

LOCALLY-LED ASSESSMENT OF LOSS AND DAMAGE FINANCE IN NEPAL:

A Case of Melamchi Flood 2021



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Acronyms

COP	Conference of the Parties
DRR	Disaster Risk Reduction
FGD	Focus Group Discussion
KII	Key Informant Interview
L&D	Loss and Damage
NRs.	Nepalese Rupee
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar



Damaged houses at Ganeshe Bagar, Helambu Rural Municipality

Executive Summary

As the consequences of climate change become more severe on a global scale, the extent of associated loss and damage continues to rise. These events entail significant economic and non-economic losses, including loss of lives, infrastructure, livelihoods, and ecosystems. Particularly, communities and individuals in developing countries, such as Nepal, suffer through disproportionate impact due to their high vulnerability, geographical remoteness, dependence on climate-sensitive sectors, and limited adaptive capacities. Ineffective policy implementation, unavailability of compensatory mechanisms, and insufficient political commitment further increase the risk compounded by existing socio-economic inequalities.

This report presents the findings of a study on loss and damage resulting from the Melamchi flood of June 15, 2021. The flood resulted from a combination of anthropogenic and climatic factors that occurred along the Melamchi River Basin. Triggered by intense precipitation upstream, the flooding led to cascading effects along the river channels, resulting in a complex interplay between landslides, river damming, and debris deposition. The findings are drawn from an extensive field visit in the Helambu Rural Municipality and the Melamchi Municipality.

The study has documented lived experiences of loss and damage from 14 key-informants, six in-depth case analysis, six community-level focus group discussions, two municipal consultations, and 120 households survey. Respondents included 46% female and 54% male from diverse ethnic backgrounds. The household survey and municipal consultation analysis illustrate that economic loss per household amounted to USD52,113 (2023). But on average, each household received only about

USD380, with some as little as USD76 while others as much as USD3,800 for reconstruction.

The Government of Nepal and its development partners provided financial support and relief following the incident. Still, a substantial gap of USD51,733^[1] per household remains, posing a challenge for both municipalities. The estimated total economic loss is approximately USD436 million for Melamchi Municipality and USD62 million for Helambu Rural Municipality. To put things in context, the annual budget in both municipalities amounts to USD10.5 million and USD3.8 million, respectively (as of 2023). This scenario depicts that a cumulative budget of even ten years or more would not be sufficient to address the needs and priorities of the affected people. It highlights the urgent need for financial assistance from external sources, particularly national and international funding mechanisms, to recover from the losses and damages of such climate-induced disaster. Larger financial allocations by the international community and the Government of Nepal are essential to fill the financial gaps.

Likewise, nearly all the survey respondents expressed non-economic losses and damages, such as loss of aesthetics, cultural assets, and biodiversity. Mental trauma and anxiety were reported by more than 85 percent of respondents, owing to the loss of houses, agricultural land, and businesses followed by sleeplessness due to fear of flood recurrence. Fever, water-borne diseases, and skin-related infections further exacerbated health issues. Obstruction in human mobility adversely affected 40% of respondents' access to health services and essentials. 73% of respondents mentioned disruptions in education. A profound impact on

¹ Residual GAP = Average Economic loss per HH (USD52,000) – Average Finance support received per HH (USD380)

culture and social interactions has led to reduced community cohesion and shared identity, with 51% of respondents reporting the impacts. Cremation sites, temples, and stupas were damaged, impacting death rituals, with 24% of respondents experiencing an impact. Furthermore, 20% of the respondents reported migration of family members to re-establish a source of their livelihood.

41% of respondents noted gender-specific impacts from the flooding, with women experiencing unique impacts as they had to manage household chores and secure food and water. Out of these, the majority (42%) of the respondents reported increased emotional and psychological impacts, and 40% reported increased workload for women, followed by health and financial effects.

Mobilization of an international fund for responding to climate-induced loss and damage, with a clear policy and a streamlined financial distribution mechanism would significantly help address similar incidents effectively. Collaboration and partnership remain vital among governments, non-governmental organizations, and communities to avert, minimize, and address climate-induced losses and damages. A comprehensive multi-hazard risk assessment, and loss and damage action plans for recovery and rebuilding are required to address short- and long-term risks, emphasizing resilience, sustainability, and intersectionality. In addition, affected communities should be provided with long-term assistance to rebuild infrastructure, agriculture, livelihood-related activities, mental health, culture, and social interaction.



Participatory FGD at Halde, Helambu Rural Municipality



Chanaute Bazaar after the flooding

Key Findings (Economic)



Almost
USD 5 million
total economic loss estimated
due to Melamchi Flood (in 120
survey respondents).



On average, each
household suffered an
economic loss of
USD 52,113
by the flood.



33%
of the respondents
mentioned that they
had lost their land
by the flood.



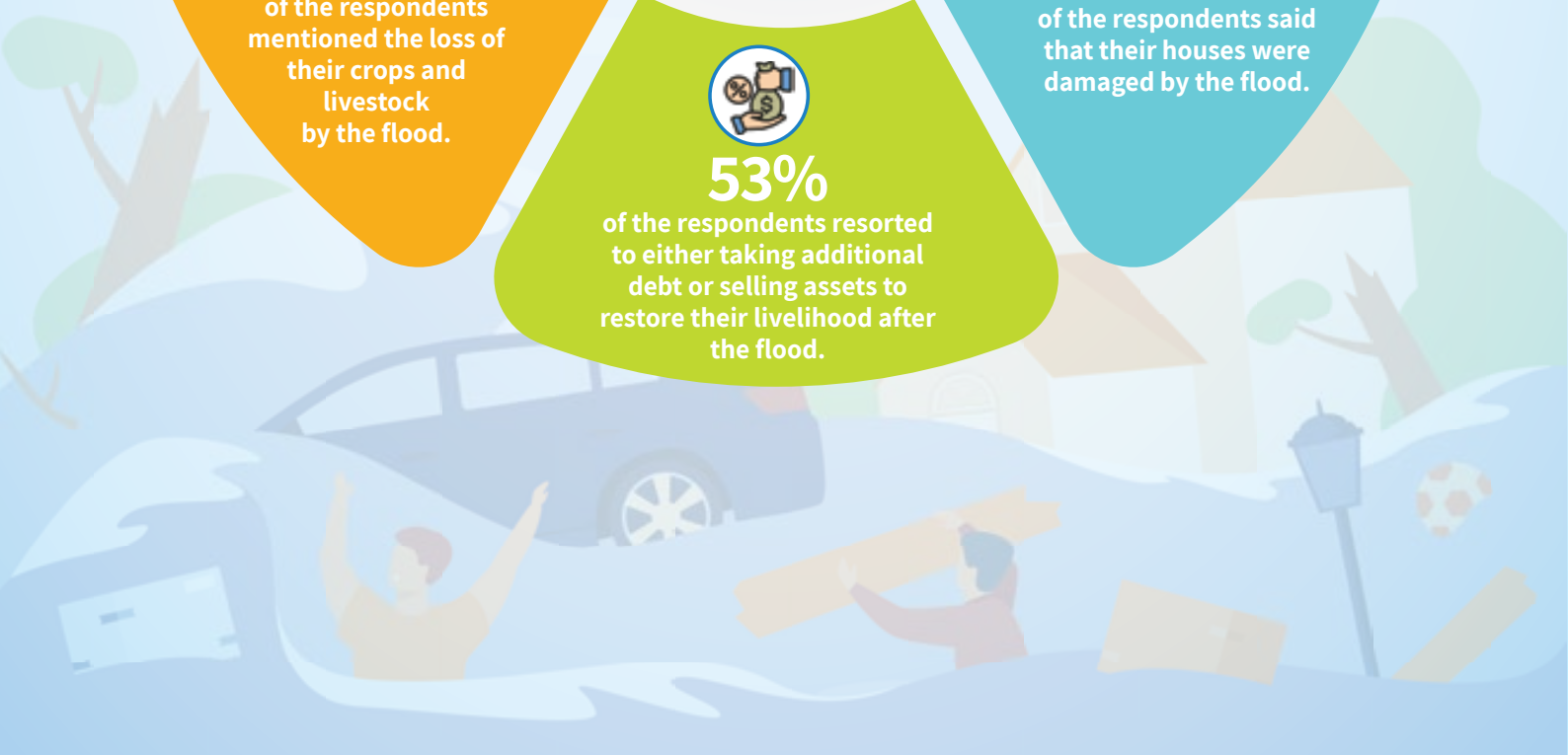
30%
of the respondents
mentioned the loss of
their crops and
livestock
by the flood.



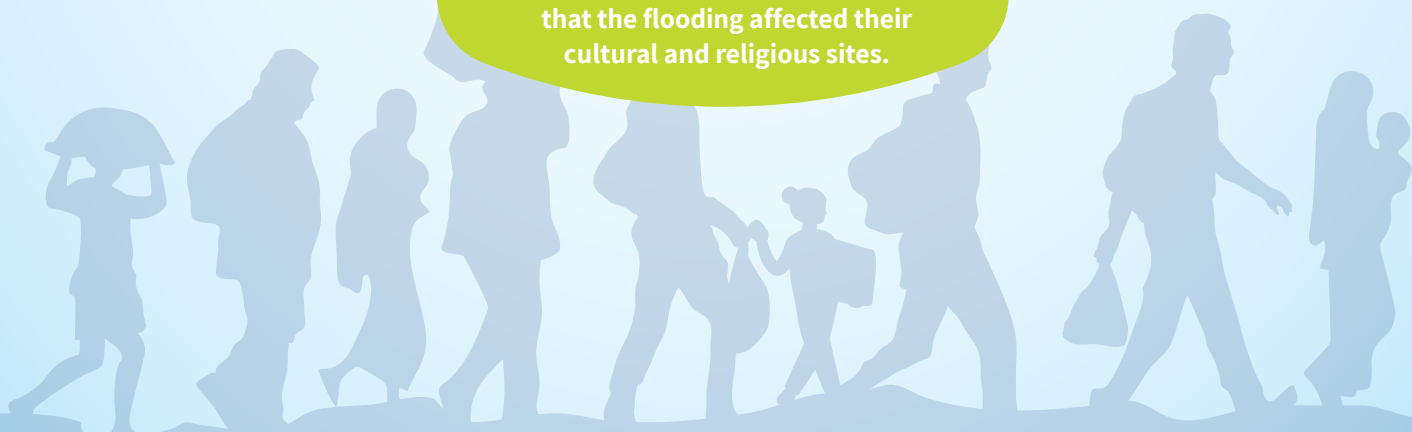
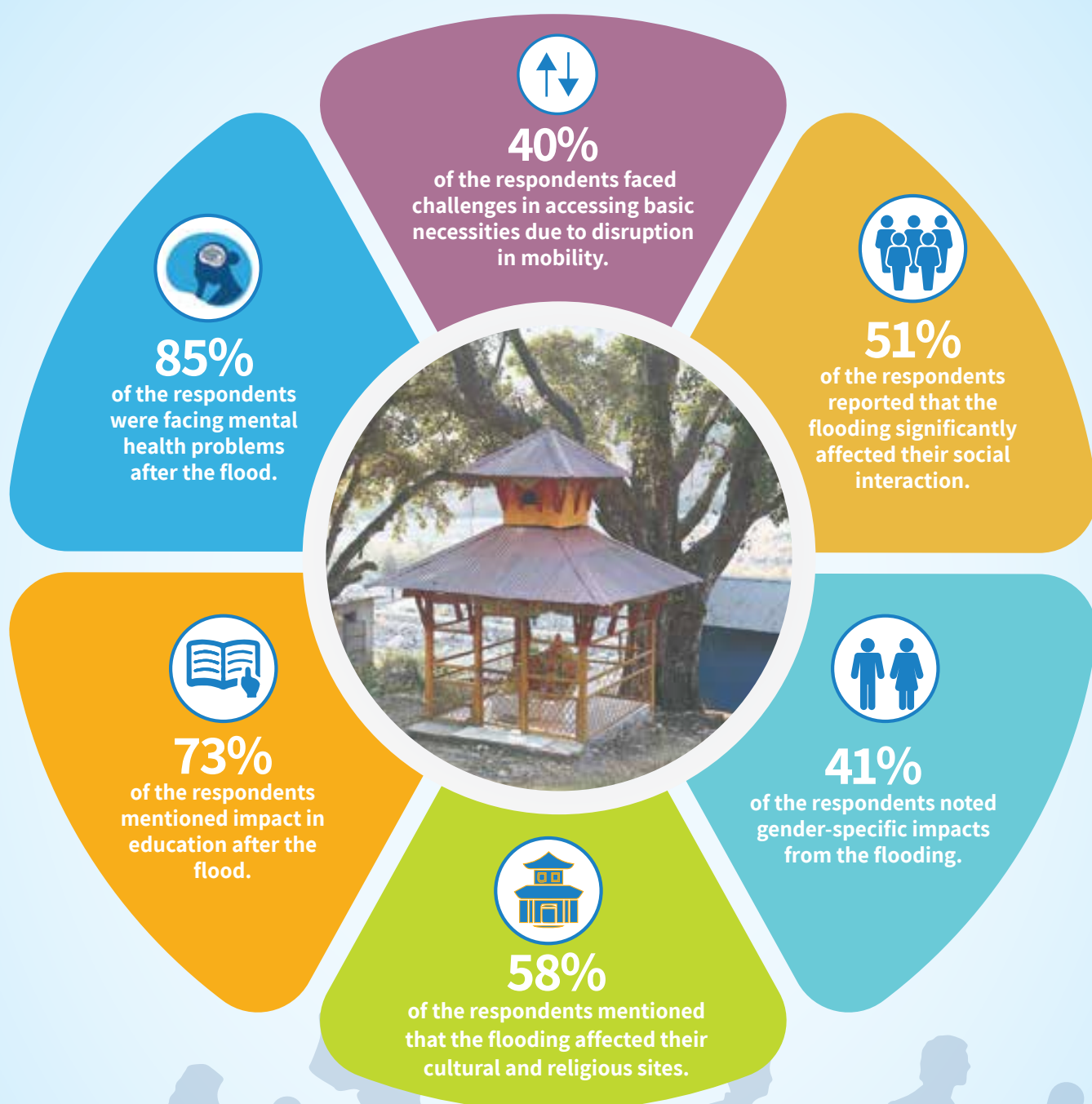
25%
of the respondents said
that their houses were
damaged by the flood.



53%
of the respondents resorted
to either taking additional
debt or selling assets to
restore their livelihood after
the flood.



Key Findings (Non-Economic)





Vulnerable houses in Gyalthum, Helambu, exposed to imminent threat of flooding and landslide

1. Introduction

1.1 Background

Nepal's susceptibility to the effects of climate change, given its mountainous landscape and dependence on agriculture and natural resources, leads to recurrent losses and damages, including human casualties, infrastructure and environmental harm. Climate-induced disasters cause approximately 65% of annual casualties in Nepal (MoFE, 2021). For example, a nationwide landslide in 2014 caused a significant loss of life and property, with an estimated yearly loss accounting for 0.08% of the country's Gross Domestic Product (GDP) (MoFE, 2021). The Jure landslide on August 2, 2014, in the Sindhupalchowk District of Nepal killed 156 people and severely impacted health and other critical infrastructures (Van der Geest, 2018). Similarly, the Melamchi flooding on June 15, 2021, caused extensive damage with disruption to the livelihood and economy (Maharjan et al., 2021).

Climate-induced disasters cause approximately 65% of annual casualties in Nepal. A nationwide landslide in 2014 caused a significant loss of life and property, with an estimated yearly loss accounting for 0.08% of the country's Gross Domestic Product.

Loss and damage (L&D) is recognized under the United Nations Framework Convention on Climate Change (UNFCCC). Recently, operationalization of a dedicated fund during the 28th Conference of the Parties (COP) provided further momentum to advance L&D discourse. The fund can play a pivotal role in assisting the most vulnerable countries affected by climate change. However, as international efforts to enhance cooperation intensify, it is essential to understand the precise financial needs of local communities.

In this context, the Prakriti Resources Centre (PRC), in collaboration with the Stockholm Environment Institute (SEI), commissioned this case study focusing on the repercussions of climate-induced hazards in Nepal, using the 2021 Melamchi flood as a specific case. This study is intended to establish a robust groundwork for identifying and evaluating the financial requirements necessary to tackle the challenges associated with loss and damage in the face of a shifting climate.

1.2 Conceptualizing loss and damage

“Loss and damage” in the context of climate change refers to the consequences that exceed human capability for adaptation and mitigation (WRI, 2022). L&D have been categorized as avoided, unavoided, and unavoidable losses and damages (Verheyen and Roderick, 2008). Those avoided by Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) interventions are the avoided losses and damages. The residual impacts and risks are characterized by limits impeding avoidance and reduction (Warner and Van der Geest, 2013). Figure 1 depicts the comprehensive climate risk layering approach and the associated finance options, adapted from Mechler et al. (2014).

The debate on L&D has gained significant momentum over the last few years. L&D was first broadly discussed during COP13 of the UNFCCC in 2007, and the institutional arrangements to address L&D was then considered at COP18 in 2012. In 2013, negotiators at COP19 led the establishment of the “Warsaw International Mechanism (WIM) for Loss and Damage associated with climate change impacts”. Further, the Paris Agreement, in 2015 at COP21, recognized a separate article on L&D endorsing the mechanism (UN, 2015), followed by establishment of the Santiago Network to facilitate technical assistance and accelerate implementation in the most vulnerable countries.

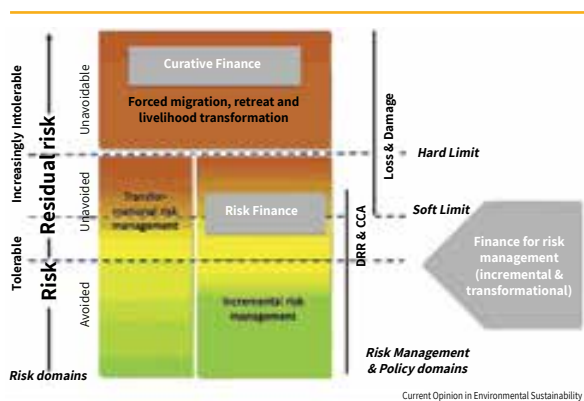


Figure 1: Comprehensive climate risk layering approach and the associated finance options (Mechler et al., 2014)

The UNFCCC has classified loss and damage as economic and non-economic. The resources, goods, and services lost that have economic value and can be quantified in monetary terms are included in the economic loss. Non-economic L&D refer to a broad range of losses that are not in financial terms and are not commonly traded in markets (UNFCCC, 2023). The non-economic losses and damages encompass loss of cultural identity, places, human health, and environmental aspects (Serdeczny, 2019). While these losses are significant and can have a profound impact on individuals, they can be challenging to assess and quantify objectively (Fankhauser and Dietz, 2014, Serdeczny et al., 2016a). As a result, they are often excluded or limited in assessments of losses and damages, particularly in economic and legal contexts (Serdeczny et al., 2016b). One reason for excluding non-economic L&D in assessments is the difficulty of assigning a monetary value to these intangible losses and damages. Determining an appropriate compensation amount becomes challenging due to the lack of objective measures and relative values of the non-economic assets concerning context, location, and perceived value by the individuals (Serdeczny et al., 2016a).

1.3 Loss and damage in the context of Nepal

The definition of L&D for Nepal is based on a global discourse that highlights the country's ecological and social diversity as it "represents the actual and/or potential negative manifestations of climate change on sudden-onset extreme events, such as heatwave and extreme rainfall and slow-onset events such as

snow loss, droughts, glacial retreat to which people in Nepal's mountains, hills, and terai are not able to cope with or adapt to as the country's natural ecosystem, infrastructure and institutions are overwhelmed, leading to the losses of life, livelihoods, including losses of cultural heritage" (MoFE, 2021).

Loss and Damage represents the actual and/or potential negative manifestations of climate change on sudden-onset extreme events, such as heatwave and extreme rainfall and slow-onset events such as snow loss, droughts, glacial retreat to which people in Nepal's mountains, hills, and terai are not able to cope with or adapt to as the country's natural ecosystem, infrastructure and institutions are overwhelmed, leading to the losses of life, livelihoods, including losses of cultural heritage.

Nepal stands at the forefront of both rapid and slow-onset events, characterized by increasing glacial retreat, drought, and Glacial Lake Outburst Flood (GLOF) events. Downstream communities face a substantial risk of potential flood outcomes, including the loss of lives, damage to infrastructures, and the displacement of communities. Landslides and erosion have also become increasingly prevalent, affecting both physical infrastructure and the livelihoods of local inhabitants. These events have resulted in significant biodiversity loss, economic setbacks, health risks, and disruptions to social and cultural practices.

As part of the second Nationally Determined Contribution (NDC), determining L&D brought on by climate change has been a critical area of interest to the Government of Nepal. In addition, Nepal's National Climate Change Policy 2019 also emphasizes the necessity of researching L&D associated with climate change impacts and implementing measures to reduce climate change-related vulnerabilities.

DRR practitioners in Nepal use several methods and tools to assess post-disaster impacts in different time

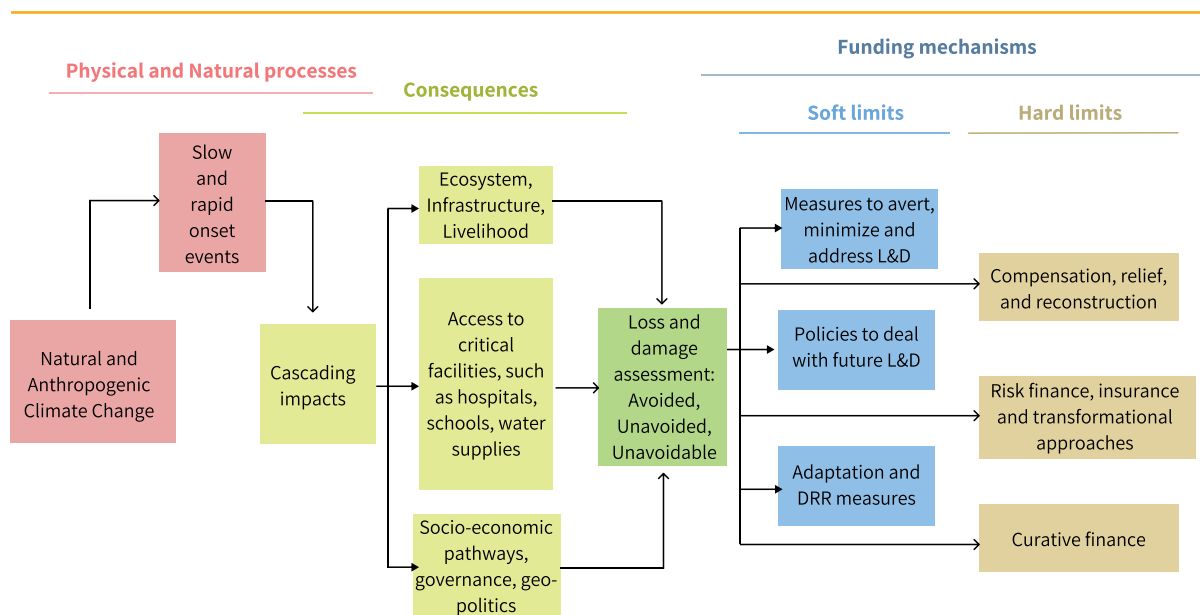


Figure 2: Framework for climate change-induced loss and damage assessment (modified based on the recommendation from Nepal’s National Framework on Climate Change Induced Loss and Damage)

intervals after the event to support post-disaster response, recovery, and rehabilitation. The methods and tools are Local Disaster and Climate Resilience Plan (LDCRP), Initial Rapid Assessment (IRA), Multi-cluster Initial Rapid Assessment (MIRA), Cluster Specified Detailed Assessment (CSDA), and Post-disaster Needs Assessment (PDNA). These methods and tools are used for both climatic and non-climatic disasters (Singh et al., 2021). However, such tools are mostly focused on assessing post-disaster economic losses to facilitate relief and rehabilitation, often excluding non-economic loss and damage. L&D assessment can only adequately reflect a post-disaster situation if it recognizes the suffering of the affected people and offers a solid foundation for future policy to prevent, reduce, and address L&D. Therefore, research on L&D is essential for disaster relief, reconstruction, compensation following a disaster, and ultimately to promote activities that reduce disaster risk. The methods can be a valuable tool to estimate losses & damages value of affected households incurred by the disasters or the amount and type of relief required during the post-disaster period and facilitate recovery.

Globally, several frameworks for performing loss and damage analysis are available, out of which Nepal’s National Framework on Loss and Damage, 2021, has identified seven different frameworks relevant to the national context. Furthermore, it has recommended a modified framework to best represent the national context. However, this needs to be tailored to fit the local context of Melamchi by incorporating socially and culturally appropriate techniques for loss and damage assessment (Figure 2).

1.4 Rationale of the study

Flooding remains a significant hazard in Nepal, devastatingly impacting people, livelihoods, infrastructure, and the environment. The Melamchi flood is a recent example of such hazard. A combination of factors such as heavy rainfall in a short period, topography, and infrastructure vulnerabilities led to such an unprecedented flooding and debris flow. Furthermore, the scale of the impact caused by this incident has been significant, leaving both the affected people and the local government still struggling to recover.

The flood transported large-scale upstream debris and deposited in downstream regions, adversely impacting human settlements, agricultural land, livelihoods, and vital infrastructures, such as roads, bridges, hydropower plants, and electric poles. The significantly damaged market centers were Chanaute Bazaar in Helambu Rural Municipality and Melamchi in Melamchi Municipality. A total of 91.57 hectares of agricultural land, a lifeline for farmers who rely on subsistence farming, had been lost in the Melamchi Municipality alone. Communities living in close proximity to the river, especially the riparian communities with high dependence on the river for their livelihood, were particularly impacted. The incident also posed challenges to meeting vulnerable groups' basic needs, raising questions about their ability to continue with their traditional livelihoods.

Studying the long-term consequences of this flooding incident helps to gain a comprehensive understanding of economic and non-economic losses and damages incurred. It further helps to identify the persisting needs of the affected population, thereby facilitating targeted support and intervention strategies. It is crucial to comprehend the implications of such incident and the potential risks it poses to develop effective strategies for preparedness and minimize future loss and damage. In addition, it is essential to consider the likelihood of similar incidents occurring in the future. Climate change, unplanned urban development activities, weak technical capacity of the local people, and other factors may increase the region's vulnerability to such events. Hence, by thoroughly assessing the L&D caused by the incident, this study can estimate potential future resource needs and provide quantified evidence for urgent technical and funding requirements to address climate-induced losses and damages. This study aims to fill the knowledge gap in terms of future risk assessment and enable proactive planning for sustainable disaster risk management.

This study focuses on the Melamchi flood as a case study to assess L&D and the financial need to address the impacts of a rapid-onset hazard in the mountain ecosystem, such as in the Helambu and Melamchi municipalities. The study helps identify and quantify the losses and damages caused by flood on economic activities, environmental ecosystem, culture, health, and the social dimension of impacts. It also contributes to developing effective strategies for disaster resilience and ensuring the well-being of the affected communities in the face of changing climate.

1.5 Objectives

The objective of this study is to assess the funding requirements for locally led actions to address L&D incurred by floods in the Melamchi Municipality and the Helambu Rural Municipality. The specific objectives are:

- Identify loss and damage (economic and non-economic) incurred in the communities impacted by the flood.
- Estimate the costing of loss and damage borne by the communities through quantification of L&D.
- Build evidence to advocate for funding needs for L&D to fit in the national and international financing system.

2. Study Area

The study area covers a 18-kilometer stretch of the Melamchi River, including Helambu Rural Municipality and Melamchi Municipality in Nepal’s Sindhupalchowk District. Elevations in these municipalities range from 712 to 5,747 meters above sea level (Figure 3). Table 1 provides the demographic information of the two municipalities.

Helambu Rural Municipality has a sub-tropical climate in the lower region, extending to the Alpine and Nival zones. Most of its terrain is filled with beautiful hills and is located in the lap of the Yangrima hills, near the Jugal Himal. Hyolmo and Tamang castes reside in the higher altitudes, and Brahmin, Chhetri, and Dalit caste people live in the lower Besi area. Helambu is famous for the view of the mountains and the residence, lifestyle, and customs of the Hyolmo, Sherpa, and Tamang tribes, attracting foreign tourists. The Melamchi River, other small streams, and the Gohore and Timbu Rivers flow through the municipality. Chanaute Bazaar, in the lower part of the municipality, is a major economic zone for the people of Helambu. This study focused on major flood-impacted areas, including Timbu, Halde, Kiul, Chanaute, and Gyalthum, representing the upstream and midstream regions of the Melamchi River stretch in the Helambu region.

Similarly, Melamchi Municipality lies south of Helambu. The lower region of Melamchi valley has a subtropical climate, while higher up, the temperature is cooler. With increasing altitude, some places in the municipality are cold throughout the year.

Since the municipality is in the southeast monsoon-affected area, there is plenty of rainfall from June to September. The main watershed areas of the city pass through low-pressure air. Hence, there is more rain in this area. The major part of the Melamchi Valley is highly landslide-prone and geologically fragile. The municipality lies under the Mahabharata region and is considered important for its biological diversity. Melamchi Bazaar is one of the major settlements and economic zones of Melamchi Municipality. The downstream stretch of the study represented Tamarang and Melamchi Bazaar in the Melamchi Municipality.

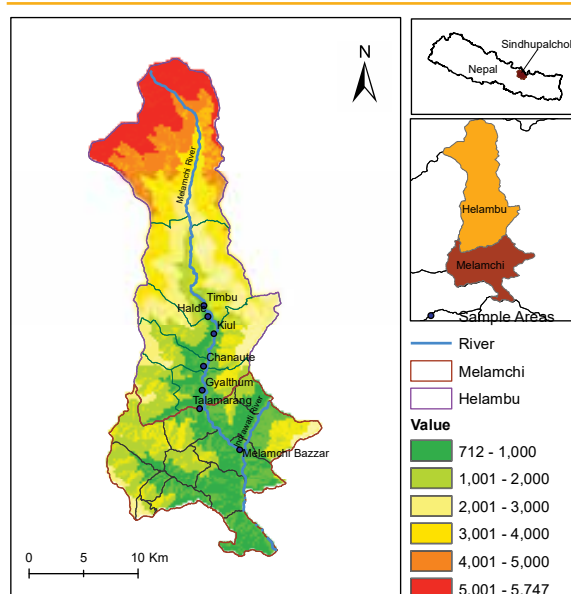


Figure 3: Location and elevation map of the study area

Table 1: Demographic information of the study area

Municipality	Total Area (sq. km)	Total Population (2021 Census)	Total Households (2021 Census)
Helambu	287.26	17,723 (8,907 Male & 8,816 Female)	4,589
Melamchi	158.17	41,170 (20,073 Male & 21,097 Female)	10, 811

2.1 Melamchi flood and associated losses and damages

The Melamchi flood is a result of anthropogenic and climatic factors and processes at various locations in the Melamchi River stretch. Intense upstream rainfall caused the Melamchi flood, intensifying downstream hazards (Maharjan et al., 2021; Takamatsu et al., 2022; Talchabhadel et al., 2023). Nepal's Department of Hydrology and Meteorology (DHM) noted heavy rainfall in the Melamchi and Indrawati basins on June 9, 2021, with the highest hourly rainfall reaching 37 millimeters (mm) on June 11. Nearby, the Shermathang village experienced more than 100 mm of rainfall on June 11, with the Shermathang station receiving over 200 mm of rainfall during six days. This intense rainfall in a short period, combined with snowmelt caused erosion in the headwaters of the Pemdang River, Yangri River, and Larche River, resulting in the formation and subsequent collapse of a landslide dam in Bhemathan. This landslide blocked the Melamchi River, creating a natural dam whose eventual outburst resulted in flood that destroyed settlements, bridges, and roads downstream. The situation was exacerbated by heavy rainfall runoff, possible glacial lake outbursts, and moraine erosion in the Pemdang River region. This resulted in riverbank failures, landslides, and another flooding incident occurring on August 1, 2021, possibly attributed to substantial rainfall and

the erosion of sediment from the prior flood (Adhikari et al., 2023; Maharjan et al., 2021; Takamatsu, 2022).

The evidences suggest that a heavy rainfall and a sudden temperature rise in June 2021, caused a glacial lake outburst resulting in a debris flow in the upper part of the catchment. It led to the collapse of a steep section of the river channel in Bhemathan, which already had a significant amount of sediment accumulated. Hence, toe erosion and continuous rainfall in the catchment resulted in a major landslide downstream near Melamchi Ghyang. The landslide blocked the river, creating a natural dam. The breach of this dam caused another outburst of flood. These outbursts eroded the river banks, and the eroded material was deposited in the headwaters area and further downstream. Additionally, the floods and prolonged rainfall saturated the soil and intensified the existing landslides as well as numerous landslides in the Melamchi River catchment, making it more vulnerable to slope instabilities.

Figure 4 describes the longitudinal profile of the Melamchi-Indrawati River, showing various processes leading to the disaster.

The preliminary analysis suggests the breaching of a temporary landslide dam that blocked the river in the upstream (ICIMOD, 2021). The deposition of an enormous amount of debris transported from

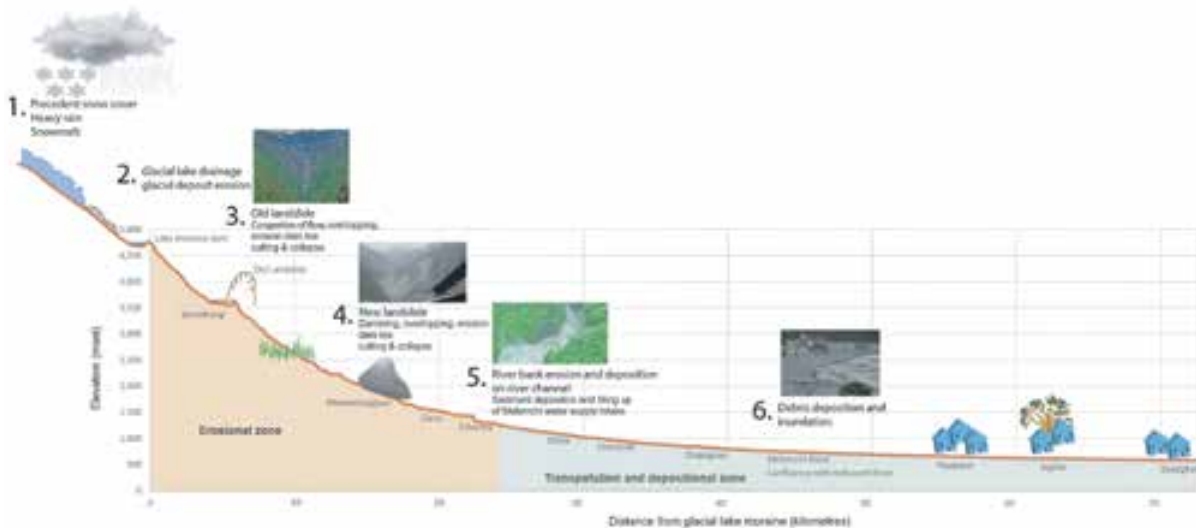


Figure 4: Longitudinal profile of the Melamchi-Indrawati River showing various processes leading to the disaster

(Source: ICIMOD, 2021)

upstream in Melamchi town and along the Melamchi riverbed caused loss of life and extreme destruction to critical infrastructures and livelihoods (Talchabhadel et al., 2023).

Figures 5 and 6 illustrate the difference before and after the incident at Melamchi and Chanaute Bazaar. In addition, the headworks for the USD800 million Melamchi Project supplying water to Kathmandu were destroyed by the flood events. An assessment by Joshi et al. (2021) suggests considerable increase in sediment load along the downstream of Melamchi River, devastating infrastructures and land within the proximity of river.

The flood completely damaged 539 households resulting in the loss of one life, injuries to six individuals and 23 people reported missing (Adhikari et al., 2023). The flood also caused significant

destruction to infrastructure, including the Melamchi-Timbu road, trail bridges, motorable and suspension bridges, a hydropower project, and the headwork of the Melamchi Water Supply Project. In addition to this, it also damaged agriculture fields, trout, poultry, and pig farms. Melamchi and Chanaute communities witnessed severe impacts, leading to buildings being either washed away, heavily covered in sediment, or damaged. Conversely, in Chanaute bazaar, where the riverbed had a steep slope, sizable boulders struck the structures directly, resulting in substantial damage and structural collapses (Dahal et al., 2023; Gautam et al., 2022; Pandey et al., 2021).

The flood in Melamchi on June 15, 2021 completely damaged 539 households resulting in the loss of one life, injuries to six individuals and 23 people reported missing.



Figure 5: Melamchi town before (left) and after the debris deposition (right)

(Source: Google Earth Observation)



Figure 6: Chanaute town in Helambu before (left) and after the debris deposition (right)

(Source: Google Earth Observation)

Pre-flood, the land cover included built-up areas, barren land, cropland, vegetation, and water bodies covering 1794.10, 17967.33, 616.99, 23455.89, and 76.59 hectares, respectively (Figure 7). Post-flood, water bodies expanded to 102.86 hectares, cropland decreased to 604.33 hectares due to riverbank damage, and built-up areas increased as people resettled uphill. Forested areas saw a notable decline.

According to the precipitation data extracted from the National Aeronautics and Space Administration (NASA) satellite observatories between 1981 and 2021, estimated at an elevation of 3,390 meters above sea level, around the Bhemathan area, the total average

annual rainfall was highest in 2013 (33 mm). Figure 8 shows that the average annual rainfall drastically increased in 2003, and the trend is increasing over the years. Similarly, the daily precipitation and daily maximum temperature of June 2021 were also observed at the same point. It was found that the highest precipitation occurred on June 15, which was around 168 mm.

Similarly, the daily maximum temperature for June 2021 was recorded highest (20.73 degrees) on June 9, as shown in Figure 9. Such an abrupt rise in temperature might have contributed to glacier melting resulting in the cascading impacts.

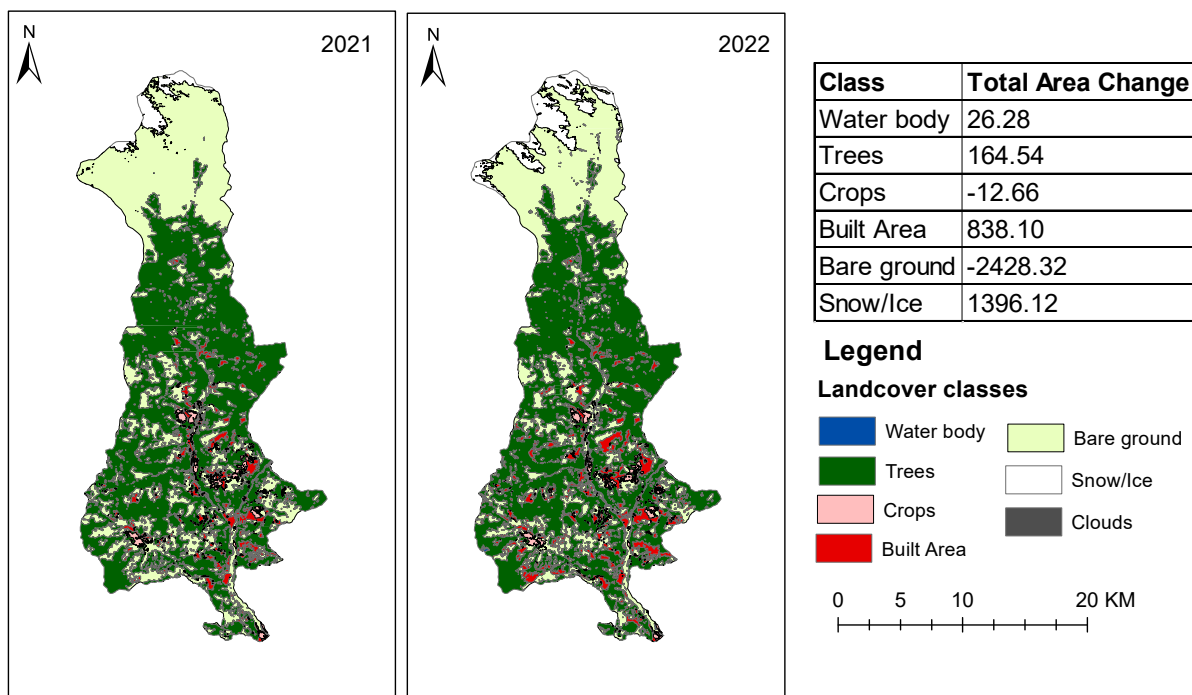


Figure 7: Land cover change detection map of the Melamchi and Helambu Region (2021 - 2022)

(Source - Esri Land Cover <https://livingatlas.arcgis.com/landcover/>)

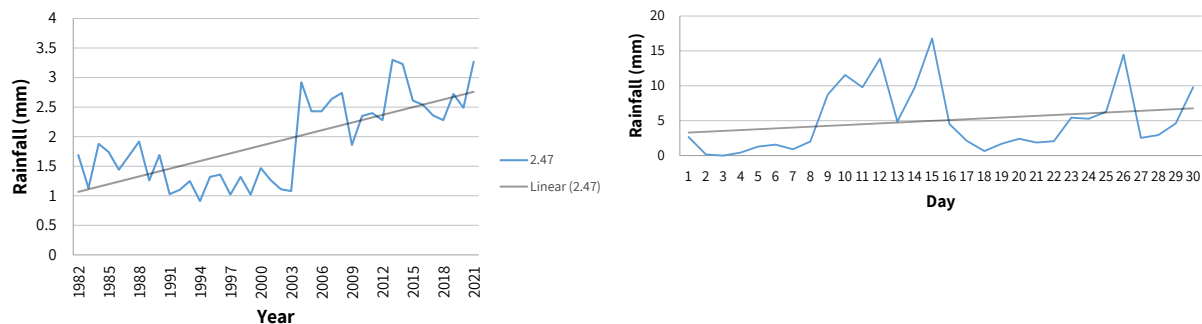


Figure 8: Annual average (1981 - 2021) and daily maximum precipitation (June 2021)

(Source - NASA <https://power.larc.nasa.gov/data-access-viewer/>)

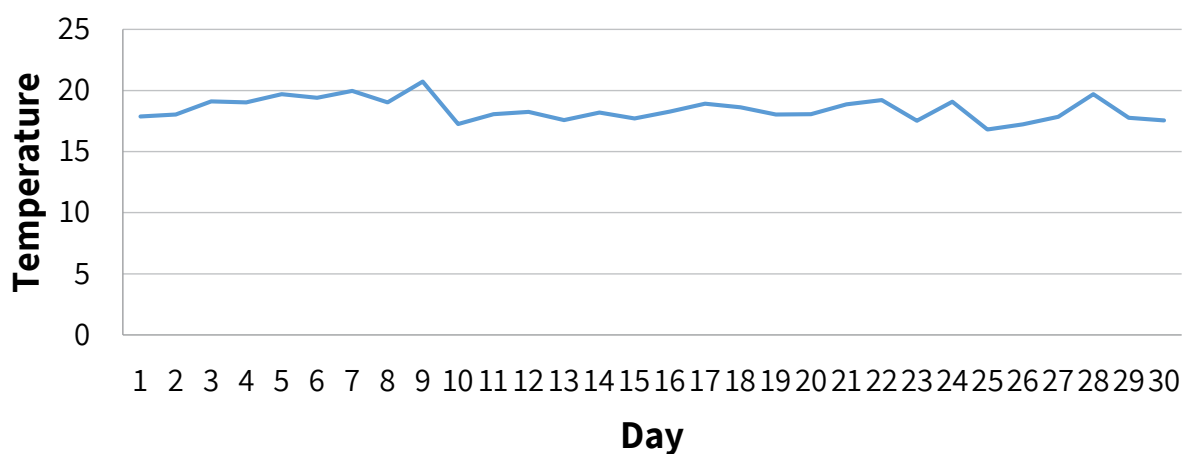


Figure 9: The Daily Maximum Temperature (June 2021)

(Source - NASA <https://power.larc.nasa.gov/data-access-viewer/>)



Damaged school near Gyalthum, still waiting for restoration

3. Methodology

A mixed-method approach was adopted to identify and assess the local context of climate change and L&D issues. The method was crucial in understanding the challenges and opportunities in addressing L&D at the community level by integrating both quantitative and qualitative data via primary and secondary

sources of information. The flowchart in Figure 10 shows the data collection strategy along with the assessment and funding interventions (recovery and reconstruction). Likewise, Table 2 elaborates on the breakdown of tools used for data collection, analysis, and information sources.

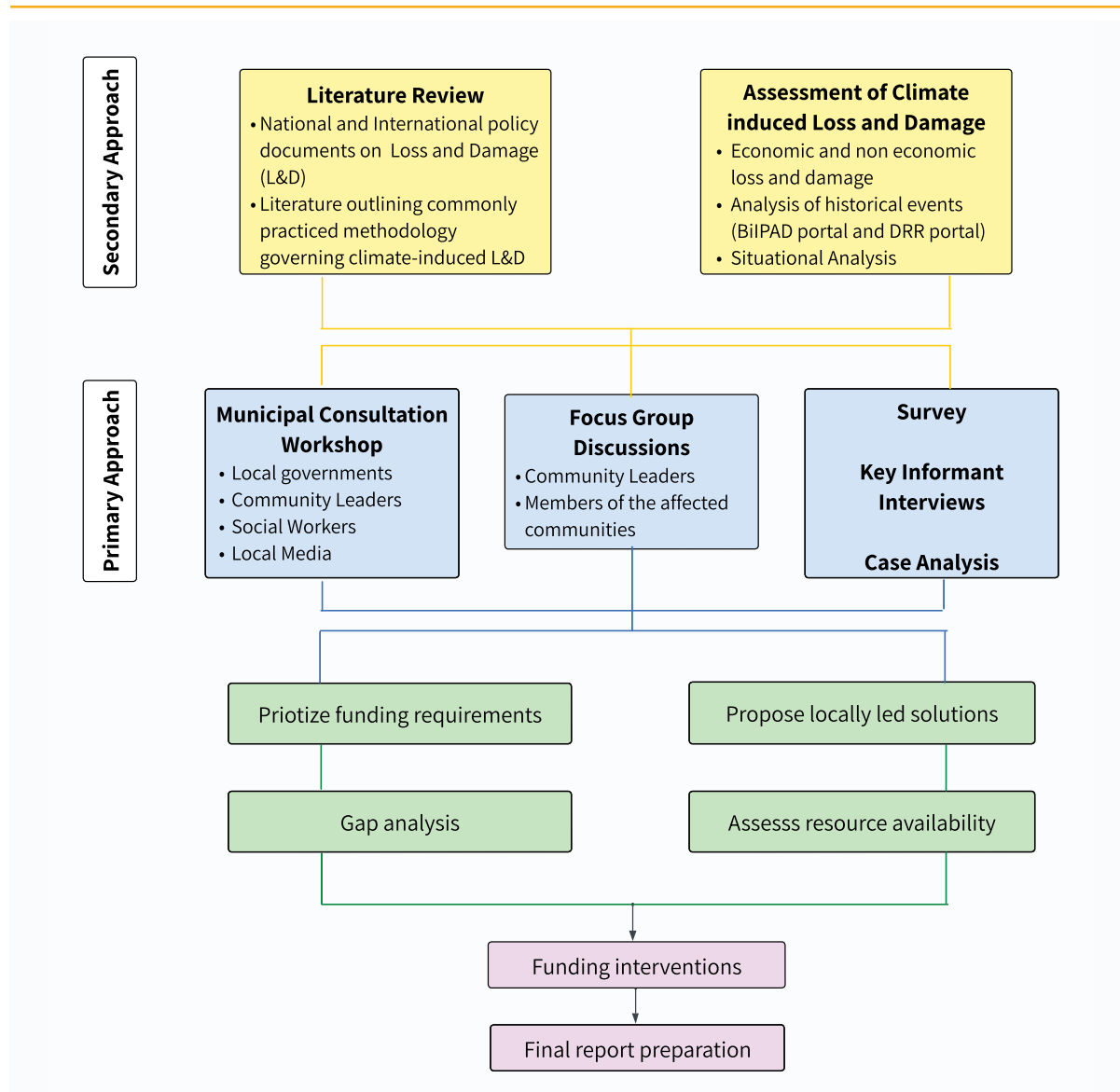


Figure 10: Methodological flow

Table 2: Tools and methods to assess the impacts of flood

Quantitative approach				
Types of Indicators	Cost indicators	Primary /Secondary data sources	Method of Analysis	Tools
Economic	<ul style="list-style-type: none"> Damage to physical structures, public infrastructure (such as irrigation channels, water pipelines, roads, culverts, dams, schools and hospitals) and livelihood assets, loss of agricultural assets (such as livestock and farms) 	<ul style="list-style-type: none"> Municipal records Bipad/DRR portal Agriculture offices Household surveys 	Economic	Cost estimation
Qualitative approach				
Types of Indicators	Cost indicators	Primary /Secondary data sources	Method of Analysis	Tools
Human, social, natural and cultural losses	<ul style="list-style-type: none"> Physical and mental illness (such as injuries, disability, trauma) Loss of life, education, employment, ecosystem, culture and traditional knowledge 	<ul style="list-style-type: none"> Municipal records, Bipad/DRR portal Household survey, FGD & KII, secondary sources 	Non-Economic	Case analysis/Box stories

3.1 Literature review

Both peer-reviewed and gray-literature relating to disaster risk reduction, climate change adaptation, loss and damage were reviewed, along with methodologies suitable for assessing climate-induced L&D.

3.2 Municipal consultation workshop

A one-day municipal consultation workshops were organized to identify the focus area and the most flood-affected communities within Melamchi Municipality and Helambu Rural Municipality. The workshops were conducted on May 3, 2023, in Melamchi Municipality and on May 4, 2023, in Helambu Rural Municipality. In addition, the workshop included the municipalities' respective Mayor and Deputy Mayor, DRR focal person/s, engineers, head of the

planning section, as well as representatives of local communities and thematic experts. The workshop included questionnaires to understand the loss and damage at the municipal level, the key sectors that were impacted by the flood, and the response measures from the municipality (Annex I).

The experiences and insights shared by the emergency responders were crucial in understanding the risk zones and the intensity and severity of the flooding event. It provided an overview of the economic and non-economic losses and damages incurred by the flooding event. In addition, it documented the locally recommended adaptation action to reduce the risk from such hazards. The workshop concluded with the identification of potential areas to focus for community discussions and data collection.

3.3 Household survey

The household surveys considered severely affected households from both the municipalities. The total number of households damaged were 252 in Helambu and 287 in Melamchi, totaling 539 (Adhikari et al., 2023). These 539 households were considered as a survey population.

The sample size was calculated to be 118 at 95% confidence level with 8% of margin of error. However, 120 samples were surveyed to distribute samples equally, where 40 represented the upstream region of the Melamchi River stretch (Helambu region), and 40 samples were from midstream, from Chanute Bazaar to Gyalthum, one of the hardest-hit towns by the Melamchi flood. Similarly, Melamchi Bazaar was represented by 40 household samples along the downstream region of the Melamchi riverbank. The following formula was used to calculate the sample size (Ahmad and Halim, 2017):

$$Sample\ size = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

The survey was administered through the Kobo toolbox on android mobile phones and data analysis was performed through Microsoft Excel and SPSS (Statistical Package for Social Sciences). The survey provided a scenario of both economic and non-economic losses and damages incurred by the families, along with government interventions in addressing their losses and immediate and long-term priorities. In addition, it provided quantitative data on the losses and damages, which served as a foundation for estimating the total economic loss. The households were selected through a purposive sampling method to ensure that the voices of the affected families were represented. In addition, representativeness and diversity were ensured to incorporate vulnerable groups, such as women, indigenous communities, and different ethnic groups in the sample. Hence, the survey was a vital tool that provided the social structure of the community and compound vulnerabilities to prioritize L&D funding and adaptation support accordingly (Annex II).

3.4 Focus group discussion

A total of six Focus Group Discussions (FGDs) were organized with an average of 10 people per group, including community leaders and affected community members. The discussions generally took around 80-90 minutes and were collaborative and gathered insights on the socio-economic impacts of the flood.

The satellite image of six pre-identified locations before and after the flood scenario were printed using Google Earth Pro, GIS, and OpenStreetMap. The maps were printed in A3 size detailing relevant features, such as roads, buildings, water bodies, and other landmarks. Participants were then asked to identify resources on the map, such as hospitals, schools, community centers, or other relevant institutions, along with their individual houses and land areas (Annex III). They were further requested to mark the impacts and associated changes resulting from the flooding event in the selected community. Likewise, potential vulnerable places were observed. The respondents were also asked to share their experiences and insights into the impact of flooding in the area.

The FGDs provided information to better understand existing capacities and vulnerabilities in the community which can be crucial in guiding future planning and understanding the resource needs and prioritization (Annex II).

3.5 Key informant interview

Key Informant Interviews (KIIs) were conducted with selected people who could provide expert knowledge and experience in the Melamchi flood. The first step to conducting these interviews was identifying the key informants, who were selected based on municipal consultation and document review. Then, the snowball sampling method was used to recruit more respondents through referrals. Finally, in-depth interviews were conducted with the respondents to understand the impacts of floods and the specific recovery activities funded by L&D finance that are not currently covered by the current financial mechanisms through humanitarian aid, mitigation, and adaptation support.

The KIIs were conducted on May 3, 2023, in Melamchi Municipality and May 4, 2023, in Helambu Rural Municipality. During the interviews, 14 key informants were interviewed in both municipalities. The informants included the Mayors, Deputy Mayors, and DRR focal persons, as well as engineers and the head of the planning department. A checklist was developed to facilitate the process (Annex I). The respondents were also asked to share their experiences and insights into the impact of flooding in the area. The list of key informants is presented in Annex IV.

3.6 Case analysis

Representative cases drawn from the FGDs, KIIs, stakeholder consultations, and surveys were used as a major tool to provide in-depth insights for case analysis into the non-economic losses and damages. Six such cases were analyzed that represented both municipalities and case-specific consultations and in-depth discussions were performed as required. Both qualitative and quantitative data were used to depict the cases as appropriate. The cases facilitated the examination of the community, ecosystem, cultural heritage, and other non-economic complexities which helped generate contextual information.

Furthermore, these cases assisted in understanding the wider consequences of climate change to help identify a holistic and effective approach to disaster management and climate resilience.

3.7 Estimation of economic loss and damage

The data on economic losses per household, including loss and damage of houses, agricultural land, properties, and businesses, were collected through the household survey. Similarly, each attribute was evaluated based on a unit cost provided by the municipalities (Table 3, 4). Finally, the asset value was estimated based on the diminishing balance method (Oxford Reference, 2023), where an asset value is diminished each year. However, due to a lack of data on the construction year of the building and assets, the depreciation rate was applied only once. The average loss per household, integrating the loss of land, house, crops, and livestock, was also estimated. Assessing economic losses and damages provided a thorough analysis of the scale and intensity of economic losses caused by the flood and could be a basis for determining the financial needs for similar future disaster scenarios.

Table 3: Basis for calculation of livestock loss as provided by Melamchi municipality

Livestock	NRs.
Pig (adult)	30,000
Piglet	7,000
Goat	12,000
Chicken	500
Buffalo (Lactating)	1,20,000
Buffalo	70,000
Oxen	50,000
Cow	70,000

Table 4: Basis for calculation of crop loss as provided by Melamchi municipality

Crop	Unit (Ropani)	Production per unit (kg)	Cost per kg (NRs. ²)
Paddy	Ropani	225	60
Maize	Ropani	170	40
Wheat	Ropani	125	62

² Currency conversion rate 1 USD = NRs. 133 (Nov 4, 2023)

The following formulas and basis of calculation were adopted.

House loss = Cost of construction - Depreciation rate

Where, Cost of construction = Cost of construction per square foot x Average area covered by a building

Cost of construction per square foot = NRs. 2000 for stone and mud, NRs. 3000 for corrugated GI sheet roof, and NRs. 4000 for concrete (provided by municipality)

Average area covered by a building = Digitized ten houses each from sampled area from OpenStreetMap.

Depreciation rate = 5%

Land loss = Total land lost x Rate per hectare

Where, Rate per Ropani = 1,000,000 (NRs.)

1 Ropani = 0.050873704704 hectare

The calculations are performed based on the current estimated cost of construction available from the municipal standards provided by the engineers of the respective municipalities. The calculations does not incorporate compound losses. Since the calculations were performed two years after the incident, the actual market value during the incident is not available. Furthermore, it can be argued that the cost of reconstruction due to the temporal aspect may be higher than the estimated cost. Therefore, these estimations should be treated carefully.

3.8 Ethical considerations

All the respondents were briefed about the purpose and procedure of the study and provided informed consent before participation.

- Participant identities and personal information were kept confidential for both household survey and FGDs. Names and details along with photographs were taken with prior consent for in-depth case stories.
- No activities had negative consequences on the mental and physical health of the respondents.
- Efforts were made to include diverse participants, representing various backgrounds.
- Data were handled carefully ensuring data usage solely for research purposes.
- The study received approval from both municipal governments to perform household survey, FGDs, and consultations.

3.9 Limitations of the study

- The study was conducted two years after the incident, which may lead to discrepancies in the information provided, as people’s memories fade over time, affecting the reliability of information and data.
- The conclusions drawn from the household survey are based on a sample of only 120 households. This sample size may not represent the entire population, potentially leading to a limited and biased perspective of the situation.
- The economic calculations and valuations in the study rely on simple economic equations and current market values provided by municipal records. This approach may not accurately reflect the real economic impact of the incidents, as market values can fluctuate, and economic equations may not consider all relevant factors.
- The study applies a flat 5% depreciation rate without considering annual depreciation due to insufficient data on the temporal depreciation of assets. This oversimplified approach could lead to inaccuracies in assessing the long-term economic impact of the incidents on assets and property.



Infrastructure damage reflecting the profound impact

4. Findings

4.1 Socio-economic background of respondents

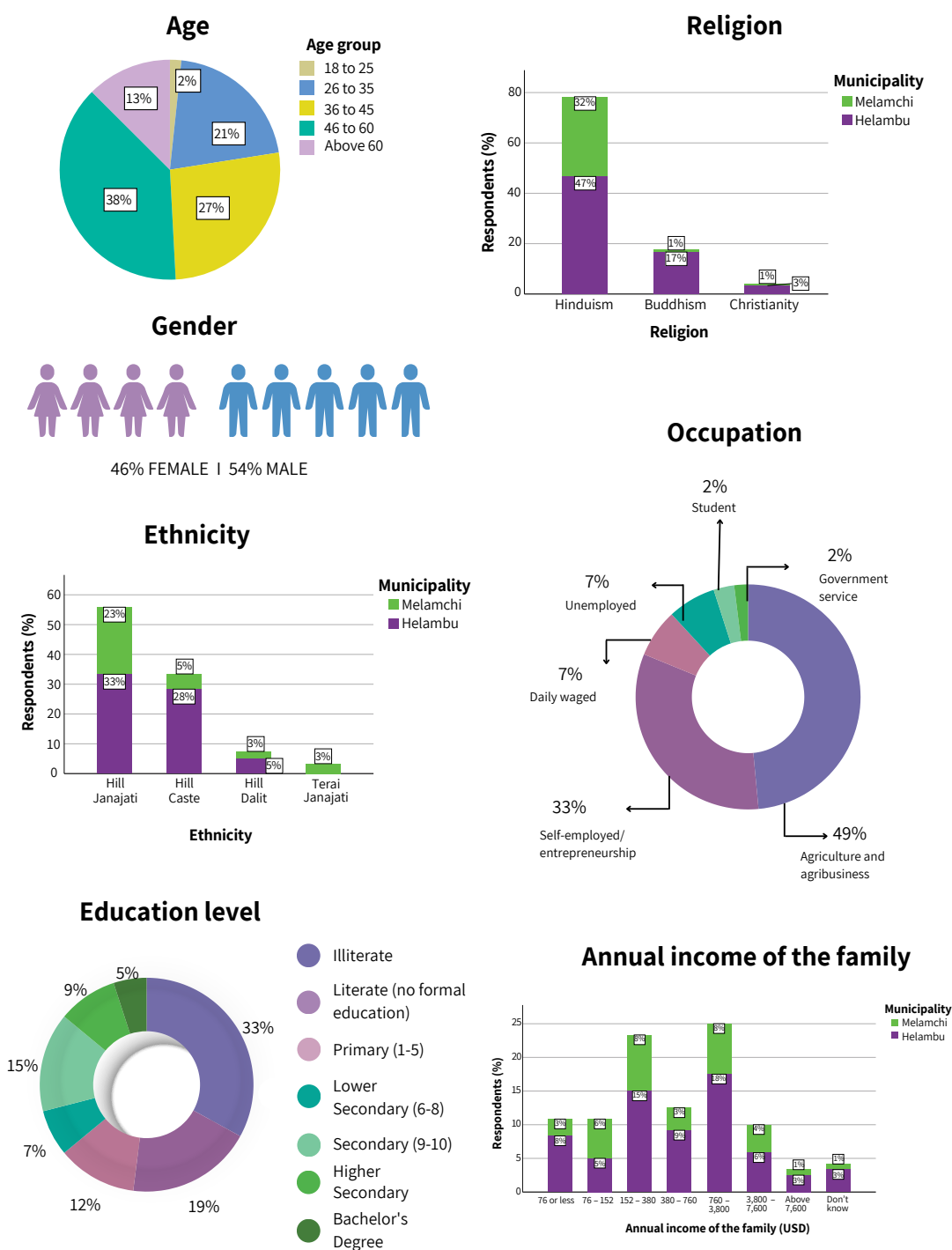


Figure 11: Socio-economic background of the respondents

The total surveyed respondents from Melamchi Municipality and Helambu Rural Municipality represented 34 and 66 percent respectively. The study focused on the most affected areas of the Melamchi River, which covers 18 km stretch and is divided into upstream, midstream, and downstream sections. Both the upstream and midstream areas fall within Helambu Rural Municipality. Therefore, a larger number of samples were collected from Helambu in the study. Figure 11 provides the socio-economic background of the respondents.

Out of the total survey participants, the majority belonged to the age group of 46 to 60 years. In contrast, the people who belonged to the age group of 18 to 25 years was only 2%. Similarly, around 54% were men and 46% were women. A balanced representation of both men and women respondents was surveyed in Melamchi. While in Helambu, there was a greater proportion of men (56%).

The respondents belonged to varied ethnic groups, with Hill Janajati (56%) represented by 23% in Melamchi and 33% in Helambu. Similarly, the Hill Caste group had a total representation of 33%, with 5% and 28% in Melamchi and Helambu respectively. Few respondents in both municipalities also belonged to the Hill Dalit group (8%). However, Terai Janajati (3%) were found in Melamchi only.

The respondents were found to be from different religious background. Most of the respondents (79%), in both municipalities, followed Hinduism. Many respondents followed Buddhism (17%), with the majority belonging to Helambu Rural Municipality, and very few followed Christianity (4%).

The FGDs conducted at six different locations along the river basin also indicated that the major ethnic groups are Hill Janajati and the Hill caste. The discussion in the upstream was held among Tamang and Lama communities belonging to Hill Janajati, while the market area was inhabited by Brahmins and Chhetris representing the Hill caste. Similarly, most of the Hill Janajati followed Buddhism, and the Hill caste followed Hinduism.



Household Survey

Total Survey **120** Households

Melamchi Municipality **40** Households

Helambu Rural Municipality **80** Households

In terms of literacy, a considerable number of respondents were found to be illiterate (28%) in Helambu Rural Municipality. Among the literate respondents, the number of respondents without formal education was higher in both municipalities.

Most of the respondents (49%) were involved in agriculture and agri-business-related occupations, with agriculture being the family members' major income source. A significant percentage of the respondents (33%) were also self-employed/entrepreneurs in the non-agriculture sector and contributed to the second-highest income source. The daily wages from agricultural and non-agricultural sectors largely contributed to income sources for a significant number of respondents. Before the incident, most of these respondents were dependent on fishing or involved in trout farms. In addition, among the respondents, a few families (11%) were found to have very low income (less than USD76 annually). Overall, 25% of the respondents' families have an annual income between USD760 and USD3800, followed by 23% ranging from USD152 to USD380 annually.

4.2 Economic losses and damages

The flooding resulted in significant economic loss and damage across various sectors, such as infrastructure, agriculture, education, businesses, tourism, and livelihoods. The destruction of bridges particularly disconnected people from accessing essential services, especially during the monsoon season. At least six bridges were damaged in Melamchi municipality. The disconnection further hampered commercial activities which then had a profound impact on the market value chain.

“We used to transport Melamchi Basmati rice to Kathmandu, which was disrupted for at least six months. The export has significantly reduced as a result of damage to the road and agricultural land itself,” said one of the participants during a municipal consultation in Melamchi.

Another significant economic revenue in the study area is generated from trout farming and tourism. As stressed during the municipal consultations, the flood-damaged major trout businesses and restricted farmers from distributing their ready-to-harvest trout in the market. Furthermore, the decreased influx of tourists in the region reduced the demand for trout fish. Consequently, many laborers lost their income opportunities due to the loss of business activities in the region. The municipality-level loss and damage data, provided by the Melamchi municipality, accounted for USD417,840,665.03 for house loss,

followed by USD17,845,821.75 for loss of land and USD91,230.66 for livestock with a total estimated financial loss of USD435,777,717.44 (Annex V, a).

Similarly, in Helambu rural municipality, the economic valuation of house loss accounted for USD4,084,343, followed by livestock loss of USD16,188 and crop loss of USD19,844,170 for 106.835-hectare land. The total financial loss incurred in Helambu was estimated as USD61,772,407, which included house, livestock, and crop loss along with valuation for infrastructure losses and loss of businesses such as trout firm, poultry firm, resorts, schools and water mills (Annex V, b).

The households survey data also reveals that the majority of the respondents in both municipalities suffered loss of their agricultural land along with the seasonal crops and livestock. Loss of land contributed to the highest economic loss, followed by the house, crops, livestock, fisheries and other losses as per 33%, 25%, 18%, 12%, 1% and 11% of the total respondents, respectively. The other losses include business losses such as loss of agriculture and livestock firms, wholesaler and retailer shops, hotels, and household assets such as beds, clothes, jewelry, refrigerators, and private vehicles that are not counted directly (Figure 12, a). The response received multiple answers, wherein one or more types of asset losses were reported. Details are provided in Annex VI.

Maximum land loss per household in Helambu was found to be 1.017 hectares and 1.272 hectares in Melamchi. On average, each affected household in Helambu lost 0.183 hectares and 0.259 hectares in Melamchi Municipality (Figure 12, b).

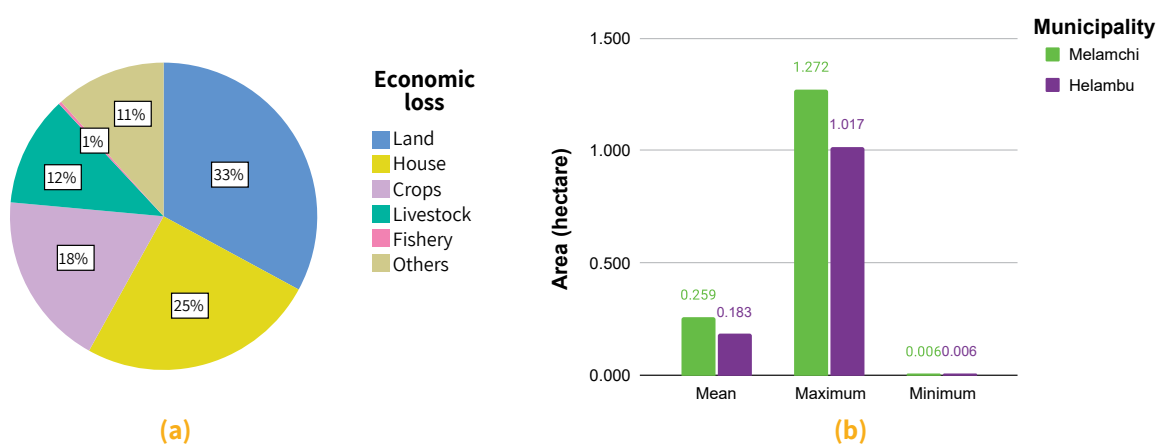


Figure 12: (a) Economic losses incurred by the survey respondents; (b) Land loss incurred by the survey respondents

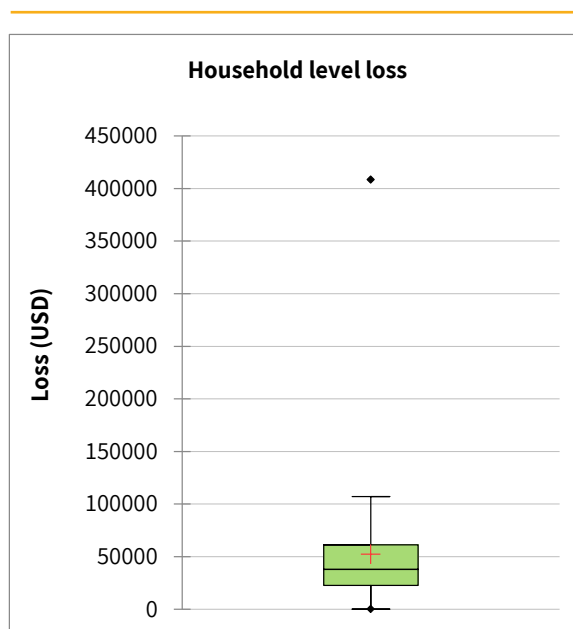
Table 5: Economic valuation of the assets loss of survey respondents

	Losses	Cost (NRs.)	Cost (USD)
Total house loss	63 houses	21,10,05,013	1,603,638
Total land loss	16.714 hectares	43,47,13,250	3,303,821
Total livestock loss	Hen:183, Goat: 58, Pig: 21, Buffalo: 10, Ox: 8, Cow: 3	27,45,500	20,866
Total crop loss		22,70,197	17,253
Total loss		65,14,08,960	4,945,578

The economic valuation of houses, land, livestock, and agricultural assets for the 120 surveyed households revealed that a total loss of USD4,945,578 was incurred. The maximum economic loss resulted from the loss of land (USD3,303,821), followed by house loss (USD1,603,638), livestock (USD20,866), and crop loss (USD17,253) (Table 5). On average, each household suffered an economic loss of USD52,113 with a maximum loss of USD408,383 and a minimum of USD91 (Figure 13).

4.2.1 Impact on livelihood sources

The economic losses incurred due to the flood significantly impacted the livelihoods of the local population. During the FGDs and household survey, most respondents reported that they were forced to shift from subsistence farming to find alternative income-generating opportunities. The damages to the agricultural land, disruption of businesses, and the decline in tourists flow significantly affected income and employment opportunities in the flood-affected areas. Small businesses and shops were either swept away or buried under the debris, leaving limited options for income to the owners. The cancellation of municipal projects such as parks and covered halls due to the flood's devastation adversely affected employment opportunities and entrepreneurship in the area. A key informant stated the following, relating to employment opportunities with improved waste management in the region:



Statistic	Household level loss (USD)
Number of observations	120
Minimum	91
Maximum	408383
1 st Quartile	22698
Median	38000
3 ^d Quartile	61326
Mean	52113

Figure 13: Box plot showing the major statistics for total loss per household

“The municipality had approved the establishment of a waste management system which was halted due to the flooding.”

Pushkal Bahadur Katuwal
50, Male, Helambu

Pushkal is the owner of *Helambu Silai Tatha Bunai Talim Kendra*, a sewing and tailoring training centre. Through the centre, he has been able to support his family, including his wife, son, and daughter.

Pushkal has always believed in the power of education and skills to bring transformative changes in the lives of people, especially women, and the marginalized Dalit community. To turn his ideas into reality, he required assistance from the government and requested the Rural Municipality to provide 20 sewing machines, a few scissors, and tables. However, even before his plan could take shape, the devastating Melamchi flood struck the village, leaving destruction and despair behind. In the name of government support, Pushkal and his six brothers in the village received two bags of rice each, which was considerably insufficient given the requirement. Besides the rice bags, the government failed to provide any form of assistance. The government also did not assess the extent of the loss and damage incurred by small scale enterprises such as Pushkal's.



Pushkal is also a member of the Saraswati Higher Secondary School, where education has always been highly valued. However, the destruction of bridges and roads disrupted the connection to the school. The floods had damaged his 0.25-hectare agricultural land, livestock, shop, and other properties. His business was shut down for over four months, significantly affecting his livelihood. The hard times had an impact on the stability of his family. Pushkal found his wife suffering from mental stress and pressure, requiring medication to cope with the adverse effects of the disaster. As the only earning member in his family, maintaining their livelihoods became increasingly challenging.

Damai Tamang
46, Male, Helambu

Damai Tamang is the owner of Rainbow Trout Farm in Kiul village, Helambu Rural Municipality. The farm, encompassing 1.37 hectares, provided livelihood support for Damai and served as an example of a successful enterprise in the municipality. Damai started the farm with an initial investment of USD 5,000 and gradually grew the business, with total investments reaching USD 61,000. Rainbow Trout Farm was doing decent business, selling 500 kgs of trout in a month, until the flooding struck.

The flood destroyed his trout farm, causing damage to his associated properties and economically destabilizing the family, significantly impacting their livelihood. In the aftermath of the incident, he received USD 11,400 in loans and minor financial aid,



but it was no match to account for the extent of the loss. A year later, he was forced to relocate the farm uphill, producing fewer fish with limited market access, but it helps the family survive and plan for the future.

The survey data provides strong evidence of how L&D impacts people's livelihood. From the surveyed population, 93% experienced a significant effect on their sources of income as a result of the incident. Among those respondents, 53% reported the greatest impact on their livelihood was due to the loss of agricultural income. Agricultural income involved selling crops, vegetables, poultry farming, pig farming, etc. Additionally, 31% experienced a loss of income from non-agricultural sources, while 10% lost their job or employment. Similarly, non-agricultural income involved retailer shops, hotels, paper factories, etc. Furthermore, 3% reported a decline in income from tourism, 1% from fishery activities, and 2% from other sources (Figure 14).

93% experienced a significant effect on their sources of income as a result of the flood.

Other livelihood sources include the indigenous water-operated mills called ghatta (a Nepali word) which were also swept away. The ghattas are the main sources of grinding maize, wheat, etc., in rural and isolated communities in Nepal. Similarly, the damage to irrigation canals and loss of crops also caused an indirect impact on the sources of income and livelihood.

Nearly 53% of the respondents resorted to either taking on additional debt or selling assets to restore their livelihoods. The majority had debts ranging from USD760 to USD3800. Specifically, 28% had taken on debts as high as USD7600, and 19% had debts ranging from USD3800 to USD7600. Additionally, 13% of the respondents had debts below USD760 (Figure 15). Similarly, the practice of selling land, livestock, and jewelry to help compensate for the loss and support livelihood was another key strategy among the respondents (Figure 16).

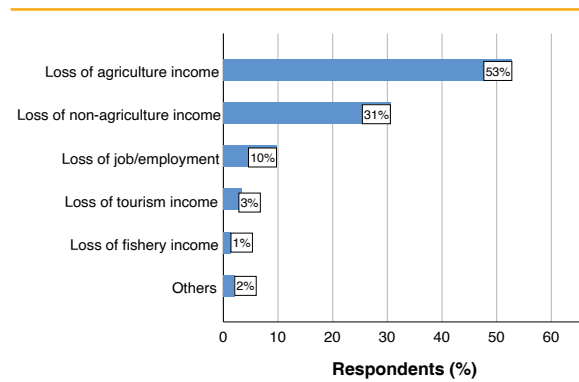


Figure 14: Sources of income/livelihood impacted by the flood

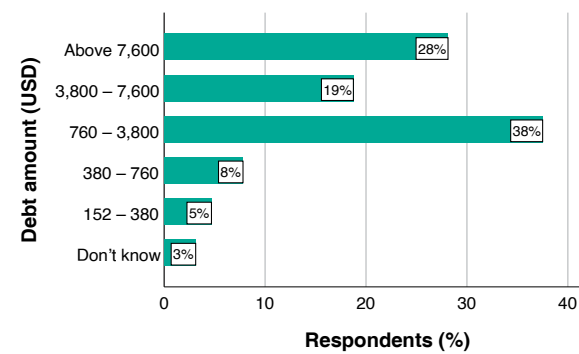


Figure 15: Debt amount taken to support livelihood



Figure 16: Assets sold to support livelihood

4.3 Non-economic losses and damages

One of the primary non-economic losses was the psychological and emotional impact such a disaster had on individuals and communities. Cases of depression, anxiety, stress, and even a tragic suicide due to the loss of business and financial pressure/challenges were documented during the focus group discussions, case studies, and household survey. The destruction of cultural and cremation sites along the river also disrupted sociocultural harmony. People were forced to use alternative locations for cremation, and the changing course of the river affected the availability of suitable sites.

“Sediment deposition has caused the river to widen significantly, forcing cremation practices onto private lands and occasionally sparking disputes,” one of the female respondents said during a focus group discussion in Melamchi.

The incident also disproportionately impacted women, who already had multiple responsibilities, as they had to bear the burden of managing households and dealing with the loss of livelihoods. One of the respondent’s husband used to work in the Helambu Rainbow Trout Farm. Owing to the flood, the respondent lost their house and all their income-generating opportunities, which forced her husband into a mentally unstable state, where she had to fulfill all the responsibilities.

“We had to vacate residence due to the flooding. Throughout the night, I, along with my two children and my 97-year-old father-in-law endured near the forest without access to adequate food and drinking water,” she said.

After the flooding, the entire monsoon season was challenging for the villagers. Travelling became difficult, with the disconnect lasting for months, intensifying the scarcity of essential items.

While the non-economic loss and damage remained significant in the study area, the municipalities do not have a database or information about the extent of non-economic loss and damage. Thus, there exists an underexplored aspect of loss and damage with a profound impact on the livelihoods of the people in these two municipalities.

This section is thematically structured to analyze non-economic losses and damages, covering eight sub-themes that span from human casualties to migration, as outlined in the following sections.

4.3.1 Human casualties

In the Helambu Rural Municipality, there was only one human casualty but 23 others were missing. Fortunately, the Melamchi Municipality did not record any human casualties as they had received early information about the flooding from informal sources in the neighboring Panchpokhari Thangpal Rural Municipality. The local authorities relayed this information to the public and evacuated them on time.

Likewise, people living downstream were alerted about the impending flood through informal means such as relatives or friends living upstream. According to the household survey of 120 respondents, 3% reported that they had either lost family members or their family members were missing. Additionally, 1% of the respondents from Helambu Rural Municipality experienced leg strain following the incident.

4.3.2 Health impacts

Physical injuries, water-borne diseases, and mental health issues in relation to trauma emerged as health issues after the flooding. Limited immediate access to healthcare services further exacerbated the situation. In the survey, about one-third of the respondents reported health issues following the event. The most common problem was fever, malaria and dengue (55%), affecting 39% in Helambu and 16% in Melamchi. Water-borne diseases impacted 36% of respondents. Skin-related conditions affected 9% of Helambu, while Melamchi had no such recorded cases (Figure 17).

Physical injuries, water-borne diseases, and mental health issues in relation to trauma emerged as health issues after the flooding.

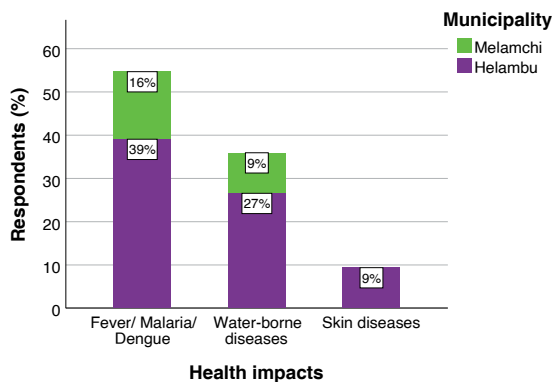


Figure 17: Health impact faced by the respondents after the flood incident

Along with the physical health impacts, more than 85% of the respondents were facing mental health problems. Anxiety, mental stress due to the loss of business and agriculture, and sleeplessness due to fear and stress were the major responses from the survey respondents. The issues of mental health problems were frequently raised during the FGDs.

4.3.3 Impact on mobility and access

The destruction of bridges and roads created barriers to the easy movement of people from one community to another.

“The disconnection hampered the emergency response in the aftermath of the incident,”
- Humanitarian responder

Limited mobility prevented students from attending schools and reduced social and economic activities. The survey illustrates that approximately 34% experienced a problem accessing health services. The major reason for healthcare inaccessibility was the disruption in mobility, as 61% of the respondents (out of 34%) reported being impacted in their mobility in the aftermath of the flood. The disruption was more pronounced in Helambu, with 52% of respondents unable to access health services due to road damage. Additionally, the mental trauma and fear of similar incidents from happening again impacted 26% of the respondents from accessing health services. Similarly, the impact of COVID-19 was prevalent during the time, which caused even more fear in people to visit the health posts. Damage to health facilities prevented 8% of the respondents from accessing the

more than
85%
 of the respondents were
 facing mental health problems.

service (Figure 18). Other responses include a lack of doctors and health care and insufficient money to access health care; however, according to a few other respondents, the local government made medicine supplies and general health check-ups available in some makeshift houses near the municipality office.

In Helambu, 56% of respondents (out of 41) experienced healthcare facility disruptions lasting up to six months. In Melamchi, only 6% of respondents reported disruptions, mostly lasting up to a month.

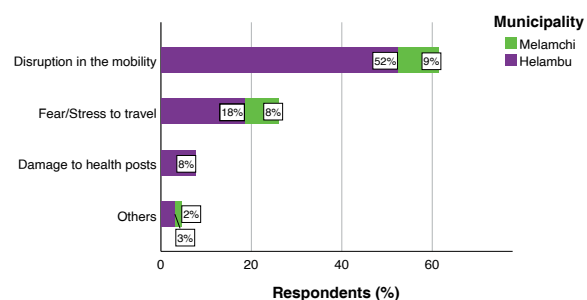


Figure 18: Challenges in access to healthcare facilities

Limited mobility has impacted on study of children, access to health services and basic necessities.

Additionally, the immediate impact of the flooding was damage to infrastructure which prevented communities from accessing basic necessities of food, water, and shelter. Among the surveyed respondents, 40% experienced such problem. Approximately 53% of respondents (out of 40%) lost access to essentials due to infrastructure damage. In Helambu, 48% of respondents experienced such disruptions. Damage to the local market/shops prevented 31% of respondents from fulfilling their basic necessities. Whereas 16% of the respondents couldn't access due to fear of travel (Figure 19). The disruptions in access lasted up to six months in Helambu and up to a month in Melamchi.

4.3.4 Impact on education

The FGD participants and household survey respondents acknowledged a range of issues in terms of access to education. In Helambu, schools were closed for two months during the monsoon post the flood. Even after that, damaged roads and bridges curtailed communities’ access to school. Especially on the side of the Melamchi River where roads were inaccessible, the destruction of suspension bridges isolated communities. thus affected In addition, due to the absence of transportation, students had to walk near canals which increased their anxiety due to the fear of encountering snakes that are common in the muddy waters during monsoon.

Among all the survey respondents, 73% mentioned disruptions in education. Out of those impacted, 50% couldn’t attend school due to road damage, and 41% of children stayed home due to fear and distress (Figure 20). Only 6% reported school closures due to flooding. Other reasons included long-term school closures, especially during the monsoon, and financial constraints for educating children.

In Melamchi Municipality, 58% experienced education disruptions for six months or more, while in Helambu, the majority (96%) reported such prolonged impacts on education.

4.3.5 Impact on social interactions

The physical displacement and loss of homes resulted in the relocation of many affected families. This had a profound impact on cultural and social interactions , which ultimately led to reduced community cohesion and shared identity.

Over half of the respondents (51%) reported that the flooding significantly affected their social interactions. Among them, 45% mentioned reduced social interaction due to damage to community gathering buildings (Figure 21). Chautari and parks are crucial for community interaction, and 34% of the respondents reported decreased social interaction due to damage to these spaces. Another 21% felt isolated, with reduced social interaction attributed to limited mobility and distress.

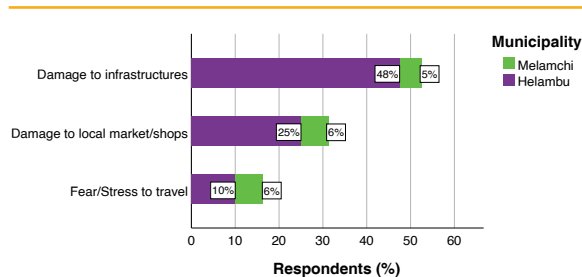


Figure 19: Challenges in access to necessities

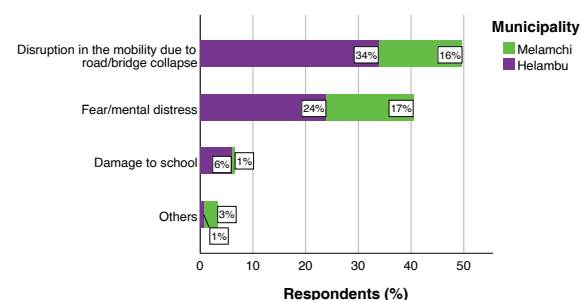


Figure 20: Reasons behind the impact on education

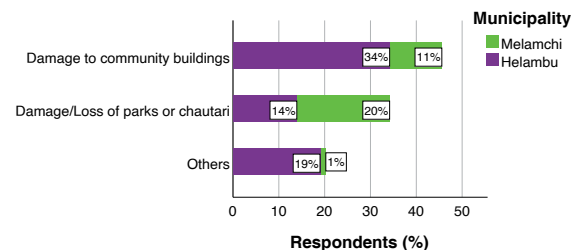


Figure 21: Reasons impacting social interactions

4.3.6 Impact on culture and religion

The loss of cultural heritage sites and the disruption of cultural practices and traditions significantly impacted the livelihood and well-being of the people of Melamchi and Helambu.

In the survey, 58% of respondents detailed how the flooding incident affected their cultural and religious sites, including cremation sites, temples, stupas, community prayer buildings, and churches. Specifically, 43% mentioned that their cremation sites and practices were impacted after the incident.

Additionally, 39% reported that damage to temples had affected their cultural traditions, 17% noted an impact on stupas and monasteries, and 1% reported an impact on their church (Figure 22).

Cultural and religious sites, such as cremation sites, temples, stupas, community prayer building and churches were damage by the flood.

Death rituals were notably affected, with 24% of respondents experiencing an impact. Festivals and cultural events also saw significant disruption, as reported by 23% and 20% of the respondents, respectively. Daily prayers, on the other hand, were the least affected, with only 15% noting changes in their prayer routines. Interestingly, 17% of the respondents reported no impact on their cultural practices due to the flooding. Figure 23 illustrates the influence the flooding event had on the cultural practices among different ethnic groups, demonstrating that all ethnicities experienced some level of impact on their cultural traditions.

4.3.7 Impact on natural resources and ecosystem services

The unprecedented flooding incident in Melamchi had significant impacts on natural resources and ecosystem services, as it resulted in the loss of biodiversity, caused damage to aquatic ecosystems, contaminated water sources, and affected the aesthetic value of the surroundings.

The impact on natural resources and ecosystem services was further substantiated by household data, with 81% of respondents expressing the impact. Among this group, over half (52%) believed that the incident led to a reduction in fish diversity and availability in the river. Additionally, 23% noted the drying of water sources, and 13% observed a decrease in the diversity of animals and birds. Only 12% of respondents perceived a reduction in fuelwood due to the flood (Figure 24).

Similarly, 97% of the respondents mentioned that the scenic beauty was lost as the agricultural land and riparian vegetation were swept away by the flood. The respondents also expressed that due to the high deposition of sediments, it feels warmer in the area.

Infrastructure damage reflecting the profound impact

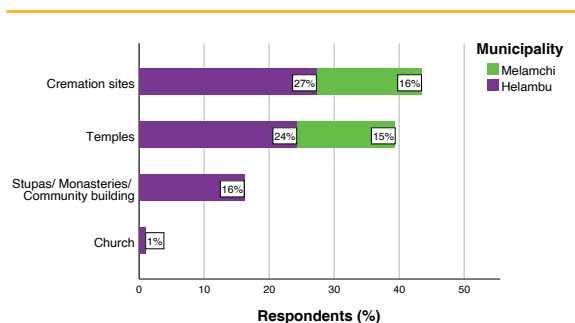


Figure 22: Cultural sites or landmarks impacted by the flood

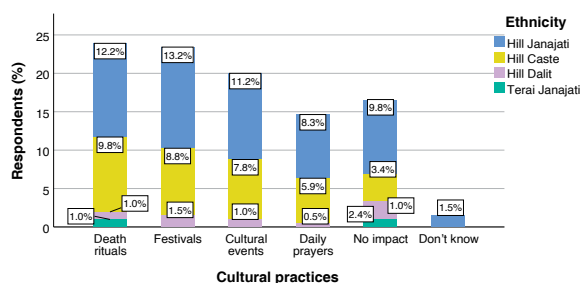


Figure 23: Impact of the flood on cultural practices

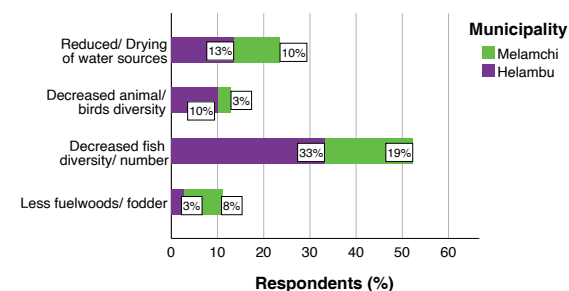


Figure 24: Changes in the natural environment as a result of the flooding

4.3.8 Migration

The destruction of homes, agricultural lands, and job opportunities forced many people and families to look for new places to live in. Many others were forced to find accommodations with relatives, friends, or makeshift arrangements. The limited support and lack of income-generating opportunities also resulted in permanent or temporary migration. The survey respondents (20%) migrated to Kathmandu and other places in the Sindhupalchowk District to re-establish a

source of their livelihood. A significant portion of the respondents (39%) had to migrate in search of income opportunities to support their families. Meanwhile, 32% were distressed and chose not to remain in the same location due to the emotional burden of their painful memories. An additional 27% of respondents left their homes because their farmlands were damaged (Figure 25).

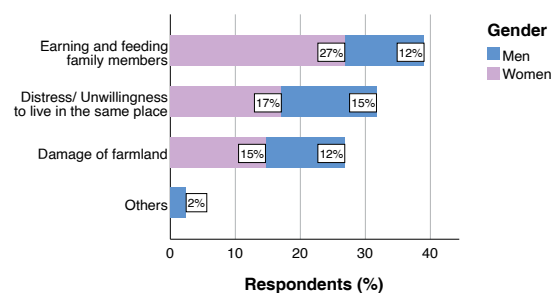


Figure 25: Reasons for migration



Stupa at the brink of flooding

Baburam Bhandari

65, Male, Helambu

Baburam lives in a small village settled along the Melamchi River. He lives with his wife, son, and grandchildren. He explained that life had always been hard but manageable on their 12 ropanis (0.61 hectares) of agricultural land alongside the river, to sustain their livelihood.

But, on June 15, 2021, a catastrophic flood swept the village, leaving behind a trail of devastation. The raging water swept away Baburam's land along the riverbank. Tragedy struck even deeper when Baburam lost his son, 32 years of age. The entire family was devastated by the loss, and the burden of rebuilding their lives remains, as does the mental stress caused by the devastation.

Before the Melamchi flood, organizations such as Helvetas and the CSRC provided incentives for buffalo farms and water mills. The Bhandari family had benefited from these initiatives, but the flood washed away everything they had built with their sweat and hard work. Baburam reflected on the devastating event, saying, *"It was like a nightmare that has never happened before."*



The flood had caught them by surprise, despite warnings from relatives in upstream areas, no one could have estimated the extent of the tragedy that would happen in their village.

Baburam believes that constructing a gabion wall and dam along the riverbank would not only aid in resettlement but also serve as a protective measure against future floods. Baburam also suggested refilling the soil along the riverside agricultural land, ensuring that their livelihoods could be restored by resuming the cultivation of crops. Additionally, he emphasized the importance of house reconstruction to provide stability and security for affected families.

Tejmani Sapkota

67, Male, Helambu

The July 2021 Melamchi flood changed the life of Tejmani Sapkota, a resident of Ward No. 2 of Helambu Rural Municipality near the Kiul floodplain. The flood severely damaged Tejmani's home and washed away his fertile farmland, making it unlikely for him to resume farming anytime soon.

Tejmani has a wife, three daughters, one son, and a granddaughter in his family. To compound their troubles, tragically, both his parents passed away in 2021 following the flood event. The devastation caused by the flood prevented them from conducting the religious last rites for his parents at their traditional ancestral site, a site that had been used by their family



for generations. They had no choice but to perform the final rituals at a neighbor's land situated along a nearby riverbank, further underscoring the emotional toll of the disaster. The devastating flood didn't just bring physical and economic hardships to Tejmani Sapkota and his family, it also had profound cultural and religious implications.

Safi Bhandari
35, Female, Helambu

Safi Bhandari, originally from Kathmandu, settled in Kiul village, Helambu, after marrying a local man. She was captivated by the village's beauty and abundant water resources.

“It was amazing to think people here had uninterrupted tap water,” she said.

Life was good for Safi, her husband, and their children until two major disasters changed everything. The 2015 earthquake had a profound impact on Safi and her family, with her son trapped under rubble after their village was shaken by tremors, creating fear and uncertainty. As they were gradually getting back to their normal lives, the unexpected flood, accompanied by enormous debris, ravaged the Melamchi River. Safi's husband was involved in managing the aftermath due to his role in the local rural municipality. Simultaneously, her brother-in-law worked at a nearby Bhandari Trout farm in



Kiul Bazaar, which was destroyed by the flood. The massive debris in the river swept away everything from the trout farm, including Safi's brother-in-law, witnessed by her elder daughter. This traumatic event has left her daughter struggling with trauma, plagued by memories of the incident and her uncle. Safi had to take her daughter to Kathmandu for counseling and treatment.

Gopal Bhujel
48, Male, Helambu

Gopal Bhujel is a generational fisherman from Jyamire Village in Helambu Rural Municipality. Inherited from his father, Bhujel developed his fishing skills from his early days. His deep love for fishing made the river his second home. Before the flood, he earned approximately USD 20 per day by selling fish which was enough for him to sustain his livelihood.

When the flood struck, it washed away homes, agricultural lands and damaged ecosystems. Consequently, it caused a significant decline in fish inhabiting the river, says Gopal, adding that the sediment deposits in the riverbank have made it difficult for fish to thrive.



With the reduced fish population, it has become challenging for Gopal to make enough money to sustain his family's needs. As an alternative source of income, he now works as a construction worker. But as a generational fisherman, he misses the joy of casting a fishnet into the river.

4.4 Impact on gender role

The surveys also revealed that the incident affected women and men disproportionately. Women experienced an increased care burden as they had to manage household chores, secure food and water, and tend to family's emotional needs. Women faced barriers in accessing resources and participating in decision-making during the response and recovery phase. Men faced challenges in providing basic needs for their families and maintaining livelihoods.

A substantial portion (41%) of respondents noted gender-specific impacts from the flooding, with women experiencing unique effects. The majority (42%), of which 22% were women respondents, reported increased emotional and psychological impacts on women (Figure 26). The incident also raised the workload for women, as observed by 40% of both men and women participant. Interestingly, women respondents mentioned financial pressure as an impact, while men did not share this concern.

From the survey, 60% of both men and women respondent noted either direct or indirect engagement of women in decision-making processes. However, among them, 78% of respondent reported that women were limited to community discussions, with only 11% having access to influence decision-

making at the planning level. Most importantly, such influence of women in relation to natural resource management was barely 3% (Figure 27).

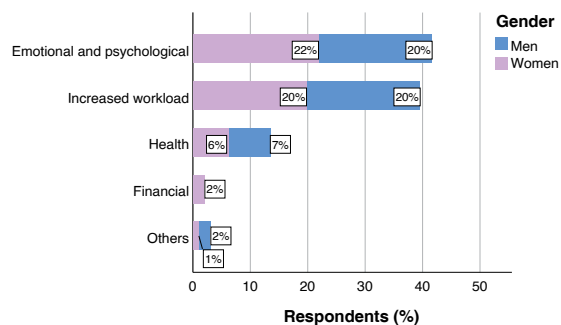


Figure 26: Unique impacts faced after the flood incident

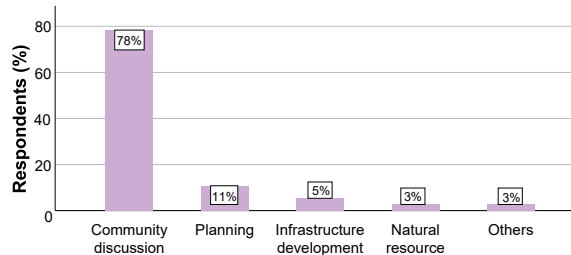


Figure 27: Involvement of women in decision-making processes

Sarita Tamang

42, Female, Helambu

After the flood, Sarita and her community faced a long period of disconnect from other villages. They were cut off from resources and support for at least three months during the monsoon in 2021. The scarcity of clean drinking water in the flood's aftermath profoundly impacted their well-being.

The flood destroyed Sarita's farms and property, killing most of her livestock. To support her family financially, she had to sell her remaining livestock. Her husband is still suffering from the trauma and depression caused by the flood. Hence, further responsibilities of the family fall on the shoulders of Sarita.

Sarita believes the availability of a proper early warning system could have saved many lives and could have reduced the extent of loss. If a system had been in place, many lives and resources could have

been saved for the people living downstream, says Sarita. Post-flooding, Sarita's family were forced to take shelter at their relatives' houses for at least three weeks.

The destruction caused by the floods led to the collapse of bridges and roads, cutting off her children from their schools. Without alternative routes, attending school was challenging for the students. The Municipality provided minor support through tents and food, which was received through an organization named 'Indreni.' Sarita has now rented some land where she continued farming to sustain her livelihood



4.5 Organizational intervention

Both the federal and local governments were involved in the response in both the municipalities. In the immediate aftermath of the event, the Nepal Police, Armed Police Force-Nepal, municipalities, Nepal Scout, the Red Cross, and locals collaborated to facilitate response and rescue operations. However, the consultations held for this report suggest that most government support were inadequate in comparison to the need. There was no substantial support from the government to compensate for losses and damages. The Melamchi Municipality provided financial compensation of only USD76 immediately after the flood to the affected households who had property deed documents (Lalpurja in Nepali).

Both municipalities have now established disaster management committees that receive funds for disaster management. However, the loss and damage incurred from the incident are out of the scope and capacity of existing financial instruments at the municipality.

The municipal consultation in Helambu revealed that only 8-9% of the total annual budget was spent either directly or indirectly in responding to disasters in the year 2021/22. Furthermore, the Helambu Municipality claimed to have distributed USD3,800 per destroyed household and an additional USD1,216 to single women-headed household. Similarly, the municipality also invested USD2,789 to construct a temporary shelter. The rural municipality is now in the process of providing USD3,800 per household after creating a roster of affected households that are completely damaged based on the field survey. However, it is unfortunate that even after two years of the incidents, people are still waiting to receive support from the government.

A majority of households received financial support ranging from USD76 to USD380, with a few, who lost everything, including their homes, receiving between USD2,280 and USD3,800 (Figure 28). However, the majority of respondents (88%) expressed dissatisfaction with the support, considering it insufficient to compensate for their losses and damages.

A majority of households received financial support ranging from USD76 to USD380, with a few, who lost everything, including their homes, receiving between USD2,280 and USD3,800

The household survey revealed that out of the assistance provided by the government, 45% received financial aid, whereas 34% of the respondents received no support (Figure 29). Only 14% of the total respondents from Helambu received relocation and resettlement support from the local government. For the trauma suffered by the victims, only 6% received psychological counseling.

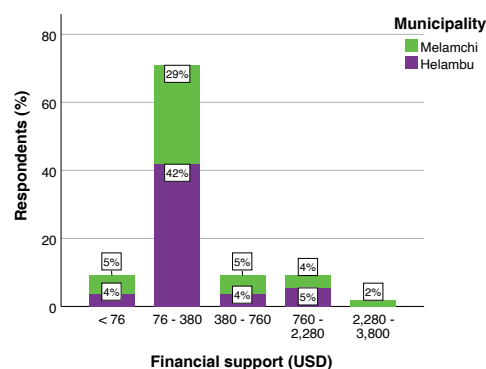


Figure 28: Financial support received by the respondents

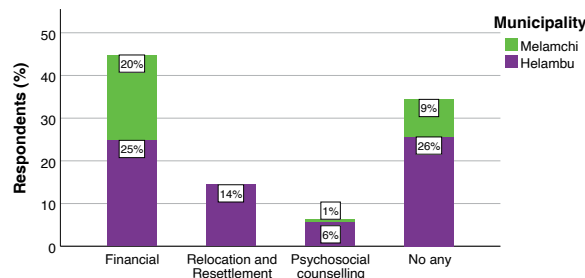


Figure 29: Interventions by governmental organizations

During a FGD in the Halde village of Helambu, participants said that organizations such as youth clubs and individuals living abroad extended financial support to families who had lost their loved ones during the flood. Furthermore, they believe that their shelter was provided by the Indreni program (a charity-based musical program) rather than the

local government supporting them in rebuilding. The survey respondents (51%) stated support from NGOs was more effective than government support (17%) (Figure 30). The non-governmental organizations that supported the victims include Community Self-Reliance Centre (CSRC) Nepal, HELVETAS, Indreni, Start Network Nepal, UK Aid, People in Need, Red-cross, Sowers Action Nepal, etc. Many respondents also mentioned that community leaders, actors, religious groups, and Nepali people living abroad were more effective in providing immediate financial and logistical support.

In addition, respondents also stated that NGOs were more effective in supporting relocation and reconstruction (26%) and providing financial support (23%) but 22% found that they were not so effective in responding to the incidents (Figure 31).

The major intervention gaps remain in providing financial assistance (30%) and relocation (24%), followed by gaps in technical (15%) and logistical (12%) support. Few respondents (4%) pointed out gaps in psychosocial counseling (Figure 32).

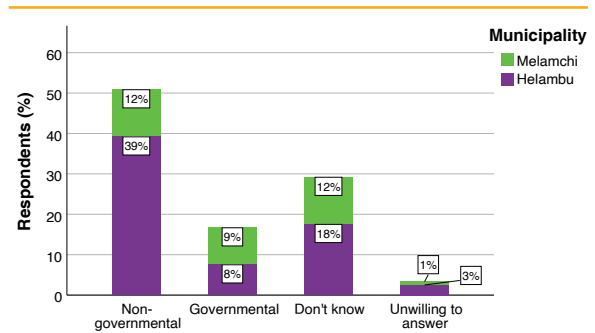


Figure 30: Respondent's perception regarding the effective organization

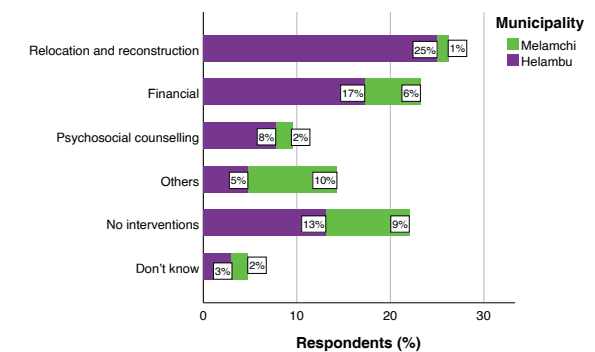


Figure 31: Interventions by non-governmental organizations

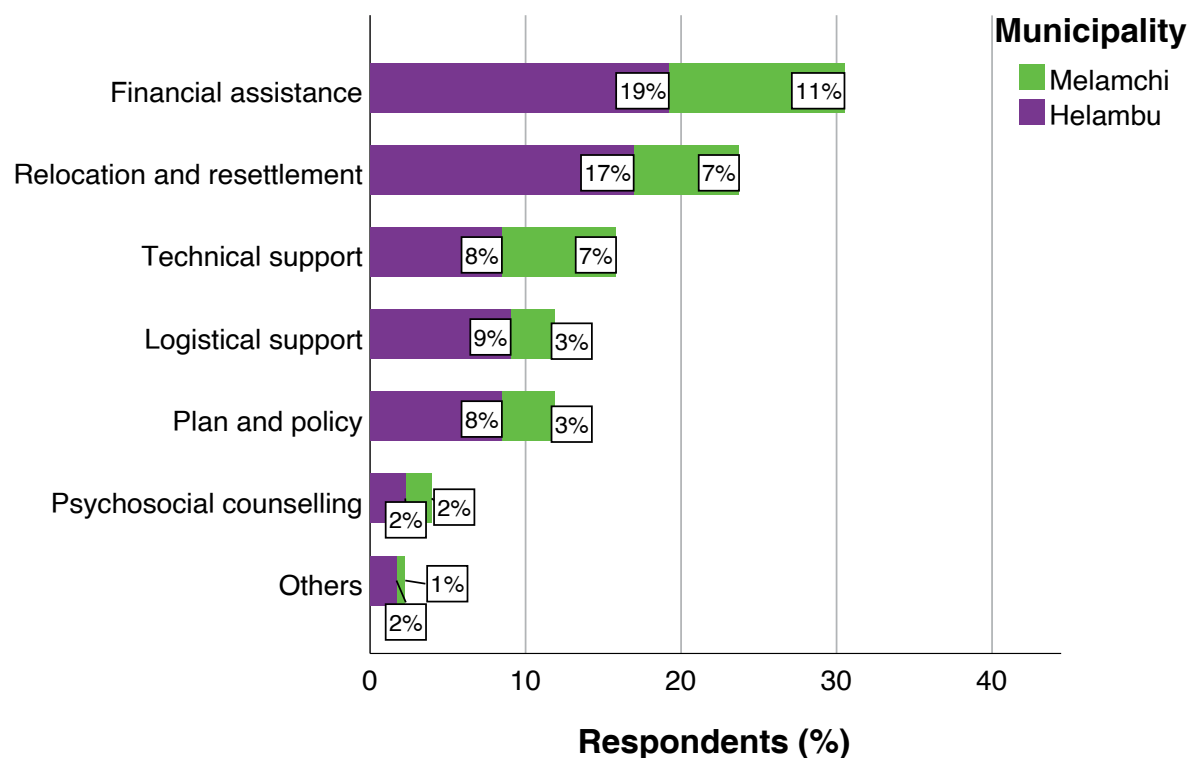


Figure 32: Intervention gaps

4.6 Information flow and community's response to losses and damages

“I had never seen a flood of this scale and nature in my entire life,” said 97-year-old Kanchha Gurung from Halde village in Helambu Rural Municipality.

His daughter-in-law further added,

“He refused to evacuate from the house, believing that the flood was a small one and would pass. Despite our repeated attempts to persuade him, he remained resolute in his decision. Eventually, my daughter carried him, and we ran uphill to a safer location.”

During the FGDs, it was pointed out that the Melamchi River does experience annual flooding during the monsoon season, but it had never significantly impacted the lives and livelihoods of the people. As revealed during the municipal consultations and KIIs, the municipalities had not established a formal early warning system. However, there were several informal channels through which information about the upstream flooding was being received prior to the incident. Some individuals received warnings through messaging systems while most were informed by their relatives or friends living upstream, as reported in the FGDs, KIIs, and household survey. Since the information was informal, there was higher uncertainty regarding scale and magnitude of the flood, making it particularly challenging to evacuate senior citizens. Although they had received information, they were more concerned about their belongings and especially involved in evacuating them. One of the male respondents residing near a trout farm in Timbu mentioned during the FGD,

“As the water level rose, the pond water became murky, prompting the owner and a group of workers to laboriously relocate the trout fish to a cleaner and safer environment. Unfortunately, this effort resulted in a tragic loss of lives.”

Meanwhile, another respondent spoke of the flood that claimed the life of his fishing companion,

“While we were fishing in the river, we observed the water level steadily rising. Unfortunately, my friend lost his life, but I was fortunate enough to survive. We had no prior knowledge or awareness of the approaching flood.”

He added,

“We were forced to spend a night on the other side of the river without food and a proper shelter. An early warning system could have provided us with enough time to prepare and anticipate the potential risk.”

The findings from the survey, FGD and KII corroborate the findings. During the survey, the majority of the respondents (64%) said they did not receive any early warning messages about the flood. Only 19% received messages from an early warning system, while the rest of the respondents received warnings from informal channels such as friends, families, neighbors, and social media (Figure 33). Most respondents (77%) considered evacuating the place after receiving the information. Similarly, 17% informed their neighbors about the flood information, while only 3% of the respondents sought support from others (Figure 34).

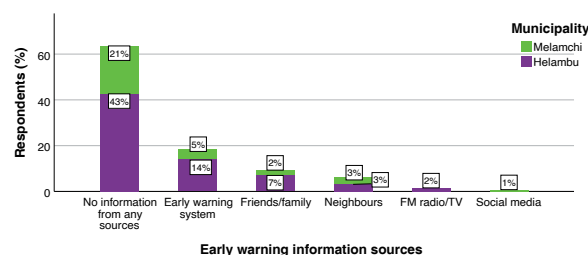


Figure 33: Information flow and early warning

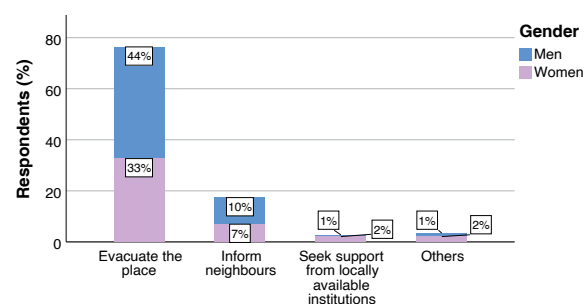


Figure 34: Gender-wise response for immediate actions carried out after receiving the flood warning information

4.7 Local needs

Communities emphasize the importance of mitigating future impacts and establishing effective institutions. The following are the key points.

1. Restoring bridges, and roads, and constructing protective barriers to prevent floods, based on survey and consultation insights.
2. Ensuring a reliable early warning system for timely alerts and safe evacuations.
3. Supporting farmers with measures such as crop insurance, training, and market access.
4. Addressing psychosocial needs through counseling services.
5. Preserving cultural and natural heritage and ensuring access to essential services.
6. Promoting collaboration among stakeholders and long-term planning, as discussed in focus groups.

In terms of immediate needs, the majority of respondents stressed the need for financial support (28%). Their responses for investment in resettlement, insurance, and training were 25%, 23%, and 15%, respectively. Furthermore, 3% of the respondents also stressed the need for employment opportunities to support their livelihood (Figure 35).

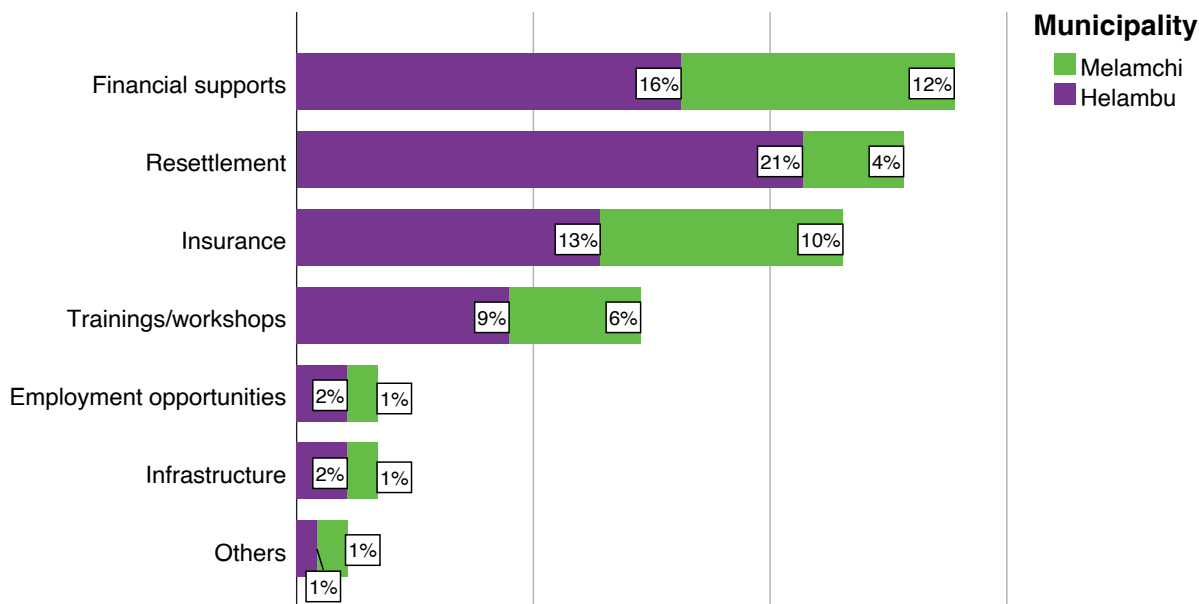


Figure 35: Key needs prioritized by respondents to reduce loss and damage



Locally-led mitigation measures to minimize future loss and damage in Kiul, Helambu

4.8 Financial needs and support

The respondents were asked if the financial support provided by the local government for their losses and damages was satisfactory. In response, 62% of the respondents expressed disagreement (14% strongly disagreed). Whereas, 22% of the respondents agreed (3% strongly agreed) that the support was satisfactory (Figure 36). Financial compensation was offered to only those who completely lost their homes, which might be the reason for dissatisfaction.

Furthermore, almost 77% of the respondents claimed not having any insurance scheme/s or other financial risk management tool/s available to help cope with the impacts of flooding. Of the remaining 23% of the respondents, the majority (66%) mentioned having an insurance scheme/s followed by 26% with grant scheme/s and 8% with access to reconstruction loan. (Figure 37).

In addition, 22% of respondents felt there are barriers to assessing financial assistance and risk management tools related to flooding. Out of which, political biases (42%) was perceived to be a significant barrier (34% from Helambu and 8% from Melamchi) and the complexity of the process was another major barrier as perceived by 31% of respondents, followed by lack of information (19%) as perceived by 31% of respondents, followed by lack of information (19%) (Figure 38).

Furthermore, respondents believe that grants, insurance, social protection, and reconstruction loans are of great financial assistance to help them address and cope with L&D. The majority of respondents (44%) sought to have grants, while the least number of respondents (4%) expressed wanting reconstruction loans as a risk management tool (Figure 39).

Market-based risk financing approaches, such as insurance, have been practiced in the context of natural hazards. The approach is argued to be effective in transferring risk to financial markets (ADB, 2019; Lane and Mahul, 2008; Surminski and Panda, 2020). However, implementation of such schemes is complicated due to its affordability and accessibility in the context of the Melamchi flood. In this context, curative finance to provide financial support for loss and compensation arrangements can be considered critical, particularly in cases where hard limits of adaptation and mitigation are unable to address the impacts of climate change.

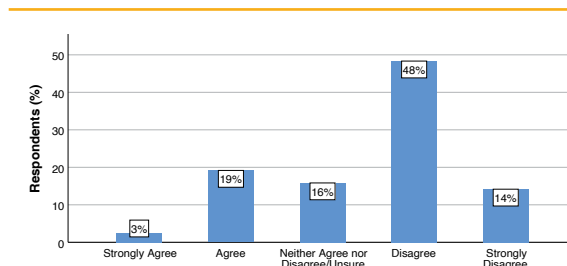


Figure 36: Perception of respondents regarding the financial assistance received

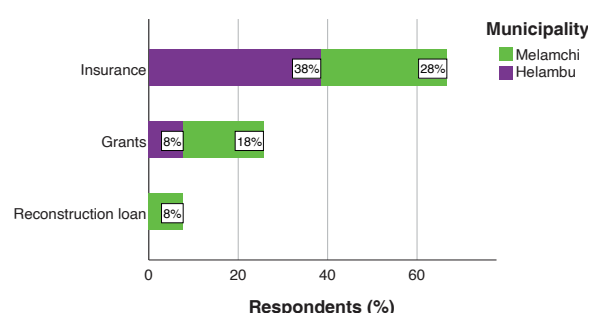


Figure 37: Financial schemes available to respondents

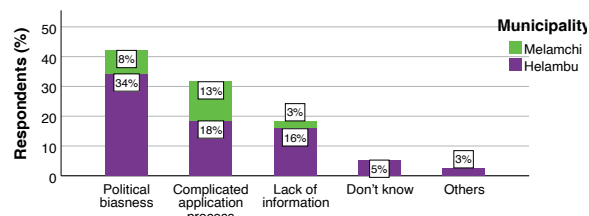


Figure 38: Barriers in accessing financial assistance or risk management tools related to flooding

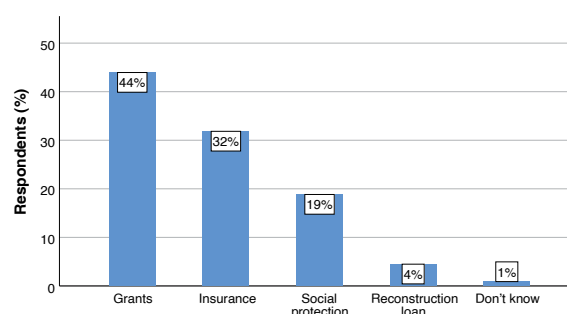


Figure 39: Types of financial assistance or risk management tools needed to address losses and damages

5. Policy and Institutional Gaps

The study has classified the policy gaps based on the existing framework and the responses received from the respondents. The process of classification began by examining the deficiencies in early warnings, response, and immediate relief following the incident, focusing on preventable losses and damages. Next, it evaluated the institutional structures and policy tools for delivering medium-term rehabilitation and recovery. Lastly, it assessed the policy and institutional shortcomings in dealing with persistent residual risks.

The lack of sufficient data to comprehend climate change's current and potential consequences is one of the significant gaps. The data deficit also reduces the ability to forecast and anticipate potential hazards more precisely and accurately. The existing gap in data also hinders the practice of effective early warning and response.

Mandated by the Disaster Risk Reduction and Management (DRRM) Act 2017, the National Disaster Risk Reduction and Management Authority (NDRRMA) is responsible for developing plans and policies and compiling data related to disasters, including climate-induced hazards. As part of the mandate, the Building Information Platform Against Disaster (BIPAD) portal is in operation to maintain L&D data. However, the system is still evolving, and the database is scattered. While a clear institutional architecture exists for disaster risk reduction (DRR) at all government tiers, there is a lack of explicit integration of climate change and L&D within these structures. Without a clear mandate and functions specifically addressing loss and damage, these institutions are unlikely to effectively advance the discourse and implementation of approaches to tackle such issue.

The federal structure allows local governments to formulate their own policies, acts, and guidelines

to identify tailored mechanisms to address context-specific requirements. However, the policy instruments and decision-making practices still follow a top-down approach. One such example was reflected in both municipalities, where the compensation cost was identified based on the national government-provided standard rate. While these rates help provide equal support to all the affected households, it generalizes the support undermining the specific requirement of each household and individual.

Due to a substantial gap between the existing need for financing and the available funding sources, access to climate finance is utmost important. The concept of risk transfer mechanisms in the context of natural hazards is relatively new. As a result, not many people are benefited from this concept in the study area. Additionally, it has been challenging to access international finance because of the lengthy procedures and complicated financial structure. Limited institutional capacities make the situation among the government, civil society organizations, and communities worse, making it harder to implement selected strategies effectively. The lack of coordination and collaboration among the relevant stakeholders remains a practical difficulty. The interventions and policies do not explicitly address intersectionality and inclusion issues.

Residual gap

The average estimated cost per household's total loss is USD52,113, yet households received only an average of USD380, with some as low as USD76 and a few up to USD3,800 for house reconstruction, leaving a significant USD51,733 residual gap per household. This highlights the need for a thorough evaluation of existing assistance programs to ensure they meet the needs of affected households.



Locally constructed temporary wooden bridge for mobility

Furthermore, the total estimated economic loss for Melamchi Municipality is about USD436 million, and for Helambu Rural Municipality, it's approximately USD62 million. In comparison, their annual budgets are much lower than the loss, amounting to just USD10.5 million and USD3.8 million, respectively.

The substantial gap between estimated losses and available budgets underscores the urgent need for external financial assistance, especially from national and international funding mechanisms to address losses and damages. Collaborative efforts among international organizations, donor agencies, federal and local governments, and concerned stakeholders can enhance comprehensive recovery and long-term resilience in the region.

Recognizing the importance of non-economic losses, though challenging to quantify monetarily, is crucial. Prioritizing unique needs related to these losses when planning mitigation, adaptation, and resilience-building interventions is vital. Promoting community cohesion and resilience through community events, dialogue, and involving affected individuals and communities in decision-making is essential for facilitating recovery and mitigating non-economic losses.

Total estimated L&D:

USD 498 million

Melamchi Municipality:

USD 436 million

Helambu Rural Municipality:

USD 62 million

Average estimated total loss:

USD 52,113 Per Household

Average financial support received:

USD 380 Per Household


Residual gap:

USD 51,733 Per Household

6. Conclusion

The devastating flood that hit the Melamchi and Helambu municipalities had profound and wide-ranging effects on infrastructure, agriculture, tourism, traditional practices, and cultural values in the areas. The substantial disparity between estimated total loss costs and actual household compensation, with an average residual gap of USD51,733 per affected household, presents a significant challenge. Estimated economic losses far exceeded the annual budgets of both municipalities, emphasizing the pressing need for external financial assistance. The collapse of essential bridges and subsequent

isolation had a considerable impact on economic activities and agricultural transportation, resulting in significant financial losses. Additionally, the flood had long-lasting non-economic consequences, affecting health, the environment, and cultural practices. While local governments provided immediate relief, it was insufficient to address the extent of the losses incurred, and the absence of risk transfer mechanisms, such as insurance, left small businesses with limited support for recovery and livelihood restoration.



Enormous debris deposition in the river places roads in close proximity to future risks, impacting mobility

7. Recommendations

The following are the general recommendation drawn from the study:

1. Prompt, equitable compensation for flood-affected individuals based on thorough assessments.
2. Tailored support for vulnerable groups: elderly, women, children, and marginalised communities.
3. Prioritize non-economic losses' restoration, shaping identity and quality of life.
4. Cultural heritage and traditions are integral to response efforts.
5. Promote affordable insurance for economic growth and risk transfer.
6. Climate-resilient infrastructure reconstruction.
7. Strengthen local early warning systems and community capacity.
8. Offer psychosocial counseling for social and economic recovery.
9. Restore cremation sites for cultural revival and social cohesion.
3. Formulation of multi-stakeholder and comprehensive Melamchi Valley plan to facilitate effective reconstruction, relocation and rehabilitation.
4. Address both short-term and long-term development requirements accounting for the associated environmental and climatic risks.
5. Mobilize financial support from external sources (including international financing mechanisms) to cover the gap in existing budget for dealing with losses and damage.
6. Initiate a long-term program, supported by the Loss and Damage fund, to help people affected by the disaster to restore their livelihoods.
7. Create a collaborative environment among the government, non-profit groups, and communities to reduce the risks of disasters by sharing resources and information.
8. Make mental health support services a priority, such as counseling and therapy, to help people deal with the stress and anxiety caused by the disaster.

The following are the policy-specific recommendations drawn from the study:

1. Operationalize a dedicated mechanism to deal with mega-scale climate-induced disasters, linking it with the Loss and Damage Fund.
2. Address the existing gap between financial requirement and assistance provided, considering extent of losses and damages in line with the principles of equity and fairness.
9. Introduce safety nets for people requiring help, and make sure they are fair, inclusive and equitable.

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Annexes

Annex I: Checklist for KII and FGD

Location		Date	
Name of facilitator		Total number of participants	
Name of note-taker		Number of Men	
		Number of Women	

Economic losses and damage

- What kind of losses and damages (loss of land, houses and personal belongings, livestock) were experienced as a result of the Melamchi flood/ landslide?
- Did the flooding/landslide affect livelihoods or sources of income (damage to crops or loss of livestock) in the community? How?
- Were the financial losses compensated? What type of support (financial/logistics/ technical) was received from the government or development partners related to loss and damage?
- Was the support adequate to hold up with the losses and damages? Were there any initiatives taken by the community members to support any household or family members for the compensation?

Non-economic losses:

- Were any family members physically affected by the landslide/flood? Any form of disability?
- Are there any health issues (affected by waterborne diseases) reported in the community after the flooding/landslide? Any mental health problems such as increased stress, anxiety, or depression? (Especially during heavy rainfall, windstorms, or lightning.)

- Did it impact people’s ability to access food, water, or other necessities? For how long? What were the alternatives/coping mechanisms used?
- Have there been any changes in daily cultural rituals or schedules due to the incident? If yes, what and for how long?
- Are there any cultural sites or landmarks that have been impacted by the flood? Did this impact the cultural practices or traditions (or religious and spiritual practices, indigenous practices related to water, medical treatment practices, natural resource management) of any religion or ethnic group?
- Has there been any modification in the cultural practices or traditions in response to the flooding incident?
- What changes were experienced regarding access to natural resources, such as forests, rivers, and other ecosystem services?
- Has there been any changes in the natural environment impacting the aesthetic value/ natural beauty? If yes, what?
- Did the incident affect tourism activities in your community? If yes, what kind of activities were impacted, and for how long?

Interventions by local government and development partners:

- What was the role/s played by the government and development partners in responding to losses and damages in your community?
- What interventions have been carried out by the government or development partners to address loss and damage? How have they collaborated with local organizations or community groups in implementing the interventions?
- How effective do you think the government and development partners' current interventions have been in addressing losses and damages in your community?
- What are gaps or challenges in the current government or development partners' interventions related to loss and damage in your community? What types of government or development partner support or interventions would be most helpful in addressing the losses and damages in your community?
- How have the government or development partners taken into account the unique needs and perspectives of your community in responding to loss and damage? How do you get to provide your input into the design or implementation of interventions related to loss and damage?

Gender issues:

- How have the landslide and flood incidents impacted women and men in your community differently? What unique challenges or opportunities due to such incidents have the women in the community faced?
- How are women included in decision-making processes related to climate-induced hazards (such as landslides or floods) and their adaptation and mitigation strategies?
- How much difference do women and men have concerning access to resources and services related to hazards (early warning information or financial assistance) to overcome landslides or floods?

Community's response to loss and damage

- How has your community traditionally responded to disasters and loss in the past? What are the recent changes in the community's response to loss and damage? Are there any visible differences in different ethnic/community groups' initiatives in responding to the losses and damages?
- What are the community-based initiatives related to adaptation or mitigation to rapid-onset hazards, and have you been part of it?
- What role do local leaders, traditional authorities, or civil society organizations play in responding to loss and damage in your community?
- What key activities could be implemented to reduce loss and damage in your community? What type of support is required?
- What types of resources or support would be most helpful in building your community's capacity to respond to loss and damage?

Financial needs and support

- What are the insurance schemes or other financial risk management tools available to help cope with the impacts of flooding? What is the access mechanism?
- Has there been any training or support program provided to help adapt to flooding or landslides and reduce the financial risks? If yes, by whom, when, what types?
- What are the barriers to accessing financial assistance or risk management tools related to flooding, such as a lack of information or complicated application processes?
- What type of financial assistance or risk management tool/s would be most helpful in addressing the losses and damages you have experienced due to flooding?

Annex II: Survey Questionnaires

The questionnaire covered various topics related to demographic information, livelihood, education, and economic and non-economic aspects of loss and damage. Key themes and broad topics covered in the questionnaire included:

SOCIO-ECONOMIC BACKGROUND

ECONOMIC LOSSES AND DAMAGES

- Types of loss and damages to assets
- Impact on livelihoods and sources of income
- Additional debt or asset selling in response to challenges

NON-ECONOMIC LOSSES AND DAMAGES

- Human and physical losses
- Health impacts
- Challenges in accessing food, water, and necessities
- Disruption of schooling for children and youth
- Impact on social interactions and community cohesion
- Impact on cultural sites and traditions

INTERVENTIONS BY LOCAL GOVERNMENT AND DEVELOPMENT PARTNERS

- Support received from the government and other sources
- Adequacy of support
- Effectiveness of the support provided
- Gaps in interventions
- Community input into the design or implementation of interventions

GENDER ISSUES

- Differential impacts on women and men
- Equality/equity in access to resources and services
- Inclusion of women in decision-making processes

INFORMATION FLOW AND COMMUNITY'S RESPONSE TO LOSS AND DAMAGE

- Mediums of receiving information
- Actions taken after receiving information
- Household and community-level initiatives
- Use of traditional knowledge/practices
- Role of local leaders and civil society organizations

FINANCIAL NEEDS AND SUPPORT

- Satisfaction with financial support from local government
- Availability of insurance schemes and financial risk management tools
- Training or support for adaptation
- Barriers to accessing financial assistance
- Types of financial assistance or risk transfer mechanism required

***Additional supplementary data and the questionnaire are available upon request**

Annex III: Pre-printed Maps for Participatory FGDs



Annex IV: List of Key Informants Interviewees

Organization	Designation
Melamchi Municipality	Environmental Officer
Melamchi Municipality	Deputy Mayor
Melamchi Municipality	Police Inspector
Melamchi Municipality	Engineer
Melamchi Municipality	Chief Administrative Officer
Melamchi Municipality	Veterinarian
Melamchi Municipality	Ward Chairman
Melamchi Municipality	Auxiliary Nurse Midwife
Radio Melamchi	Reporter
Helambu Rural Municipality	Mayor
Helambu Rural Municipality	Engineer
Helambu Rural Municipality	Agriculture Technician
Helambu Rural Municipality	Planning Division
Helambu Rural Municipality	Certified Medical Assistant

Annex V: Estimated Economic Valuation of Losses and Damages


(a) Melamchi Municipality

आर्थिक क्षति मूल्यांकन विवरण

क्र.स.	क्षति विवरण	रकम	कैफियत
१	पूर्ण क्षति भएका घरको क्षति मूल्याङ्कन	५४,९६,०५,५८,०००	
२	पूर्ण क्षति भएका जग्गा जमिनको मूल्याङ्कन	२,३४,७३,४५,३०१	
३	पूर्ण क्षति भएका पशु/पंछी/चौपाया र मत्स्य को मूल्याङ्कन	१,२०,००,०००	
जम्मा		५७,३१,९९,०३,३०१	
जम्मा क्षति मुल्याङ्कन : अक्षरुपि सन्ताउन्न अर्ब एकतिस करोड उनान्सय लाख तिन हजार तिन सय एक रुपैयाँ मात्र ।			

(Source: Melamchi Municipality)

(b) Helambu Rural Municipality



हेलम्बु नगरपालिका									
विस्तृत विवरण									
क्र.स.	विवरण	माप	माप	माप	माप	माप	माप	माप	माप
१	सम्पत्ति	५	१						
२	सम्पत्ति	५	१						
३	सम्पत्ति	५	१						
जम्मा		५	१						
जम्मा क्षति मुल्याङ्कन : अक्षरुपि सन्ताउन्न अर्ब एकतिस करोड उनान्सय लाख तिन हजार तिन सय एक रुपैयाँ मात्र ।									

Annex VI: Types of Assets Lost or Damaged Based on Multiple Responses

Types of assets lost	Number of respondents	Percentage
Land	6	5
House	3	3
Livestock	2	2
Others	5	4
Land, house	16	13
Land, house, livestock	8	7
Land, house, livestock, crops	9	8
Land, house, livestock, crops, others	6	5
Land, house, livestock, others	1	1
Land, house, crops	17	14
Land, house, crops, others	2	2
Land, house, fishery	1	1
Land, house, others	8	7
Land, livestock	3	3
Land, livestock, crops	2	2
Land, livestock, crops, others	1	1
Land, crops	14	12
Land, crops, others	1	1
Land, others	7	6
House, livestock	1	1
House, livestock, crops	1	1
House, livestock, crops, others	2	2
House, crops	1	1
House, others	2	2
Crops, others	1	1
Total	120	100





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Established in 2015, **Prakriti Resources Centre (PRC)** is a non-governmental organization working for sustainable development and environmental justice in Nepal. We are carving a niche for ourselves in the areas of national and international climate policy processes, climate finance, climate resilient and low carbon development practices, and loss and damage associated with climate change impacts.



Climate, Risk & Resilience Lab

Climate Risk & Resilience Lab is a research based organization that focuses on the use of data and frontier technologies for better understanding risk and environmental hazard. Leveraging the strength of geospatial technologies, open-source data and research tools, it aims to bridge the gap between data, policy and practice.



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