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AN INTRODUCTION TO FLOOD RISK AND ADAPTIVE CAPACITY ASSESSMENT BASED ON DISASTER RISK REDUCTION

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Abstract

Flooding is a global issue facing many parts of the world. Floods have become a more frequent natural hazard, which has caused loss of life, the devastation of property and infrastructure, and harm to the environment. A relative method of analysis is to look at how affected people and natural systems are by flooding and how well they can adjust to alterations. The mainstay of the flood mitigation method is flood risk assessment, which enables managers and decision-makers to act by implementing flood prevention or mitigation solutions to safeguard the exposed population or assets. The creation of a participative database on the vulnerability, risk, and adaptive capacity of places and individuals, as well as their causes and effects, would aid in disaster risk reduction strategy. The former Disaster risk management framework was initiated in the Hyogo framework of action in 2005 and when it came to an end in 2015, there is still a need to carry it forward. So, in 2015, the United Nations endorsed the Sendai Framework for Disaster Risk Reduction.

Keywords: *Flood risk, Vulnerability, Adaptive Capacity, Sendai Framework, Mitigation*

Introduction

Disasters can be the disruptions that occur in the functioning of this world which strikes the community badly so that they face challenges in the coping capacity of their own natural settings. A natural disaster is something that is caused by the abnormal intensity of a natural agent (flood, landslide, earthquake, avalanche, etc.) and significantly has the potential to pose threat to life, property and society (Kalpana Srivastava, 2010). When a natural disaster occurs, it affects all aspects of the community. It cannot be said that it is based on loss of life and loss of property only. The affected society involves components such as dwelling, energy security, food security, water security, health security, the ecosystem services which we derived from nature, the economy, communication, and the infrastructure all being influenced by the event. Natural disasters and natural hazards are linked but not the same. A natural hazard is an incident that is likely to have a negative consequence.

Understanding the Terminologies

A natural disaster is a fatalistic outcome of a natural hazard that significantly affects a community. Simply the hazard possesses a threat to society as it may have the chance to become a disaster. So the chances of occurrence of any hazard imply social disruptions and it is also possible to have more than one hazard for the same region. Those areas can be said as multiple hazard-prone regions. Each hazard has its own identity and always creates a negative impact on the physical and social aspects. In disaster management, the term risk assessment indicates the identification and analysis of potential hazards and what can be the aftereffects of

such hazards in society (B. K. Rout and B. K. Sikdar, 2017). Disaster management is a broad subject that manages to include many sub-branches in it. The understanding will not be complete if the following terms such as hazard, exposure, vulnerability, risk, etc. not mentioned.

"A procedure, phenomenon, or human activity that endangers human life, causes physical injury, has unfavorable health impacts, damages property, disturbs the social or economic order, or has an environmental impact is referred to as a hazard." (UNDRR). The Disaster Management Act, 2005 (Central Act 53 of 2005) of India, a disaster is "a catastrophe, mishap, calamity, or grave occurrence affecting any area from natural and manmade causes, or by accident or negligence, resulting in substantial loss of life or human suffering, damage to, and destruction of property, or damage to, or degradation of the environment, and is of such a nature and magnitude as to be beyond the community's capacity. "Exposure is the occupancy and volume of community, property, livelihoods, systems, or other goods in dangerous regions, which contribute something susceptible to losses (2019 NDMP Guidelines). According to the 2019 NDMP Guidelines, "vulnerability is the characteristics and conditions of a community, system, or asset that make it susceptible to the detrimental effects of a hazard. Then finally comes the Risk, which is the "combination of the probability of an event and its negative consequences" (NDMP Guidelines, 2019). Risk can be expounded as the subset of all three means hazard, exposure and vulnerability. When it comes to flood it can simply be defined as "a relatively flat land adjacent to a natural water course, composed primarily of unconsolidated depositional material derived from sediments transported by the related stream and subjected to periodic flooding (KSDMA)."

Disaster Risk Reduction (DRR) can also be identified as the mitigation strategies which involves reducing the impact of the hazard or the situation by taking proper actions beforehand, which is needed to be implemented ahead.

Flood Risk and Adaptive Capacity Assessment

It is very evident that flash floods are a major threat to the smooth functioning of the world. Most of the geographic area is flood risk-prone when it is analyzed all over the world. It happens due to many reasons. Sometimes it is due to the changes in the annual weather pattern, the physiography of the region, poor drainage infrastructure, lacking management and sometimes caused by the dam's default. The effect of flooding is increasing at a faster rate because of both physical, social and climatic factors. It is not like only one factor is responsible for the increase in intensity. An increase in atmospheric temperature and resulting heavy torrential rainfall in the tropics can be explained as one of the major causes. But its intensity of flood hazard to become a disaster occurs when it dangerously affects the population. So, it can be said that is very much important to investigate flood-vulnerable regions and so analyze the risk, and adaptive capacity elements. The records from the 1970s to 2012 more than one million people lost their lives due to the impact of floods globally. (Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes, WMO, 2014). India is extremely susceptible to flooding. Over 40 million hectares of the 329 million hectares total geographic area are at risk of flooding. As the monsoon arrives in India, it wreaks havoc on several sections of the country, bringing more harm than good.

The flood can have a variety of causes, including rapid flooding, which is commonly connected with hydrologically tiny areas. This condition has a brief lifespan but can inflict significant damage. Floods have become more recurrent in contemporary years. There are some spatial similarities and variances in flood-prone locations that might be used to determine policy imperatives for sustainable development (Sharma S, 2018). Flood susceptibility was influenced more by social variables than by economic and physical conditions. The total susceptibility of the study community falls into the 'high vulnerability to floods' category. The flood vulnerability assessment and conceptual framework were effective in arriving at coping methods. Contextual coping methods in this community included brief relocation, evacuation to a safe location, and waiting for help from the authorities and nearby neighbours. According to the study, public awareness campaigns, early warning systems, and enhanced disaster management tactics must take into account varied levels of susceptibility as well as community coping mechanisms and preferences (Rendani.B. Munyai et al, 2019).

Adaptive capacity is a system attribute that allows it to construct an analogy for allocating its precious resources in response to stressful occurrences rather than futuristic thoughts. The background demonstrates that exposure and sensitivity factors influence regional vulnerability cumulatively. Identifying vulnerable zones is useful for developing policies for channeling scarce resources to places in need of adaptation to climate disasters. The flood risk analysis also indicated the importance of societal variables in increasing the region's

susceptibility to climate extremes. The main constraints we faced were the lack of free and authentic spatial data. The most recent population data available for research is Census 2011, but more recent data on socioeconomic characteristics can provide deeper insights into susceptibility (Sagar Ratna Bajracharya, 2021). Assessing and enhancing both the social and physical systems' capacity for adaptation to help them better adjust to climate change, especially variability. Users will get assistance on a variety of crucial actions, such as developing adaptable capacity for priority groups, creating adaptive capacity indicators, and identifying and assessing key adaptation choices. It covers the nature of current and future risks and gives recommendations for assessing and improving the capacity of systems (and populations) to adapt to these hazards based on the five APF (Adaptive Policy Framework) Components (Nick Brooks and W. Neil Adger, 2004). Biophysical vulnerability, social vulnerability, risk, adaptive capability, and adaptation all interact. The relationship between adaptable ability and actual adaptation is discussed, as well as worries regarding the concept's possible misuse. The concept of adaptation likelihood is proposed as a tool of combating any attempt to use "capacity building" as a political lever to distract attention away from large-scale structural issues that frequently cause or exacerbate vulnerability among populations with little control over such factors. The risks that a human system faces, as well as the timescales connected with them, will influence the nature of its adaptive capability and appropriate adaptation techniques (Nick Brooks, 2003).

To design communities that are robust to flooding, flood risk specialists and planners must comprehend the effects of flooding. Assessments of the effects of flooding can be used for many different things, including risk management and decision-making. The idea of resilience has emerged as a means of comprehending how systems anticipate, react to, and recover from shocks. Making resilience a useful tool still presents difficulties. The expenses of risk mitigation should be taken into account when comparing the cost-effectiveness of various resilience solutions. The effects of floods on infrastructure will be discussed individually due to the highly specialist nature of infrastructure components and the complexity of networks. Due to its specialist nature and dependency, flooding on infrastructure is tough to quantify, making it challenging to identify and calculate costs (M. J. Hammond et al., 2013).

A number of financing programs, most of which were geared towards regional research and capacity building, supported projects on DRR and CCA. Risks and hazards can result in loss of life, injury, property damage, social and economic upheaval, and other environmental harm. Lack of technical and human resources for conducting impact assessments, a lack of technological tools required for modeling and forecasting, a lack of non-structural measures that are adequate, a lack of access to resources, and a lack of governance capacity for putting DRR measures into action and enforcing them. Recent research has shown that there is a knowledge gap between what is known and how DRR capacity building is really carried out (Christmas Uchiyama et al, 2021)

Odiongan's geographical flood risk is assessed using the analytical hierarchy method (AHP), which takes into account disaster risk elements and data from multiple government agencies. The geographic information system (GIS) was used in the study to depict the spatial distribution of flooding in the municipality. The Sendai Framework served as the foundation for risk analysis in this study. The Sendai Framework recognized the community's vital role in disaster risk reduction. This framework, which is utilized in disaster risk management, provides quantitative parameters for calculating disaster damage reduction on a national and local scale. The Sendai Framework's compilation and evaluation of disaster damages improves our understanding of the efficacy of disaster risk mitigation initiatives (Jerome G. Gacu et al, (2022). Because the evaluation procedure requires spatial information, the GIS tool is an essential component of flood risk assessment. The use of a common approach for evaluating and combining unique data has an impact on the precision and comparability of assessment results. Some countries have established national rules to estimate the likelihood for flooding. Furthermore, GIS can be used to investigate international, regional, and local flood risks and to guide the development of a risk mitigation plan (Noamen et al, 2020). The usage of AHP as a weighing criterion approach offers various advantages as well, such as stressing the structure of decision-makers preferences among a number of criteria. Instead of selecting the "best" alternative, this method gives the foundation and tools for intelligent decision-making, allowing decision-makers to find the alternative that best meets their needs. Flood risk mapping based on GIS and multi-criteria analysis is a powerful tool for evaluating flood risk areas and assisting water resource planners and decision-makers in focusing on specific areas in order to do a more complete assessment of flood risk As a result, this simplified yet reliable methodology can help to reduce resource needs for reasonably accurate flood risk assessments (Daniela Rincon et al, 2018).

Importance of Sendai Framework for Disaster Risk Reduction

The former Disaster risk management framework was initiated in the Hyogo framework of action in 2005 and this was basically been identified for the next 10 years from 2005 to 2015 rested on 3 pillars such as; a) Risk Identification b) Risk Reduction c) Risk Transfer. When the Hyogo framework of action came to an end in 2015, there is still a need to carry it forward. So, in 2015, the United Nations endorsed the Sendai Framework for Disaster Risk Reduction. Sendai is a city in Japan that was affected by the 2013 tsunami, the framework was named after the city because it was a salute for the resilience of the society of Sendai as they could overcome the extreme event and kept back in life on track within one year. Then the global community identifies Sendai as the location for the next conference. The UNDRR supervises the Sendai Framework for Disaster Risk Reduction and its monitoring, sharing, and implementation in all countries.

During the same time period United Nations also prepared the 17 SDGs which are the global goals for 2030 and the Sendai framework is actually inbuilt into all the SDGs. The concept of risk is becoming more systemic. If we wish to reduce risk, we must also become more integrated into our approaches: collaborating across sectors, between and within institutions, and ensuring alignment from policy to activity. The Sendai Framework was the world's first well-known policy agenda which argued that risk-conscious development is sustainable. Over the last 20 years, direct economic losses from disasters have increased by more than 150%, with losses borne disproportionately by vulnerable developing countries. Both the Sendai Framework and the achievements of the Sustainable Development Goals (SDGs) are the result of interconnected social and economic processes. As a result, there is a great deal of overlap between the two policy instruments (Sendai Framework for Disaster Risk Reduction 2015-2030, United Nations, 2015).

Conclusion

Analysis of the effects of flooding is essential for improving flood risk management and boosting community resilience. In this study, localities in flood prone were subjected to analyses of flood damage and loss estimation under past flood scenarios. Real-time data on flood-prone populations and locations can aid with emergency planning, land use, river basin management, and policy improvement by identifying more efficient mitigating measures. For decision-makers and the general public, this study can be converted into a web-based geospatial analytical system or incorporated into virtual reality environments to give accessible flood effect information. The benefits of community and property measures can be enhanced by the specific economic and human implications of mitigation solutions.

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