
COASTAL DISASTER MANAGEMENT: LAW, POLICY AND RESILIENCE

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ABSTRACT

Coastal disasters, including cyclones, floods, sea level rise, are primarily driven by climate change, environmental degradation and unsustainable human activities. These changes disproportionately affect coastal regions and vulnerable populations. This paper provides a comprehensive analysis on coastal disaster management through a judicial perspective, emphasizing the role of legal frameworks and initiatives taken by the government in mitigating risks and ensuring justice for affected communities. It examines causes of climate disaster, risks, alongside international mitigation efforts such as Law of Sea, Sendai Framework for disaster management and Paris Agreement; with a comparative study of the mechanism system within nations. Further, this paper also discusses about national mechanisms and legislative frameworks, as, Environment protection act, Disaster Management Act, Coastal Regulation Zone Notification, National Green Tribunal Act, Integrated Coastal Zone Management act, also special attention is given to mitigation strategies adapted by Odisha State govt- Odisha State Disaster Management Authority, Odisha State Relief Code, Odisha Early Warning and Communication System. This research explores case studies from Indian coastal regions, highlighting Odisha's success and challenges in implementing disaster management strategies, efforts taken by NGOs and duty of common people. This work concludes by recommending strengthened mitigation mechanisms that integrate human rights and environmental justice to better protect vulnerable communities.

Keywords: Disaster management, Coastal justice, Mitigation mechanisms, Legal case studies.

INTRODUCTION:

Coastal regions are intersection of environmental sustainability and socio-economic development, as they are essential to global economies, environmental sustainability and human settlement, serving for trade, tourism, and cultural heritage. They are home to a diverse ecosystem, supporting millions of livelihoods. As per UN data, about 40% of global population living in coastal regions, so the importance of these areas can't be overlooked¹. Coastal disasters, such as floods, cyclones, tsunamis and sea-level rise, are increasingly driven by climate change, environmental degradation and unsustainable human activities. They disproportionately affect coastal region, particularly vulnerable populations, resulting in loss of life, damage to infrastructure and long-term socio-economic impacts.

Addressing coastal disasters requires a combination of global cooperation, national legislation and local policy implementations. Internationally, frameworks like Sendai Framework for disaster Risk Reduction, Paris Agreement on Climate Change, Law of the Seas set the foundation for disaster mitigation and climate resilience. These agreements provide emphasize the need for mitigation of risks, it's strategies, sustainable development and international support for vulnerable nations. India being the most disaster-prone countries in world due to its geo-climatic conditions. In the decade 1990-2000, an average of 4344 people lost their lives and about 30 million people were affected due to disaster every year². To mitigate these impacts, the legislation of India has enacted policies like Disaster Management Act, 2005; Coastal Regulation Zone Notification; National Green Tribunal Act; Integrated Coastal Zone Management act, providing a comprehensive legal framework for disaster preparedness, response and recovery. And for this research paper, main attention is given to the legal implications adapted by the Odisha government, as this state is frequently hit by coastal disaster, and several measures, including construction of cyclone shelter, establishment of early warning systems and engaging communities in preparedness efforts under Odisha State Disaster Management Authority, The Odisha State Relief Code and more. The paper also highlights some disaster cases of Odisha as well in national level, such as: 1999 Super Cyclone, 2004 Cyclone Phailin, 2014 Cyclone Hudhud, 2019 Cyclone Fani, 2021 Cyclone Tauktae,

¹ UN, *Pop_coastal_areas*, UNITED NATIONS, https://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/oceans_seas_coasts/pop_coastal_areas.pdf (last visited Oct. 21, 2024).

² Dipankar C. Patnaik & N. Sivagnanam, *Disaster Vulnerability of Coastal States - A Short Case Study of Orissa, India*, SSRN JOURNAL (2007), <http://www.ssrn.com/abstract=1074845>.

2004 Indian Ocean Tsunami.

COASTAL ZONES, DISASTER AND IMPACTS:

Coastal region refers to the geographic area where land meets the ocean or sea. It encompasses various ecosystems, such as beaches, wetlands, mangroves, coral reefs, and other marine environments. It includes not just the shoreline but also the adjacent areas and waters up to a certain distance offshore, including areas of human settlement, economic activity and environmental significance. Coastal regions are essential for their biodiversity, natural resources, economic value (fisheries, tourism, transportation), and as protective barriers against natural hazards like storms and floods.

Legally, coastal zones can be defined in different ways according to jurisdictions. Under India's Coastal Regulation Zone (CRZ) Notification, coastal areas are divided into various zones, mentioned hereunder³:

Coastal Zone I: Areas Designated as ecologically sensitive; Coastal Zone II: Areas identified as Areas of particular concern such as economically important areas, high population areas and culturally imp. Areas; Coastal Zone III: All other areas as coastal areas, excluding those classified into Zone I and II; Coastal Zone IV: Areas in Andaman and Nicobar Islands and Lakshadweep Islands.

However, coastal regions are highly susceptible to coastal disaster such as cyclones, tsunamis, storms and erosions. These areas are naturally exposed to sea including high winds and tides and storms. Rising sea-level, caused by climate change, further increases the threat for these areas. Coasts are also home to natural features like mangroves, forests, coral reefs etc, which provide protection against coastal disaster. Mangroves and coral reefs act as buffers by reducing the energy of storm and waves.

Human activities such as deforestation, overfishing and coastal development weaken these natural defences, leaving coastline move vulnerable to disaster. Rapid urbanization, infrastructure development, also coastal pollution including plastic waste, industrial discharge and agricultural runoff, contributes to degradation of ecosystem like coral reefs and wetlands.

³ R. R. Krishnamurthy et al., *Managing the Indian Coast in the Face of Disasters & Climate Change: A Review and Analysis of India's Coastal Zone Management Policies*, 18 J COAST CONSERV 657 (2014), <http://link.springer.com/10.1007/s11852-014-0339-7>.

This pollution weakens the natural resilience of coasts and makes them more vulnerable to the impacts of storms and floods.

On the other hand, climate change is causing sea-level rise, leading to submersion of low-lying coastal areas. Climate change is also associated with an increase in frequency and intensity of extreme weather events like cyclones and hurricanes. And these storms cause significant damage to coastal infrastructure, homes and ecosystems, leading to long-term economic and environmental losses⁴.

Coastal hazards refer to the risk to life and property on the coastline due to coastal disasters caused by the mentioned factors. To mitigate these risks of post-disaster various regulations and legislations have been adapted which are to be discussed later in this paper.

INTERNATIONAL APPROACH TOWARDS MITIGATION:

Coastal disaster including storms, tsunamis, sea-level rise have a devastating affect on coastal regions globally. These hazards are intensified by climate change, environmental degradation and human activities. Coastal areas are habitat to diverse ecosystem and human population, who are highly vulnerable to these disasters. To mitigate these hazards a range of international laws, agreements and regulations has been made to manage the effects of coastal disasters. These instruments emphasize disaster risk reduction, climate resilience, environmental protection and sustainable development. Key International frameworks can be explored hereunder:

1. The United Nations Convention on the Law of the Seas (UNLOS,1982):

UNLOS is referred as “constitution of the Oceans” establishing a comprehensive legal framework governing all aspects of ocean space, including marine environmental protection, the protection and management of natural resources and the delimitation of the maritime boundaries, ratified by over 160 countries. It is primarily focused on ocean governance and equitable use of marine resources. Also, it highlights some provision for managing coastal disasters and its impacts. Key provisions are provided below:

⁴ *Climate & Environment - Coastal Hazards & Risks*, <https://greatlakesresilience-floodscience.hub.arcgis.com/pages/climate-environment-coastal-hazards-risks> (last visited Oct. 24, 2024).

i. Protection and preservation of the marine environment

Article 192: Imposes obligation on states to protect and preserve the marine environment.

Article 194: States to take measures to prevent, reduce and control coastal pollution.

Article 207: Adoption of laws and regulations to prevent, reduce and control pollution from land-based sources, such as pipelines, outfall structures.

Article 208-212: Coastal pollution and different reasons.

ii. Coastal Disaster Mitigation through Marine Scientific Research

Article 243: Encouraged cooperation of international organizations to conduct research.

Article 200: Development and transfer of marine technology, essential for monitoring coastal disaster including use of early warning system and satellite imagery to track storms and tsunamis.

iii. Responsibility and liability for Environmental harm

Article 235: Ensures that no jurisdiction causes environmental damage and they must provide compensation for harm caused.

2. Sendai Agreement for Disaster Risk Reduction⁵:

An international agreement adopted by 187 UN member states in 2015, aims to reduce the risk and impact of disaster worldwide by promoting adaptive measures. It addresses key areas essential for effective risk assessment, governance and community preparedness. It works with other 2030 agenda agreements, such as Paris agreement on Climate Change, the Sustainable Development Goals⁶. Under this The UN Disaster Risk Reduction is tasked to support the implementation and review the framework.

⁵ *Sendai Framework*:. Sustainable Development Knowledge Platform, <https://sustainabledevelopment.un.org/frameworks/sendaiframework> (last visited Oct. 25, 2024).

⁶ *What Is the Sendai Framework for Disaster Risk Reduction?* | UNDRR, (Apr. 4, 2023), <https://www.undrr.org/implementing-sendai-framework/what-sendai-framework>.

It has set of priorities, goals and guidelines for global, national and regional level.

Priorities:

- i. Understanding Disaster Risk
- ii. Strengthening Disaster risk governance to Manage Disaster Risk
- iii. Investing in Disaster Risk Reduction for Resilience
- iv. Enhancing Disaster preparedness for effective response and to 'build back better' in Recovery, Rehabilitation and Reconstruction

Global Targets:

- a. Reduce global target mortality
- b. Reduce the no. of affected people
- c. Reduce disaster damage to critical infrastructure and disruption of basic services

NATIONAL STRATEGIES IN ADDRESSING COASTAL DISASTER:

India with over 7,500kms of coastline is vulnerable to coastal disaster. States such as Odisha, West Bengal, Andhra Pradesh and Tamil Nadu, frequently facing the impacts of these disasters resulting in economic loss, environmental damage and displacement of coastal communities. About 60% of the landmass is prone to earthquake and 40million to floods, 8% to cyclones. Between 1990-2000 about 4300 people have lost their lives and assets⁷.

India also implements Sendai Framework for Disaster Risk Reduction through legislative measures, policy frameworks and institutional structures, aimed at enhancing resilience and strengthening disaster management.

To address these risks, India has adopted certain legislative measures, described below:

⁷ Patnaik and Sivagnanam, *supra* note 2.

1. Disaster Management Act, 2005⁸

The act mandates formation of National Disaster Management Authority (NDMA) under *section 3-9*. NDMA formulates policies that are essential for disaster-prone coastal regions. It has issued guidelines for managing cyclones, floods etc. It collaborates with scientific agencies like Indian National Centre for Ocean Information Services and Indian Meteorological Department, which provides early warnings on coastal hazards.

National Disaster Response Force (NDRF) in *section 44* of the act, which provides specialized force to coastal areas. This force undergoes rigorous training for handling coastal hazards, including flood rescues, underwater search and rescue operation. It conducts community awareness programs in coastal areas, educating the public about safe practices, evacuation procedures and first aid.

State Disaster Management Authorities (SDMAs) in *section 14-22*, establishes plans in state level to address hazards, construction of shelters, sea walls and elevated buildings and affected areas.

District Disaster Management Authorities in *section 25-34*, it works closely with local govt. bodies, police and ngos to coordinate resources and personnel evacuation, relief and recovery operations.

Early Warning System in *Section 35*, providing real time alert in coastal areas.

National Disaster Mitigation fund in *section 47*, it allocates fund for development of coastal infrastructure, restoration of mangroves, coral reefs and to build local training centers for disaster management officials.

National Disaster Management Plan in *section 11*, aligned with SDGs promoting sustainable development.

2. Coastal Regulation Zone (CRZ) Notification:

Issued in 1991 by the Ministry of Environment, forest and climate change under the

⁸ Indian legislation, *The Disaster Management Act, 2005*, <https://ndmindia.mha.gov.in/ndmi/images/The%20Disaster%20Management%20Act,%202005.pdf> (last visited Oct. 25, 2024).

Environmental Protection Act, 1986. The aim is to protect coastal ecosystem from unregulated development, preserves the rights of local communities and reduce risks associated with coastal disasters. It categorizes coastal areas into different zones which are mentioned earlier. It lays down detailed guidelines for some essential infrastructure projects such as ports, harbours, airports allowed in zone 1; low impact tourism activities, small huts in zone 2 and 3; traditional fishing and community based livelihood in zone 4 areas. It also mandates states and UTs to prepare Coastal Zone Management Plans to define high tide and low tide lines, hazard lines and boundaries; to identify “No Development Zones” in some areas.

Sec 6.3 emphasizes prohibiting dumping of solid waste and discharge of untreated sewage into coastal waters; strict pollution control measures for projects within 500 meters of HTL; zero-liquid discharge system for industrial activities near coastal areas.

It stresses public involvement in coastal management, it emphasizes feedback from the local communities to ensure that the plans reflect the need of communities.

A comparative study between disaster management between Japan and India: Compared to other countries, Japan is more prone to natural disasters and damages caused by this. 20.5% of the world’s earthquakes magnitude of 6 or higher are in Japan (2000-2009). It has 7% of world’s most dangerous volcanos and 0.3% of the deaths caused by disasters worldwide⁹.

Japan’s coastal management is governed by several laws, including the Basic Act on Ocean Policy (2007) and Law on Special Measures for the Promotion of Urban Renewal in Coastal Areas mandating establishment of Comprehensive Coastal Management Plans for CZM, to approach to risk reduction, preparedness, response and recovery. Also, the govt conducts regular disaster drills, educational campaigns, implementation of tsunami-resistant designed buildings. The govt actively promotes the restoration of coastal ecosystem, such as mangroves and wetlands.

India’s coastal management is regulated by the CRZ notification under Environment Protection Act and Disaster Management Act, which provides frameworks for mitigation and adaptation. It establishes NDMA. India faces significant challenges in balancing development and

⁹ *Is Japan a Disaster Prone Country? Know the Types of Natural Disasters and Countermeasures along with the Recent Disaster Chronology | Living | Japan Guide & Information | アクセス日本留学*, <https://www.studyjapan.jp/en/topics/life/natural-disaster-in-japan.html> (last visited Oct. 25, 2024).

environmental sustainability. The CRZ aims to protect coastal ecosystem but the enforcement is often weak.

POLICIES ADOPTED BY ODISHA¹⁰:

A state prone to cyclones and floods, has emerged as a global for effective coastal disaster management. Some key policies and initiatives are mentioned hereunder:

- i. Odisha State Disaster Management Authority: A nodal agency responsible for overall disaster management in the state. It coordinates various departments and agencies involved in disaster response and recovery.
- ii. Early Warning Dissemination System: A comprehensive system for timely dissemination of cyclones and tsunami warnings. It also utilizes a network of sirens, loudspeakers and mobile alerts to reach coastal communities.
- iii. Cyclone Shelter: Equipped with essential amenities to accommodate large number of people. It is regularly maintained and upgraded to ensure their effectiveness.
- iv. Integrated Coastal Zone Management: It aims to promote sustainable development and protect coastal ecosystem. It includes measures like coastal erosion control mangrove conservation and beach nourishment.

CASE STUDIES ADDRESSING COASTAL DISASTER MANAGEMENT:

1. Vanashakti & Anr. v. UOI & Ors¹¹:

This case highlights the issue of post-facto clearances for projects violating CRZ regulations. It underscores the importance of obtaining prior environmental clearances and adhering to the due process of law.

2. Shweta Wagh & 8 Ors vs Municipal Corporation of Greater Mumbai¹²:

¹⁰ Patnaik and Sivagnanam, *supra* note 2.

¹¹ *COASTAL REGULATION ZONE MANAGEMENT AND THE GRANT OF POST FACTO CLEARANCES: THE CASE OF VANASHAKTI & ANR. V. UOI & ORS.* | National Law School of India University, (May 18, 2021), <https://ceerapub.nls.ac.in/coastal-regulation-zone-management-and-the-grant-of-post-facto-clearances-the-case-of-vanashakti-anr-v-uoi-ors/>.

¹² *Shweta Wagh And 8 Ors vs Municipal Corporation Of Greater ...* on 16 April, 2019,

This case challenged the 2015 amendment to the CRZ Notification, which allowed for the reclamation of land for road construction in exceptional cases. The court scrutinized the criteria for determining "exceptional cases" and emphasized the need for stringent environmental safeguards.

3. **M.C. Mehta v. Union of India**¹³:

This landmark case established the principle of public interest litigation and led to significant environmental reforms, including the protection of coastal ecosystems.

CHALLENGES AND SUGGESTIONS:

Though India has made significant strides in coastal disaster management, several challenges persist:

- i. Lack of Awareness
- ii. Inadequate Constraints
- iii. Financial Constraints
- iv. Climate Change
- v. Institutional Coordination

Suggestions for Effective Implementation:

- i. Invest in advanced technology and communication system to provide accurate warnings.
- ii. Empower Local communities to participate in disaster preparedness, recovery and response.
- iii. Prioritize construction of infrastructure such as, cyclone shelters, roads and bridges.

<https://indiankanoon.org/doc/106314923/> (last visited Oct. 25, 2024).

¹³ *M.C. Mehta vs Union Of India & Ors on 11 October, 1996*, <https://indiankanoon.org/doc/1084083/> (last visited Oct. 25, 2024).

- iv. Collaboration with other countries to share knowledge, best practices and technology.

CONCLUSION:

Coastal disasters, exacerbated by climate change and human-induced environmental degradation, pose a significant threat to coastal communities worldwide. This paper explored the legal and policy dimensions of coastal disaster management, emphasizing the importance of justice and equity. By strengthening legal frameworks, enhancing institutional coordination, and prioritizing community-based approaches, we can build more resilient and sustainable coastal communities. As climate change intensifies, it is imperative to adapt and innovate to ensure a sustainable future for our coasts.