

Climate Change and Disaster Risk Reduction

Dr. Anamika Singh

Assistant Professor, St. Xavier's College Jaipur

Dr. Arya Nair

Assistant Professor, Christ University, Bangalore

Abstract

Climate change is the most discussed concern across the world. The Sustainable Development Goal thirteen calls for pressing motions to fight climate change and its impact. The consequences of climate change trigger the events of disaster. According to United Nations International Strategy for Disaster Reduction Secretariat (UNISDR), “disaster many of which are exacerbated by climate change are increasing in frequency and intensity which significantly impede the progress towards sustainable development.” The future projections by IPCC AR4 also points out that there is ‘increased number of weather events with anomalies and such extremes will become more frequent, more widespread and/or more intense during the 21st century and impacts due to altered frequencies and intensities of extreme weather, climate and sea level events are very likely to change.’

Studies done by Intergovernmental Panel on Climate Change (IPCC) based on General Circulation Model (CGM), projected “warming of Indian sub-continent by 2-4.7⁰ C. Assessments conducted by Indian scientists at Hadley Centre Regional Model (HadRM2) reveals an increase in the temperature by 3 to 4⁰ C towards the end of 21st century.” The different models/experiments uncover the variability in the nature of rainfall. The increase in global sea level from 0.09- to 0.88 m by 2100 would cause a cascade of disasters like flash floods, excessive rain, droughts, forest fires and cyclones. Such climate induced events will severely affect the territorial land and waters of India. Increase in temperature due to global warming causes the melting of glaciers in the Hindukush- Karakoram-Himalayan region causing episodes of flash floods and landslides in the mountain ranges and alteration of the monsoon rain pattern threatening the thickly populated states of the Ganga-Brahmaputra plain regions.

The mapping of climatic and anthropogenic disasters in India as reported by National Institute of Disaster Management (NIDM) and the German Development Agency says that from 1995

to 2020, India experienced more than 1058 disasters of cold waves, heat waves, drought, floods, and cyclones.

Developing economies like India suffers a major financial set back inflicted by disasters. Eventually they threaten the country's food security, posing water stress and increase in outbreaks of water borne and air borne diseases.

The following research paper aims at studying the interconnections of climate change and disasters according to Sendai Framework for Disaster Risk Reduction 2015-2030 to further understand the mechanism of disaster risk reduction.

Keywords: climate change, disaster preparedness, disaster risk reduction, Sendai Framework

Introduction

The modern world boasts about the far-reaching developments but, on the flip side climate change and its irreversible effects threaten the planet. A long-term change in climatic elements such as rise in temperature and shift in weather patterns can be understood as climate change. Search alterations have occurred due to both natural forces and human interventions like volcanic eruptions, burning of fossil fuels, deforestation etc. (UN Climate Action, 2024).

Objective

1. To study the impact of climate change causing disasters.
2. To understand the measures of Disaster Risk Reduction by Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR).

Methodology

1. Case study of various natural and anthropogenic disasters to derive the impacts of climate change causing disaster.
2. Study and analysis of Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR), to enhance capacities in disaster risk management.

Climate Change and Disaster

Human interventions exacerbating climate changes can mainly be grouped into two activities. Firstly, the increase in global temperature by release of greenhouse gases especially carbon

dioxide and methane. Such gases trap the heat in the atmosphere leading to increase in earth's average temperature. Secondly, human activities which restricts the absorption of greenhouse gases, for instance deforestation and receding green cover limit the absorption of carbon dioxide. (Ilan Kelman, 2015)

Climate change is considered as a potential hazard and disaster risk trigger. According to IPCC-AR6 report,

“approximately 3.3 to 3.6 billion people live in context that are highly vulnerable to climate change. Human and ecosystem vulnerability are interdependent. Regions and people with considerable development constraints have high vulnerability to climatic hazards. Increasing weather and climate extreme events have exposed millions of people to acute food insecurity and reduced water security with the largest adverse impacts observed in many locations and/or communities in Africa, Asia, Central and South America, small islands and Arctic and globally for indigenous people, small scale food producers and low-income households. Between 2010-2020, human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability.” (IPCC-AR-6)

The future projections of emissions of greenhouse gases poses a grave picture. According to IPCC-AR6 report, “the global warming will continue to increase in the near term (2021-2040) mainly due to increased cumulative carbon dioxide emissions in nearly all considered scenarios and modelled pathways.” (IPCC AR-6, b 1.1) These continued emissions will compound the climate changes and ultimately lead to increased frequency of disaster events like heatwaves, droughts, flash floods, variabilities in global precipitation and intensification of tropical and extra tropical storms.

Climate Change and Disasters in India

As per the EM- DAT (Natural disasters 2019, CRED, 2020),

“there were 396 major natural disasters recorded in the year 2019 with 11,755 deaths, 95 million people affected and 103 billion U.S. dollars in economic losses across the world. Among the continents of the world, Asia suffered highest level of impact and accounted for 40% of disaster events, 45% of death and 74% of the total affected population. India suffered the hardest hit and recorded nearly 20% of the total deaths and 24.5% of the total number of people affected.”

According to Government of India,

“The geographical landmass of India is reported to be the world's most disaster-prone region. Nearly 59% of India's landmass is prone to earthquakes of moderate to very high intensity, over 40 million hectares (12% of total land area) is flood-prone zone, out of 7516 kilometres of countries long coastline, approximately 5700 kilometres is prone to tropical cyclones, storms and tsunamis, 2% of land is prone to landslides and avalanches and 68% of India's agricultural land is affected by episodes of drought.” (GOI, Disaster Management in India, 2004 a)

According to a report on disasters occurred in India presented by Gupta,

“during 1995-2020, a total of 1058 climatic disaster events (floods, cyclones, droughts, cold waves and heat waves) were reported to hit India. Floods accounted for 33% of India's total number of climatic disaster incidents, followed by heatwaves (24%), drought (22%), cold waves (16%) and cyclones (25%).” (Gupta et al, 2021)

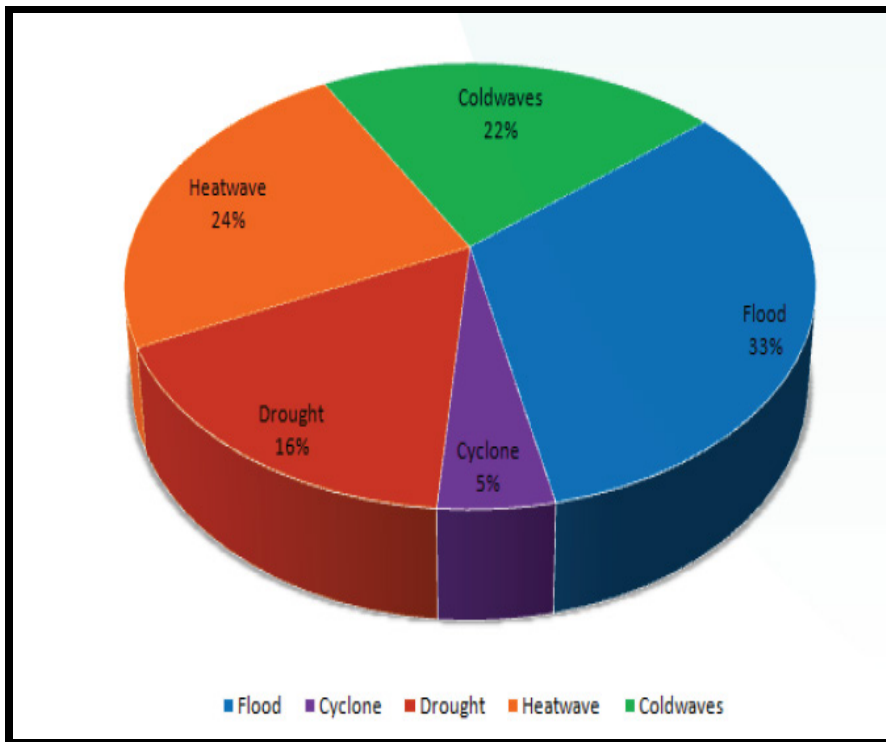


Figure 1: Occurrence by disaster type (number of events occurred)- Five climate related events during the period 1995-2020.

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

Uttar Pradesh has recorded the highest number of deaths due to events of disaster followed by the states of Bihar, Odisha, Andhra Pradesh, West Bengal, Gujarat, Punjab, Maharashtra and Rajasthan. The state level composite spatial analysis conducted by GIZWIDM reports that 8 out of 36 States and union territories of India have experienced more than 50 disasters during 1956 to 2020. The maximum disaster events have recorded in Rajasthan followed by Odisha, Uttar Pradesh, West Bengal, Bihar, Maharashtra and Andhra Pradesh. Also, the multi hazard spatial analysis reports show that the majority states of India suffer from risks of four to five climatic disasters. (Gupta et al, 2021)

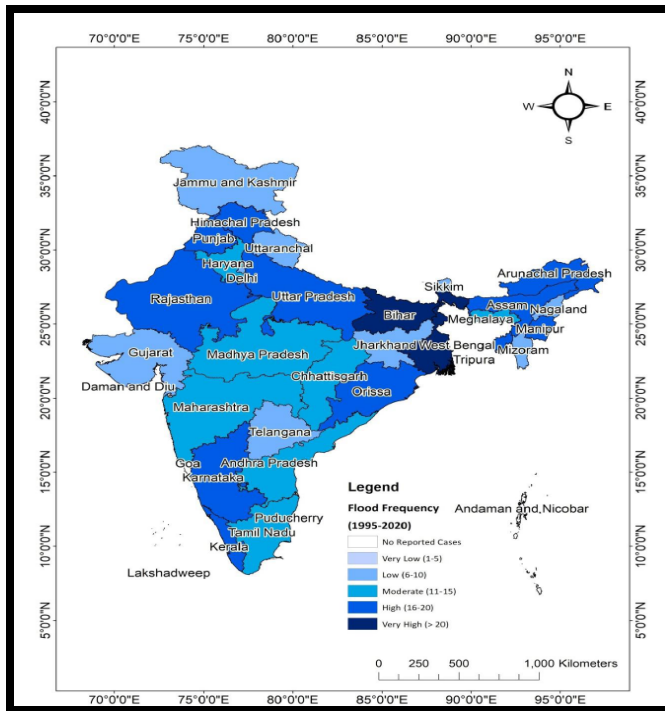


Figure 2: State-wise distribution of total number of Flood events from 1995 to 2020.

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

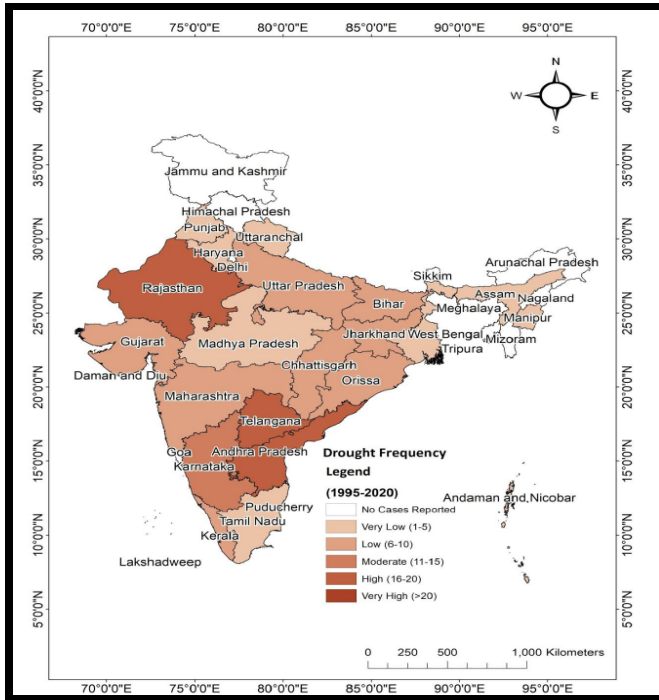


Figure 3: State-wise frequency of Drought from 1995 to 2020.

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

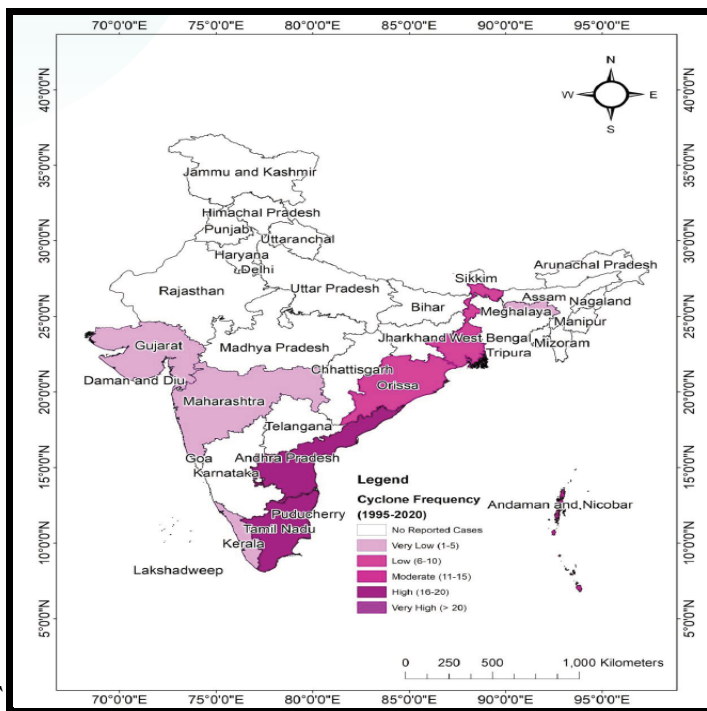


Figure 4: Cyclone Frequency Map of India from 1995-2020.

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

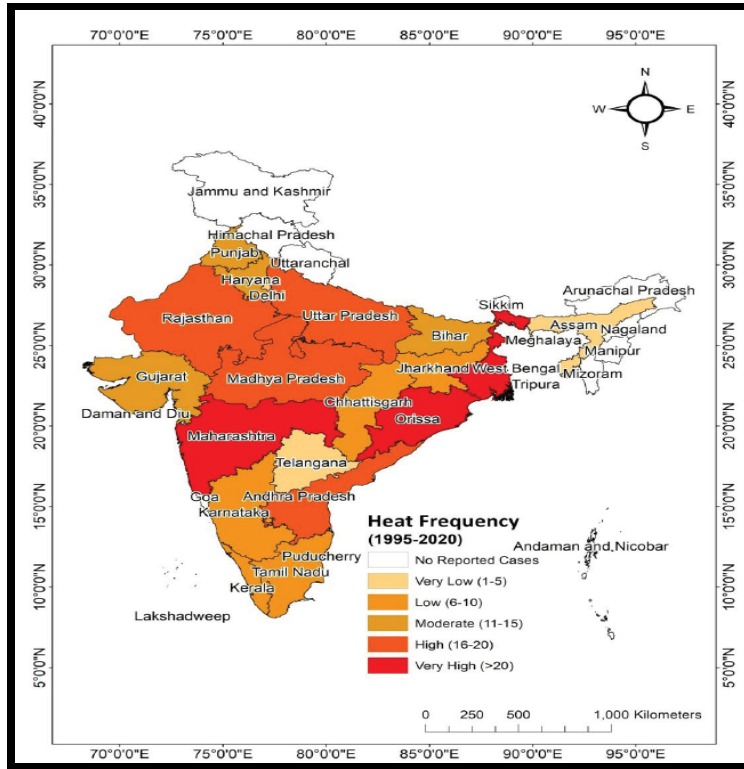


Figure 5: State- wise Heatwave Frequency Map of India from 1995-2020.

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

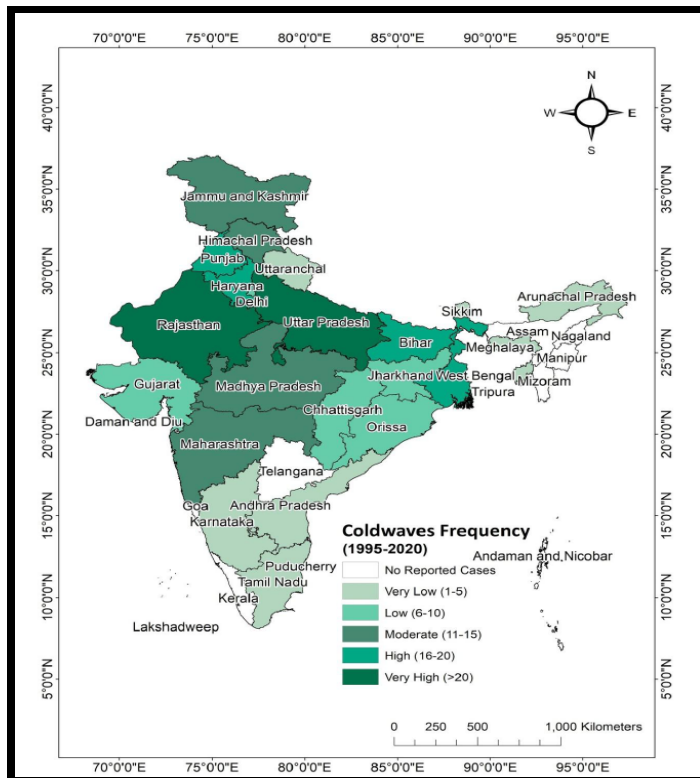


Figure 6: State- wise Cold wave Frequency Map of India from 1995-2020.

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

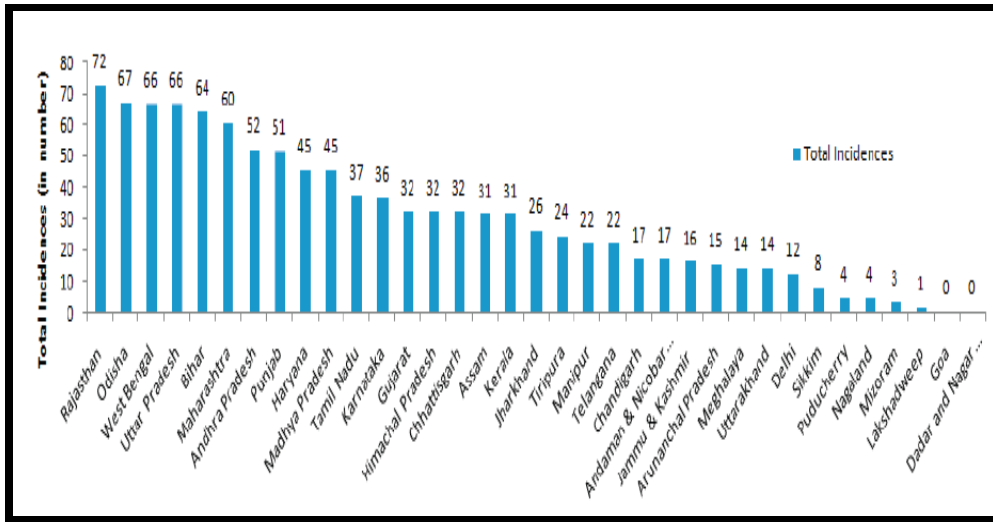


Figure 7: State-wise overall climatic disasters in India from 1995-2020

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

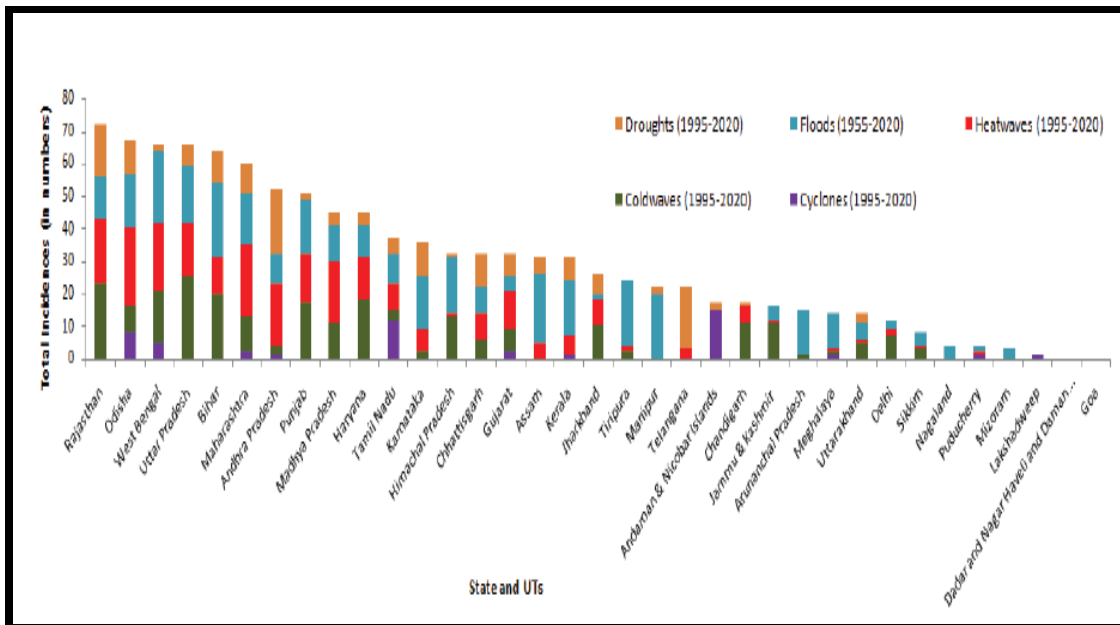


Figure 8: State-wise breakup of climatic disasters in India from 1995-2020

Source: National Institute of Disaster Management (NIDM), Climatic Mapping, 2021.

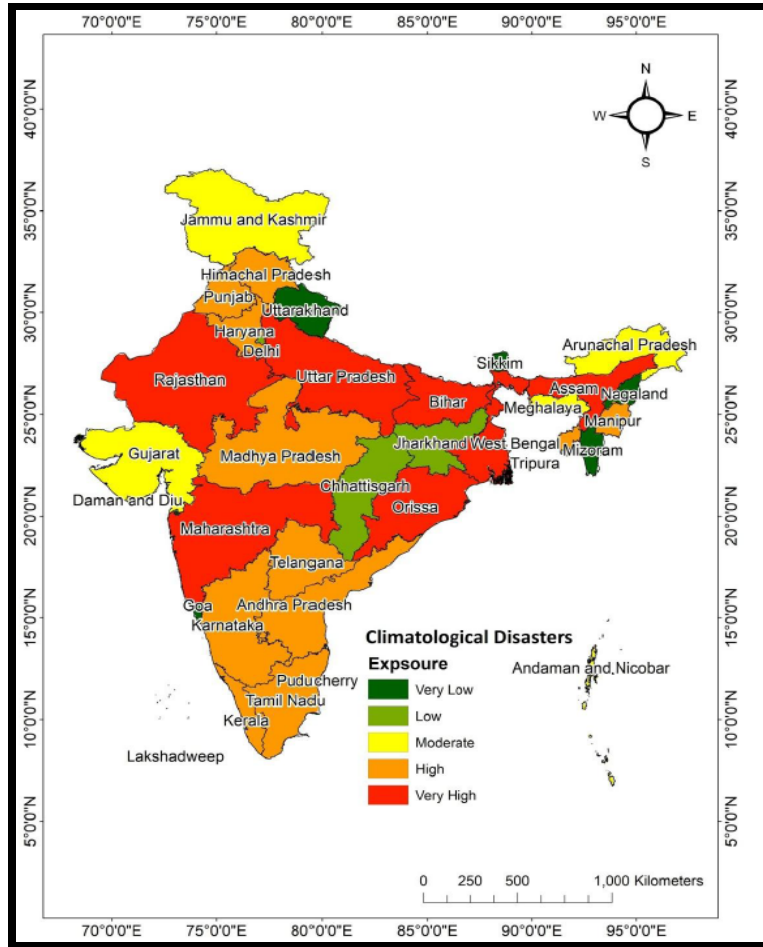


Figure 9: Composite Climatic Disaster Frequency Map of India (1995-2020)

Source: Disastrous Weather Event Reports, IMD and MHA Reports.

Case Studies of Disaster Events from India

The events of past disasters are instrumental to study as they help us understand to handle disaster crisis. They help us to understand and analyse disasters and equip us with knowledge that can help us being prepared. The evaluation of happenings of disaster events occurred previously provide an insight to prepare and stay disaster ready for the future (GFDRR, 2018). The study highlights important disaster events which happened in India. These landmark disaster events later on have helped India to understand and adopt policies and build institutions dedicated to understanding disaster and work for Disaster Risk Reduction, Disaster Management and preparedness.

- **Odisha Super Cyclone, 1999**

On 29 October 1999 a severe tropical cyclone originated in the Bay of Bengal struck the coast of Odisha and effected 12 districts and more than 15 million people. The cyclone took a toll of 9885 people. According to UN report “a total of 3.7 million children were affected and 1500 were orphaned.” (UNDMT,1999)

- **Bhuj Earthquake, 2001**

Gujarat which lies on the western coast of India, falls under Zone V and witnessed a powerful earthquake of 6.9 magnitude reading in Richter scale at Bhuj district on 26 January 2001. 21 districts out of 33 suffered huge losses. About 20,086 persons were killed and around three lakhs of buildings and residential colonies were completely demolished.

- **The Indian Ocean Tsunami, 2004**

Sumatra, the northern territory of Indonesia Island was founded to be the epicentre of 9.0 magnitude earthquake, which resulted in generating monstrous tsunami waves in the Bay of Bengal of Indian Ocean. The tsunami tidal waves hit island and coastal states of India on 26-December 2004. The tidal waves of 3 to 10 metres high hit the Great Nicobar Island. According to World Bank report, “it also affected coastal states of Tamil Nadu, Kerala, Andhra Pradesh, and union territories of Puducherry.” As per the Government of India report—“12,405 people lost their lives, and 2,000 kilometres of Indian coastline was submerged up to a distance of 2 kilometres.” (ABD, UN and WB,2005).

- **Uttarakhand Flood, 2013**

In June 2013, Uttarakhand received heavy rainfall which severely affected 5 districts of Uttarakhand. According to Indian metrological department (IMD), “the state received more than 375% then normal monsoon rain, which caused melting of Chorabari glacier and flooding of Mandakini River.” According to the state government “169 people died and 4021 went missing.” These flash floods caused washing away of areas around Kedarnath temple. (NIDM,2014).

Psychological Impacts of Disasters

The traumatic incidences of disasters impact the psyche of the sufferer and cause abnormalities in their behaviours. According to IGNOU Disaster Response Manual, “Researcher studies show the victims go through distinct emotional phases following a disaster there being: (IGNOU Disaster Response, 2006)

- a. Impact Phase:

In this phase victims do not panic or show no emotions and keep themselves and their families alive.

b. The Inventory Phase:

This phase immediately follows the event; victims assess damage and try to locate other survivors.

c. The Rescue Phase:

In rescue phase emergency services providers are responding and victims are willing to take direction from these agencies without protest.

d. The Recovery Phase:

In this phase victims may be tense and apprehensive. They believe that rescue efforts are not proceeding quickly enough but gradually they regain psychological equilibrium. In an abnormally stressful event such as disaster, people normally experience a range of psychological and physiological reactions and intensity, timing, and duration of such responses may vary from person to person.”

The victims often suffer from psychological disorders like anxiety, depression and fear etc.

Sendai Framework for Disaster Risk Reduction

According to UN, “Natural hazards by themselves do not cause disasters. It is a combination of an exposed, vulnerable and ill prepared population or community with a hazard event that result into a disaster.” (UNISDR, 2008)

Disaster Risk Reduction can be defined as “action taken to reduce the risk of disasters and the adverse impacts of natural hazards through systematic efforts to analyse and manage the causes of disasters including through avoidance of hazards and reduce social and economic vulnerability to hazards and improved preparedness for diverse events.” (UNISDR, 2004)

As per the UN document of Hyogo framework, “the foundation for the implementation of Disaster Risk Reduction was provided by Hyogo Framework for Action (HFA) which was agreed at the world conference on disaster reduction in January 2005 in Kobe, Japan.” (UNISDR, 2008). The Hyogo Framework summarises “5 priorities of action: (Summary HFA)

1. In sure that Disaster Risk Reduction is a national and local priority with a strong institutional basis for implementation.
2. Identify, assess and monitor disaster risks and enhance early warning.
3. Use knowledge innovation and education to build a culture of safety and resilience at all levels.
4. Reduce underlying risk factors.

5. Strengthen disaster preparedness for effective response at all levels.”

The continuity of work done under HFA was ensured by the Sendai Framework. The Sendai framework for Disaster Risk Reduction 2015-2030 was adopted by the third UN World conference in Sendai, Miyagi, Japan.

SFDRR sets out 4 priorities for action viz - “1. Understanding disaster risk. 2. Strengthening disaster risk governance to manage disaster risk. 3 Investing in Disaster Risk Reduction for resilience. 4 enhancing disaster preparedness for effective response and to ‘build back better’ in recovery rehabilitation and reconstruction.” (UNSFDRR,2015)

SFDRR highlights particular vulnerability of disaster-prone developing nations, small island states, landlocked developing countries and African countries. The guiding principle of SFDRR elaborates that Disaster Risk Reduction requires a multi hazard approach and inclusive risk informed decision making based on the open exchange and dissemination of data. (UNSFDRR, 2015).

To achieve goals of Disaster Risk Reduction it is paramount to develop strengthen and implement relevant policies, plans, practices and mechanism in coherence with food security, climate change and environmental management. (UNSFDRR. 2015)

Furthermore, only collaborated efforts of entities of United Nations systems including the funds and programmes and specialised agencies along with global partnership are essential for disposal of effective Disaster Risk Reduction mechanism.

Findings

1. Global climate change is marked by anthropogenic influence.
2. Climate change is a potential hazard driver inducing vulnerability to disaster risks.
3. Disaster risk reduction emphasises on enhancing disaster preparedness for effective response, recovery, rehabilitation and reconstruction.

Conclusion

Disasters exacerbated by climate change is an issue of global importance. Developing nations, islands are more vulnerable to disaster risks Hyogo Framework followed by Sendai Framework have provided strategies for Disaster Risk Reduction and appeals to the global agencies and countries to participate together to build back better efficiently. Disaster Risk Reduction is key to sustainability and hence it must be ensured that measures for Disaster Risk Reduction becomes a global, national and local priority.

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- A summary of the HFA may be found at the end of the Briefing Note. For guidance on implementing the HFA <http://www.unisdr.org/eng/hfa/hfa.htm>