6.29
8	Haryana	2.72	0	3.56	1.12	0.23	0.16		0.48	3.37	0.00	3.14	1.92	1.47	1.44	1.60	3.04
9	Himachal Pradesh	1.24	2.26	1.15	5	0.11	1.55		0.09	1.71	1.75	1.20	3.12	0.68	1.40	0.67	1.48
10	Jammu &Kashmir	1.27	1.51	0.31	7.12	0.09	0.53		0.06	0.88	1.39	0.79	4.20	0.68	0.90	0.67	1.08
11	Jharkhand	1.88	0	4.89	0.42	3.33	2.93		0.39	2.62	0.00	3.39	1.15	2.61	2.41	1.14	2.25
12	Karnataka	3.70	0	2.21	0	3.15	2.07		2.03	3.61	0.00	2.96	0.00	3.43	2.89	2.87	3.66
13	Kerala	3.02	0	2.64	0	1.04	1.44		0.4	2.89	0.00	2.83	0.00	2.03	2.23	1.71	2.95
14	Madhya Pradesh	2.63	0	3.99	1.47	9.9	3.63		3.63	2.93	0.00	3.31	2.05	6.26	3.13	3.13	2.78
15	Maharashtra	5.16	0	4.07	0.37	8.55	2.79		9.99	9.38	0.00	4.62	2.77	6.86	3.98	7.58	7.27
16	Manipur	0.55	0	1.34	1.26	0.01	4.24		0.02	0.53	0.00	0.94	0.90	0.28	2.39	0.28	0.54
17	Meghalaya	0.63	0	1.73	2.02	0.09	5.27		0.02	0.6	0.00	1.18	1.32	0.36	2.95	0.32	0.61
18	Mizoram	0.46	0	2.45	0.39	0.01	4.67		0.01	0.51	0.00	1.46	0.43	0.24	2.57	0.24	0.49
19	Nagaland	0.55	0	1.63	0.26	0.01	5.32		0.02	0.53	0.00	1.09	0.41	0.28	2.94	0.29	0.54
20	Odisha	2.19	0	6.95	0.55	7.92	2.03		0.62	2.75	0.00	4.57	1.37	5.05	2.11	1.40	2.47
21	Punjab	2.45	0	4.23	2.89	1.89	0.56		0.47	3.29	0.00	3.34	2.67	2.17	1.51	1.46	2.87
22	Rajasthan	2.99	0	3.46	1.25	1.89	0.18		1.17	3.74	0.00	3.22	2.12	2.44	1.58	2.08	3.36
23	Sikkim	0.50	0	1.64	0.36	0.04	0.31		0.01	0.52	0.00	1.07	0.00	0.27	0.40	0.25	0.51
24	Tamil Nadu	4.05	0	6.13	0	2.47	0.77		2.81	4.51	0.00	5.09	0.00	3.26	2.41	3.43	4.28
25	Telangana	2.80	0	3.17	0	2.87	2.55		2.41	4.53	0.00	2.98	1.40	2.83	2.67	2.60	3.66
26	Tripura	0.81	0	1.92	0.43	0.23	5.27		0.03	0.6	0.00	1.36	0.62	0.52	3.04	0.42	0.70
27	Uttar Pradesh	4.11	0	6.16	0.59	5.52	0.85		1.84	4.89	0.00	5.13	2.35	4.81	2.48	2.97	4.50
28	Uttarakhand	1.57	1.79	2.28	4.04	0.1	3.83		0.14	1.78	1.68	1.92	2.80	0.83	2.70	0.85	1.67
29	West Bengal	4.06	0	5.43	0.12	4.01	0.91		1.31	3.97	0.00	4.74	0.00	4.03	2.48	2.68	4.01
	UNION TERRITORIES																
1	Andaman & Nicobar Islands	0.29	0	2.4	0	0.01	1.85		0.02	0.53	0.00	1.35	0.00	0.15	1.07	0.16	0.41
2	Chandigarh	4.69	0	1.45	0.85	0	1.13		0.03	0.5	0.00	3.07	2.77	2.35	2.91	2.36	2.60
3	Dadra & Nagar Haveli	0.48	0	2.29	0	0.01	0.96		0.01	0.5	0.00	1.39	0.00	0.25	0.72	0.25	0.49
4	Daman & Diu	1.08	0	1.79	0.05	0	1		0.01	0.5	0.00	1.44	0.57	0.54	1.04	0.55	0.79
5	Delhi	7.63	0	3.13	0.49	0.02	0		0.59	2.24	0.00	5.38	4.06	3.82	3.81	4.11	4.93
6	Lakshadeep	1.02	0	1.6	0	0	1.05		0.01	0.5	0.00	1.31	0.00	0.51	1.04	0.52	0.76
7	Pondicherry	1.68	0	5.66	0	0.01	1.01		0.05	0.58	0.00	3.67	0.00	0.85	1.35	0.87	1.13

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-R.1: Hazard Specific Disaster Risk Index - I

		Earthquake				Landslide				Flood				Drought				
	STATES/ UNION TERRITORIES	Hazard	Vulnerabil- ity	Expo- sure	Risk	Hazard	Vulnerability		Exposure	Risk	Hazard	Vulnera- bility	Exposure	Risk	Hazard	Vulnerabil- ity	Exposure	Risk
	STATES	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
1	Andhra Pradesh	2.67	2.53	2.78	1.88	1.65	2.53		2.27	0.95	3.27	2.84	3.08	2.86	6.80	1.99	4.85	6.56
2	Arunachal Pradesh	10.00	1.79	5.26	9.41	6.70	1.91		3.61	4.61	1.30	2.06	0.91	0.24	1.82	1.36	1.17	0.29
3	Assam	10.00	2.46	5.93	9.93	1.29	2.55		1.57	0.52	5.67	2.76	2.39	5.31	3.03	2.02	2.44	1.50
4	Bihar	6.23	2.73	4.45	7.57	0.21	2.73		1.44	0.08	5.19	2.94	3.93	6.00	4.05	2.28	3.36	3.10
5	Chattisgarh	2.31	2.22	2.10	1.08	2.37	2.25		2.13	1.14	1.48	2.53	1.68	0.63	4.56	2.01	3.22	2.96
6	Goa	4.00	1.43	2.50	1.43	3.04	1.43		2.02	0.88	1.70	1.62	1.35	0.37	2.29	1.16	1.64	0.44
7	Gujarat	5.42	3.07	4.57	7.61	0.41	3.14		2.07	0.27	3.07	3.44	3.40	3.59	4.63	2.54	4.18	4.92
8	Haryana	4.56	2.08	3.64	3.45	0.25	2.16		1.48	0.08	4.12	2.41	3.42	3.39	2.77	1.94	2.74	1.47
9	Himachal Pradesh	7.41	1.90	4.33	6.09	7.55	1.95		4.40	6.47	1.00	2.20	1.12	0.25	3.80	1.29	2.52	1.24
10	Jammu &Kashmir	6.39	1.92	3.83	4.70	5.30	1.92		3.29	3.35	1.33	2.09	1.30	0.36	2.77	1.29	2.02	0.72
11	Jharkhand	3.20	2.09	2.54	1.70	1.90	2.16		1.89	0.78	1.58	2.43	1.73	0.66	5.98	1.88	3.93	4.42
12	Karnataka	2.27	2.94	2.99	1.99	1.46	3.02		2.58	1.14	1.45	3.31	2.58	1.24	7.05	2.39	5.38	7.18
13	Kerala	3.96	2.11	3.49	2.91	4.22	2.11		3.62	3.22	3.24	2.34	3.13	2.37	3.96	1.55	3.49	2.14
14	Madhya Pradesh	2.72	3.07	2.67	2.23	0.98	3.11		1.80	0.55	1.86	3.36	2.24	1.40	5.30	2.66	3.96	5.59
15	Maharashtra	3.21	3.69	4.19	4.96	1.65	3.72		3.41	2.09	1.79	4.02	3.48	2.50	7.23	2.87	6.20	8.05
16	Manipur	10.00	1.85	5.27	9.76	7.57	1.87		4.06	5.74	1.00	2.11	0.77	0.16	3.09	1.31	1.82	0.74
17	Meghalaya	10.00	1.68	5.31	8.93	5.11	1.71		2.87	2.51	1.49	1.82	1.06	0.29	1.30	1.09	0.96	0.14
18	Mizoram	10.00	1.70	5.23	8.89	8.15	1.71		4.31	6.00	1.22	1.92	0.84	0.20	2.49	1.14	1.48	0.42
19	Nagaland	10.00	1.70	5.28	8.97	7.41	1.82		3.98	5.37	0.55	2.04	0.55	0.06	2.92	1.29	1.74	0.65
20	Odisha	2.28	2.49	2.23	1.27	1.96	2.49		2.07	1.01	2.51	2.74	2.35	1.61	4.34	1.96	3.26	2.78
21	Punjab	5.02	2.03	3.74	3.81	0.16	2.15		1.31	0.04	7.19	2.35	4.82	3.98	1.95	1.80	2.20	0.77
22	Rajasthan	2.69	3.23	2.84	2.47	0.51	3.34		1.75	0.30	1.36	3.72	2.17	1.10	6.67	2.86	4.83	7.23
23	Sikkim	6.00	1.39	3.25	2.71	7.78	1.39		4.14	4.48	1.28	1.58	0.89	0.18	1.88	1.04	1.19	0.23
24	Tamil Nadu	2.56	2.87	3.31	2.43	0.67	2.87		2.36	0.45	1.55	3.16	2.80	1.37	5.66	2.13	3.86	5.01
25	Telangana	2.59	2.10	2.69	1.47	1.20	2.22		2.00	0.53	1.74	2.50	2.27	0.99	5.85	2.00	4.32	5.06
26	Tripura	10.00	1.68	5.40	9.08	3.54	1.73		2.17	1.33	1.52	1.90	1.16	0.34	3.16	1.16	1.98	0.73
27	Uttar Pradesh	4.20	3.99	4.15	6.96	0.12	4.01		2.11	0.10	4.54	4.21	4.32	4.26	3.83	3.25	3.97	4.94
28	Uttarakhand	7.64	2.00	4.60	7.03	7.74	2.02		4.65	7.28	1.14	2.27	1.35	0.35	5.74	1.45	3.65	3.04
29	West Bengal	4.61	2.83	4.33	5.65	0.22	2.83		2.14	0.13	6.76	3.05	5.41	4.78	3.10	2.17	3.58	2.41
	UNION TERRITORIES																	
1	Andaman & Nicobar Islands	10.00	1.58	5.15	8.13	0.00	1.71		0.15	0.00	0.00	2.14	0.15	0.00	2.85	1.20	1.57	0.54
2	Chandigarh	6.00	1.39	5.35	4.46	0.00	1.39		2.35	0.00	1.53	1.76	3.11	0.84	1.52	1.48	3.11	0.70
3	Dadra & Nagar Haveli	4.00	1.50	2.24	1.35	1.95	1.63		1.22	0.39	0.89	1.86	0.69	0.11	2.71	1.39	1.60	0.60
4	Daman & Diu	4.00	1.58	2.54	1.61	0.00	1.58		0.54	0.00	1.32	1.98	1.20	0.31	4.35	1.59	2.72	1.88
5	Delhi	6.00	1.33	6.81	5.44	0.00	1.33		3.81	0.00	1.92	1.81	4.77	1.66	1.60	1.50	4.61	1.11
6	Lakshadeep	4.00	1.32	2.51	1.33	0.00	1.45		0.51	0.00	0.00	1.71	0.51	0.00	2.86	1.38	1.94	0.77
7	Pondicherry	2.16	1.44	1.92	0.60	0.04	1.44		0.86	0.00	0.84	1.73	1.26	0.18	2.35	1.31	2.02	0.62

Table-R.2: Hazard Specific Disaster Risk Index - II

		Cyclone				Tsunami				Coastal Erosion				Avalanche				
	STATES/ UNION TERRITORIES	Hazard	Vulnerability	Exposure	Risk	Hazard	Vulnerabil- ity		Exposure	Risk	Hazard	Vulnera- bility	Exposure	Risk	Hazard	Vulnera- bility	Exposure	Risk
	STATES	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
1	Andhra Pradesh	6.34	2.84	4.62	7.61	5.29	2.84		4.09	6.15	3.68	2.21	3.29	2.67	0.00	0.00		
2	Arunachal Pradesh	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
3	Assam	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
4	Bihar	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
5	Chattisgarh	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
6	Goa	2.37	1.62	1.68	0.65	1.18	1.62		1.09	0.21	0.29	1.28	0.64	0.02	0.00	0.00		
7	Gujarat	4.90	3.44	4.31	5.87	2.78	3.44		3.25	3.11	3.88	2.44	3.80	3.60	0.00	0.00		
8	Haryana	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
9	Himachal Pradesh	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			2.26	1.66	1.75	0.66
10	Jammu &Kashmir	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			1.51	1.70	1.39	0.36
11	Jharkhand	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
12	Karnataka	2.72	3.31	3.21	2.89	1.71	3.31		2.71	1.53	0.79	2.44	2.25	0.43	0.00	0.00		
13	Kerala	2.54	2.34	2.78	4.51	3.49	2.34		3.25	2.66	1.43	1.84	2.22	0.59	0.00	0.00		
14	Madhya Pradesh	0.00	0.00			0.00	0.00				0.00	0.00			0.00	0.00		
15	Maharashtra	3.22	4.02	4.19	4.42	3.90	4.02		4.53	7.10	2.25	3.03	3.71	2.53	0.00	0.00		
16	Manipur	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
17	Meghalaya	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
18	Mizoram	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
19	Nagaland	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
20	Odisha	6.87	2.74	4.53	7.74	3.49	2.74		2.84	2.71	1.44	2.23	1.81	0.58	0.00	0.00		
21	Punjab	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
22	Rajasthan	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
23	Sikkim	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
24	Tamil Nadu	5.77	3.16	4.91	6.71	5.45	3.16		4.75	8.18	2.13	2.20	3.09	1.45	0.00	0.00		
25	Telangana	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
26	Tripura	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
27	Uttar Pradesh	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
28	Uttarakhand	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			1.79	1.68	1.68	0.50
29	West Bengal	8.88	3.05	6.47	8.78	1.98	3.05		3.02	1.82	0.98	2.47	2.52	0.61	0.00	0.00		
	UNION TERRITORIES																	
1	Andaman & Nicobar Islands	3.06	2.14	1.68	1.10	7.67	2.14		3.98	6.53	9.91	1.66	5.10	8.39	0.00	0.00		
2	Chandigarh	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
3	Dadra & Nagar Haveli	2.58	1.86	0.00		0.00	1.86		0.00		0.00	0.00			0.00	0.00		
4	Daman & Diu	3.45	1.98	2.27	1.55	0.98	1.98		1.03	0.20	0.09	1.46	0.59	0.01	0.00	0.00		
5	Delhi	0.00	0.00	0.00		0.00	0.00		0.00		0.00	0.00			0.00	0.00		
6	Lakshadeep	2.36	1.71	1.69	0.68	1.35	1.71		1.19	0.27	0.40	1.25	0.71	0.04	0.00	0.00		
7	Pondicherry	4.08	1.73	2.88	2.03	3.99	1.73		2.84	1.96	0.16	1.17	0.92	0.02	0.00	0.00		

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-R.3: Hazard Specific Disaster Risk Index - III

		Heat Wave				Cold Wave				Lightening				Forest Fire				
	STATES/ UNION TERRITORIES	Hazard	Vulnera- bility	Expo- sure	Risk	Hazard	Vulnerability		Exposure	Risk	Hazard	Vulnera- bility	Exposure	Risk	Hazard	Vulnerabil- ity	Exposure	Risk
	STATES	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
1	Andhra Pradesh	5.77	1.11	4.33	2.78	0.00	0.00				2.96	1.11	2.93	0.96	4.17	1.84	3.53	2.71
2	Arunachal Pradesh	1.65	1.06	1.08	0.19	0.32	0.94		0.42	0.01	0.01	0.94	0.26	0.00	5.90	1.89	3.21	3.57
3	Assam	2.96	1.35	2.41	0.96	0.31	1.26		1.08	0.04	0.74	1.26	1.30	0.12	4.03	2.11	2.94	2.50
4	Bihar	4.64	1.52	3.66	2.58	0.68	1.52		1.68	0.17	3.09	1.52	2.88	1.35	0.93	2.08	1.80	0.35
5	Chattisgarh	3.20	1.24	2.54	1.01	0.47	1.21		1.18	0.07	4.11	1.21	3.58	2.96	4.75	1.85	3.32	2.92
6	Goa	1.52	0.67	1.26	0.13	0.00	0.00				0.01	0.67	0.50	0.00	1.20	1.27	1.10	0.17
7	Gujarat	3.07	1.24	3.40	1.29	0.40	1.17		2.06	0.10	1.69	1.17	2.71	0.54	1.24	1.89	2.48	0.58
8	Haryana	3.56	1.13	3.14	1.26	1.12	1.05		1.92	0.23	0.23	1.05	1.47	0.04	0.16	1.68	1.44	0.04
9	Himachal Pradesh	1.15	0.82	1.20	0.11	5.00	0.77		3.12	1.20	0.11	0.77	0.68	0.01	1.55	1.78	1.40	0.39
10	Jammu &Kashmir	0.31	0.92	0.79	0.02	7.12	0.92		4.20	2.75	0.09	0.92	0.68	0.01	0.53	1.74	0.90	0.08
11	Jharkhand	4.89	1.27	3.39	2.10	0.42	1.19		1.15	0.06	5.33	1.19	4.53	1.03	2.93	1.86	2.41	1.31
12	Karnataka	2.21	1.24	2.96	0.81	0.00	0.00				3.15	1.15	3.43	1.24	2.07	1.85	2.89	1.11
13	Kerala	2.64	0.77	2.83	0.57	0.00	0.00				1.04	0.77	2.03	0.16	1.44	1.45	2.23	0.47
14	Madhya Pradesh	3.99	1.54	3.31	2.03	1.47	1.50		2.05	0.45	6.90	1.50	6.48	9.30	3.63	2.06	3.13	2.34
15	Maharashtra	4.07	1.34	4.62	2.52	0.37	1.30		2.77	0.13	5.55	1.30	4.95	7.62	2.79	1.97	3.98	2.19
16	Manipur	1.34	0.90	0.94	0.11	1.26	0.88		0.90	0.10	0.01	0.88	0.28	0.00	4.24	1.91	2.39	1.94
17	Meghalaya	1.73	0.80	1.18	0.16	2.02	0.77		1.32	0.21	0.09	0.77	0.36	0.00	5.27	1.59	2.95	2.47
18	Mizoram	2.45	0.81	1.46	0.29	0.39	0.80		0.43	0.01	0.01	0.80	0.24	0.00	4.67	1.78	2.57	2.13
19	Nagaland	1.63	0.84	1.09	0.15	0.26	0.73		0.41	0.01	0.01	0.73	0.28	0.00	5.32	1.78	2.94	2.78
20	Odisha	6.95	1.28	4.57	4.06	0.55	1.28		1.37	0.10	7.92	1.28	5.05	5.12	2.03	1.92	2.11	0.82
21	Punjab	4.23	1.10	3.34	1.56	2.89	0.97		2.67	0.75	1.89	0.97	2.17	0.40	0.56	1.63	1.51	0.14
22	Rajasthan	3.46	1.49	3.22	1.66	1.25	1.39		2.12	0.37	1.89	1.39	2.44	0.64	0.18	2.13	1.58	0.06
23	Sikkim	1.64	0.70	1.07	0.12	0.36	0.70				0.04	0.70	0.27	0.00	0.31	1.41	0.40	0.02
24	Tamil Nadu	6.13	0.98	5.09	3.06	0.00	0.00				2.47	0.98	3.26	0.79	0.77	1.58	2.41	0.29
25	Telangana	3.17	1.12	2.98	1.06	0.00	0.00		1.40		2.87	1.01	2.83	0.82	2.55	1.69	2.67	1.15
26	Tripura	1.92	0.81	1.36	0.21	0.43	0.76		0.62	0.02	0.23	0.76	0.52	0.01	5.27	1.67	3.04	2.67
27	Uttar Pradesh	6.16	1.86	5.13	5.88	0.59	1.84		2.35	0.26	5.52	1.84	4.81	4.89	0.85	2.34	2.48	0.49
28	Uttarakhand	2.28	0.98	1.92	0.43	4.04	0.96		2.80	1.09	0.10	0.96	0.83	0.01	3.83	1.88	2.70	1.94
29	West Bengal	5.43	1.31	4.74	3.37	0.12	1.31				4.01	1.31	4.03	2.12	0.91	1.95	2.48	0.44
	UNION TERRITORIES																	
1	Andaman & Nicobar Islands	2.40	0.85	1.35	0.27	0.00	0.00				0.01	0.72	0.15	0.00	1.85	1.97	1.07	0.39
2	Chandigarh	1.45	0.96	3.07	0.43	0.85	0.96		2.77	0.23	0.00	0.96	2.35	0.00	1.13	1.60	2.91	0.53
3	Dadra & Nagar Haveli	2.29	0.84	1.39	0.27	0.00	0.00				0.01	0.71	0.25	0.00	0.96	1.53	0.72	0.11
4	Daman & Diu	1.79	0.92	1.44	0.24	0.05	0.92		0.57	0.00	0.00	0.92	0.54	0.00	1.00	1.70	1.04	0.18
5	Delhi	3.13	0.81	5.38	1.36	0.49	0.81		4.06	0.16	0.02	0.81	3.82	0.01	0.00	1.57	3.81	0.00
6	Lakshadeep	1.60	0.72	1.31	0.15	0.00	0.00				0.00	0.59	0.51	0.00	1.05	1.29	1.04	0.14
7	Pondicherry	5.66	0.68	3.67	1.41	0.00	0.00				0.01	0.68	0.85	0.00	1.01	1.31	1.35	0.18

Table-R.4: Hazard Specific Disaster Risk Index - IV

		Fire				Industrial Hazard				
	STATES/ UNION TERRITORIES	Hazard	Vulnerability	Exposure	Risk		Hazard	Vulnerability	Exposure	Risk
	STATES	1	2	3	4		5	6	7	8
1	Andhra Pradesh	2.41	2.07	2.65	1.32		3.31	1.53	3.10	1.57
2	Arunachal Pradesh	0.01	1.77	0.26	0.00		0.50	1.09	0.51	0.03
3	Assam	0.18	2.12	1.02	0.04		1.04	1.49	1.45	0.22
4	Bihar	0.73	2.27	1.70	0.28		1.30	1.75	1.99	0.45
5	Chattisgarh	1.10	1.93	1.49	0.32		2.17	1.51	2.03	0.66
6	Goa	0.06	1.30	0.53	0.00		0.75	0.87	0.87	0.06
7	Gujarat	3.51	2.32	3.62	2.95		6.86	1.84	6.29	7.95
8	Haryana	0.48	1.81	1.60	0.14		3.37	1.45	3.04	1.49
9	Himachal Pradesh	0.09	1.80	0.67	0.01		1.71	1.03	1.48	0.26
10	Jammu &Kashmir	0.06	1.80	0.67	0.01		0.88	1.11	1.08	0.11
11	Jharkhand	0.39	1.92	1.14	0.09		2.62	1.50	2.25	0.88
12	Karnataka	2.03	2.26	2.87	1.32		3.61	1.72	3.66	2.27
13	Kerala	0.40	1.68	1.71	0.11		2.89	1.13	2.95	0.96
14	Madhya Pradesh	3.63	2.31	3.13	2.62		2.93	1.87	2.78	1.52
15	Maharashtra	6.57	2.66	7.58	8.57		6.97	1.98	7.27	8.01
16	Manipur	0.02	1.90	0.28	0.00		0.53	1.12	0.54	0.03
17	Meghalaya	0.02	1.57	0.32	0.00		0.60	0.88	0.61	0.03
18	Mizoram	0.01	1.78	0.24	0.00		0.51	1.01	0.49	0.03
19	Nagaland	0.02	1.69	0.29	0.00		0.53	0.95	0.54	0.03
20	Odisha	0.62	2.10	1.40	0.18		2.75	1.57	2.47	1.07
21	Punjab	0.47	1.74	1.46	0.12		3.29	1.31	2.87	1.24
22	Rajasthan	1.17	2.50	2.08	0.61		3.74	1.91	3.36	2.40
23	Sikkim	0.01	1.42	0.25	0.00		0.52	0.89	0.51	0.02
24	Tamil Nadu	2.81	2.29	3.43	2.21		4.51	1.73	4.28	3.34
25	Telangana	2.41	1.82	2.60	1.14		4.53	1.46	3.66	2.42
26	Tripura	0.03	1.64	0.42	0.00		0.60	0.93	0.70	0.04
27	Uttar Pradesh	1.84	2.99	2.97	1.64		4.89	2.36	4.50	5.19
28	Uttarakhand	0.14	1.94	0.85	0.02		1.78	1.22	1.67	0.36
29	West Bengal	1.31	2.28	2.68	0.80		3.97	1.64	4.01	2.61
	UNION TERRITORIES									
1	Andaman & Nicobar Islands	0.02	1.65	0.16	0.00		0.53	0.95	0.41	0.02
2	Chandigarh	0.03	1.61	2.36	0.01		0.50	1.33	2.60	0.17
3	Dadra & Nagar Haveli	0.01	1.40	0.25	0.00		0.50	0.94	0.49	0.02
4	Daman & Diu	0.01	1.70	0.55	0.00		0.50	1.32	0.79	0.05
5	Delhi	0.59	1.64	4.11	0.40		2.24	1.37	4.93	1.51
6	Lakshadeep	0.01	1.16	0.52	0.00		0.50	0.85	0.76	0.03
7	Pondicherry	0.05	1.47	0.87	0.01		0.58	1.12	1.13	0.07

Data pertaining to J&K in this report refers to the UT of J&K and UT of Ladakh as a whole

Table-R.5: Composite Disaster Risk Index

	STATES/ UNION TERRITORIES	Earthquake	Landslide	Flood	Drought	Cyclone	Tsunami	Coastal Erosion		ava- lanche	Heat Wave	Cold Wave	Lightening	Forest Fire	Fire	Industrial Hazard	Composite Risk Index
	Weights (%) >	15%	7%	15%	15%	15%	3%		3%	3%	6%	3%	6%	3%	3%	3%	100%
	STATES																
1	Andhra Pradesh	1.88	0.95	2.86	6.56	7.61	6.15		2.67		2.78		0.96	2.71	1.32	1.57	3.56
2	Arunachal Pradesh	9.41	4.61	0.24	0.29						0.19	0.01	0.00	3.57	0.00	0.03	1.93
3	Assam	9.93	0.52	5.31	1.50						0.96	0.04	0.12	2.50	0.04	0.22	2.70
4	Bihar	7.57	0.08	6.00	3.10						2.58	0.17	1.35	0.35	0.28	0.45	2.78
5	Chattisgarh	1.08	1.14	0.63	2.96						1.01	0.07	3.58	2.92	0.32	0.66	1.17
6	Goa	1.43	0.88	0.37	0.44	0.65	0.21		0.02		0.13		0.00	0.17	0.00	0.06	0.52
7	Gujarat	7.61	0.27	3.59	4.92	5.87	3.11		3.60		1.29	0.10	0.54	0.58	2.95	7.95	3.98
8	Haryana	3.45	0.08	3.39	1.47						1.26	0.23	0.04	0.04	0.14	1.49	1.39
9	Himachal Pradesh	6.09	6.47	0.25	1.24					0.66	0.11	1.20	0.01	0.39	0.01	0.26	1.67
10	Jammu &Kashmir	4.70	3.35	0.36	0.72					0.36	0.02	2.75	0.01	0.08	0.01	0.11	1.20
11	Jharkhand	1.70	0.78	0.66	4.42						2.10	0.06	4.53	1.31	0.09	0.88	1.54
12	Karnataka	1.99	1.14	1.24	7.18	2.89	1.53		0.43		0.81		1.24	1.11	1.32	2.27	2.40
13	Kerala	2.91	3.22	2.37	2.14	4.51	2.66		0.59		0.57		0.16	0.47	0.11	0.96	2.20
14	Madhya Pradesh	2.23	0.55	1.40	5.59						2.03	0.45	6.48	2.34	2.62	1.52	2.14
15	Maharashtra	4.96	2.09	2.50	8.05	4.42	7.10		2.53		2.52	0.13	4.95	2.19	8.57	8.01	4.44
16	Manipur	9.76	5.74	0.16	0.74						0.11	0.10	0.00	1.94	0.00	0.03	2.07
17	Meghalaya	8.93	2.51	0.29	0.14						0.16	0.21	0.00	2.47	0.00	0.03	1.67
18	Mizoram	8.89	6.00	0.20	0.42						0.29	0.01	0.00	2.13	0.00	0.03	1.93
19	Nagaland	8.97	5.37	0.06	0.65						0.15	0.01	0.00	2.78	0.00	0.03	1.92
20	Odisha	1.27	1.01	1.61	2.78	7.74	2.71		0.58		4.06	4.06	0.10	5.12	0.82	0.18	1.07
21	Punjab	3.81	0.04	3.98	0.77						1.56	0.75	0.40	0.14	0.12	1.24	1.47
22	Rajasthan	2.47	0.30	1.10	7.23						1.66	0.37	0.64	0.06	0.61	2.40	1.88
23	Sikkim	2.71	4.48	0.18	0.23						0.12		0.00	0.02	0.00	0.02	0.79
24	Tamil Nadu	2.43	0.45	1.37	5.01	6.71	8.18		1.45		3.06		0.79	0.29	2.21	3.34	3.06
25	Telangana	1.47	0.53	0.99	5.06						1.06		0.82	1.15	1.14	2.42	1.42
26	Tripura	9.08	1.33	0.34	0.73						0.21	0.02	0.01	2.67	0.00	0.04	1.71
27	Uttar Pradesh	6.96	0.10	4.26	4.94						5.88	0.26	4.89	0.49	1.64	5.19	3.31
28	Uttarakhand	7.03	7.28	0.35	3.04					0.50	0.43	1.09	0.01	1.94	0.02	0.36	2.22
29	West Bengal	5.65	0.13	4.78	2.41	8.78	1.82		0.61		3.37		2.12	0.44	0.80	2.61	3.77
	UNION TERRITORIES																
1	Andaman & Nicobar Islands	8.13	0.00	0.00	0.54	1.10	6.53		8.39		0.27		0.00	0.39	0.00	0.02	1.94
2	Chandigarh	4.46	0.00	0.84	0.70						0.43	0.23	0.00	0.53	0.01	0.17	0.95
3	Dadra & Nagar Haveli	1.35	0.39	0.11	0.60						0.27		0.00	0.11	0.00	0.02	0.36
4	Daman & Diu	1.61	0.00	0.31	1.88	1.55	0.20		0.01		0.24	0.00	0.00	0.18	0.00	0.05	0.83
5	Delhi	5.44	0.00	1.66	1.11						1.36	0.16	0.01	0.00	0.40	1.51	1.37
6	Lakshadweep	1.33	0.00	0.00	0.77	0.68	0.27		0.04		0.15		0.00	0.14	0.00	0.03	0.44
7	Pondicherry	0.60	0.00	0.18	0.62	2.03	1.96		0.02		1.41		0.00	0.18	0.01	0.07	0.67

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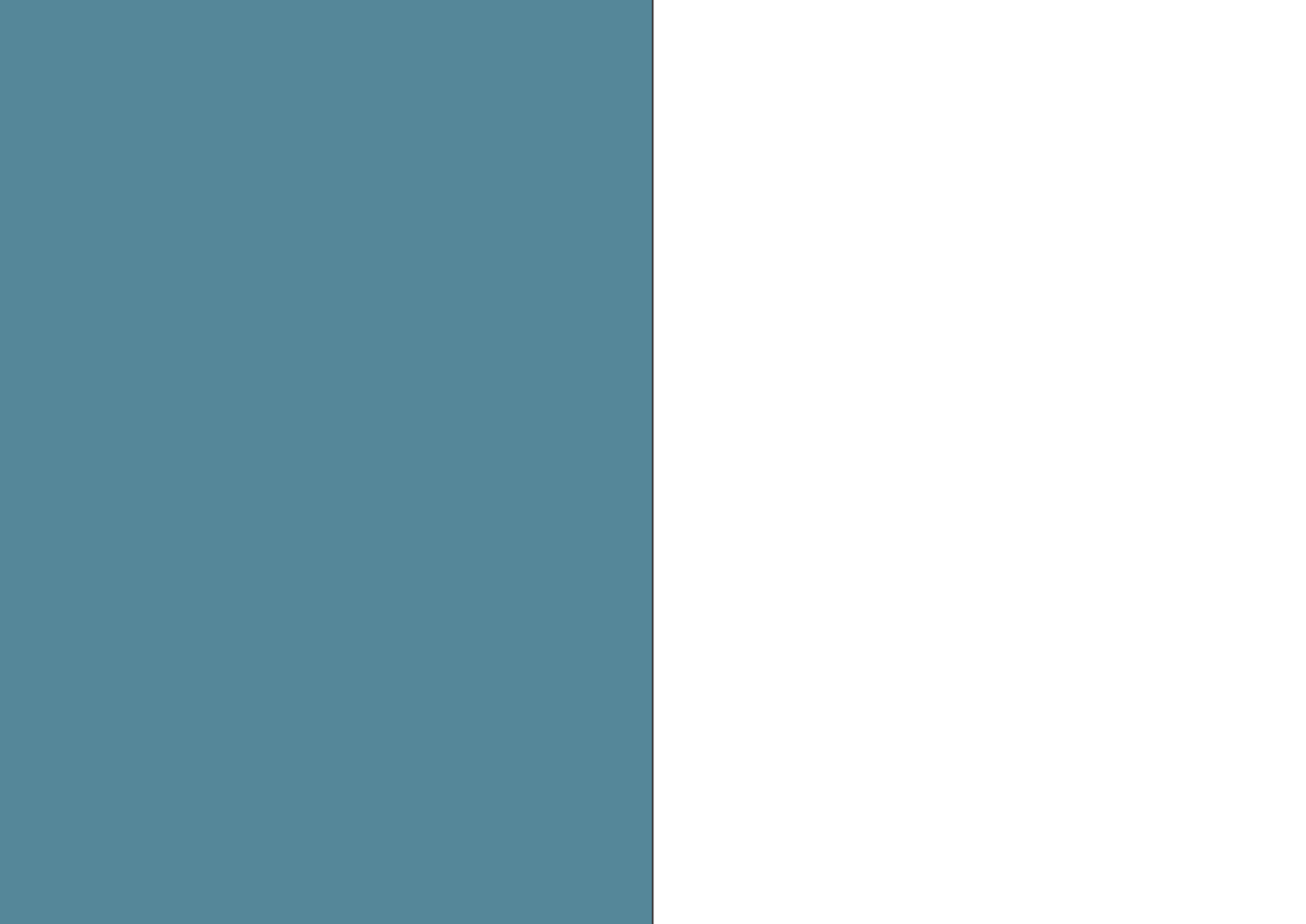
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