

**RESILIENCE TO FLOOD DISASTER IN RATUKHOLA WATERSHED
MAHOTTARI DISTRICT, NEPAL**



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Master's Degree of Social Work

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DECLARATION

I, Pragya Rajbhandari, hereby declare that this thesis entitled **“Community Resilience to Flood Disaster in Ratukhola Watershed, Mahottari district, Nepal”** is submitted to the Department of Social Work, Faculty of Humanities and Social Sciences, Tribhuvan University is the result of my original and independent work done by me under the close supervision and guidance of Mr. Laxman Subedi, Department of Social Work. All the ideas borrowed to complete this thesis from any sources are acknowledged and cited accordingly. The paper has not been submitted for any kind of assessment to any other college or university and the work herein represents the sole work of the author.

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LETTER OF RECOMMENDATION

The thesis entitled “Community Resilience to Flood Disaster in Ratukhola Watershed, Mahottari district, Nepal” has been prepared and submitted by Ms. Pragya Rajbhandari to the Department of Social Work, Tribhuvan University under my guidance and supervision for the partial fulfillment of the requirements for the degree of Master’s in Social Work. I would like to recommend this thesis for the final evaluation.

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LETTER OF APPROVAL

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ABSTRACT

The idea of resilience is getting increasing attention among researchers, policymakers and experts. Abundant frameworks have been introduced and papers conscripted, and projects formulated to build community resilience. As a result, this is being undertaken in the various community of Nepal as well. This study addressed the issue of flood vulnerability and resilience at the level of communities residing along with Ratu watershed, Mahottari Nepal. This study sets out to analyze the community resilience to flood disasters in the Ratu watershed of Nepal based on the Disaster Resilience of Place (DROP).

This study introduces resilience as an active process varying with antecedent conditions, disaster severity, and exogenous variable effects. Although resilience is supposed to be adaptive, immediately before the disaster, recovery level results in the static modeling of the antecedent conditions. The local community has been facing floods since the time of their ancestors, so they have exceeded their absorptive capacity. Similarly, the recurring impact of floods decreases the economic capability to bounce back from the following flood event and thus becomes ever more challenging to recover. In the same manner, the community learnings from the hazard event and the opportunity to improve mitigation and preparedness are very limited, the community is not able to increase their inherent resilience and capacity before the next event.

The study truly highlights the need of the hour which is an inclusive approach and long-term disaster risk management strategy within Bhangaha Municipality Ward No. 1, to cater to the vulnerability of these marginalized groups along with the seasonality floods experiences. Further stating the inadequacy of temporary flood protection measures and a lack of comprehensive disaster risk reduction policies at the municipal level. The research emphasizes the need for building community engagement and public awareness in resilience enhancement, further calling for increased participation in disaster preparedness. The outcomes of such studies point to increased preparedness action through an increase in financial resources and improved governance that enhances flood response and recovery. Thus, these insights provide policy-level guidelines for the future development of better flood management strategies and stronger community resilience.

Keywords: community resilience, flood disaster, Ratu Khola watershed, disaster risk reduction, adaptive capacity, absorptive capacity, Disaster Resilience of Place (DROP) framework, social capital, Terai region, Nepal.

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ABBREVIATIONS

CBDRM	Community-Based Disaster Risk Management
CBDRR	Community-Based Disaster Risk Reduction
CBFEWS	Community-Based Flood Early Warning System
CDRMP	Community Disaster Risk Management Program
DMC	Disaster Management Center
DRM	Disaster Risk Management
DROP	Disaster Resilience of Place
DRR	Disaster Risk Reduction
EWS	Early Warning System
FGDs	Focus Group Discussions
GIS	Geographic Information System
GLOFs	Glacial Lake Outburst Floods
ICIMOD	International Centre for Integrated Mountain Development
INGOs	International Non-Governmental Organizations
IOM	International Organization for Migration
KIIs	Key Informant Interviews
LDCRP	Local Disaster and Climate Resilience Planning
LDMC	Local Disaster Management Committee
MoFAGA	Ministry of Federal Affairs and General Administration
MOHA	Ministry of Home Affairs
NAPA	National Adaptation Program for Action
NGOs	Non-Governmental Organizations
PWD	Public Works Department
SLA	Service Level Agreement
SMS	Short Message Service
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
VDC	Village Development Committee

CHAPTER I INTRODUCTION

1.1 Background of the Study

Bhangaha Municipality which is located in the Terai region of Nepal is listed among one of the most flood-prone areas of the country. Similarly, Ward No. 1 of this municipality faces recurrent and severe problems related to flooding due to its location near the Ratu Khola watershed. The Ratu Khola, originating from the Siwalik foothills is highly dynamic with a river system showing high sedimentation rates, along with a very rapid flow of water during the monsoon season. During the monsoon, the heavy rainfalls in the Terai region increase the volume of the rivers and since the land is flat the water finds no outlet and thus keeps flooding and causing waterlogging for the people. In such times, floods hamper local people's ways of life by directly threatening agriculture, infrastructure, and livelihoods. The frequency and intensity of such flooding events have increased over recent decades which is probably due to the impacts of climate change. As a result, the communities in Bhangaha Municipality always have to be under pressure to adapt and mitigate the risks of such frequent disasters.

Geographical location, unplanned settlement development, and rising urbanization have resulted in disasters suffering the loss of lives and properties (MOHA, 2019). For instance, the settlement of Wards No. 1 is located along the embankment of the Ratu Khola and is most vulnerable to seasonal floods which cause serious damage to agriculture which is the main source of income for the majority of the population. Farming being a major part of the economy the floods pose serious problems by destroying crops, delaying recovery efforts, and prolonging financial suffering for the community. Although the local measures for preventing floods from sandbag embankments provide short-term consolation, they do not handle the flooding issue in the long term and show a lack of resources from the community with inefficient governance.

The Bhangaha municipality is rich in socioeconomic and cultural diversity. The municipality includes Madhesi, Janajati, Dalit, and Muslim ethnicities. The livelihoods of these communities are based on agriculture which is very highly

vulnerable to floods. Besides the natural environmental issues, socio-economic ones such as poverty, poorly developed education and infrastructures also make up a more significant threat. Floods are accompanied by immediate harm and some long-term impacts, including loss of income, food insecurity, and health risks from water-borne illness. However, the local communities have developed some coping and adaptation mechanisms to flood risk. These are indigenous knowledge systems, community cooperation, and spiritual existence, thus providing the panoply for disaster resilience. But the effectiveness of such native coping mechanisms is variable, confirming that local wisdom ought to be supplemented by more formal disaster risk reduction interventions., especially as the environmental and socio-economic challenges become more complex.

This study is being carried out with the perspective of understanding the resilience of the communities in Bhangaha Municipality Ward No. 1 by exploring the relationships between the social, ecological, and cultural environment that shapes disaster preparedness, response, and recovery. In fact, the research recognizes that infrastructural or technical measures do not determine resilience solely but it is the social fabric built from local beliefs, insight, and tradition that is of great consequence to community resilience. For example, indigenous practices in the sharing of resources, spiritual rituals for divine protection, and traditional water management techniques all contribute to critical disaster preparedness. Such types of local approaches usually complement official disaster risk management methods in the creation of a hybrid model of resilience that is both practically and culturally rooted.

The thesis adopts a mixed-method study to obtain an in-depth knowledge of flood resilience in the study area. The qualitative method which includes focus group discussion, in-depth interviews, and key informant interviews is used to record the lived experiences, perspectives, and coping strategies of the community. This method also provides insights into the role of traditional beliefs and practices that communities are using for disaster preparedness. On the other hand, the quantitative method which includes data from government papers, flood risk assessments, and secondary sources ultimately supports the qualitative results and provides a more comprehensive contextual knowledge of the problem. This mix approaches also analyzes the interactions between the social, economic, and governance factors. By

analyzing these factors the particular study aims to offer practical recommendations for improving the flood risk management in Bhangaha Municipality.

Resilience has been a part of disaster management for quite a long time, and investment in mitigation, risk reduction, and management in effective policies and systems is a need. Naturally, Nepal is prone to the calamities all the more it has been suffused by disasters growing worse by the year and has never been able to fit resilient community development into its government agenda. The Nepali government, however, enacted the Disaster Risk Reduction and Management (DRRM) Act-the replacement for the now-defunct Natural Calamity (Relief) Act of 1982, which had been in existence for over four decades-in 2017, as an effort to bring the disaster management initiative up to date. Nevertheless, Nepal is still stressed to form a functional coordinating agency projected in the new act (Sanam and Christopher, 2020). This study assessed community resilience and factors associated with differential community vulnerability to floods. It focused on different dimensions of our community resilience based on the Disaster Resilience of Place (DROP) focused on flood disasters.

The main purpose of this study is to gain more knowledge on disaster resilience in flood-prone communities with a focus on Bhangaha Municipality. This study highlights the importance of integrating traditional knowledge with contemporary disaster risk reduction techniques in order to come up with sustainable and culturally appropriate solutions. This study assessed community resilience and factors associated with differential community vulnerability to floods. It focused on different dimensions of community resilience based on the Disaster Resilience of Place (DROP) focused on flood disasters. The results of this study aim to close the gap between scientific disaster management techniques and local knowledge systems by encouraging a more flexible and community-centered approach to disaster preparedness, response, and recovery. In addition to Bhangaha Municipality, this study applies to other flood-prone areas of Nepal and abroad by showing how local populations may more appropriately adapt to the challenges that climate change and frequent natural disasters present.

1.2. Statement of the Problem

The Bhangaha Municipality is located in the flood-prone Terai region of Nepal which have been experiencing many devastating floods especially in Ward No. 1 which lies close to the Ratu Khola watershed. The main source of income for the local population of that area is agriculture, which the floods adversely affect every year whereby climate change also plays an important role which worsens the conditions of the individual and communities. The government and community are constantly making efforts to reduce the risks of floods through sandbag embankments and other temporary solutions which shows the long-term challenges and limitations of interventions. Often the existing flood management techniques are disorganized that is exposing the community to face the repeated cycles of destruction.

The research conducted by Khanal, Shrestha, and Ghimire (2007) emphasizes the growing flood risks in the region. As the Ratu Khola River originates from the Siwaliks, it is not at risk of Glacial Lake Outburst (GLOFs) but it faces flood risks from the riverbed rise, bank cutting, and channel shifting. The more frequent one in the region is sheet flooding. The built of infrastructures such as highways constructed perpendicular to drainage pathways has made the sheet flooding worse and more common as well. This particular study also points out that the infrastructure projects near the Nepal-India border like roads, dams and dykes have increased the risk of flooding in the Ratu Watershed. The researchers have recommended the use of Geographic Information Systems (GIS) and remote sensing for the efficient mapping of flood hazards and land-use planning to manage such risks. The document has also called for early warning systems, along with institutional strengthening at the local level and increased community awareness to reduce the impact of flooding on the Ratu Watershed.

Another existing research conducted by Bajracharya et al. (2021) studied the involvement of the community in flood risk management and the impact of the community-based flood early warning system (CBFEWS) in the Ratu Watershed, Koshi basin, Nepal. The study showed that CBFEWS not only raised the community's awareness but also developed its capability to cope with forthcoming floods by involving them in risk evaluation, vulnerability mapping, and real-time flood

monitoring. The use of water level monitoring and the application of many different methods of communication such as sirens, SMS, and social media resulted in the fact that early warning messages were both more accurate and more reliably broadcasted hence benefiting downstream communities who are in the focus of the study. Disaster management committees and task forces including the setting up of institutional frameworks such as disaster management committees and task forces were used to fortify local responsiveness. On the grounds of education, rehearsals, and the priorities proposed by the society, the inhabitants made possible that the measures taken during the flood would be effective. The study revealed that CBFEWS did not only protect the most vulnerable members but was also more successful in the case of weak ones such as women, children, the elderly, and people with disabilities. Despite the system having performed to limit flood damages, the study also gave a clear pointer to the future direction which is the necessity of thoroughgoing research in determining the continuing sustainability, facing the challenges of the financial factor, institutional support, and technological advancements. The findings of the authors showed CBFEWS as a model of flood risk management, which is efficient, cost-effective, and can be proliferated to other areas with sustainability being the main aspect.

While a few efforts for managing flood risks in Bhangaha Municipality, but they remain inadequate as those measures are temporary and reactive most of the time. Most of the existing studies and interventions are confined within the infrastructural and technical measures lacking more of a holistic approach that considers sustainable long-term strategies and their wider socio-economic implications. The social, ecological, and cultural aspects have been often overlooked, giving rise to the understanding of vulnerability and resilience from a perspective that is too fragmented. This added exposure of Bhangaha Municipality to various impacts of natural disasters, compounded by climate change, rapid urbanization, and depletion of resources, necessitates the urgent reassessment and reframing of existing DRR measures. Although efforts are underway, local communities still continues to struggle with the challenges in the construction of resilience and adaptive capacities for effective mitigation, response, and recovery from such events. This is shown by the absence of adequate early warning systems, low preparedness, and low access to recovery resources. Failure to make the community resilient does not only translate to

loss of lives and properties over and over again but also significantly undermines long-term development goals. In line with these challenges, this study intends to investigate the underlying factors that shape community resilience and adaptive capacity in the case of Bhangaha Municipality. By applying the Disaster Resilience of Place (DROP) framework, the research integrate social, ecological, and cultural dimensions, in gathering community insights plus lived experiences, and ultimately the study identifies the key challenges and provide the evidence-based, context-specific recommendations for strengthening disaster preparedness, recovery, and long-term resilience at the local level.

1.3. Research Questions

The study aims to interpret disaster resilience and assess how disaster risk reduction interventions perform in Bhangaha Municipality, Ward No. 1, using quantitative indicators and qualitative perceptions. It raises the following research inquiries:

- How do social and ecological factors influence community resilience in Bhangaha Municipality Ward No. 1 with regular floods at the area?
- What is the role of the local beliefs and insights towards the community disaster resilience in the study area?
- How do communities develop adaptive capacities to anticipate, respond to, and recover from flooding?
- What are the major barriers to strengthening community resilience and adaptive capacities in flood-prone areas?
- How effective are existing policies and programs in addressing these barriers?

1.4. Objectives of the Study

The study was conducted with the following objectives:

Specific Objectives

- To determine the effect of social-ecological considerations, including poverty, educational accessibility, and facilities, on communities in

Bhangaha Municipality Ward No. 1 toward disaster resilience, particularly in flood disaster scenarios.

- To examine how local knowledge, perception, and understanding influence community disaster resilience of Terai belt of Bhangaha Municipality, Ward No. 1.
- To evaluate existing adaptive capacities within communities to mitigate, respond to, and recover from disasters.
- To identify barriers and challenges faced by communities in building resilience and enhancing adaptive capacities.

1.5. Rationale of the Study

Flood is one of the most prevalent and fatal natural disasters in Nepal especially in the Terai plain where the community is extremely vulnerable to recurrent floods. In such a situation, the Bhangaha Municipality's Ward No. 1 is extremely vulnerable to flood disaster but there exists a general unawareness of how the local community is adapting to flood hazards. As the local community of Ward No.1 Existing research in the area shows that the flood management interventions such as temporary sandbag embankments tend to provide short-term solutions but not long-term ones exposing the community to repeated hazards. This study addresses a critical gap by examining social-ecological factors of flood resilience in the community, including poverty, education, infrastructure, and institutional arrangements within the community, as well as coping strategies and the local perceptions of flood risks by the community.

By focusing on this background, the study demonstrates a balanced understanding of flood-prone areas, the resilience drivers and fills the literature gaps. It provides valuable information regarding the effectiveness of current disaster risk reduction (DRR) practices in Bhangaha Municipality and assesses community attitudes, coping strategies, and governance structure issues. These findings highlight the strengths and weaknesses in current DRR operations and provide practical and evidence-based recommendations that are culture- and locality-sensitive.

For disaster management authorities and policy-makers, the study provides practical suggestions for flood preparedness and response based on community-based

methods. As the frequency and severity of floods continue to rise it is imperative to understand social, ecological, and institutional drivers relationships to develop location-specific, inclusive, and participatory policies that empower local communities.

Academically, the study adds to the body of existing literature on disaster resilience by contributing to the understanding of social-ecological relationships in flood management. It also provides comparative lessons that can be transferred to other regions with similar challenges ensuring the disaster management frameworks are adaptable across diverse contexts.

Besides, this research provides real advantages for the people of Ward No. 1 of Bhangaha Municipality and other flood prone communities by determining the vulnerabilities and resilience indicators. By empowering the local communities with key information and practical tools for flood preparedness, it strengthens community-based risk reduction efforts and overall resilience.

Ultimately, this research fills an essential gap in knowledge as well as feeds into disaster management practice directly, adds to policy-making, and provides useful instruments for the local population to draw upon and adapt. The implications of this research are essential in championing a more secure and sustainable future for communities exposed to flood risk within Bhangaha Municipality and other places.

CHAPTER II

REVIEW OF LITERATURE

The literature review brings to light important variables that have significant influence on flood resilience in Bhangaha Municipality, Ward No. 1 and these include social, ecological and cultural. This literature on flood risk in the Terai region, discusses existing limitations in the current flood control measures, and elaborates on the local knowledge and beliefs communities possess towards increased resilience. The Disaster Resilience of Place (DROP) framework is employed for the review through which communities are investigated in the ways they adapt to floods and huddles against building resilience. The content under review directly correlates to capturing the question by providing groundwork on these factors as they affect disaster preparedness, response and recovery in the area of study.

2.1 Theoretical Foundations of Disaster Resilience

Resilience is an important community resource in flood disaster responses by communities. Components of community resilience include effective communication; an exchange of information, social network among community members; then, and active participation of community members in disaster risk reduction policy planning and response. Among the terms that are employed when managing community resilience is "social capital" which seeks to address relationships, norms, and trust between people to construct cooperation among communities. Communities that have more social capital have also been found to be more resilient when disasters occur.

2.1.1 Community Resilience in Disaster Management

Floods and landslides are the commonest kinds of natural disaster in Nepal due to land forms, topography, and the monsoonal climate. Nowadays, the worst-hit, especially in terms of livelihood and health, are the people of the low-lying Terai region that appears to be flood-prone (Khanal, Shrestha, & Ghimire, 2007). Nepal has made a number of attempts to increase community resilience against floods. The most well-known of these may be the National Adaptation Program for Action (NAPA) prepared by the government, with an emphasis on community-based disaster risk management (CBDRM) together with other major strategies of building resilience.

Besides these, several national NGOs and international organizations working in Nepal have actually expanded on the issue by initiating such programs as community-based early warning systems and community-based disaster risk reduction (CBDRR) strategies for building the resilience of communities against floods.

The notion of resilience underwent a transition in meaning, in a process that involved becoming more explicitly multidisciplinary; it therefore means to withstand highly adverse and stressful conditions. The term bounce back was first used in 17th century connection with adversity (Alexander, 2013). Other than to recover, Holling (1973) drastically changed the paradigm by introducing another concept of resilience as the ability of systems to buffer disturbance and maintain their essential functions while continuing to change and be chaotic. The wider view of resilience is concerned with the idea's multifaceted character-in fact, not a single definition applies, as it is frequently defined differently in particular cases (Klein, Nicholls, & Thomalla, 2003).

Resilience has today become an important idea in international parlance due to increasing concern regarding environmental modifications within socio-ecological systems (Janssen et al. 2006). Today, resilience refers to the ability to withstand and quickly recover from any calamities through the capacity to absorb the disturbances and adapt to them; thereby, allowing the smooth functioning to follow. DRR (2005) states that resilience should be understood as the capacity of systems, communities, and societies to resist, absorb, accommodate to, and recover from the effects of hazards so that critical functions can be restored in order to maintain the stability of society.

As noted by Janssen et al. (2006), resilience is important not only for understanding how social-ecological systems respond to a whole host of stressors but especially within the context of global environmental change. Such observations are central to using resilience frameworks to strengthen mechanisms for disaster risk reduction and sustainable community development.

Thus, at the core of the resiliency-building process are disaster risk reduction (DRR) programs and policies, they aim to reduce disaster impacts while enabling recovery after the disaster. Resilience indicators, according to Cutter (2016), are very critical in measuring and enhancing a community's ability to withstand hazards.

Indicators mainly derived from geographical or socio-economic factors are very important when defining exposed areas and ensuring they are targeted for preparedness. Long-term resilience planning and a more comprehensive recovery model are advocated for by Emrich and Tobin (2018), further establishing the need for resilience in disaster management. Twigg (2007) adds that disaster resilience is more than just the reduction of vulnerability; it also involves building the autonomy and capacity of people to recover from disasters. Together, the studies stress that resilience is an integrated concept, incorporating the reduction of vulnerability, capacity development, local participation, and long-term planning for sustainable recovery.

Frameworks, models, and methods of approaches to vulnerability analysis have been designed to analyze resilience, particularly against natural hazards. While such frameworks may differ in their components, they share certain inherent similarities, for example, vulnerability measurement by using a social-ecological framework, the need for site-specific research, and the application of vulnerability analysis to hazard area mapping. Such frameworks are necessary for pre-impact and hazard mitigation planning and form the cornerstone for effective disaster management (Cutter, Emrich, & Webb, 2008).

Resilience is a most critical factor occurring at the crossroads of the household and the national social level and serves as a significant mechanism for responding to disruptions caused by socio-economic and environmental drivers. It embodies a community's capability to restore to pre-disaster status and adapt to changing post-disaster contexts (Shaikh, 2016). Overall, the target of disaster risk reduction interventions is to enhance disaster resilience. The focus of recent studies is on developing disaster response and recovery capacities in a way that enables communities to be resilient and absorb shocks, survive under poor conditions, and facilitate an efficient recovery process (Aksha & Emrich, 2020; Sanam, 2020). All these measures are important for establishing resilient communities to face future disasters while safeguarding their well-being and ensuring long-term sustainability.

2.1.2 Social Capital Theory

Social capital is the social networks, norms, and trust that enable coordination and cooperation for mutual benefit. The value of social relationships and the resources can be mobilized through them. Social capital takes different forms, including relationships with family, friends, and coworkers, and memberships in local organizations or community groups (Putnam, 2000). Differences within social capital theory usually are defined mainly in terms of the bridging social capital that creates bridges among unrelated communities and groups and the bonding social capital which strengthens ties within a defined group (Woolcock, 2001). While both social capital types contribute to collective well-being and social cohesion, they impact economic and social outcomes differently.

The relationship between social capital and community resilience has been investigated intensively, especially in disaster response and recovery. High-social-capital communities have a much better ability than low-social-capital ones to expect, react, and bounce back from disruptions (Aldrich & Meyer, 2015). Efficient social networks enable such rapid transmission of information about relief operations and resource mobilization during disaster occurrences (Norris et al., 2008). In contrast, low social capital communities provide no effective disaster management and response due to a lack of trust and cooperation among individuals (Grootaert, 1998).

Flood resilience is a form of social capital for preparedness, response, and recovery to flood effects. According to the evidence, efficient networks serve as channels for information flow about floods, resource mobilization, and preparedness for emergencies (Adger, 2003). On the one hand, trust among communities strengthens cooperation and efficiency in response systems, giving rise to more concerted responses during disasters (Berkes et al., 2003). Social norms such as mutual support and collective responsibility also serve to strengthen the ability of a community to respond to and recover from flood events (Aldrich, 2012).

Formal and informal organizations strengthen resilience against floods by assisting preparations and subsequent response actions. Such traditional institutions as emergency management bodies and government authorities usually offer systematic relief responses to disasters, while informal organizations such as neighborhood

associations and volunteer networks are pivotal in mobilizing resources and aiding recovery (Berkes et al., 2003; Norris et al., 2008).

Although disaster resilience is a major concern, social capital can also contribute to many social and economic benefits, such as better health, greater civic engagement, and economic opportunities (Putnam, 2000; Kawachi & Berkman, 2001). In other words, social capital strengthens individual health and provides avenues for action both physically economically, and politically toward enhanced agency and aspiration. Social capital can also be used as an instrument for exclusion and inequality when the privileged use it to legitimate their interests in marginalizing the less privileged (Bourdieu 1986). Social capital thus has great potential in motivating the building of community resilience and well-being. For all the above structures to benefit all, it is equally important that everybody should have access to social networks and mechanisms of trust-building for making social development sustainable and equitable.

2.1.3 Adaptive Capacity

The definition of adaptive capacity can be referred to as the capacity of a system to adopt changes in a condition as well as bear disturbances. Adaptive capacity is defined as "the ability of a system to learn, adapt, and change in order to maintain its function, structure, and identity" (p. 269) according to Adger, 2006. Such social, economic, and institutional stimuli are the roots for adaptive capacity that encourage communities to evolve and adjust.

There are certain critical factors that influence adaptive capacity. Social capital, that is, norms, networks, and trust enable cooperation and collective action, both of which are critical when it comes to crises situations (Aldrich & Meyer, 2015). Economic capital, such as infrastructure and financial resources, gives power to communities to make investments into resilient structures as well as emergency response systems (Cutter et al., 2008). Human capital consists of individuals' knowledge, skills, and capability, which serve as an innovative and sound decision-making asset during times of change (Norris et al., 2008). Institutions and policies, which constitute governance, play a central role in coordinating disaster management and resource allocation (Adger, 2003). Wisely used, natural resources and ecosystems

come under the category of environmental capital and offer critical support to disaster mitigation. For example, wetlands and other natural flood buffers mitigate flood effects and protect communities from suffering severe damage because of flooding (Berkes et al., 2003).

Communities that possess great adaptive capacity are better positioned to cope with environmental and socio-economic changes. Being able to go through risk assessment, preventive measure implementation, and recovery from disasters effectively, build capacity through strengthened social networks, territorial economic investments, skilled human resources, responsive governments, and environmental preservation toward long-term resilience.

2.1.4 Absorptive Capacity

Absorptive capacity is referred to as the potential of a system or community to absorb shocks, and adapt to changes, and continue to function in essential capabilities during disruptions and post disruptions. In community resilience, absorptive capacity means the capacity of a community to anticipate, absorb and respond to shocks such as floods without changing structurally or functionally (Cohen & Prusak, 2001). The absorptive capacity of the community hastens the returns from disruption and enables the community to maintain most of its principal functions and thus cope better during crises.

Absorptive capacity is influenced by many factors, namely, social, economic, and human capital. Amongst these, social capital, which consists of close social networks and trust within the community, is a significant factor in facilitating cooperation and mobilization of resources at times of crises (Adger, 2003). Economic capital, which contains infrastructure and financial assets, gives the resilience of a community to a certain extent against economic shock and stability against disasters (Cutter et al., 2008). Human capital, which is composed of individuals' experience, skills, and knowledge, serves to enhance the community's innovative capacity and ability to adapt to adversity (Berkes & Ross, 2013).

Studies have shown that societies that have high absorptive capacity are more able to minimize the impacts of floods and bounce back better. For instance, societies that are well-connected socially and economically are more resilient to floods because

these networks allow them to communicate more easily and exchange resources during emergencies (Aldrich, 2012). In addition, neighborhoods that practice preparedness activities, i.e., floodproofing and disaster preparedness plans, can absorb flood impacts and reduce long-term vulnerabilities (Gallopín, 2006).

Absorptive capacity, in summation, is one of the main components of community resilience that enables communities to absorb shocks, change in line with shifts, and continue functioning. Through social, economic, and human capital empowerment, communities are able to enhance their ability to deal with and recover from perturbations effectively.

2.1.5 Resilience Triangle

The resilience triangle theory serves as a good theoretical premise in understanding the community resilience against flood situations (Turner et al., 2003). The approach has three interrelated elements: social, economic, and ecological resilience; these are basic components to determine a community's robustness against disasters and recovery from them.

Community social resilience refers to the maintenance of social networks, norms, and trust during and after a flood. It includes the ability of an individual in a community to communicate, cooperate, and reestablish relationships following a disaster. Studies on communities have shown that communities with highly connected social networks and great trust are more likely to be resilient in the case of floods (Adger, 2000).

Economic resilience is that characteristic enabling a community to sustain its economic activity, such as employment, infrastructure, and finances, before and after flooding. In this sense, business resilience and organizational resilience are encompassed as they are capable of carrying on with operations and fundraising while recovering from economic losses. Research has also indicated that communities characterized by a higher level of economic capital, including infrastructure and resources, are likely to maintain stability and recover quickly from floods (Cutter et al., 2003).

Ecological resilience describes the ability of nature, that community ecosystems that is, land and water systems to absorb flood shocks and recover therefrom. It will define the proficiency of ecosystems in rendering a suite of vital services, notably purification of water, flood control, and reconstruction of habitats. Communities endowed with good environmental capital e.g., resilient ecosystems are more likely to have the ecological resilience needed to recover from flooding incidences (Turner et al., 2003).

The resilience triangle model helps in understanding the complex interactive nature of social, economic, and ecological factors and how these variables help a community collectively resist, adapt, and recover from floods. The model, through the investigation of these interconnected fields, further anchors an integrated approach to building resilience in flood-prone communities.

2.1.6 Vulnerability-Resilience Nexus

This "vulnerability-resilience nexus" is an important analytical tool in analyzing how communities experience disaster effects from a dynamic interaction of properties which render them vulnerable to harm (vulnerability) and those which help them limp along (resilience). In undulating high-frequency flood occurrences, Nepal has a great deal from which to assess how communities respond to and cope with flooding.

According to Cutter et al. (2003), social vulnerability refers to "the potential for loss, injury, or death in human populations and damage to property and equipment" and emphasizes economic, social, and political factors in producing vulnerability. In contrast, Pelling (2003) states that vulnerability is a state created by exposure of the community to hazards, while resilience is just the ability to resist and recover. In flood hazard areas of Nepal, more particularly marginalized communities such as Tharu in western Nepal, are more under threat (Sharma et al., 2022).

Social capital is a critical element in the creation of flood resilience. Gyawali et al. (2020) examined the Susta municipality of Nawalparasi Paschim and discovered that the communities had good bonding social capital and bridging social capital but lacked linking social capital that connects them to outside institutions. The study noted that 94% of the respondents were engaged in community groups but only 67%

had weak external access to resources, which slowed down their ability to respond to flood hazards.

Sharma et al. (2022) also analyzed household vulnerability among the Tharu people and found that dependency on subsistence agriculture and weak income diversification exacerbated flood risk. Additionally, problems of poor resettlement of ex-bonded laborers and land fragmentation due to family divisions further exacerbated vulnerability. The research highlighted the need for targeted interventions to enhance economic resilience and flood preparedness.

Bista (2019) talked about determinants of household flood vulnerability, where indigenous knowledge, customary agrarian systems, and demography were seen as key determinants that define resilience. More disaster-aware households with early warning mechanisms were found to be more adaptable, hence emphasizing the importance of preparedness programs and early action. The September 2024 Kathmandu floods are evidence of lower resilience. The tragedy, which resulted in over 200 fatalities and huge destruction, arose from unplanned urbanization, poor infrastructural planning, and climate change effects (The Guardian, 2024). This is a pointer to the need for visionary urban planning, green growth, and efficient disaster risk reduction.

The vulnerability-resilience nexus provides important conclusions about the adaptation processes of Nepalese communities to flood disasters. A major aspect of preventing flood disaster consequences is addressing vulnerabilities through infrastructure development, education, economic diversification, and the building of social capital in conjunction with enhancing preparedness and supporting actions on resilience through institutional capacity development.

2.2 Empirical Review

Floods have always remained one of the most frequently occurring and severely damaging natural disasters in many regions of the world, including Nepal. Over the years, several studies have analyzed communities' experiences of and responses to flooding with focus on different factors that influence their coping, adaptation and recovery. It is critical to review those studies to see what had been gained and what gaps still persist. This section presents the major findings of previous

research on flood risk and community resilience. The ordering begins with investigations done in Nepal, which is followed by international case studies that have presented useful comparisons and lessons toward improvement of local flood resilience.

2.2.1 Studies in Nepal

Flooding continues to be a recurring and recurrent disaster in Nepal, primarily in regions like the Terai. It has resulted in massive loss of life, damage to property, and interference with livelihoods, and thus requires the development of resilience among communities.

Some of the determinants of the flood resilience of Nepalese communities have been explained by studies conducted recently. Gyawali et al. (2020), for instance, studied the role of social capital as a determinant of flood resilience for the Kudiya and Paklihawa communities of Susta Municipality, Nawalparasi Paschim. The research established that intra-community communication and coordination of sufficient bridging and bonding social capital was a determining factor that enhanced flood resilience significantly. Nevertheless, the study reported that bridging social capital deficits existed with definite poor external access to resources and support. The authors suggest that local authorities get more directly involved with individuals to address their specific needs and to allow resources to be channeled towards them.

Adaptive community-level responses have also played a critical role in flood risk mitigation. Sapkota and Pokharel (2024) examined the mechanisms of adaptation of Roshi Rural Municipality, Kavrepalanchowk people to flooding. According to their study, farmers are the most vulnerable to disruption from flooding with high frequency of short- and long-term livelihood changes with low alternatives. On the other hand, entrepreneurs were more resilient with business continuity during disruption. Skill acquisition is emphasized as a non-migration adjustment strategy for better employment opportunities and future economic gains. In addition, loans facilitated recovery but imposed economic burdens on families. Migration was also another key adjustment strategy with effects on living costs and levels of children's education. In general, the study places greater emphasis on the need for holistic support systems that target economic resources, capacity development, and sustainable livelihood opportunities.

Empirical evidence of flood disaster risk vulnerability among households of the Tharu people in western Nepal is highly relevant. Sharma et al. (2022) analyzed Tharu household vulnerability to flooding within the Thapapur Village Development Committee of Kailali district. The study concludes that subsistence agriculture-based, small-sized landholder households with restricted income diversification are highly exposed to flood hazards. Land fragmentation due to family dissolution and ill-planned resettlement of erstwhile bonded laborers are prime reasons leading to small holdings. These findings can be useful while formulating the proper flood management practices for the population of Nepal's lowlands, particularly the Terai region.

Hence, empirical facts expose the co-existence of various dynamics of Nepal's community flood resilience. Social capital strengthening, adaptive strategies improvement, and reducing household vulnerability are very important factors for an effective disaster risk reduction program. Context-specific interventions to address local conditions and community-based intervention are important aspects of building flood resilience for potential floods.

2.2.2 International Case Studies

Flood risk management and resilience building are global issues currently under research. This extensive research program within Bangladesh, India, and the Netherlands has assessed the effectiveness of various flood risk reduction measures and their ramifications on communities. It presents important case studies on how to enhance flood resilience so that initiatives, similar to the ones discussed here, may be taken up elsewhere, like in Nepal.

Bangladesh has put flood risk management high on its agenda. The country is extremely prone to excessive rainfall and flooding. Community flood risk management in the broader context of Bangladesh has been studied by Mondal et al. (2022), who focused on structural and non-structural measures-embankments and community awareness programs-in importance. The study found that flood risk management strategies should include community perceptions and that the local knowledge and participation of communities were instrumental in strengthening resilience by enabling context-specific interventions that catered to the needs of flood-affected communities (Mondal et al., 2022).

In India, Islam and Ghosh (2022) studied community-based flood risk assessment in the Rarh Plains, a landscape adversely and critically affected by riverine flooding. They highlighted the significance of community vulnerability assessment in aiding flood management strategies. The flood risk is exacerbated by several factors: poor infrastructure, weak land-use planning, and socio-economic vulnerabilities. These researchers call for a more holistic approach toward flood risk management, integrating community assessment with structural interventions for flood impact minimization (Islam & Ghosh, 2022).

In the Netherlands, lessons on adaptive governance derive from their sophisticated flood risk management scheme. Van den Brink et al. (2019) focused on the governance evolution on flood risk management in the Netherlands, and institutional frameworks were observed and made resilient. The results highlighted the flux of adaptive governance and continuous learning in practical flood management applications. The authors conclude that the Dutch model stands to benefit those interested in improving flood resilience in other nations due to its emphasis on collaboration among government, stakeholders, and communities (Van den Brink et al., 2019).

These international cases effectively offer guidance for the development of useful strategies for flood risk management in Nepal. Emphasizing community participation, adaptive governance, and a holistic consideration of socio-political and environmental settings and their interrelation with flood risk reduction come as an apt observation in the identified challenges and opportunities in the Nepalese context. Integration of these observations will further strengthen their actions in the realization of flood risks in vulnerable communities in Nepal.

2.3 Conceptualizing Flood Disasters

Floods constitute a pressing concern in the study area, considerably interfering with local communities and their lifestyles. This section will outline specific causes and impact of flooding in the area concerning the unique challenges of the people who live there. This will inform also about how the communities perceive and respond to floods, emphasizing the necessity of formulating solutions responsive to the

communities' needs. These local considerations can further assist in improving flood prevention and recovery planning in the future.

2.3.1 Conceptual Understanding of Flood Disasters in the Study Area

A comprehensive picture of flood disasters must integrate scientific studies, local experiences, and environmental factors. Flooding in the Ratu Watershed has been caused by a combination of hydrological, climatological, and anthropogenic factors such as heavy rainfall, river overflow, land use, and poor watershed management. Flood hazard mapping and vulnerability assessments as done by Khanal et al. (2007) were scientific inquiries encompassing GIS, remote sensing, and hydrological modeling. It has separated flood risk or probability of flooding from vulnerability, which stands for exposure and susceptibility to flood losses by human societies. This research emphasizes that using a system that identifies areas of serious risk and analyzes socioeconomic impacts, holistic flood management approaches will build resilience through watershed conservation and cooperation across boundary lines.

Beyond the technical assessments of flood disasters, there remains a necessity for studies on how flood risk is perceived and responded to by the communities living in those areas. Bajracharya et al. (2021) highlight the significance of local adaptation practices and traditional knowledge in flood preparedness. Observation-based experiences, such as changes in river levels, weather patterns, and animal behavior, are utilized by numerous communities to predict floods and take early response measures. However, mismatches in local perceptions and scientific risk analysis generate variations in response and preparedness. Shrestha et al. (2021) also cover the roles played by flood risk communication in disaster preparedness, where issues in accessibility, distrust of outside agencies, and the need for more inclusive early warning systems are demonstrated. These studies highlight the imperative of connecting scientific inquiry and community-based approaches to enable effective disaster management.

The flood disaster in the area under study is known to have a serious socioeconomic and environmental implication. Agricultural land destruction, infrastructure destruction, and population displacement cause long-term economic and social disruption. Environmental by-products such as deforestation, soil erosion, and

water contamination further increase the flood risks, hence threatening the sustainability of the ecosystem of the locality. Research by Khanal et al. (2007) and Bajracharya et al. (2021) indicates that loss due to floods is not only direct economic loss but also public health, the most precious commodity access to drinking water, and the level of community resilience. Solutions to these challenges will involve integrated scientific research, policy action, and community engagement.

In order to hold together all these varied elements, flooding is perhaps more than a technical problem; it demands a special collaboration among researchers, policymakers, and local residents. GIS mapping, hydrological modeling, and satellite-derived information are necessary elements for hazard analysis; their relative strengths shine brightest, however, when they are fused with indigenous knowledge and participatory methodologies. Cores to a field encompassed by flood preparedness and long-term resilience will be focused on strengthening early warning systems, communication mechanisms, and trust between scientific institutions and local communities. From technical knowledge and community-based research, the disaster management of the study area will work toward more effective and inclusive means of flood mitigation. The points developed in these various studies will feed into this literature review in an attempt to contribute to the ongoing flood risk-reduction and community-resilience discourse within the study area.

2.3.2 Flood Risk Reduction in the Ratu Watershed: Challenges, Strategy, and Community Resilience

The Nepal's Ratu Watershed continues to be a concern on flood risk reduction, as it has history and the potential of getting flooded again and again. Flood risk mitigation in this watershed has a multi-dimensional regard and needs a multi-dimensional intervention involving technical measures complemented with community interventions. Observations from the Khanal et al. (2007) and Bajracharya et al. (2021) research provide useful insights on the difficulty, approach, and resilience interventions being undertaken in the watershed.

One of the primary flood risk reduction problems is the lack of resources, especially in the rural regions, whose populations have poor economic capabilities and poor infrastructure. The limitations impede the application of flood defense, such as embankments and better drainage, to alleviate the impact of floods (Khanal,

Shrestha, & Ghimire, 2007). Besides that, the escalating flood frequency and severity with the changing climatic patterns added to the necessity of more efficient flood management strategies. Unchecked urbanization and deforestation make these issues even worse, causing erosion, and lowering the watershed's ability to absorb surpluses of rainfall, thus further elevating flood hazards (Bajracharya et al., 2021).

Khanal et al. (2007) observe that among the key challenges facing effective flood risk reduction in the Ratu Watershed is the insufficiency of current flood forecasting and early warning systems. Although indigenous practice and knowledge have somehow achieved some degree of flood forecasting, precision and punctuality are limited. The research acknowledges the necessity of applying sophisticated technologies like Geographic Information Systems (GIS) and hydrological modeling to enhance the accuracy of flood hazard mapping and forecasting (Khanal et al., 2007). Nevertheless, with the integration of new technology, the absence of communication infrastructure unstable electricity and mobile telephone network coverage is also still a big hindrance to the issuance of flood warnings to at-risk populations, especially those who live in distant communities (Bajracharya et al., 2021).

Other than technology-related barriers, social barriers like outmigration also decide the vulnerability of the region to flooding. As men migrate to urban areas for work, it becomes convenient for women, children, and the elderly who remain behind in villages for precautionary work against floods to be beyond reality. The very absence of men in the villages also complicates their mobilization during emergencies, making vulnerable segments more susceptible to suffering flood impacts (Bajracharya et al., 2021).

In spite of all these challenges, much work has been undertaken in improving flood resilience in the Ratu Watershed. Most significantly, effort has been dedicated to the design of community-based flood early warning systems (CBFEWS). Khanal et al. (2007) note that by training and educating local communities to use and operate early warning systems, preparedness has been enhanced. Both local traditional and modern warning instruments, including mobile phones, sirens, and radio, have been embraced by the local community to facilitate effective communication of flood warnings to the vulnerable population. Local caretakers have also been supplied with

early warning instruments to deliver more accurate and timely alerts during floods (Khanal et al., 2007).

Bajracharya et al. (2021) highlight the role of the participation of the local community in building flood resilience. Disaster management committees have been established in community villages in the Ratu Watershed to respond and prepare against floods. They are tasked with implementing training programs, mobilization of resources, and ensuring there is effective implementation of flood risk reduction interventions. The engagement of non-government organizations, international agencies, and the local government administration has also significantly assisted in convening and marshaling resources in favor of disaster risk reduction (Bajracharya et al., 2021).

Promotion of flood-resilient infrastructure is one of the key strategies mentioned by Bajracharya et al. (2021). The development of elevated buildings and flood shelters has been promoted in such a manner that their destruction by flooding is prevented. The application of community-based monitoring, early warning, and flood-resilient construction techniques offers an integrated process to counteract flood-related threats.

Institutional cooperation and local knowledge mainstreaming in flood risk management are equally as important components of the Ratu Watershed resilience development plan. Both studies highlight that flood protection interventions must consider the unique needs of local communities, supplementing scientific data with local knowledge to enhance knowledge of flood risk and the community's response capacity to floods (Khanal et al., 2007; Bajracharya et al., 2021).

Briefly, though the Ratu Watershed is plagued by a wide range of problems related to flood risk reduction, enormous strides have been recorded in community resilience and preparedness for floods. Community-based early warning systems, the promotion of flood-resilient infrastructure, and local community engagement in disaster risk reduction practices are the focal points behind such achievements. But for long-term sustainable flood risk management, there must be ensured continuous investment in infrastructure, technology, and public awareness as well as enhanced coordination among all stakeholders at all levels.

2.4 Analysis of Disaster Risk Reduction Programs, Policy, and Challenges in Nepal

Nepal has been naturally prone to hazards such as flood, landslide and earthquake due to geography, climatic situation and socio-economic conditions. In this sense, many DRR activities are in place, initiated by the government of Nepal, alongside with a number of NGOs and other international bodies; finally it strives to minimize disaster risk and prepare the country in terms of resilience at both national and local levels.

2.4.1 National Strategies and Frameworks

Nepal has, therefore, set in place a continuum of major frameworks to be used in national policy for disaster risk reduction as well as resilience building in susceptible communities. The most notable achievement is the Disaster Risk Reduction and Management (DRRM) Act, 2017; it superseded the long-standing and outdated Natural Calamity (Relief) Act 1982. The act changed disaster management from being relief-centered to a more integrated all-hazard disaster management system that emphasizes preparedness, response, rehabilitation, and mitigation (Nepal et al., 2018). The Act provides an effective legal framework for institutionalizing disaster management from local to national levels so that disaster risk management can be done systematically.

In addition to this, a National Policy and Strategic Action Plan on Disaster Risk Reduction and Management (2018-2030) has been put in place for the operationalization of the DRRM Act. Hence, the policy meets the Sendai Framework for Disaster Risk Reduction (2015), that is a global accord for decreasing disaster risk, strengthening resilience, and ensuring sustainable development. Nepal's policy identifies priorities like map hazard and vulnerability, build local capacity and incorporate disaster risk management at all development planning levels (UNDP, 2018).

2.4.2 Local Implementation Challenges

The implementation of policies clearly has very severe challenges at the local levels. These challenges include funds shortfalls, which would be sufficient to complete such critical interventions as hazard assessments, retrofitted buildings, and public

awareness campaigns. Lack of coordination among the different government ministries and NGOs and international organizations usually gets into inefficiencies or duplication of efforts, which in turn delay the whole disaster management program.

In addition, legislative inconsistencies among different laws-such as the Water Resource Act (1992), Building Act (1998), and Local Government Operation Act (2017)-create overlapping mandates and responsibilities, which complicate disaster management. These gaps in legislation might delay the efficient implementation of DRR measures and create confusion concerning roles by local authorities (Nepal et al., 2018).

Another big challenge is the technicality of many DRR programs that sometimes neglect the root causes of vulnerability like poverty, inequality, and environmental degradation. Infrastructure works are essential, but just as importantly, an inclusive approach addressing these social determinants is necessary for long-term resilience. Moreover, DRR programs tend to ignore the special needs of vulnerable groups-women, children, the aged, and the disabled-which obstructs the success of programs aimed at building a holistic community resilience.

2.4.3 Institutional Gaps and Opportunities

Nevertheless, within this backdrop of challenges, several institutional gaps will prove to be opportunities for improving the present-day disaster management policies. First, the lack of a coherent policy framework and inter-agency coordination is a considerable area of development. Particularly, an enhanced relationship among different authorities at the national and local level, as well as institutions and community-based organizations (CBOs), will strengthen disaster preparedness and response operations. Another area is strengthening the skill sets of local government officials and community leaders in disaster risk management, thereby significantly improving the implementation of DRR programs.

The integration of DRR into national development planning is, indeed, a major achievement. Risk reduction should be built within socio-economic development, as is pointed out by the Sendai Framework, and Nepal's efforts in that direction to evaluate with these global standards are encouraging. Going forward, Nepal could

benefit from international cooperation and donor assistance to fill the funding gaps that may reduce its achievement on sustainability for DRR interventions.

2.5 Reviews frameworks enhancing resilience in Nepal

Even though there are different frameworks adopted by the different levels of government to enhance performance in relation to DRR, disaster resilience and vulnerability in Nepal are focused through such frameworks. Global influences, as well as local perspectives wherein the effects of disasters are encountered, are combined. The following are some of the major frameworks for disaster risk reduction in Nepal:

2.5.1. Disaster Resilience of Place (DROP) Framework

Disaster Resilience of Place (DROP) Framework concerns improving resilience at local levels through specific vulnerabilities affecting distinct places or communities. Using indigenous knowledge and scientific research, integration establishes risk assessment, adaptive strategies, and local capacity building for disaster management. The focus locates on targeted geographic areas so the DROP framework promotes place-based approaches that involve local communities in disaster resilience planning. This is particularly useful for Nepal that rural and marginalized communities often face the most destructive impacts of earthquakes, floods, and landslides. DROP framework emphasizes community participation so that local actors lead disaster risk reduction initiatives with enhanced adaptive capacities to cope with recurrent hazards (Practical Action, 2015).

The relevance of this framework, especially under the conditions that Nepal harbors such diversity in topography and localized disaster risks, is exceptional. In addressing vulnerability locally, the DROP framework compels to evolve tailored solutions at the community level rather than mass approaches with a view toward increasing the potential effectiveness and sustainability of disaster resilience programs in the country.

2.5.2 Sendai Framework for Disaster Risk Reduction

It is to mention that at the global scale, the Sendai Framework for Disaster Risk Reduction (2015-2030) is a very broad and comprehensive framework for disaster risk management. It states that without the understanding of the nature of

disaster risks, designing disaster preparedness and investments in safety would amount to waste in the efforts made-to-reduce the losses which disasters inflict-in lives, livelihoods, and health. For its part, Nepal has also recognized disaster risk reduction policies within the Sendai framework due to their international best practices. Among some of the priority areas suggested in the Sendai Framework are strengthening disaster governance, mainstreaming disaster risk reduction in development planning, and instilling a culture of resilience among communities, governments, and businesses. Cases in which national policies were aligned with the Sendai Framework have helped to prepare the country against disasters and risk reduction measures both in urban and rural settings along sustainable development; hence, in general reducing the population's vulnerability.

With the adoption of Sendai Framework, Nepal has been able to uphold its record of making improvements in the mainstreaming disaster risk reduction into various sectors of governance, planning, and development. In addition, the country has been able to ensure efficient disaster preparedness, as well as coherence in national and local disaster risk management strategies.

2.6 Gap in Literature

While numerous studies on flood risk management have been conducted in Nepal, significant knowledge gaps persist in understanding the overall resilience of flood-risk communities, particularly in Bhangaha Municipality. Most literature largely limited their findings towards the topic to infrastructural provisions such as embankments or early warning systems or even flood hazard mapping (Khanal, Shrestha, & Ghimire, 2007; Bajracharya et al., 2021). However, it did not capture the socio-ecological as well as cultural dimensions crucial for a community's ability to respond and bounce back after disasters.

Moreover, while other studies have analyzed CBFEWS and their impact regarding awareness and preparedness (Bajracharya et al., 2021), studies are lacking on how traditional knowledge, local governance, and socio-economic institutions contribute to long-term flood resilience. Most of the studies adopt a hazard-focused approach rather than an integrated social capital, adaptive capacities, and indigenous coping mechanisms approach.

One other key gap is the lack of detailed analysis using existing resilience frameworks such as the Disaster Resilience of Place (DROP) model that provides a multidimensional description of disaster preparation, response, and recovery. Existing studies have also failed to sufficiently investigate how poverty, education, cultural practices, and governance influence differential vulnerability among flood-risk societies. Additionally, while climate change is acknowledged as one reason for increased flood risk, insufficient work has been done on how and in what ways local communities perceive and adapt to these changes over the long term. Long-term sustainability of existing interventions, especially in the areas of financial sustainability, institutional support, and policy mainstreaming, is also not well studied.

This study seeks to address these loopholes by adopting a mixed-methods strategy in assessing the social, ecological, and cultural facets of disaster resilience in Bhangaha Municipality. By integrating qualitative observations with quantitative assessments, this study seeks to bridge the gap between scientific disaster management solutions and local knowledge systems, thereby proposing sustainable and culturally sensitive flood risk reduction solutions.

CHAPTER III

METHODOLOGY

This survey was executed in Bhangaha Municipality Ward No. 1, the prime flood-affected hair place along the Ratukhola River in the Terai region of Nepal. In terms of various climatic conditions, the region is exposed to wide river channels in winter and experiences frequent and probably torrid monsoonal floods. The research study brought about how disaster resilience was further propagated in the community and how have been active in disaster reduction strategies. The reflections were further drawn on understanding how the social-ecological dimensions in the likes of poverty, education, and infrastructure defined resilience from flood-related disasters while exploring the local beliefs and insights across the success of disaster resilience.

In the mixed-method approach, quantitative data on flood frequency, economic impacts, and infrastructure assessments were collected along with qualitative narratives presented through interviews and focus group discussions conducted with the local respondents and key informants. These all presented an exhaustive representation of the community's capacity to adapt to such changed circumstances and the coping mechanisms and preparedness levels for flood incidences. Besides identifying resilience-enhancing strategies for disaster risk reduction, this study also shows the effectiveness of incorporating both social-ecological factors and local perceptions in community resilience among effective disaster risk reduction strategies for future floods that might come.

3.1. Research Design

A descriptive research design has been followed to study the community's resilience against flooding within Bhangaha Municipality, Ward No. 1, in Nepal. This being one of the most appropriate avenues to understand the community deeply concerning adaptive responses toward flooding, the study took into consideration the nature and impacts of flooding and the coping strategies involved. The aims of the study included identifying the particular problems the community faces due to flooding, in terms of frequency, scale, and severity, along with resultant damage. Impact on flooding in terms of households, infrastructure, local economy, agriculture, and public health was also examined in this study.

Based on the impact of flooding as an important criterion, socioeconomic characteristics of the most affected populations were included in the study. The study collected data from area residents along dimensions of age, income, education, and occupation to form a profile for communities characterized as flood-prone, which has been gauged on the capacity for vulnerabilities of different groups to flood disasters as well as the ability to respond and recover from flooding. Finally, the study casts its net on major stakeholders in flood management and humanitarian assistance, these include local residents, community leaders, emergency responders, and NGOs. Thus, this has brought realization to the ability of joint efforts and partnerships towards bettering the flood resilience of the community.

Geographic analysis was also done to distinguish how flood disasters differ across regions in Ward No. 1. The research mapped flood-prone zones, infrastructure damaged in the floods, and community resources which gave a spatial context for resilience strategies and challenges. This particular study uses a combination of quantitative and qualitative methods to foster a balanced approach to assessing DRR strategies and community resilience. In the quantitative component, surveys and statistical analysis were used to measure some of the indicators, such as flood frequency, extent of damage, and state of preparedness of the community. Qualitative results were derived from descriptive statistics to evolve trends and specific correlations, thus evaluating existing DRR strategies and identifying possible areas for improvement.

Focus group discussions and interviews with local residents, local leaders, and experts produced qualitative data. This information further clarified the community perspectives on flood risk, traditional coping strategies, and social and cultural attributes of resilience. Qualitative data assisted in providing contextual clarification for quantitative outcomes toward a detailed interpretation of the community's attitudes, behaviors, and flood responses. By melding the numerical and contextual data, the study drew measurable conclusions but also aided in contextualizing them, making for a full understanding of disaster resilience. This process will assist DRR intervention strategies for coming flood events to be much more effective and context-specific.

3.2 Study Area

The research is based in Bhangaha Municipality, Ward No. 1, and examines flood risks related to the Ratu Khola watershed in the Terai area. The area is very important with a high profile for flood risk, influenced by several key factors. The Ratu Khola River system has high dynamicity with flow and sediment load being very important variables in determining flood behavior in the area. The flat topography of the Terai region also aggravates flooding. Water has very limited opportunity for natural drainage and tends to overspread in a flat terrain. Sedimentation alters river channels and increases the chances for overflow; climate change can alter rainfall patterns and hydrological cycles adding up to the flood frequency in this area. All these make Bhangaha Municipality, Ward No. 1 a well-pronounced vulnerable area for flood disasters, demanding a specialized study for flood risk understanding and control mechanisms to increase community resilience against these frequent and devastating occurrences.

3.3. Data Collection Methods

The study used combined stratified and purposive sampling techniques for a total and representative study on the flood resilience of Bhangaha Municipality Ward no 1. Stratified Sampling has stratified the population into sub-groups with respect to income levels, proximity to the river, and other pertinent factors that might affect coping with floods. This gave the opportunity for a close look to be made into how each part of the population perceives and copes with their flood experience and problems. Purposive sampling was also used within these strata to capture specific respondents that possess knowledge or experience relevant to the phenomena being studied. These included community leaders who reported informed data on local flood management traditions, experts and professionals having detailed knowledge of the flood mechanics of the region, and personal experiencers of flooding and its impacts. This more comprehensive approach to sampling aimed to draw in a range of perspectives and experiences in order to better define the knowledge of resilience mechanisms of the community and invite targeted solutions for improving flood management.

3.3.1. Quantitative Data Collection

3.3.1.1 Flood Risk Assessment

The flood studies and disaster resilience were supplemented with secondary data from earlier hydrological and topographical studies such as ICIMOD and Shrestha et al. (2004). These sources provided information regarding flood processes in terms of the condition of watersheds and historical trends of floods in the region. However, depending solely on these earlier studies was a bit challenging because most of these were concentrated on the principal rivers which might not involve the details of very small tributaries and sediment transport across Ratukhola catchment. They were indeed critical in the local definition of flood hazards, especially at places such as Bhangaha Municipality which could have experienced differential sedimentation impacts, changes in watercourse flow, or the addition of minor streams to the flood. To compensate for such limitations, however, the analysis went into a more extensive investigation of the tributary systems and sediment dynamics of the watershed, which will allow a much more nuanced and detailed assessment of flood hazards reflective of the distinctive vulnerabilities of the region.

3.3.1.2 Socio-economic Vulnerability Analysis

To gather primary data on flood vulnerability and resilience in Ward No. 1 of Bhangaha Municipality, household surveys were employed as a key data collection tool. The study uses a stratified and purposive sampling technique to select 100 households to reflect all the diverse socio-economic conditions and geographical areas within the community. It thus allows for focusing adequately on households which are most generally at risk from flood impacts, such as those in low-lying or flood-prone areas, yet captures variations in other factors that influence the households' resilience.

The following key indicators along which the survey are focused: Income levels: income levels used to characterize economically resilient households; Livelihood sources-nationality on agriculture (hereas a farming community is typically regarded to be more susceptible to flood risks); Infrastructure availability: including access to roads and drainage systems, as well as other crucial services; and

DRR resources access, such as early warning systems, emergency shelter, or community-based preparedness programs.

The data were then analyzed descriptively for summation and exploration of these socio-economic factors distribution within the community. Hence patterns of vulnerability could be identified: households that had lower income or less access to infrastructure, but the patterns of better preparedness to withstand flood incidences were longer resources availability or access to DRR support. The investigation linked by these socio-economic factors to resilience provides a better understanding of the ingenious origins of vulnerability and possible avenues for strengthening communities resilience to flood.

3.3.2. Qualitative Data Collection

3.3.2.1 Focus Group Discussions (FGDs)

To ensure a diverse range of views on flood risk management and disaster resilience, the study held different focus group discussions (FGDs) on some participant groups including male and female members of the community, small-scale farmers, and members of the local governments. This method ensured that the different experiences and knowledge of these groups were obtained because gender roles, livelihood, and roles in governance could have influenced the way these people perceive and behave toward flood risks. Among the pertinent issues discussed were the experiences of the community with past flood events, perceptions about current interventions in disaster risk reduction (DRR), and local knowledge or coping mechanisms they apply in case of floods. The forums were platforms for communities to share both common and personal challenges, as well as for identifying strengths and identifying areas for resilience building.

In this research, sampling was done employing three groups of 8-10 members each with enough variety to reflect different opinions. Stratified sampling meant that any given socio-economic status, gender roles, and positions within local authority had a voice. In this way, by having different experiences of participants, a fuller picture emerged of how various members of society interacted with DRR initiatives and flood hazard responses, leading to profound, actionable findings.

3.3.2.2 Key Informant Interviews (KIIs)

The research incorporated key informant interviews (KIIs) from resourceful people knowledgeable in flood control and disaster risk reduction in-depth. Interviewees included municipal officials, disaster risk reduction (DRR)-tagged professionals, and leaders in local communities where each one plays a fundamental role in planning, implementing, and managing DRR actions impended. Such interviews helped inform on some fundamental issues such as "what current DRR interventions are achieving," "what hindrances are faced in the management of flood interventions," and "what recommendations emerge as better ways of making improvements to DRR planning and implementation." The interviews provided perspectives along several fronts in terms of institutional and technical barriers, policy gaps, and realities when attempting to connect community-based knowledge to formal interventions.

In sampling terms, 5 of these interviews were done for the study. This was sufficient in collecting richness of information but also allowed for a deep probe of these data to elicit more understanding of complicated matters such as governance bottlenecks, resource constraints, and strategic areas for improvement on disaster preparedness and response. The findings from these interviews serve as a valuable input in formulating recommendations for a more effective and locally relevant DRR response.

3.4 Data Analysis

3.4.1 Quantitative Analysis

For quantitative analysis of the surveys, Excel was utilized as the primary statistical package to manage, coordinate, and analyze the data obtained. This began with the utilization of descriptive statistics to produce a clear sketch of significant variables such as socio-economic vulnerabilities, population demographics in communities, and levels of preparedness. This approach allowed the estimation of factors like age structure, income, education, and resource availability in the community. Summarizing all these arguments, the analysis highlighted the implicit vulnerabilities that may have shaped the flood resilience of the community. Descriptive statistics also allowed the identification of vulnerable groups, such as

families with lower incomes or individuals with limited mobility, which could be utilized to identify more precise disaster risk reduction.

3.4.2 Qualitative Analysis

Thematic analysis was employed to evaluate the texts written from the FGDs and KIIs. Such analysis systematically went through the records in search of common themes, patterns, and perceptions regarding critical issues like flood risk, efficacy of disaster risk reduction (DRR) strategies, and resilience of the community. The reports were determined according to the researching categories in the themes that arose; these captured community concerns, adaptive practices, and local views on successes and failures of DRR efforts so far. In order to enhance the strength of conclusions made on the validity and reliability of the qualitative findings, triangulation was employed to correlate the results from FGDs and KIIs with the quantitative data collected from surveys and other sources. Thus the cross-interpretation of qualitative and quantitative data ensured convergence along major findings and accuracy, resulting in a detailed yet comprehensive picture of the disaster resilience of the community.

3.5 Ethical Considerations

Ethical considerations were a top priority in this research since it was to uphold the dignity, privacy, and independence of all participants. Participants received full information concerning the purpose and objectives of the study as well as their expected roles. This information was used to obtain informed consent from them because they understood the research fully, and their participation was purely voluntary, with a complete freedom to withdraw at any time. Confidentiality was observed, all personal data collected through surveys, interviews, and focus group discussion (FGDs) were kept anonymous and safe, and accessed only by the research team. No identifiable data was shared or published. Also, cultural sensitivity was displayed throughout the data collection process when considering local customs, traditions, and social norms. Apparently, this would build trust and ensure that research occurs in an all-inclusive as well as respectful manner, therefore increasing the quality and authenticity of the data collected.

3.6 Limitations of the Study

Geographical Context: The study has been limited to Bhangaha Municipality Ward no 1 of Nepal. The results cannot be generalized to other geographies which are different with respect to geography, society or culture.

Sampling Bias: There have always been possibilities of sampling bias despite trying to achieve a representative sample, and this would affect the generalizability of the results to the whole community.

Data Dependence: Data would have been as accurate and reliable as the participant's truthfulness and recall ability. Self-report data would have- had response biases or inaccurate answers.

Time Limitation: The research had a specific time frame. This would limit the depth of data collection and the extent to which longer-term changes in community resilience could be captured.

Resource Constraints: The data collection and analysis efforts were wide and comprehensive in the extent to which they were affected by the available resources, time, budget, personnel, and other related factors.

Subjective Interpretation: Divorce qualitative data analysis subject to thematic analysis would also involve a subjective bias that could have been introduced by researcher bias in interpreting themes and patterns.

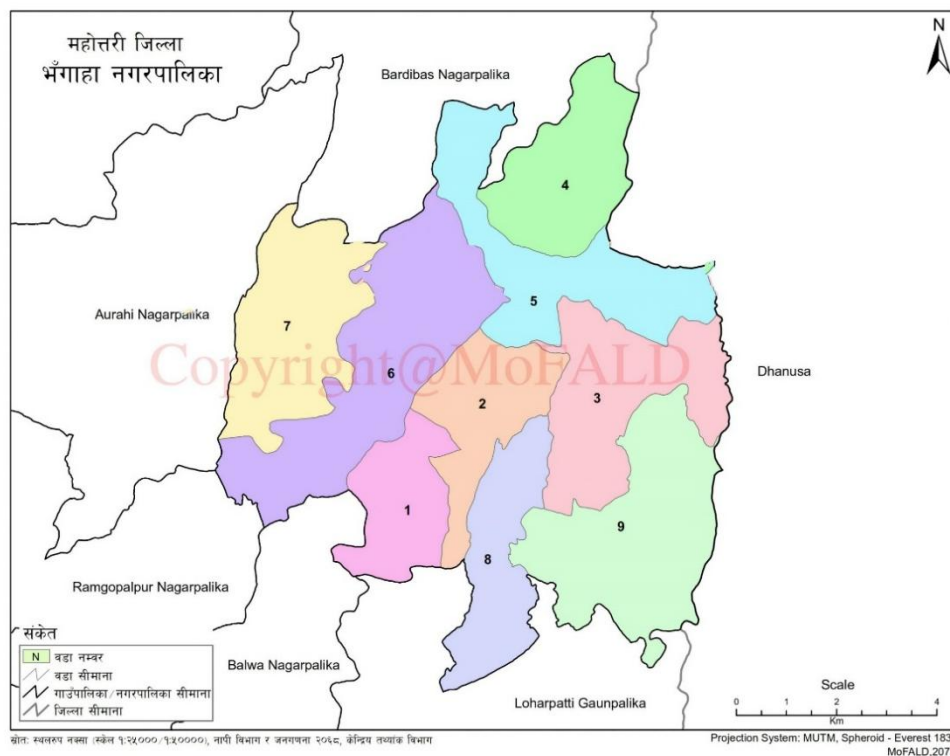
These limitations were important to acknowledge in order to establish a well-rounded and candid assessment of the outcomes.

CHAPTER IV

DATA ANALYSIS AND FINDINGS

4.1 Rational Behind Choosing the Study Area

Bhangaha Municipality is located in the Mahottari district of province no.2. The research was conducted in Bhangaha Municipality Ward no 1 which is directly affected by the flood risks that originate from the Ratu Khola watershed. The study was carried out on four villages which are Kabilasha, Singyahi, Dostia, and Barka Tole because these communities are directly and frequently affected in the rainy season due to flooding. The location of these villages within the flood catchment area, these settlements are extremely vulnerable to seasonal floods which impact people's daily lives and livelihoods.



4.2 Community Resilience Analysis of the Study Area

To comprehend the resilience of the community, many methods use theories of complex (adaptive) systems. In adopting such approaches, the community is considered to be a multifaceted adaptive system that is composed of diverse social, economic, physical, environmental, and institutional components. These components

are carefully interlinked and the functioning of the system is determined by the interaction between them. In case of disruption of a one-component, falling effects may happen that can entirely affect the functioning of the whole system. The study focused on the major aspects of community resilience based on the disaster resilience of place (DROP) model. “This model is designed to present the relationship between vulnerability and resilience; one that is theoretically grounded, amenable to quantification; and that can be readily applied to address real problems in real places”(Cutter, 2008).

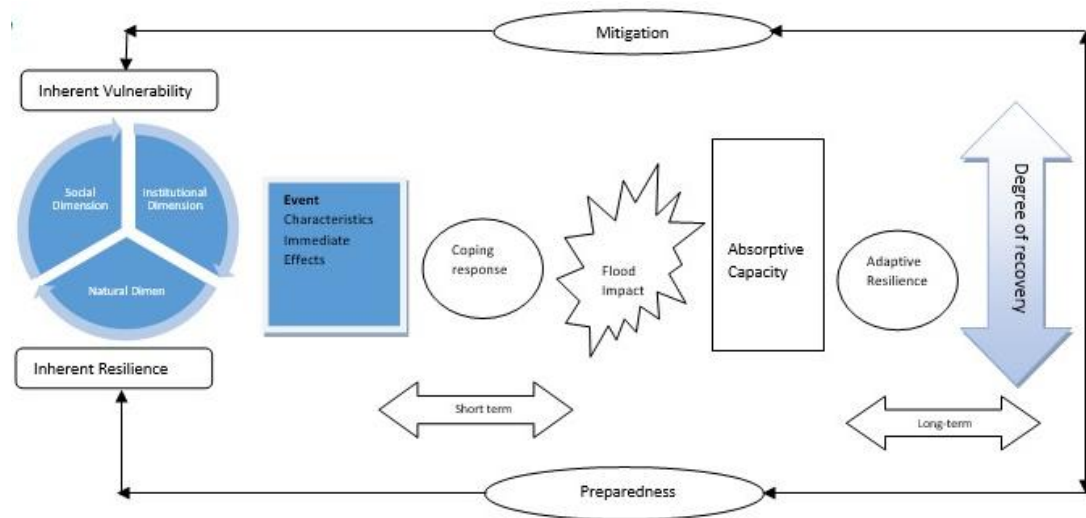


Fig.1: Schematic representation of the disaster resilience of place (DROP) model

4.2.1 Natural Dimension

The Ratu Watershed is drained by more than 1,000 streams and rivers including distributaries with a total length of 1,439 km. According to the topographic map of Ratu Khola, (1:25,000), there is a fifth-order river. The drainage density of the total basin is 2.7 km/km². However, there is a wide variation in drainage density with varying geomorphic units. Maisthan is the origin of the Ratukhola in with an altitude of 740 masl. The total length of the channel is 82 km within the territory of Nepal. It streams through comparatively wide valleys within the Siwaliks (25 km), fan (10 km) and alluvial plain (47 km) and finally across the India-Nepal boundary. Jangha Khola, the Sunjhari Khola, and the Badahare Khola are the major tributaries of the Ratu River. “These rivers originate in the Siwaliks. The Jangha Khola intersects the Ratu Khola in the west at Sarpallo, and the Sunjhari Khola and the Badahare Khola meet the Ratu Khola in the east at Patu and Bhuchakrapur, respectively”(Khanal, 2007).

4.2.2 Social Dimension

Social vulnerability states to the socio-economic and demographic aspects that affect the resilience of communities (Flanagan et al. 2011). Numerous studies have shown that during and after disaster events the socially vulnerable are more likely to be unfavourably affected, i.e. they are less likely to recover and more likely to die. Effectively addressing social vulnerability reduced both human misery and the financial loss related to providing social facilities and public assistance after a disaster. The social dimension includes demography, migration, and displacement, social groups, education, health and well-being, culture, institutions, and governance aspect.

Bhangaha Municipality is constituted by 6 existing village developments committees (VDC) and our study area is one of the existing VDCs Singyahi which wards no 1 of the Municipality. It lies 30 kilometres far from the headquarter of Jaleswor and 25 kilometres from the east-west highway connected by a gravel road. However due to the lack of a bridge, all 4 villages namely Barka, Korla, Dostia and Kabilasha remain unreachable due to the flood in Ratukhola during the rainy season. Altogether 4979 individuals (2290 female and 2689 male) including 55 persons with a disability reside in this ward. Terai janajatis, Dalits and Muslims are the major ethnic groups of this area.

4.2.2.1 Demographic profile of the respondents

The demographic profile of the respondents provides important information about the population characteristics of the four selected villages, Kabilasha, Singyahi, Dostia, and Barka Tole, located in Ward No.1 of Bhangaha Municipality. The demographic plays a crucial role in understanding the community's vulnerability and resilience to flood risks originating from the Ratu Khola watershed.

4.2.2.2 Distribution of Population by Household

Bhangaha Municipality Ward No.1 has a total population of 4,979 individuals. The study was conducted mainly on four of the villages within the ward. A total of 100 households were surveyed, and the total population of these households was 583 individuals.

Table 1
Distribution of Population by Household

Male	Female	Others	Total
280	303	0	583

Source: Field Survey, 2024

Out of the total surveyed individuals 280 are male, 303 are females and nobody identified as ‘Other’. This distribution shows female population in all four villages are higher which may also influence the community roles in disaster preparedness, household management and providing care to families during any flood occurrences.

4.2.2.3 Distribution of Population by Ethnicity

In Bhangaha Municipality Ward No.1, the population is diverse with various ethnic groups who are contributing to the community. In the studied area there are various ethnic groups which include Dalit, Brahmin, Madeshi, Janajati, Muslim, and other small groups.

The table below shows that the Madeshi community is the largest ethnic group in the ward, which is respectively followed by the Janjati. Smaller groups such as the Dalit, Muslim, Brahmin, and others also play an essential role in the diversity of the community and suggest the importance of inclusive initiatives and policies to help all the groups in the community.

Table 2
Distribution of Population by Ethnicity

Ethnicity	Number of Households
Dalit	13
Brahmin	3
Madhesi	36
Janajati	31
Muslim	15
Others	2
Total	100

Source: Field Survey, 2024

4.2.2.4 Distribution of Population by Age

Age is one of the significant demographic elements in the analysis of community structure. In this regard, Bhangaha Municipality Ward No. 1 classifies its total population into only four age groups: 0-5 years, 5-18 years, 18-50 years, and above 50 years. The population was sampled to get a total of 100 households housing 583 persons, including 280 males and 303 females. The age composition of this population is 103 in 0-5 age brackets, 126 in 5-18, 219 in 18-50, and 135 at 50+. Thus, the so-called vulnerable groups are 0-18 and above 50 years. These groups define health, education, and disaster preparedness needs for the groups.

Table 3
Distribution of Population by Age

Age Group	Male	Female	Total
0-5	49	54	103
5-18	59	67	126
18-50	104	115	219
50 +	68	67	135
Total	280	303	583

Source: Field Survey, 2024

4.2.2.5 Education Status

Education is one of the important aspects for analyzing the ability of community people to cope with disasters in the community. With the help of education, individuals can be aware, prepared for and respond to and recover from the emergencies of any disaster including flood.

Table 4
Distribution of Population by Education Status

Qualification	Male	Female	Total
No formal Education	101	205	306
Pre-primary (0-5)	70	47	117
Primary (Grade 0-10)	43	12	55
Secondary (SEE)	27	18	45
Higher Secondary (Plus Two)	23	13	36
Bachelor's Degree	11	7	18
Master's Degree or Higher	5	1	6
Total	280	303	583

Source: Field Survey, 2024

The education status in the Bhangaha Municipality demonstrates certain differences. Out of 583 individuals, 306 have not attended any formal education. Similarly, the Pre-primary and primary levels comprise 117 and 55 individuals respectively. Furthermore, there are only 45 individuals who have completed secondary education (SEE). Additionally, looking at the data, individuals who attended higher education are low with only 36 individuals. Whereas the individuals studying for bachelor's degree and master's degree are 18 and 6 respectively.

4.2.2.6 Vulnerable Group

In Ward No.1 of Bhagaha Municipality, flood can have an immense impact on vulnerable groups. Certain population faces challenges due to age, health, social position, and lack of resources to respond to any crises that arise from flood.

Disability

Individuals with disabilities are a fundamental part of any community including the study area. It represents not only diversity in the community but also resilience by displaying the strength and determination of individuals as they overcome the challenges in their lives.

The data from the study area shows that there are a total of seven people with disabilities (PWD). Out of a total four are male and three are female.

Table 5
People with Disabilities

PWD Male	PWD Female	Total PWD
4	3	7

Source: Field Survey, 2024

Single Women

Single women are those who are unmarried, widowed or who are separated. These segments of women face a unique set of challenges in the community as well as during floods. In this particular ward, single women are also among the most vulnerable groups due to different factors such as social, economic and safety. In a total of 100 households, there are 303 total female population out of these 23 include single women who are unmarried, widowed, or separated.

Table 6
The proportion of Single Women

Category	Number of women
Total Female Population	303
Single Women	23

Source: Field Survey, 2024

Age-Related Vulnerable groups

During floods or any other disaster in the community, the most at risk are children and the elderly. Both groups are highly vulnerable in the time of crisis. In this ward, both children and adolescents (0-18 years) and the elderly (50+) are the most vulnerable populations. Children and Adolescents are vulnerable due to their physical dependence on caregivers, and prone to injuries, diseases and emotional distress.

Table 7
Age-Related Vulnerable Groups

Age Group	Total	Vulnerable Group
0-18	229	Children and Adolescents
50+	135	Elderly (50 years and above)

Source: Field Survey, 2024

According to the data, the (0-5 years), school-aged children (6-18years), and adolescents. include a total population of 229 which includes children. During floods, they are at high risk of drowning, getting caught by waterborne diseases and trauma. Similarly, the Elderly are vulnerable due to a lack of reduction in mobility and different health complications. In this particular ward, the total population that falls under the 50+ group is 135. In the occurrence of flood they also face significant emotional distress due to loss of family members, homes and displacement.

4.2.2.7 Occupation

The primary occupational distribution in the study area shows the economic structure of the community. Out of 100 households, 63 households depends on the farming as their primary source of income which reflects the population is more inclined towards agriculture. Similarly, 13 households are seen being involved in labor work for a daily wage. Additionally, individuals from 12 households are employed in private jobs while only 7 households earn their income through craft-related work which includes traditional skills and handicrafts. Moreover, Only 5 households are employed in government jobs representing smaller group but more stable income source.

Table 8
Major Occupation and Household Income Distribution

Major Occupation	Number of Households
Farming	63
Government Job	5
Private Job	12
Craft	7
Labor	13
Total	100

Source: Field Survey, 2024

4.2.2.8 Sufficiency of Food Production

Food production is one of the important aspects which plays a crucial role in the resilience of communities to flood risks. The capacity to produce sufficient food is often threatened by the recurring floods which in term damage the crops and ultimately disrupt the local economy by reducing food availability.

The table below shows the detailed breakdown of food sufficiency among the households. The data shows that out of 100 households 29 households have sufficient food production which lasts for more than 9 months which indicates better food security. However, 25 households food lasts for only 3 months, making them vulnerable to food shortages during any disaster including flood. Simultaneously, the other 30 households can manage their food up to 3 to 6 months, while 16 households have access to food supplies lasting them for 6 to 9 months.

Table 9
Sufficiency of Food Production

Food Sufficiency Status	Duration	Number of Households
Sufficient	More than 9 months	29
Insufficient	Less than 3 months	25
	3–6 months	30
	6–9 months	16
Total		100

Source: Field Survey, 2024

4.2.2.9 Drinking Water Accessibility

In Bhangaha Municipality Ward No. 1, all the surveyed households depends on tubewells as the primary source of drinking water. This shows that the whole community is completely dependent on tubewells for portable water. In these areas where flood is very prone having a secure source of drinking water becomes very important. Floods often contaminate the surface water sources which leads to different waterborne diseases. Therefore, tubewells are considered as the important alternative for cleaner and safer water compared to surface during floods.

Table 10
Drinking Water Accessibility

Water Resource	Number of Households
Tubewell	100

Source: Field Survey, 2024

4.2.2.10. Status of Wellbeing, Shelter and Vulnerability

In Nepal, the drainage density is 0.3 km per square kilometre which shows how close and flood sensitive the drainages are. In addition to damaging the crops, the flood causes great loss of humanitarian and physical assets and generally epidemics spread out after the flood. Predominantly, the poor people are the most insecure from it. (MoHA 2018)

According to the focus group discussion, the status of well-being, shelter and vulnerability is very poor in the study area. The charts below illustrate that 29 households fall under the lower-level vulnerability whereas only 19 households fall under moderate-level vulnerability. In contrast, 51 households are considered to be at a higher level of vulnerability. Similarly, 72 residents are living in unsafe shelters while only 28 inhabitants have safe shelter for living. Additionally, 8 households are classified as living under higher well-being, and 13 households are living under middle level of well-being. Furthermore, 41 and 37 households respectively have low levels and below low levels of well-being.

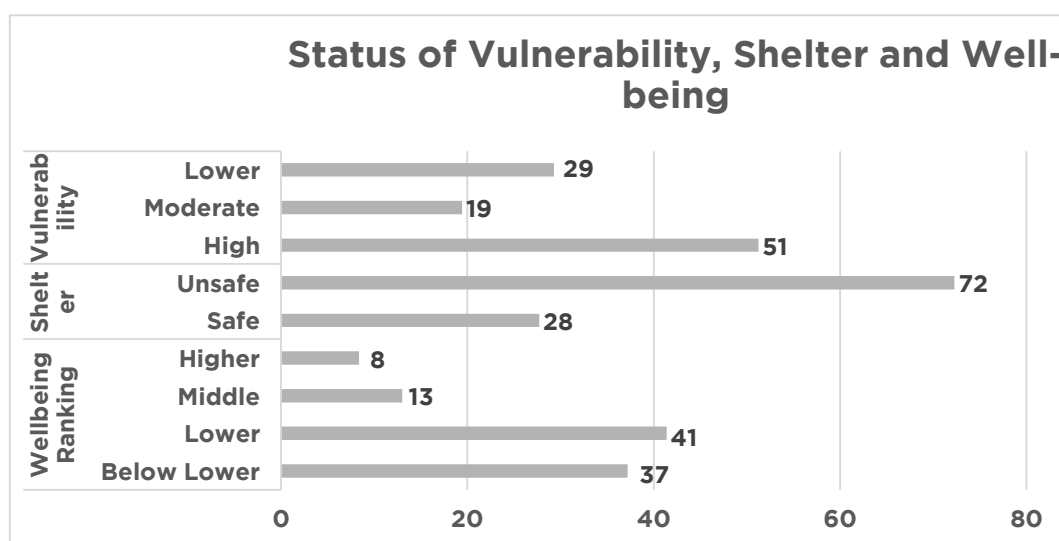


Figure 2 Status of Vulnerability, Shelter and Wellbeing

<p>Wellbeing Ranking Indicators:</p> <p>Below Lower Level: Production (own) sufficient for less than 3 months, unemployed, Labour, house made from mud and bamboo</p> <p>Lower Level: Production (own) sufficient for 6 months, employed, house made from mud and stones</p> <p>Middle Level: Production (own) sufficient for 9 months, employed, house-made from brick or stone</p> <p>High level: Production (own) sufficient for 9 months, employed (high-class job), house-made from brick, Rod, Cement.</p> <p>Safe and Unsafe Shelter indicators:</p> <p>Unsafe: No earthquake resistance structures, Unsafe houses from storm and cyclones and other disasters, Houses build in flood, landslide-prone areas.</p> <p>Safe: Earthquake resistance structures, Safehouses from storms and cyclones and other disasters, Houses build free from flood, landslide-prone areas.</p> <p>Vulnerability Ranking Indicators:</p> <p>High level: Poor family, Family with PWD, Unsafe shelter, No or less access to education and health services, Unsafe houses from storm and cyclones and another disaster, Malnourished family</p> <p>Moderate level: Below lower or lower-level wellbeing ranking, medium level house, limited access to education and health services, knowledge about disaster response,</p> <p>Low level: High-level wellbeing, Safe Shelters, access to education health and other basic services, know about disaster preparedness, resilient</p>
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Figure 3: Status of Vulnerability, Shelter and Wellbeing Source: Survey 2024

4.3 Institutional Dimension

4.3.1 Act and Policy

The government of Nepal's prioritized area addresses the following: 1. Reduce existing disaster risk by investing in increasing resilience 2. Avoid forthcoming risks by promoting private and public investment in disaster risk reduction (MoHA, 2018).

National policy for Disaster Risk Reduction (MoHA, 2018) aims to enhance disaster resilience by increasing public-private partnerships. The Constitution of Nepal has assigned DRM as a priority for all levels of government in Nepal for post-disaster recovery, rehabilitation and reconstruction to ensure the 'Build Back Better Approach'. Schedule 9 assigns shared DRM priority to all levels of government,

Schedule 8 describes the sole responsibilities of the local governments, Schedule 7 assigns the responsibilities of DRM as a shared priority of the federal and provincial governments (MoFAGA, 2020).

The National DRR Strategic Action Plan includes several activities that are aimed at developing Disaster Risk Management (DRM) capacity at the local government level. The Local Government Operations Act of 2017 also prominently addresses the orientation of DRM activities at the local government level by delineating the major functions of local governments for disaster risk management. Apart from this, the Government of Nepal has also formulated policies such as Local Disaster Risk Reduction and Management Act, Standard Operating Guidelines for Emergency Operation Centres, Guidelines for Local Disaster Management Fund Operations, the Local Environment and Natural Resources Protection Act, and guidelines on the preparation of Local Disaster and Climate Resilience Plans (LDCRP). While such steps are in the right direction, the point is to institutionally implement such tools in practice (IOM & MoFAGA, 2019).

4.3.2 Understanding National and Local DRRM Governance

The Bhangaha Municipality seems to be missing out the knowing the DRRM governance at the national level. It has been a while Government of Nepal circulated numerous samples and directions; Bhangaha Municipality has not prepared basic DRRM tools. The local DRRM act has not been endorsed so far. However, ward no 1 recently formulated their Ward level Disaster and Climate Resilience Plan in the support of non-governmental organizations but still, it is not endorsed to the date. The plan seems to stand in isolation due to the lack of a DRRM mainstreaming strategy with the municipality and wards.

The Municipality has created Disaster Management Fund without preparing its mobilization guidelines. Although municipal, ward level staff and representatives have been taken participation in various capacity building training on DRRM, it couldn't be replicated in their plan policy and strategies to mainstream DRRM to the development process.

4.3.3 Disaster Risk Reduction and Management (DRRM) institutional mechanism at the local level

The municipality has formed Disaster Management Committee (DMC) at the municipal (LDMC) level and ward level (WDMC) only in 2 wards. The municipality has a building code but it has not been followed properly. The early Warning System (EWS) is in operation in Ratukhola which is partially effective. However, a survey showed that the majority of community people have no idea about its mechanism and information about the early warning system. However, LDMC and WDMC at the ward level and municipal level are inclusive, with representation ensured from gender and sexual minorities, religious minorities, different age groups, persons with disabilities and other vulnerabilities and discriminated groups of municipality and wards.

4.4 Flood Characteristics and Impacts

4.4.1 Characteristics of Flood Disaster in Study Area

Floods in Nepal that have intense damage are driven by five main causes: excess rainfall, glacial lake outburst, dam failure, infrastructure issues, and floods caused by excessive rain or river flow obstructions due to infrastructure. The most affected area is the Terai region, accounting for about 77% of the total damage caused by water-related disasters like landslides, floods, and avalanches, and the most common among these are floods (Khanal, 2007).

The climate at the macro-level is prevailed by the monsoon and topology plays an vital role in creating meso- and micro-level variances (Chalise 2001). Hence, there are pronounced time-based and spatial variations in rainfall. “The average weight of annual precipitation for the country is about 1,630 mm. More than 80% of the total annual precipitation occurs during the summer months (June-September)” (Khanal, 2007).

In the rainy season when Ratu gets flooded, it ruins most of the part of ward no 1 of Bhangaha Municipality specially Kabilasha, Singyahi, Dostia and Barka tole. As the result, it damages crops and also causes a great loss of humanitarian and physical assets annually.

As the ward lies alongside Ratukhola, it has a river training embankment which often gets destroyed and flood enters into the village and agriculture field. Due to the low budget and apathy of governance, they made river training embankments of sand sacs each year before the rain starts and eventually it destroys immediately after the very first rain.

4.4.2 Flood Vulnerability, Cause and Impact

There continuously remains a substantial degree of uncertainty about the incidence of serious floods; consequently, knowing the nature of risk and problem goes a long way in preparing for its prevention, thereby strengthening management capabilities. People's idea about the nature of risk affects their perception of it and change their choice of deterrence and coping approaches. Based on the findings from the study revealed that the degree of the perceived risk of flood threats was significantly low among the residents of the study area.

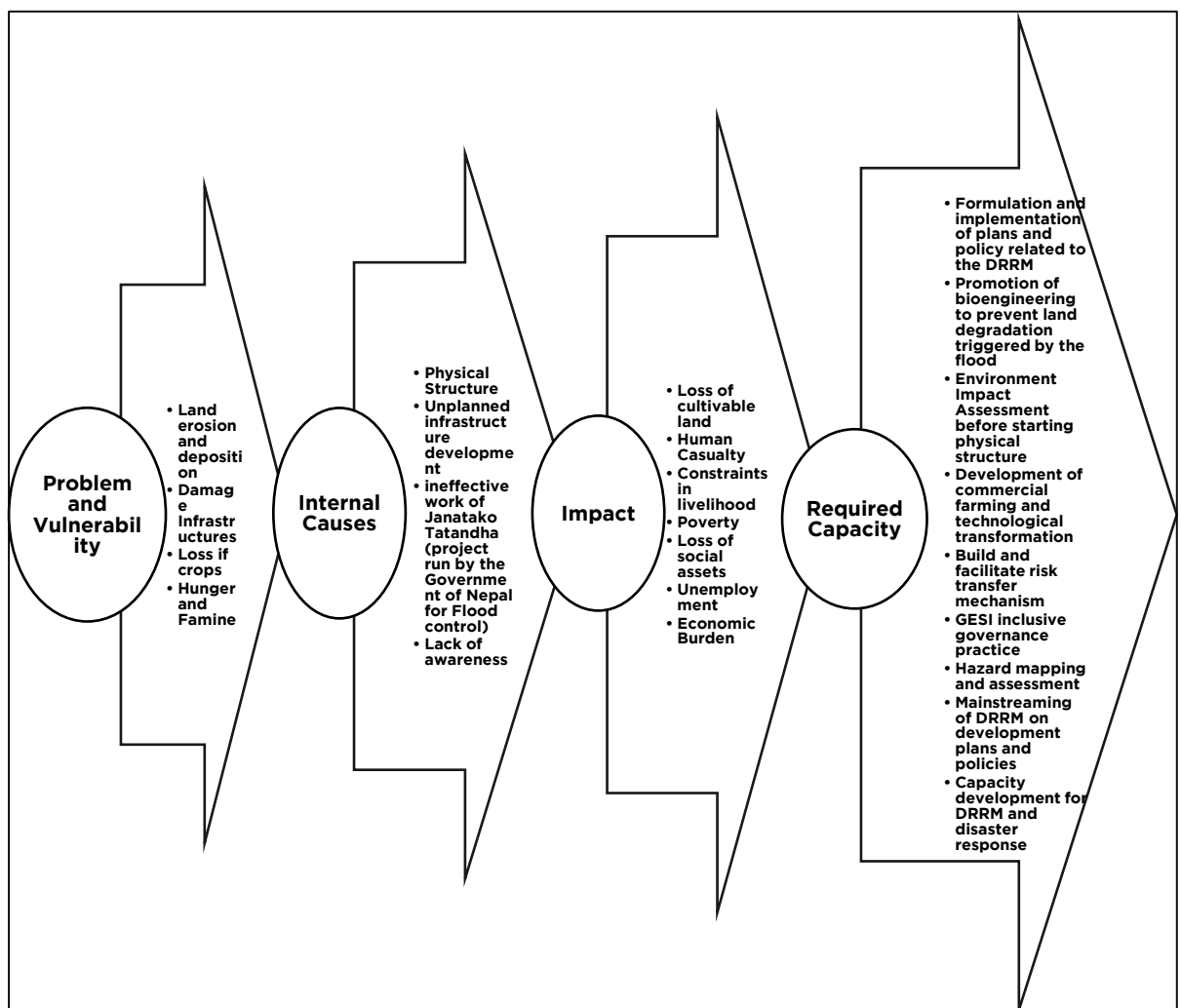


Figure 4 Flood Vulnerability, Cause and Impact, Source: Survey 2024

4.5 Quality of life

These studies analyze the effect of flood calamities on farming, livestock, businesses, and livelihoods which are essential in the development of well-established and sustainable families and communities. Livelihoods commonly include the talents, assets, and activities that are employed in earning a livelihood and developing the assets employed for sustainable living (Papola, 1999; Bhurtel, 2000; Dahal, 2001; Subedi & Pandey, 2002; Subedi, Subedi, Dawadi & Pandey, 2007; Paudyal, 2017).

Land use connects people's activities with their livelihood. In Nepal, people depend on traditional economic activities like agriculture, animal husbandry, and forestry that are locally resource-based (Banskota and Pradhan, 2007). Studies showed that the livelihood of the study area also depends on subsistence agriculture, but recurring floods have been degrading cultivable agricultural land annually.

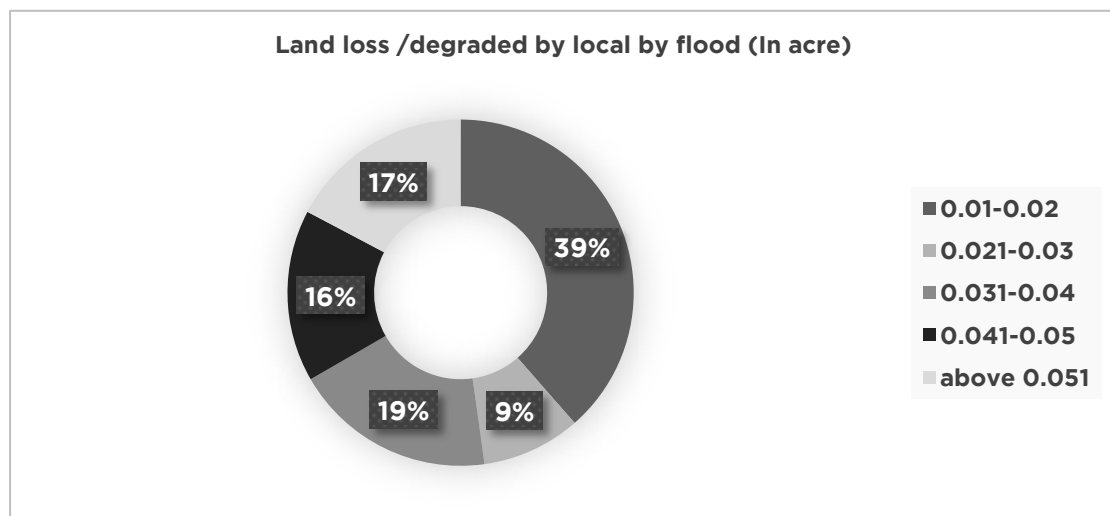


Figure 5: Land loss /degraded by local by flood, Source: Survey 2024

Altogether 294 families lost a total of 424 acres of land from the flood in the past 10 years. Noticeably total of 43 families lost more than 0.051 acres of land in this area. Few farmers tried to rehabilitate the land by planting fruits and other seasonable riverbed farming but the majority of the land remained abandoned due to the loss of yield and irrigation facility after the flood. As a consequence of flooding, cultivated land often converts into a degraded wasteland, or it takes a long time and is very

expensive to rehabilitate for farming. In this area, the damage caused to agricultural land is relatively more severe than valuable infrastructure, and the damage is mostly to crops and the land itself.

4.6 Capacity Analysis

A community's resilience to rebound depends on members' capacities, resources, and capabilities. The term draws inspiration from the Sustainable Livelihoods Approach (SLA) (Sinha, 2001) as well as from the absorptive capacity notion that identifies the capacity for rebounding against adversity (Pelling, 2011). The study analyzed capacity as follows:

4.6.1 Absorptive Capacity

Absorptive capacity refers to the ability to take conscious precautionary steps and effectively cope with anticipated shocks and stressors. Briefly, it is the capacity to bounce back and grow resilient after a disruption. It manifests in the form of anticipation of risk, planning for imagined challenges, management of short-term effects, and shock recovery from temporary shocks (A. Bahadur, 2016).

The following table presents the absorptive capacity of the study area, which has been determined in order to guarantee stability. Its key purpose is to minimize the negative effects of shocks on households, communities, and individuals.

Table 11
Capacities of the communities

Description	Capacity	Specifics/Status
Physical Capacities		
Road	Gravel and Muddy Road connected to the service providers	Functional in winter season only due to the lack of bridge and unfavourable condition of the road
Bridge	4 bridges are under construction	The construction process has been stopped in 2 bridges due to political reasons.
Safe shelter as a collection centre	3 shelters for 200 people	Community building and school
Early Warning System	EWS is in operation for Flood in Ratukhola	Community people are unaware of the operation mechanism and communication
Search and Rescue Materials	Very few Government offices	Not adequate
Sources of Drinking Water	Water Pump Machine	Not safe
Housing	20 per cent of houses are safe from the flood disaster	More than 80 per cent of houses are unsafe and no flood resistant
Human Capacity		
Trained Search and Rescue Team	25 people	Recently trained but not worked yet
Health Team	1 Health Post	(3 health workers, office-based and 9 Female Community Health Volunteers)
Trained Resources on DRRM	10	The municipal team has taken training on DRRM
Disaster Management Fund	No	
Social Capacity		
Income generation related women groups	7	
DRRM committees	4	Not functional
Finance Enterprises	8	Small family-run enterprises
Industry	No	
Job	20	(NGOs and Government Job)
Bank and Cooperative	4	
Natural Capacity		
River	Geruka and Ratu	
Jungle	No community forest	
Irrigation	Boring water pump	
Cultivable Land	80 per cent of the total land	Around 20 per cent of land degraded by flood, siltation and deposition

Absorptive capacities for community resilience were found inadequate. Studies also showed that communities need to build all sorts of capacities for hazard mitigation both at the household and community level.

4.6.2 Adaptive Capacity

Adaptive capacity is the ability to foresee and react to change, whether future or unexpected, in a way that promotes long-term flexibility. Since change is ongoing and often unexpected, adaptation requires ongoing effort and a willingness to alter overtime (S. Levine, 2011). Essentially, adaptation is about making intelligent changes to maintain pace with evolving conditions. Adaptation capacity is in the fundamental understanding that not only is change continuous but that it is also uncertain. This implies building flexibility the ability for continuous adjustment, learning, and innovation in response to evolving challenges.

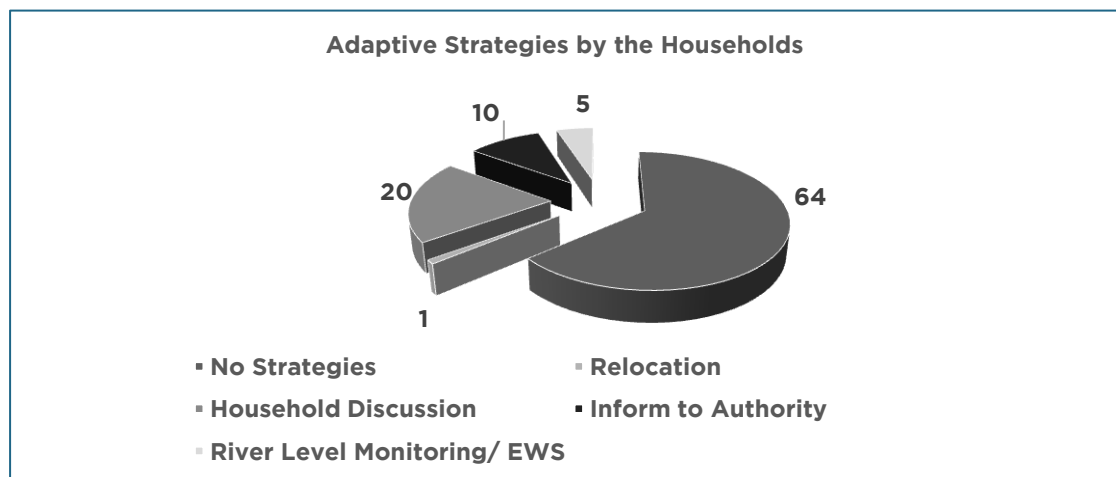


Figure 6: Adaptive Strategies by the Households, Source: Survey 2024

In the study area, more than 60 per cent of households have no strategy to deal with flooding whereas 20 per cent of households discuss it with their families. Discussions were stated to focus on grown ups counselling children on where to sleep or how to live with floodwater in the house and neighbourhood area. Contrary, 10 per cent of households inform about the flood effects and impact to the government authority and the rest 5 per cent are concerned and monitor river levels directly and by the established Early Warning System (EWS) during the rainy season. Lastly, a minimum of 1 per cent of households relocate to a safer place, perhaps due to their higher educational accomplishment, and were more stable financially.

A key informant from Bhangaha Municipality shared their perspective on the general lack of preparedness in the community:

“We lack knowledge and preparedness strategies for flooding, as we view it merely as a natural phenomenon and take no action. Although we now receive messages from authorities about rising river levels, most people tend to ignore them.” -Ward chair, Bhangaha Municipality

This reveals the different dynamic qualities of the absorptive capacity elements of resilience where higher resilience pre-flood led to lower influences post-flood and vice versa.

4.7 Community Competence

4.7.1 Local Understanding of DRRM

Community members are not aware of DRR because of the significance put on DRR by the INGOs and NGOs work with the stakeholders rather than community people, whereas the government body only works in response during a disaster. The community people would like to join hazards and disaster awareness-raising programs such as floods and other disasters. Often programs focused on a policy level and capacity building of staff and representatives though there is no roll-out or community awareness program can be seen in the community. Very less program has focused on the community level and as a result, people are unable to understand the actual situation to apply things to make them resilient. The local states that the communities should be prepared for a disaster, people are aware of the risks and are aware of the response but they need to be more. The study showed that only 4 per cent of the local community participated in the disaster-related planning training or workshop and 14 per cent of the people listened and observed jingles, hoarding boards and other knowledge related materials. Similarly, 5 per cent of people know about disaster management funds and the ward disaster management committee were, and 17 per cent of the community aware of flood disaster preparedness prepared to create a resilient community.

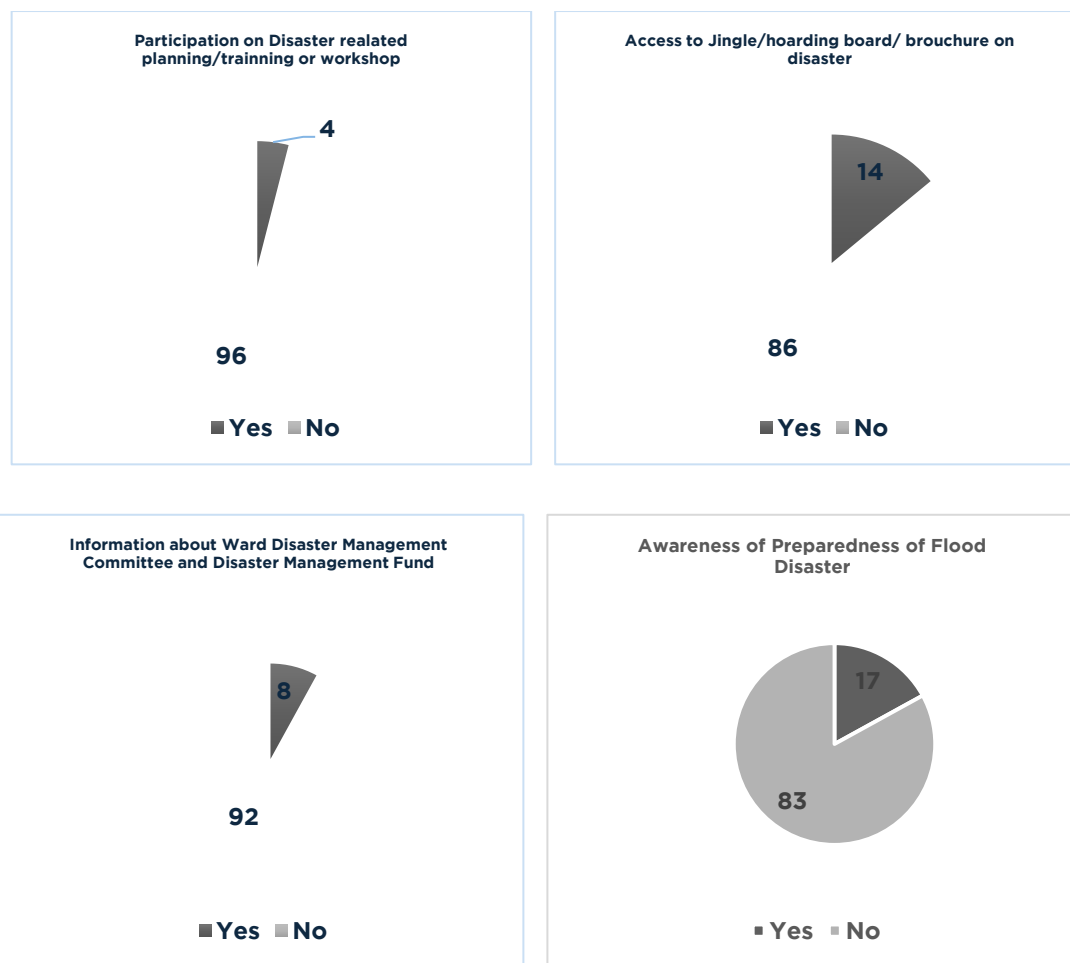


Figure 7,8,9,10: Local Understanding of DRRM, Source: Survey 2021

4.7.2 Access to the Services

The availability of information and services is closely associated with the ability of people and communities to do well. Information right is premised on the right to expression because individuals have to be informed in a proper manner in order to express their thoughts and opinions. Information that is collected by the government is for public benefit and is actually an intrinsic aspect of democracy.

Additionally, the right to information is linked with the right to truth as it is up to governments to keep people abreast of basic events such as natural disasters or health emergencies. This entails carrying out such incidents and open investigations (Mendel, 2003). Despite its significance, access to significant services and information remains inadequate. The study has shown that existing government structures and service providers tend to fail to adequately address the needs of individuals and communities in the study region.

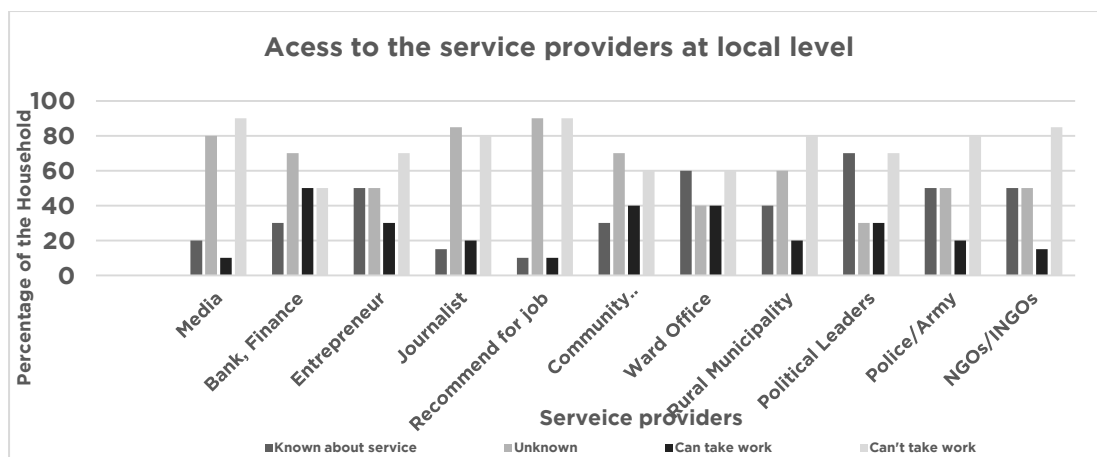


Figure 8: Access to the service providers at the local level, Source: Survey 2024

The chart illustrates the status of community access to the 11 different local service providers, where the percentage of the ones known about the services is lower than the unknown about the services. Similarly, most community households can't take services from the service providers and government organizations due to a lack of knowledge and unreachability.

4.7.3 Access to Basic Services and Infrastructure

It is essential for any individual to have access to basic services and Infrastructure is for the overall well-being. It plays an important role for the resilience and development of any community that is vulnerable. To have better and improved livelihoods one needs access to clean drinking water, better education, health facilities, economic stability, infrastructure, and connectivity Without these services individuals and communities remain vulnerable to any risks and face challenges in recovery and sustainability.

This lack of access and participation in essential services is more visible where marginalized groups are concerned, as highlighted by a group of Dalit women in Bhangaha. According to the group:

“As a Dalit women’s group in Bhangaha, we face significant challenges in terms of participation and access to disaster-related information and support. We are often excluded from meetings and workshops that focus on disaster risk management or relief efforts. This lack of participation leaves us unaware of the assistance

available from the government or other organizations, particularly in times of need.”- FGD, Bhangaha

As seen in the chart below, all the households have access to the marketplace and drinking water. Additionally, 90 households have access to primary and secondary schools which is an indication of a strong educational infrastructure. However, only 35 households are seen utilizing the banks and cooperatives and just 25 households are seen benefitting from the road access, which directly suggests better financial and transportation infrastructure. Additionally, only 50 households have access to health posts or primary health centers, and 45 households have access to hospitals which is a concern during disasters like floods. There are only 35 households that have access to government offices, while 37 households can reach the police stations hinder access to any administrative support and security. To better the health and well-being of the community, addressing the shortcomings in healthcare, transport, and governance remains crucial.

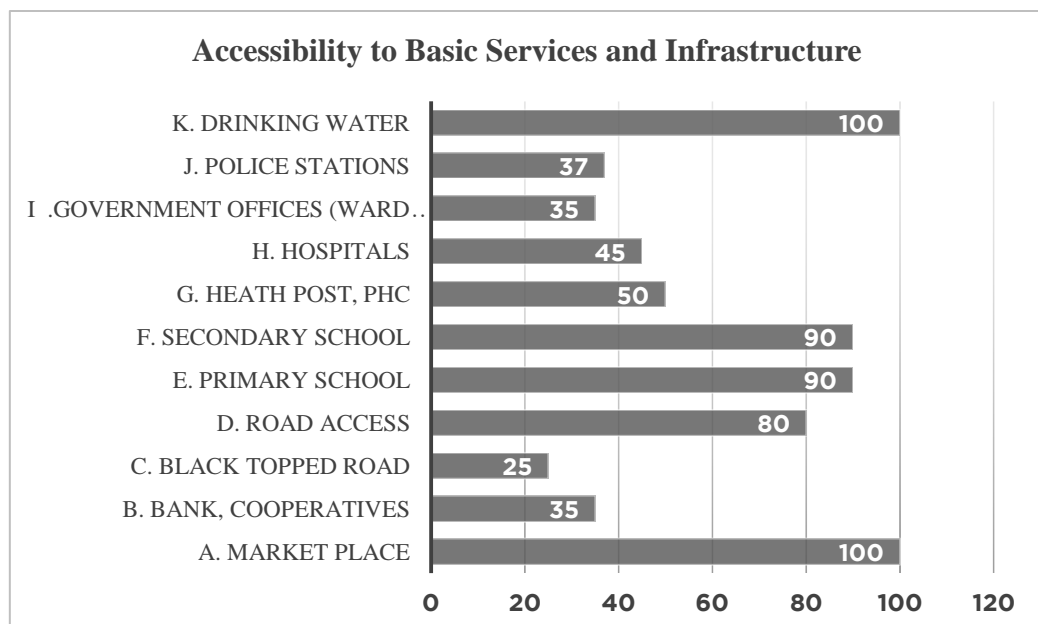


Figure 9: Access to the service providers at the local level, Source: Survey 2024

4.7.4 Awareness of Flood Preparedness Strategies

One of the critical needs for improving disaster management is providing awareness and strategies for flood preparedness. These are necessary strategies for minimizing the effects of the flood. Lack of awareness is one of the concerns which

lets communities to be vulnerable at time of disaster. However, the majority of the communities are not aware of these preparedness strategies. As per the data only 15 out of 100 households are familiar with the flood preparedness strategies while 85 households are unaware.

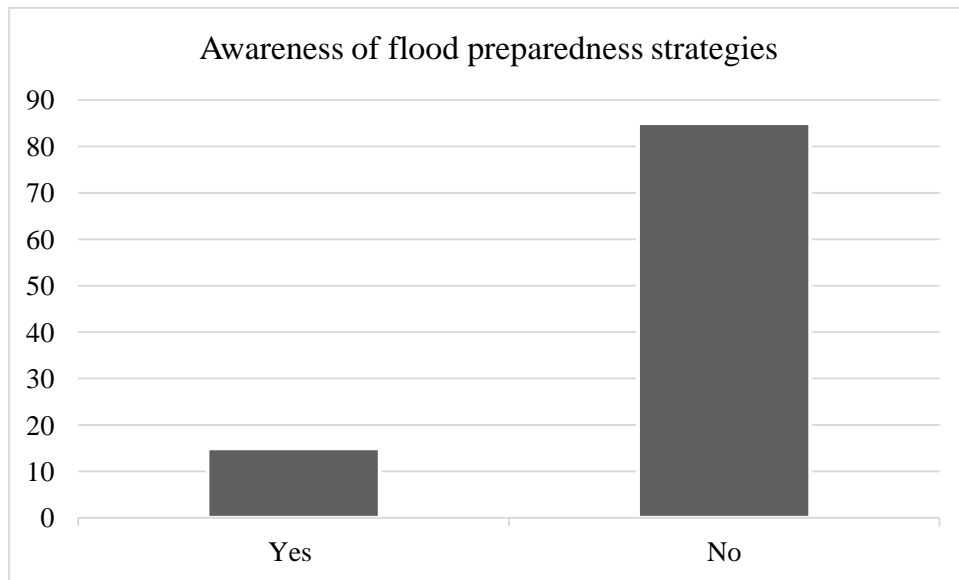


Figure 10: Awareness of flood preparedness strategies, Source: Survey 2024

4.7.5 Role of Media in Disaster Preparedness

Media builds an important awareness for the disaster preparedness of the community. It helps to communicate important information about the risks and safety measures involved to communities. Media also provides communities with updates, warnings, and instructions to be safe at the time of flood disaster. For more than a decade different media have been providing awareness by conducting media campaigns which include jingles, advertisements, and public service announcements.

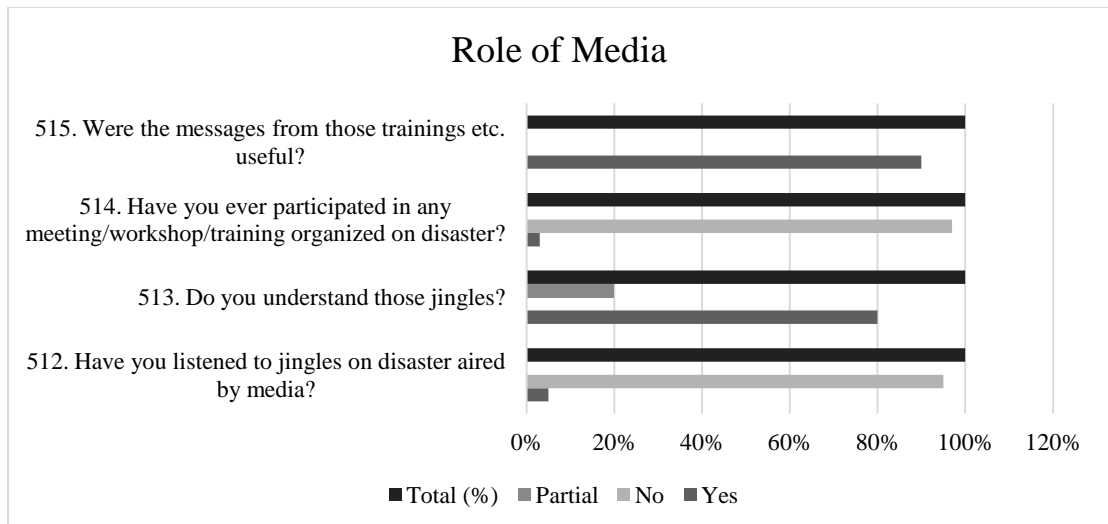


Figure 11: Role of Media, Source: Survey 2024

The data shows that only a small number of people are exposed to disaster preparedness jingles. On the other hand, those who listen to those jingles can understand them partly, which reduces the impact of the information. Aside from that, only 3% of the population ever attended any disaster preparedness-related workshops and programs, while the rest-97%-never participated in any training or workshops at all, thus showing the unenlightened face of the community. However, these training courses are seen as useful by those who attended them.

4.7.6 Role of Disaster Risk Reduction Committees in Community Engagement

The disaster risk reduction committees of the community actively promote involvement and encourage disaster preparedness. These committees were created to guide the community and to raise awareness on community matters. The committees will detail the disaster preparedness concepts and internalize disaster plans within the community so that response to emergencies becomes second nature to the communities.

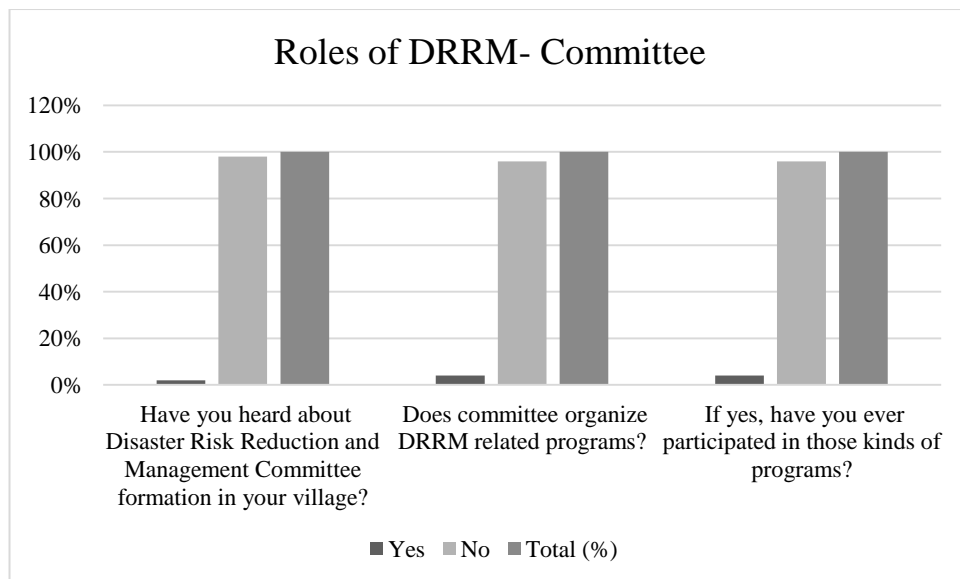


Figure 12: Role of DRRM- Committee: Survey 2024

The research reveals that from a total sample of 100, only 2% of the respondents were aware of the existing DRRM Committee in their village. Furthermore, only 4% of the respondents responded that the existing committee organizes the DRRM-related program. Whereas, the other 96% were unaware of the ongoing programs conducted by the committee. Similarly, the participation in these programs remains very low with only 4% of the respondents attending the program.

4.8 Degree of Recovery

The degree of recovery can be supposed to as a ranging from high to low. When the absorptive capacity of a community is not exceeded, then the higher degrees of recovery are reached rapidly. A lower degree of recovery may result if the absorptive capacity is surpassed and the adaptive resilience process does not occur. However, when absorptive capacity is surpassed and the adaptive resilience process does take place the community can be more inclined to attain a higher degree of recovery. In either scenario, aggregate recovery is ongoing and can continue until the subsequent event. (Cutter, 2008).

There is a close link between disaster and development. Unsuitable development raises the levels of vulnerability to disaster risk and disasters adversely affect the development of poor communities. Studies confirmed the most vulnerable to flood hazard are the populations that are already socially, economically, and

geographically vulnerable. The limited capacity of poor populations is further undermined by inadequate or absence of social access and protection. Poverty in these areas has a tendency to increase disaster risk because of the exposure of rural livelihoods to floods. Access to land, annual land loss, crop loss, and subsistence farming are the main constraints of households that are highly dependent on rain-fed agriculture for survival and therefore are highly vulnerable even to moderate seasonal weather fluctuations. This intrinsic relationship of development and flood makes reducing the level of recovery significantly in the study area.

Disaster Recovery Functions are separated into four groups that span overlapping periods done by the government, local stakeholders and other counterparts.

Table 12
Degree of Recovery

Recovery Functions	Yes	No	Partial
Disaster Assessment			
Preliminary damage assessment			√
Site assessment	√		
Victim needs assessment		√	
Short-Term Recovery			
Impact area security		√	
Temporary shelter/housing			
Infrastructure restoration	√		
Donations management			√
Disaster assistance			√
Long Term Reconstruction			
Hazard source control and area protection		√	
Land use practices		√	
Building construction practices		√	
Public health/mental health recovery		√	
Economic development		√	
Infrastructure resilience		√	
Environmental recovery		√	
Recovery Management			
Agency notification and mobilization			√
Mobilization of recovery facilities and equipment		√	
External coordination			√
Public information		√	
Recovery legal authority and financing		√	
Administrative and logistical support			√

Source: Survey 2024

“The recovery phase’s disaster assessment function should be integrated with the emergency response phase’s emergency assessment function in identifying the physical impacts of the disaster”(Lindell 2006) nevertheless, it has been partially done in the study area in the past 10 years. Safeguarding the impact area and the need assessment of the victim are partially done by the donor in coordination with the local government under the short-term recovery process, which is inadequate. Long term reconstruction including psychological, demographic, economic, and political recovery processes has not been initiated so far. In conclusion rate of recovery management, disaster assessment and any other functions of the recovery are very low due to the dysfunction of the recovery process in the study area.

4.9 Recovery Challenges

It is challenging to address all the DRRM stages “due to their geographical size, physiography, socio-cultural and economic capacities, demography, natural resource base, human development, remoteness, literacy, physical infrastructure, available services, language and culture” (IOM & MoFAGA, 2019).

In the study area, local governments are still in the early stages of developing their administrative capacity, physical substructure, and legal and governing documents. Though the municipality and wards facing recurrent hazards, no concrete initiation has been built on DRRM and has better engagement with communities as local partners, with support from various agencies for the long-term recovery. According to the responses from the local government representatives, there is no clarity from local governments on what DRRM capacity they require to meet flood recovery challenges. A DRR focal person from Bhangaha Municipality admitted:

“Although there are some plans and policies for DRRM, these instruments have not been properly endorsed for integration into other planning processes due to a lack of resources, and DRRM is not considered a priority for the municipality.” -DRR Focal Person, Bhangaha Municipality

Table 13
Recovery Challenges

Recovery Challenges	Effects	Floods Disaster Challenges in Recovery
Social and Psychological Needs	Shock and Stress due to the Flood	No practice of stress debriefing and counselling
Housing	113 households destroyed and 675 households partially destroyed in the past 10 years	Most residents can return home in 2-3 years with even worse conditions. Because there is no such plan for relocation from the Government side and the local government is struggling to stop flooding in the villages.
Economic Sector	More than 100-acre crops are destroyed annually in this area, as a result, an additional economic burden arises.	Neither there is an effective structure to stop flooding the cultivated land nor could have introduced risk transfer mechanisms such as crop insurance and so forth.
Environment	More than 400-acre land degraded due to the flood in the past ten years.	Few farmers tried to rehabilitate the land by planting fruits and other seasonable riverbed farming but the majority of the land remained abandoned due to the loss of yield and irrigation facility after the flood.

Source: Survey 2024

CHAPTER V

CONCLUSION, RECOMMENDATION AND SOCIAL WORK INTERVENTION

5.1 Conclusion

The research has identified various factors that are contributing to the flood risks and resilience challenges which has been faced by Bhangaha Municipality Ward No.1. The ward one is highly impacted by Ratu Khola watershed during flood. As Ward One is situated in the embankment of Ratu Khola the drainage patterns of that particular area make it very vulnerable to seasonal flooding. The overflow of the Ratu Khola river during rainy seasons leads to severe flooding which disrupts the livelihoods damaging the infrastructures.

There are varieties of factors that come into consideration while talking about risk due to flood. Social vulnerabilities are one factor that plays a crucial role in intensifying the risk in the community. The ward no.1 population of Bhangaha municipality includes diverse population such as Madhesi, Janjati, Dalits, and Muslims which also includes vulnerable groups including children, elderly people with disabilities, and single women. These vulnerable groups often face limited access to services which is essential for them. Essentially, they are also limited to like necessary resources for disaster preparedness making them more vulnerable to flood impacts. This study's findings highlight the importance of integrating social-ecological perspectives when planning disaster risk reduction (DRR) strategies, and underscore the need for inclusive, community-driven approaches that directly address the specific needs of marginalized populations.

Most of the people earn their living from agriculture. That is why the area becomes susceptible and prone to the influence of floods since it depends only on agriculture. This study found that the flood causes significant damages to the agricultural production of surveyed households reporting reduced yields or crop failures during monsoon seasons which ultimately leads to the hardship of economic for the farmers which also causes delays in the recovery process. Additionally, the study shows that the municipality often depends on temporary flood protection measures like the sandbag embankments which highlights the financial limitation and

governance inefficiency. These kinds of short-term solutions are not reliable and are insufficient for addressing the flood risks faced by the community.

While Nepal has established its national risk reduction and management (DRRM) policies the implementation of these policies at the municipal level is inadequate. This research shows that the Bhangaha Municipality lacks specific DRRM policies, procedures, and sufficient financial resources. The lack of these is limiting the ability of the Municipality to prepare for and respond to flood events. Furthermore, the formed disaster management committees are found either inactive or lack capacity which hampers the ability of the municipality to address the flood risks.

According to the study, the role of community engagement in disaster preparedness was found to be the key factor that helps in community resilience. However, the study also suggested that community participation in disaster risk reduction activities is minimal. There is a lack of coordinated early warning systems, and fewer respondents were aware of emergency shelters or community response plans. Additionally, public awareness programs on flood preparedness are insufficient, which correlates with low levels of individual household preparedness as reflected in the data. This ultimately loses and weakens the community's overall capacity to respond to and recover from floods. The findings of the study highlight the challenges faced by the Bhangaha Municipality Ward 1 in managing floods and building long-term resilience in the community.

Despite the challenges, the study has also established that there are adaptive capacitive features of the community like informal early warning mechanisms, strategized seasonal movement, and dependence on social networks for recovery assistance. These informal adaptive mechanisms can still serve as the bedrock on which solid community disaster risk management systems can be built.

Thus, the research answers the research questions and meets the study objectives by establishing that not only social-ecological factors and community perceptions, but also the adaptive capacities and institutional gaps are instrumental in understanding and improving disaster resilience in flood-prone areas, like Bhangaha Municipality, Ward No. 1.

This study, therefore, recommends integration of localized, participatory DRRM planning, refined implementation of policies at ward level, investments into improved infrastructures and long-term early warning systems, and empowerment of vulnerable groups through education and community training programs. These structural barriers must be addressed in order to realize permanence in resilience as the community will remain highly incapacitated in future floods if improvements are not made.

5.2 Recommendations

A recommendation is an opinion and suggestion which is made by the researcher which is based on the study's results, analysis and conclusions. The research recommendations is to provide actionable counsel to a variety of stakeholders including policymakers, practitioners, industry professionals, and individuals involved in the topic being studied.

To effectively solve the effects of flooding and enhance the community resilience recommendations are necessary at different levels. Recommendations at micro, mezzo and macro levels are essential for sustainable recovery and disaster preparedness in Bhangaha Municipality.

5.2.1 Micro Level Recommendation

Micro-level recommendations in research are specific, practical suggestions or interventions stated based on study findings and aimed at resolving specific difficulties or obstacles at a detailed, individual level within the scope of the research. It is a way of helping individuals and families cope with and recover from disasters. At this level, recommendations are targeted to individuals and family.

- Establish community-based counseling services targeted towards the vulnerable population, especially the children, elderly, and those with disabilities. Training of social workers has to be done for trauma care and mental health support for flood recovery.
- Financial literacy and skills development training for families to diversify their sources of income outside agriculture- for instance, introducing climate-resilient practices in agriculture or using alternative generation of incomes.

- Develop training courses on emergency preparedness such as orderly evacuation and flood-proofing homes using locally found materials.

5.2.2 Mezzo Level Recommendation

Mezzo-level recommendations in research are to help address difficulties and encourage positive changes within small groups or organizations. Regarding flood resilience in the community of Bhangaha Municipality, the social workers can work towards strengthening community resilience through collective action and local organizations. At this level, the recommendations are targeted at the community and organizations for better intervention of the problem.

- Mobilize the local communities to conduct disaster preparedness drills focusing on coordinated responses to floods. Include vulnerable groups, for instance, women, children, and the elderly, into evacuation plans.
- Collaborate with local radio stations and leverage mobile alerts to ensure the speedy dissemination of real-time flood warnings and emergency evacuation instructions. The messages should reach remote areas and isolated groups.
- Promote the construction of evacuation safe houses with very basic provisions in the form of food, water, and medicines, making them accessible for all vulnerable groups during floods.

5.2.3 Macro Level Recommendation

Macro-level recommendations focus on large-scale of systemic changes in policy, advocacy, and structural reforms to address the social issues of the communities. In the context of flood resilience in Bhangaha Municipality this level of intervention mainly aims to improve disaster preparedness, strengthen the system, and implement long-term sustainable policies.

- Work with local authorities to monitor and enforce disaster risk reduction (DRR) policies. Provide capacity building in disaster management committees of Bhangaha Municipality. Allocate adequate resources to manage flood risk.

- Promote climate-resilient infrastructure and flood control projects and develop reinforced embankments and drainage systems to reduce flooding risks in flood-prone areas such as in Bhangaha.
- Promote cross-border collaboration in flood mitigation and address the actual causes of flooding within the Ratu Khola watershed regions through integrated watershed management.

To conclude, flood resilience in a society is not achieved through a single solution but through different layers of approach which involves individual, community, and systemic interventions. To reduce the vulnerabilities, strengthen the coping mechanisms and create sustainable solutions one should incorporate micro-level preparedness, mezzo-level coordination and macro-level policy action which should go hand in hand.

5.3 Social Work Intervention

The methods used by social workers to help families, groups, and communities to deal with any social issues, help them enhance their well-being, and improve their ability to cope with different challenges. It is the intentional act performed by social workers to assist anyone with obstacles in improving their overall well-being. The interventions are usually based on social work concepts, theories, and values.

The challenges posed by the recurring floods in Bhangaha Municipality Ward No.1 are essential to address. To address the issues and challenges of recurring floods effective social work interventions play a crucial role. Social work interventions often are done in micro-level, mezzo-level, and macro-level strategies to build resilience and enhance disaster preparedness.

5.3.1 Micro-Level Social Work Intervention

Micro-level social work intervention is often practiced with individuals, families, or small groups, with an emphasis on vulnerable groups such as children, elderly people, people with disabilities, and single mothers. As per the study, the vulnerable groups often lack access to basic resources and struggle with the impact of floods, making the targeted interventions crucial.

- Deliver trauma-informed counseling services for at-risk groups, particularly children, elderly persons, and persons with disabilities who have experienced displacement, anxiety or death as a result of flooding.
- Organize mobile mental health outreach camps in wards that are frequently hit hard to bring services closer to rural and marginalized households.
- Conduct seminars on financial literacy for affected households with an emphasis on loss processing and preparing alternative revenue sources.
- Assist households in accessing government relief programs for compensation for crop damage and/or repairs in the house through documentation and application procedures.
- Promote climate-resilient livelihoods such as fish farming and poultry rearing to reduce dependence on flood-prone agriculture.

5.3.2 Mezzo-Level Social Work Intervention

Mezzo level social work intervention is a practice that focuses on working with small groups or communities to address social problems and promote change. At this level the social work intervention is focused more on strengthening community structures and organizations to improve the disaster resilience of the community.

- Generate or strengthen ward-level disaster preparedness committees with strong involvement of local leaders, youth volunteers along with women's groups to coordinate community response efforts.
- Conduct community awareness sessions on preparedness for floods, emergency evacuation, first aid, and use of safe shelters in the local language using participatory methods.
- Encourage simple, low-cost flood mitigation measures, such as raising the plinth level of houses, constructing barriers with local materials, and preparing household emergency kits.
- Facilitate partnerships with NGOs and cooperatives in areas of vocational training and community rebuilding efforts.

5.3.3 Macro-Level Social Work Intervention

Macro level social work intervention is a type of social work practice that focuses on addressing social problems and promoting change at the broader systemic

or societal level. At this level of social work intervention focuses on influencing the policies, advocating and systemic change ensuring that disaster risk reduction strategies are integrated into national and local development plans.

- Advocating for and asserting the need for disaster risk reduction (DRR) in municipal local plans with provisions for budgets and policies supportive to proactive management of flooding.
- Advocating for long-term investment in structural interventions such as the strengthening of embankments along Ratu Khola improved drainage infrastructure, and flood-resilient dwelling design.
- Collaborate among national and transboundary stakeholders to form an integrated watershed management strategy toward the Ratu Khola basin.
- Disseminate real-time flood information through early warning systems such as SMS alerts and local radio broadcasts to remote areas.

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Research on Community Resilience to Disaster (A place based model)

1. Socio Economic and Demographic Situation

101. Name of the households head:

102. Ethnicity:

103. Sex:

104. Mother tongue:

105. Religion:

106. Status of Loss

A. Complete Loss

B. Partial Loss

107. Total number of Family:

3. Land Income and Livelihood

301. Do you have land in your own ownership?

1. Yes
2. No

302. Type of Land	303. Owners hip 1. Male 2. Female 3. Both	304. Unit 1. Big ha 2. Ropani	305. Area of Land			306. Does the land used in Agriculture or Livestock? (Before Flood)	(After Flood)
			Bigha/Ropani	Kathha/Aana	Dhur/Paisa		
1. Khet							
2. Bari							
3. Ghaderi							

1 ropani=16 aana=64 paisa/1 aana=4 paisa

1 bigha=20 kattha=400 dhur/ 1 katthha = 20 dhur

1 bigha=13.63124 Ropani, 1 Ropani = 1.46722 kathha, 1 kathha = 10.905 aana

307. Do you have land of others?

1. Yes
2. No

308. if yes type of Land	309. Unit 1. Bigha 2. Ropani	310. Area of Land			311. Deal of the land 1. Thhekka 2. Adhiya/Tiya 3. No Deal 4. Mohi 5. Bandhaki 6. Others
		Bigha/Ropani	Kathha/Aana	Dhur/Paisa	
1. Khet					
2. Bari					

312. Do you have irrigation facility in your land (both)?

1. No
2. Partial
3. Yes

313. Sufficiency of agri-products (in month)		314. Have you sold agri-products?			
Before FLOOD	After FLOOD	Before FLOOD	Mention Amount in NPR	After Flood	Mention Amount in NPR
		1. Yes 2. No		1. Yes 2. No	

315. Details of Livestock	316. Do you have livestock ?	317. Number	318. Have you lost livestock in Flood 1. Yes 2. No 3. There were no livestock	319. If yes mention number
1. Cow/Ox				
2. Sheep				
3. Buffalo				
4. Nak/Yak				
5. Pigs				
6. Horse/Donkey				
7. Chickens/ducks				
8. Goat				
9. Others				

320. Does your family have/ had any other kind of other occupation for livelihood?

1. Yes
2. No

321. If yes what is that?	322. Did that occupation effected by FLOOD? 1. Completely Damaged 2. Partial Damage 3.No	323. Did you get compensation from? 1. Other people and relatives 2.Government 3.NGOs 4.No	324. Did you bounce back? 1. Yes 2. Getting Back 3. No	325. How is income? 1. Good 2.Sufficient for livelihood expenses 3. Partial expenses 4. No Income
1. Pawa				
2. Tailoring				
3. Knitting				

carpets and Cloths				
4. Knitting (Wool)				
5. Jewelry				
6. Allo, hangro, Nepali Papers				
7. Metal				
8. Local craft (Doko Namlo Gundri)				
9. Mill				
10. Saw Mill, Furniture				
11. Small cottage industry				
12. Others				

326. Does your family have/ had any other kind of other business for livelihood?

3. Yes
4. No

327. If yes what is that?	328. Did that business effected by FLOOD? 1. Completely Damaged 2. Partial Damage 3.No	329. Did you get compensation from? 1. Other people and relatives 2.Government 3.NGOs 4.No	330. Did you bounce back? 1. Yes 2. Getting Back 3. No	331. How is income? 1. Good 2.Sufficient for livelihood expenses 3. Partial expenses 4. No Income
1. Seasonal (Mobile)				
2. Grocery				
3. Wholesale				

332. Does anyone involved in daily wages work?

1. Yes
2. No

333. If yes can you tell me you income?

.....

334. Do you have bank account?

- 1. Yes
- 2. No

335. Name of Pension, Salary holder member and ID	336. Occupation? 1. Army (Foreign) 2. Security forces 3. Teaching 4. Government Job 5. NGOs 6. Private Company 7. Social Security 8. Others	337. Do you have bank account? 1. Yes 2. No	338. Name of account holder 1. Own 2. Spouse 3. Others	339. Major Expenses 1. Daily Expenses 2. Health 3. Education 4. Saving 5. Other Property 6. Others

340. Did FLOOD affected you job?

- 1. Yes
- 2. No

341. If yes, How?

341. How did you salary help to reconstruction?

- 1. Additional to government grants

2. Livelihood as usual

3. All expenses depends on salary

Access in private and public facility of utilities	Before FLOOD	After FLOOD
401. What is you major source of drinking water? 1. Pipe 2. Tube well 3. Well water 4. Pond 5.Spring 6.Mineral Water 7.Tanker 8. Others		
402. How is your toilet 1. Flush 2. Pan without Flush 3. Improved Pit 4. Traditional Pit 5. Open Space		
403. What is your maid source of energy for cooking? 1. Electricity 2. Bio Gas/LPG gas 3. Firewood 4. Kerosene 5.Dung 6. Others		
404. What is your main source of lights? 1. Electricity 2. Bio Gas/LPG gas 3. Firewood 4. Kerosene 5.Solar 6. Others		
405. Status of Residence? 1. Own house 2.Camp or Temporary Shelter 3. Rent 4. Other's house (FoC)		
406. How many rooms are there in your home?		
407. Is there separate kitchen? 1. Yes 2. No		
408. What material used on roof? 1. RCC 2. Galvanized Sheets 3. Block, Slet, Stone		

4. Wood, bamboo 5. Plastic 6. Hay/ Grass 7. Others		
409. What material used on Wall? 1. Cement 2. Mud 3. Wood, Plank 4. Ply wood 5. Prefab 6. Bamboo 7. Mud, hay, grass 8. Mud 9. other		
410. What material used on floor? 1. Cement 2. Stone 3. Wood, Plank 4. Bamboo 5. Mud/Dung 6. Other		
411. Do you have following item in your home? (Yes- 1, No-2)		
a. TV		
b. Telephone		
c. Mobile		
d. Internet		
e. Laptop/Computer		
f. Cycle		
g. Motorcycle, Scooter		
h. Motor, Car		
I .Washing Machine		
412. Do you have access to following services? How far the services are located? (In minutes)		
a. Market Place		
b. Bank, Cooperatives		
c. Black topped road		
d. Road access		
e. Primary School		
f. Secondary School		
g. Heath Post, PHC		
h. Hospitals		
I .Government Offices (Ward Office, RM Office)		
J. Police Stations		
k. Drinking Water		

510. Did you know about the preparedness strategies before the FLOOD? a. Yes b. No			
511. If yes how do you know? (Sources) 1. Community 2. School/College 3. Government/NOOs/INGOS 4. Media			
512. Have you listened jingles on disaster aired by media? 1. Yes 2. No	513. Do you understand those jingles? 1. Yes 2. Partial 3. No	514. Have ever participated in any meeting workshop, training organized on disaster? 1. Yes 2. No	515. Were the messages from those trainings etc. useful? 1. Yes 2. No
516. Have you ever prepared plan to protect from Natural Disaster 1. Yes 2. No			
516. Have you heard about Disaster Risk Reduction and Management Committee formation in your village? 1. Yes 2. No			
517. Does committee organize DRRM related program? 1. Yes 2. No			
518. If yes have you ever participated in those kind of program? 1. Yes 2. No			

Reconstruction

601. How is the status of your shelters? 1. Camp/Temporary Shelter 2. Sheltering in ground floor after cleaning debris 3. Partially damage so residing in same house 4. New home 5. In Rent 6. Others	
602. Why your home looks like temporary? Why? 1. This is not my permanent place 2. Unavailability of land 3. Planning for new one 4. Under construction	
603. Are you residing in temporary shelter? It is because of FLOOD? 1. Before 2015	

2. Migrated due to disaster				
3. Others				
604. When you are going to build new house?				
1. I won't (go to 605)				
2. Soon				
3. Unable to build				
605. Why?				
1. Unavailability of land				
2. Cannot use land due to disaster				
3. Inadequate land				
4. Due to building code of RM				
5. Others				
606. You have plan to build to house?				
1. Own Money				
2. Government Subsidy				
3. Subsidy and Debt				
4. Debt for Government				
5. Donor's support				
6. Others				
607. What type of house do you want to build?				
1. Private Home(building code)				
2. Building code and importance				
3. I have engineer's design as per building code				
4. Others				
608. Comparing your house, which one in better?			A. Before Flood	B. Before Flood
	1. Good 2. Bad	1. Design		
	1. Adequate 2. Inadequate	2. Number Room		
	1. Bigger 2. Smaller	3. Shape of Room		
	1. Yes 2. No	4. As per need		
	1. Yes 2. No	5. Traditional architecture		
609. Have you ever discuss on the design, expenses, numbers of room and FLOOD resistance during your construction?				
1. Sufficient discussion has been done				
2. No discussion, construct as per design of technician				
3. Got lots of suggestion but could not incorporated				
4 Others				
610. Is your house FLOOD resistance?				
1. Yes I believe				
2. Followed the criteria, so it has to be				
3. I don't this so				
4. Others				
611. How do you like government grant?				
1. I don't need grants				

2. adequate 3. Good, inadequate 4. Not Practical 5. Others	
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701. Did there any disease outbreak immediate after disaster? 1. Yes 2. No If yes, Specify.....	
702. Did disease affected your family? 1. Yes 2. No If yes, How.....	
703. Is your family prepared for next outbreak?	

Questions for ward and municipality KII

- Does the municipality have a formal disaster risk reduction and management (DRRM) Act, plan and policy in place?
- Is DRRM integrated into the municipality's local development plans and budgets?
- Has the municipality allocated a specific budget for DRRM activities?
- Are resources available for community-based DRRM initiatives?
- Does the municipality have an operational Early Warning System (EWS) for natural disasters for flood?
- Are residents aware of and familiar with the EWS in their community?
- Are there community awareness programs about disaster preparedness and risk reduction?
- Does the municipality conduct regular drills or simulations for disaster response?
- Has the municipality conducted any risk assessments for critical infrastructure?
- Have local government staff and community leaders received training in DRRM?
- Has the municipality identified vulnerable groups (e.g., children, elderly, disabled) and integrated them into disaster preparedness plans?
- Does the municipality have an ongoing public awareness campaign on disaster risks and preparedness?
- Is there an effective communication system in place to inform the public before, during, and after a disaster?

Questions for ward and Community FGD

- Are you aware of the types of natural disasters (e.g., floods, earthquakes, landslides) that affect this area?
- Does your household have a plan in place for what to do during a disaster?
- Have you ever participated in any community-level disaster preparedness activities or drills?
- Have you received any warnings or alerts about rising river levels or other disasters from local authorities?
- How effective do you think these warnings are in helping you prepare for disasters?
- Are there any community groups or local leaders actively involved in disaster preparedness and response in your area?
- Do you feel that the community is working together to reduce the impact of disasters?
- Do you know where to go or what to do if you need to evacuate during a disaster?
- Have local authorities ever provided assistance or guidance to your community in disaster preparedness?
- How do you rate the support provided by the municipality during or after a disaster?
- Are there any community buildings or spaces that could be used as shelters during a disaster?
- Are resources (e.g., food, water, medicine) readily available in your community in case of a disaster?
- Do you think there are enough resources allocated for disaster response in your area?
- How do you usually receive information about disasters (e.g., through radio, social media, community meetings)?
- Do you feel that the community plays an active role in managing disaster risks?
- Are there volunteer groups or local teams that help in disaster response in your community?
- After a disaster, how do you think your community recovers? Are there any support

To,

Department of Social work

Tribhuvan University

Kirtipur, Kathmandu

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