LOSS AND DAMAGE IN THE HIGH MOUNTAINS OF THE EVEREST REGION

Realities, Pains, and Perils from Thame Village

LOSS AND DAMAGE IN THE HIGH MOUNTAINS OF THE EVEREST REGION: REALITIES, PAINS, AND PERILS FROM THAME VILLAGE

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Authors:
Binod Prasad Parajuli, Preshika Baskota, Abhishek Shrestha, Nischal Sedhai, Somy Bhattarai, Jhalak Paudel, Prayash Adhikari, and Pratima Khatri-Chhetri

Reviewers:
Sunil Acharya and Colin McQuistan

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FOREWORD

खुम्बु पासाङ्ल्हामु गाउँपालिका

Khumbu Pasanglhamu Rural Municipality

गाउँ कार्यपालिकाको कार्यालय, चौरीखर्क, सोलुखुम्बु, कोशी प्रदेश, नेपाल

Office of the Rural Municipal Executive, Chaurikharka, Solukhumbu, Koshi Province, Nepal

Khumbu Pasanglhamu Rural Municipality
Office of Rural Municipal Executive
Chaurikharka, Solukhumbu
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The impacts of climate change on high mountain communities, particularly in regions such as Khumbu Pasang Lhamu Rural Municipality, are profound. As a municipality in the Everest region, we experience firsthand the realities, pains, and perils our communities face due to climate-induced disasters. The recent Glacial Lake Outburst Flood (GLOF) that struck Thame Village stands as an urgent reminder of the critical need for immediate and long-term action to protect vulnerable high-altitude regions, particularly given the fragile nature of the region.

In this context, the report, Loss, and Damage in the High Mountains of the Everest Region: Realities, Pains, and Perils from Thame Village, offers valuable insights and solid evidence of the economic, social, and environmental impacts due to a GLOF event that devastated one of a prominent touristic destination of our municipality on August 16, 2024. Khumbu Pasang Lhamu Rural Municipality has also conducted a detailed assessment of post-incident conditions in Thame, and we are pleased that these findings have been incorporated into this report. This collaborative assessment captures the extensive losses experienced by the community and highlights immediate and long-term challenges for recovery, rehabilitation, and resilience building. We believe that this report serves as a critical foundation to advance the ongoing discourse on loss and damage. We further believe that this report will serve as an essential resource in shaping policies and guiding future actions to mitigate the risks associated with climate change, with a particular focus on mountains.

On behalf of Khumbu Pasang Lhamu Rural Municipality, I extend our gratitude to all contributors, from community members and local officials, technical experts, and global partners, for their contribution to documenting this unfortunate incident and providing support to restore livelihood. We believe this document will serve as a foundation to connect us with the federal government, civil society organizations, and international communities to advocate early access to the fund for responding to loss and damage by recognizing such unprecedented events in the highest landscape of the world. We further request that global communities stand alongside us to ensure justice is delivered to the people of the mountains.

Mingma Chhiri Sherpa
Chairman
Khumbu Pasanglhamu Rural Municipality

Email: ito.khumbupasanglhamumun@gmail.com, info@khumbupasanglhamumun.gov.np
Phone: +97738590046

ACKNOWLEDGEMENT

We are deeply honored to bring the lived experiences and voices of people from Thame to national and global audiences. We sincerely thank the residents of Khumbu Pasanglhamu Rural Municipality for their invaluable support in the research to bring the realities of Thame to the world. In particular, we would like to thank Chairperson Mingma Chhiri Sherpa for his leadership and assistance in facilitating the research process and for providing municipal-level assessed data that greatly enriched the findings and analysis presented in this study.

We are also grateful to the support of Dhan Raj Acharya, Administrative Assistant, Khumbu Pasanglhamu Rural Municipality, whose expertise and insights were essential in guiding our understanding of the Glacial Lake Outburst Flood (GLOF) impact. Our heartfelt appreciation to Chakra Karki for his logistics management and coordination role, which were instrumental in data collection and in connecting the research team with the people of Thame. We extend our special thanks to Pasang Tshering Sherpa, of Khumbu Bijuli Company Limited for his support in providing valuable information regarding the Impact of GLOF on local infrastructure and energy resources.

We are thankful to Dr. Maheshwar Dhakal, a board member at Fund for Responding to Loss and Damage (FrLD), for his guidance in the research design and review of this study. We sincerely thank Mr. Amrit Thapa for providing advisory suggestions on accessing satellite imageries, temperature data and interpretation. A special thanks to the people of Thame, particularly Mingma Nuru Sherpa, Diki Sherpa, and other community members, whose hospitality and willingness to share their stories enriched this study. We would also like to thank our enumerators, Pasang Tshering Sherpa, Mingma Yanji Sherpa, and Mingma Rita Sherpa, for their assistance in the questionnaire survey. Without their engagement, we would not have achieved the in-depth findings.

We express our gratitude to Gopal Tamang, Kami Temba Sherpa, Ang Maya Sherpa, Mingma Chammji Sherpa, Ang Doma Sherpa, and Nyigma Sherpa for sharing their personal experiences within the Key Informants Interview (KII) for this research. The stories from the people of Thame have deepened our understanding of non-economic loss and damage. We would like to acknowledge all the participants of the Thame village who attended focus group discussion and shared their experience and understanding of the GLOF in Thame. We would also like to thank Paras Shrestha and Bijesh Rai from Made. by.studios for designing the report.

This study is an effort of the collective work, support, and shared commitment of all those mentioned above. We hope it serves as a valuable resource to delve into Thame's economic and non-economic climate-induced loss and damage and to understand communities' need in responding to loss and damage.

EXECUTIVE SUMMARY

Nepal is home to over eight of the world's tallest mountains, including Mount Everest. These mountains are essential sources of water, life, culture, and livelihood and thrive civilizations in Asia. However, global environmental change including climate change has led to increased extreme weather events, making these regions fragile and susceptible. On the afternoon of 16th August, 2024, a Glacial Lake Outburst Flood (GLOF) struck Thame village in Solukhumbu district in the Everest region of Nepal. The GLOF has been originated from the Thyanbo glacial lake (about 8 km upstream of the Thame village), which was recently formed, as per the locals. The incident devastated the Sherpa community, profoundly affecting cultural heritage, livelihoods, infrastructure, agricultural land, connectivity, energy access, and the natural environment. This study assessed economic and non-economic losses and damages through extensive field research, including eight key informant interviews, 46 household surveys, two focus group discussions, and eight case stories. The findings of this study were validated and triangulated using the municipal data provided by the Khumbu Pasanglhamu Rural Municipality, which includes a detailed survey conducted by the municipality.

An estimated economic loss of 4.13 million USD was incurred due to the damage to houses, land, and crops alone. A detailed household-level assessment revealed that the average loss per household was about 103,342 USD, with the most affected household suffering losses of up to 311,862 USD. The economic valuation of the trail damage carried out by the local government provided an estimated loss of 22,484 USD. Furthermore, a loss of 503,121 USD was estimated for the Thame School. Additionally, the loss of infrastructure such as bridges, hydropower infrastructure and drinking water supply is yet to be carried out.

The GLOF also reported substantial non-economic losses. Community members, including children, women, and the elderly, reported significant mental health impacts, with increased instances of anxiety and post-traumatic stress. This disaster has impacted social harmony among the Sherpa community's cultural practices, including collective prayers at sacred glacial lakes. The reshaped landscape, shifting riverbanks, and damaged trails have reduced the village's aesthetic appeal and created mobility and accessibility challenges. Environmental degradation is an additional, long-term consequence, as riverbank erosion and altered ecosystems have threatened local biodiversity, agriculture, livelihood and the future of tourism.

Khumbu Pasanglhamu Rural Municipality and organizations working in the region provided immediate relief, including financial aid, infrastructure repairs, and resources including food supply, tents, and solar lamps. In response to the incident, an available budget was channelized from existing development-related headings to compensate and meet the immediate requirements of the affected population by Khumbu Pasanglhamu Rural Municipality. The total financial support raised from various sources (municipality, NGOs, community, individuals, and a GoFundMe campaign) amounted to 684,332 USD, while the total estimated losses evaluated by the municipality is 6,171,649 USD, leaving a funding gap of 5,487,317 USD.

Financial support, although essential, has fallen short of the need, many residents expressed concerns over the lack of social protection and safety nets, which has left households and businesses unable to recover or rebuild without sufficient financial support.

This study underscores the need for a comprehensive GLOF risk assessment supported by infrastructures for ground-based monitoring to advance early warning systems, and climate adaptation strategies tailored to high-mountain communities. Furthermore, the study urges financial and technical support in detailed risk assessment to inform local and regional planning so that future development plans are risk-informed. Most importantly, it is imperative to build the capacity of the locals, including communities and authorities, recognizing that they are and will be the first responders during the crisis. At the planning level, learnings from such incidents should inform long-term planning, informed by future scenarios. One of the demands of the community and the local government was access and disbursement of the resources for rebuilding Thame, without any conditionalities, to be channeled through local institutions.

Economic Losses and Damages

6.17 million
The municipality estimated total losses for the loss of houses, furniture, schools, and trails.

4.13 million USD
An estimated economic loss for houses, land, and crops, as per household survey among ***46 households.***

103,342 USD
(Among 46 households)
The average loss per household.

95%
of the respondents mentioned having their land affected.

503,121 USD
A total loss was estimated for the school alone as per the assessment carried out by the local government.

85.37%
of respondents had an agricultural income loss, followed by business income loss for **70.73%** of the respondents.

95.6%
of respondents used personal savings to cope with the income loss from GLOF in the short term.

22,484 USD
The trails were disrupted, limiting access to the region with total estimation loss.

Non-Economic Losses and Damages

95.65%
mentioned facing mental Impact due to the GLOF

Increased Difficulty
in transporting goods led to shortages and higher prices for essential supplies.

67.39%
of respondents mentioned fear and mental distress stopped childrens from attending school.

Destruction of the Power Supply
left the villagers without electricity for more than a month, limiting access to basic necessities.

76%
of the respondents mentioned decreased social interactions due to the incident.

25.71%
respondents mentioned regarding damage to stupa/monasteries.

Amolst 90%
of the respondents agreed on the Impact of GLOF on the natural environment.

Increased Workload on women
The workload on women had increased post-incident. particularly impacting single women who had to deal with the situation alone.

ACRONYMS

AOSIS	Alliance of Small Island States
COP	Conference of the Parties
CMA	Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement
DHM	Department of Hydrology and Meteorology
FGD	Focus Group Discussions
GDP	Gross Domestic Product
GLOF	Glacier Lake Outburst Flood
HKH	Hindu Kush Himalaya
ICIMOD	International Centre for Integrated Mountain Development
KII	Key Informant Interview
KPRM	Khumbu Pasanglhamu Rural Municipality
LDOF	Landslide Dam Outburst Floods
MoFE	Ministry of Forests and Environment
SPSS	Statistical Package for the Social Sciences
PTSD	Post-Traumatic Stress Disorder
L&D	Loss and Damage
NPR	Nepalese Rupees
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
TC	Transitional Committee
WIM	Warsaw International Mechanism

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INTRODUCTION:

BACKGROUND

Global climate change, as a consequence of long-term changes in trends and weather patterns (UN, 2016), significantly impacts the planet and people. These continuous changes in climate have intensified events that include droughts, intense wildfires, rising sea levels, flooding, melting ice, devastating storms, and a loss of biodiversity (UNDP, 2023; WMO, 2024). Glaciers are among the most prominent indicators of climate variability, and evidence suggests accelerated glacier melting (Armstrong et al., 2009). Such melting is prominently impacting the Himalayas, leading to a reduction in the volume of ice and snow, alterations in land use, changes in vegetation, and a decline in biodiversity, negatively impacting people, the ecosystem, and the lives of the people (Rani et al., 2022).

Glacial lakes are significant water resources in the Himalayan regions. However, they pose serious risks as potential triggers for mountain-related hazards, including flash floods, landslides, Landslide Dam Outburst Floods (LDOF), and GLOFs. These events have been linked to rising positive trends in both annual and seasonal maximum temperatures (IPCC, 2023). IPCC (2023) has recognized the differential impact of mountains and people living in the highlands despite their negligible contribution to global greenhouse gas emissions.

Nepal, a Himalayan country, is recurrently impacted by climate change and climate-induced extreme events (Kapri, 2024). In Nepal, the annual and seasonal maximum temperatures are increasing at 0.056°C and 0.002°C per year, respectively (DHM, 2017). Rapid melting has led to the formation of new glacial lakes and the expansion of existing ones, increasing the potential for GLOFs (Fujita et al., 2009). In 2020, 47 of 2,420 glacial lakes were identified as potentially dangerous, particularly in the Koshi, Gandaki, and Karnali basins (MoFE, 2021a). Sudden outbreaks of these glacial lakes can severely damage downstream communities through debris flows and floodwaters, devastating communities, infrastructures, and the downstream environment.

While enhanced efforts in climate change mitigation and adaptation strategies can help reduce these impacts, certain losses and damages remain unavoidable (Van der Geest et al., 2015). UNFCCC (2013) refers to loss and damage (L&D) as the climate-related impacts and risks arising from sudden or slow events. Furthermore, MoFE (2021b) defined L&D as "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 Tarai 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." According to a report by MoFE, climate-induced disasters account for approximately 65% of disaster-related annual deaths with an average yearly economic loss of 20.687 million USD, which is around 0.08 percent of the total Gross Domestic Product (GDP) for the fiscal year 2018/19 (MoFE, 2021b).

1.2 EVOLUTION OF LOSS AND DAMAGE ISSUE IN CLIMATE DEBATE

Loss and damage have evolved through a series of milestones within the UN climate change discourse. The first proposal for Loss and Damage was tabled by Vanuatu on behalf of the Alliance of Small Island States (AOSIS) in 1991. At COP 13, in Bali, "loss and damage" was adopted for the first time in the decision text driven by AOSIS and other vulnerable developing country Parties. At COP 16, Cancun, in 2010, a work program was created to increase the understanding of assessing and addressing loss and damage. This led to the establishment of the Warsaw International Mechanism (WIM) in COP 19, Warsaw. The main objective of the WIM is to address the loss and damage associated with the impacts of climate change, including extreme events and slow-onset events in vulnerable developing countries.

The WIM has three functions:

1. Building understanding and knowledge of comprehensive risk management to address loss and damage.

2. Strengthening dialogue, coordination, coherence, and synergies amongst relevant stakeholders and

3. Increase action and support to include finance, technology, and capacity building to address loss and damage.

Further, loss and damage were recognized as a dedicated pillar in the Paris Agreement in 2015. Santiago Network on Loss and Damage (SNLD) was established in 2019 to contribute to effectively implementing WIM. SNLD aims to catalyze the technical assistance of organizations, bodies, networks, and experts (OBNEs) to implement relevant approaches at the local, national, and regional levels in vulnerable developing countries to the adverse effects of climate change.

Parties at COP 27 in Egypt agreed to establish a Loss and Damage fund as a part of new funding arrangements for assisting developing countries particularly vulnerable to climate change's adverse impacts in responding to loss and damage. COP 27 in Egypt decided to establish a Transitional Committee (TC) to provide recommendations for establishing institutional arrangements, modalities, structure, governance, and terms of reference for the fund, as well as define elements of new funding arrangements, identify and expand sources of funding, and ensure coordination and complementarity with existing funding. The recommendations were adopted on the first day of COP 28 in Dubai, UAE, to operationalize the Loss and Damage Fund. The decision on operationalization had two annexes: Annex I: Governing Instrument for the new Fund and Annex II: Funding Arrangements. The loss and damage fund is directed by an independent board which comprises 14 board members from developing countries and 12 from developed countries. The representation of the board members in the fund is based on geographical representation. Each board has an alternate member on board. The board is mandated to decide on the fund, set policies and processes for the disbursement of the fund, and establish access modalities for the countries to access the fund. The World Bank will serve as the interim host for the Fund for Responding to Loss and Damages for four years.

1.3 LOSS AND DAMAGE CONTEXT IN HIGH MOUNTAIN REGION

Mountain regions cover nearly one-third of the Earth's land area and offer a wide range of ecosystem services by regulating climate and hydrological cycles (ICIMOD, 2006; Tenorio et al., 2023). In the past decade, glacier mass loss in the Hindu Kush Himalaya (HKH) region, for instance, has increased by 65%, and they are expected to continue losing mass for coming decades (UNEP, 2023). The increasing population, tourism, and socio-economic development have further exacerbated the exposure of communities and infrastructure to climate-related hazards. Consequently, mountaineering activities such as skiing and climbing have suffered due to diminishing snow cover, glaciers, and permafrost. In many areas, deteriorating route safety has limited mountaineering opportunities.

The IPCC's Sixth Assessment Report, with high confidence, refers to mountain regions as highly susceptible to cryosphere-related changes, including GLOFs, landslides, and water availability, which can impact lives, livelihoods, the economy, and infrastructure (IPCC, 2021).

Furthermore, reductions in snow cover have adversely affected the reflective capabilities of these regions and the feedback mechanisms (IPCC, 2019). Such a phenomenon has contributed to the shifting patterns of water availability, resulting in water insecurity, livelihood loss, displacement, loss of biodiversity, and cultural diversity (Mena et al., 2023). According to a report, the HKH region, between 1985 and 2014, experienced the highest reported economic damage as a result of floods and mass movements, totaling 45 billion USD (UNEP, 2023).

In Nepal, 2,420 glacial lakes spread across the high mountain regions, with Solukhumbu, Sankhuwasabha, and Taplejung districts highly susceptible to GLOF incidents (ICIMOD, 2011). The Dig Tsho outburst in 1985 led to over $3 million in damages and long-term disruptions in the Khumbu region. As climate change intensifies, GLOFs are expected to become more frequent and intense (Cui et al., 2014).

1.4 THAME GLOF INCIDENT

The outburst originated from the Thyanbo glacial lake, which is close to three associated glacial lakes in the upstream region of the Thame village (figure 1). In a press note released by ICIMOD, the size of the glacier lake, four to five hours before the burst, was estimated to be 0.05 square kilometers (ICIMOD, 2024). A comparison of before and after images of the glacial lakes reveals significant changes in its size (figure 1). The most notable differences are observed in the lake in the northern part on the top, which changed in size with a decrease in water accumulation (after the GLOF). This indicates that the GLOF originated from these lakes, causing their water levels to drop drastically as the large volume of water was released, accelerating erosion and deposition of sediments downstream, as evident in Figure 2.

Figure 1: *Satellite imagery of glacier lake areas before and after, highlighting the origin of the GLOF (Source: Planet Lab)*

Once a breach occurred (yellow circle), the floodwater rapidly drained downstream (following the topography) towards its outlet, transporting massive sediment and debris. Satellite imagery from August 15 (pre-GLOF) and August 17 (post-GLOF) showed a significant increase in the width of the glacier lake discharge (figure 2), resulting in severe damage to Thame village that is located approximately 8 km downstream of the glacier lake.

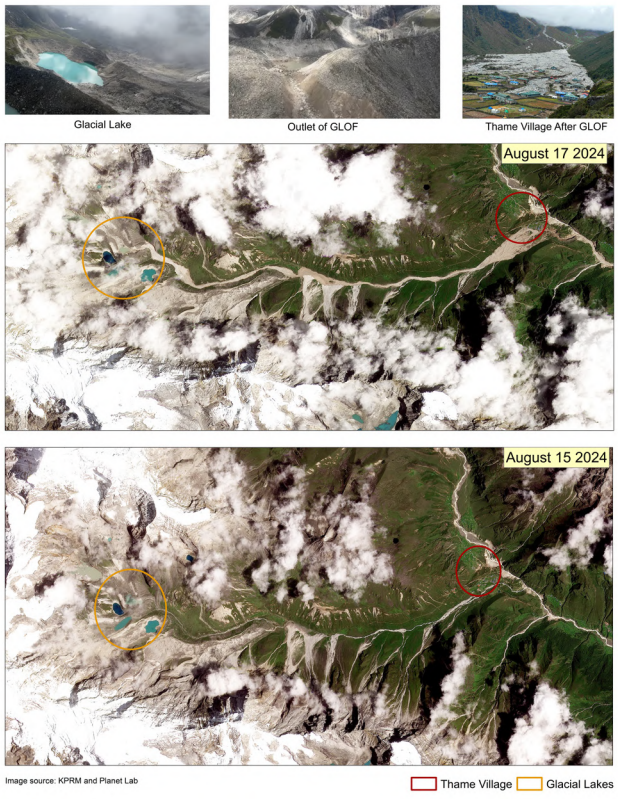


Figure 2: *Before and after satellite imagery of Thame Area with Glacial lakes (Source: Planet lab) and photographs after the GLOF (extracted from the aerial footage of Khumbu Pasanglhamu Rural Municipality)*

According to the preliminary study of the incident by the Department of Hydrology and Meteorology (DHM), observations from the nearby Phortse weather station, a total of 65 mm of rainfall was recorded in the past seven days (before the incident), with a gradual increase in the average daily temperature from 9.7°C to 11.0°C since 9th August 2024. The maximum temperature recorded on 15th August 2024 reached as high as 15.9°C (DHM, 2024), which is unusual for the region.

The graph (figure 3) shows a satellite observation of the average annual temperature from the European Centre for Medium-Range Weather Forecasts (ECMWF) between 1980 and 2024 near the glacial lake at an altitude of 4800m. The data shows an increasing trend for the selected period and suggests a gradual increase in the temperature, which contributed to the accelerated melting of the glaciers.

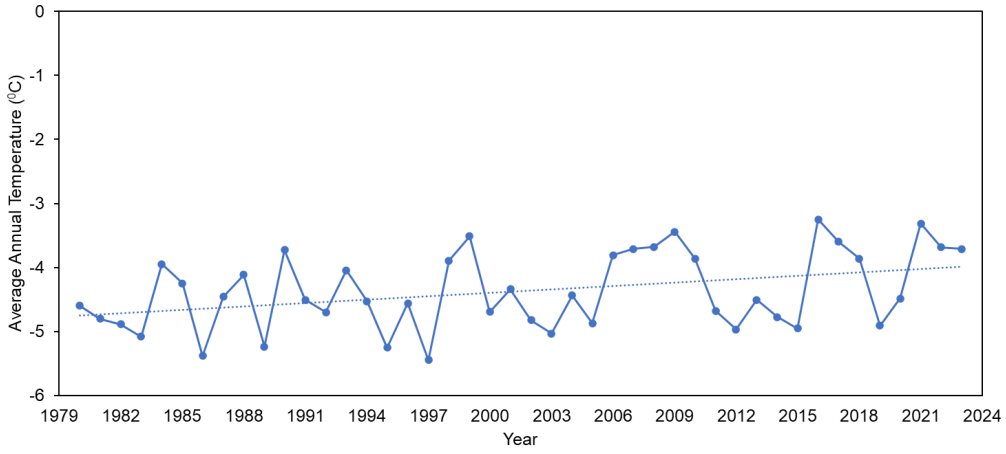


Figure 3: *Average Annual Temperature (1980 - 2023) of a point near the Thyanbo Glacial Lake (Data source: ECMWF)*

1.5 NATIONAL FRAMEWORK ON LOSS AND DAMAGE

Nepal formulated the National Framework for Loss and Damage in 2021 under the Ministry of Forests and Environment (MoFE, 2021b). The framework aims to guide loss and damage assessment, primarily focusing on the vulnerability of the local community to climate-intensified events. The framework guides methodology design for vulnerability and risk assessment along with operationalizing a method for assessing L&D. The framework includes assessment approaches for climate-induced slow-onset and extreme weather events. It also analyzes the adaptation limits and the constraints of adaptation (figure 4).

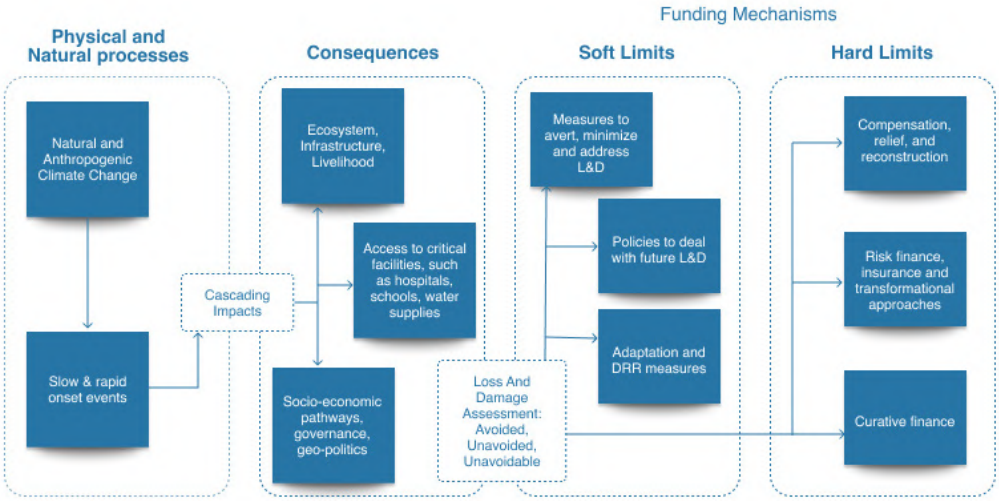


Figure 4 *:National Framework established for assessing L&D caused by climate-induced hazards (Original source: MoFE (2021b) adapted by Parajuli et al. (2023)*

To develop a mechanism for assessing L&D, six key steps are recommended by the national framework, as listed below:

- Identifying Key elements for climate extreme events
- Identifying key indicators for vulnerability and exposure
- Indicator for losses and damages assessment
- Data collections and interpretation
- Analysis of climate induced hazards
- Analysis of climate informed multi-hazard risk

1.6 OBJECTIVES

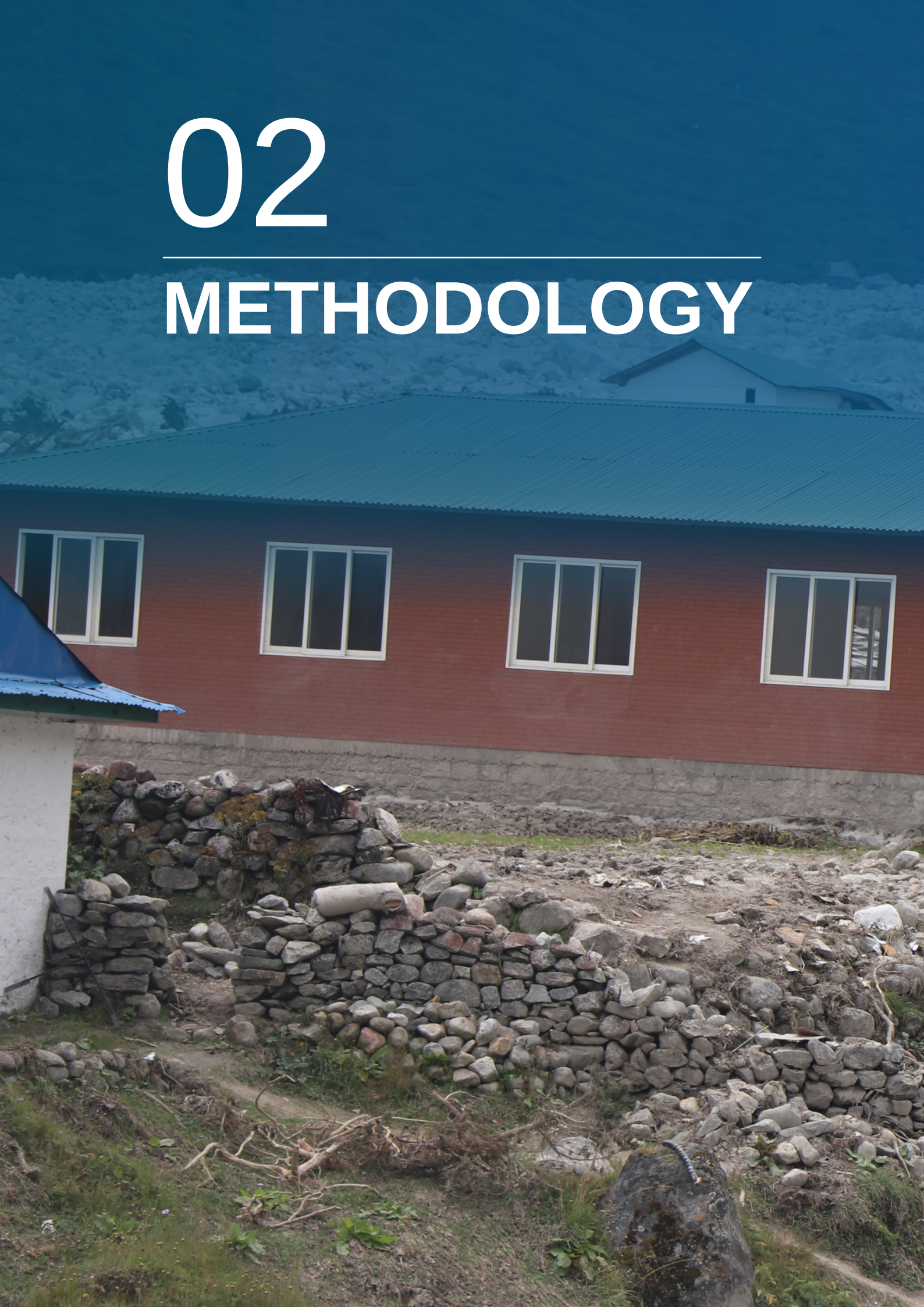
The main objective of this study is to assess the economic and non-economic losses and damages resulting from the climate-intensified GLOF that occurred on 16 August 2024, which devastated Thame, a historic Sherpa village in Nepal's Khumbu region.

The specific objectives are to:

- Identify and quantify both economic and non-economic losses and damages caused by the GLOF event .
- Document locally-led interventions by government and the community.
- Determine the residual gap in addressing economic and non-economic losses and damages.

02

METHODOLOGY




HOTEL YAK

2.1 STUDY AREA

Thame village is situated at 3785 m in ward number 5 of Khumbu Pasanglhamu Rural Municipality (KPRM) in Solukhumbu district, Koshi Province, Nepal. KPRM is named after two important representatives; "Khumbu," which refers to the uppermost part of the district, and "Pasanglhamu," named after the first Nepali woman to summit Mount Everest, the highest peak in the world. Ward 5 includes Namche Bazaar, which serves as the gateway to Everest. According to the 2021 national census, the ward's total population is 1,255, with 418 households.

The Sherpa village of Thame, located at the base of Kongde Peak, holds historical and cultural significance and is home to legendary mountaineers namely Kami Rita Sherpa, Apa Sherpa, and Tenzing Norgay. It is also one of the resting stations for the Everest Three Passes Trek that crosses three of the highest mountain passes in the region, namely Renjo La Pass (5,465 m), Cho La Pass (5,420 m) and Kongma La Pass (5,535 m). Renowned Buddhist lama Thubutan Zopa Rinpoche (1946–2023) was also born in Thame. He is recognized worldwide for the preservation and spread of Buddhism worldwide. Figure 5 provides the location map of Thame, depicting the Thame village and glacial lakes.

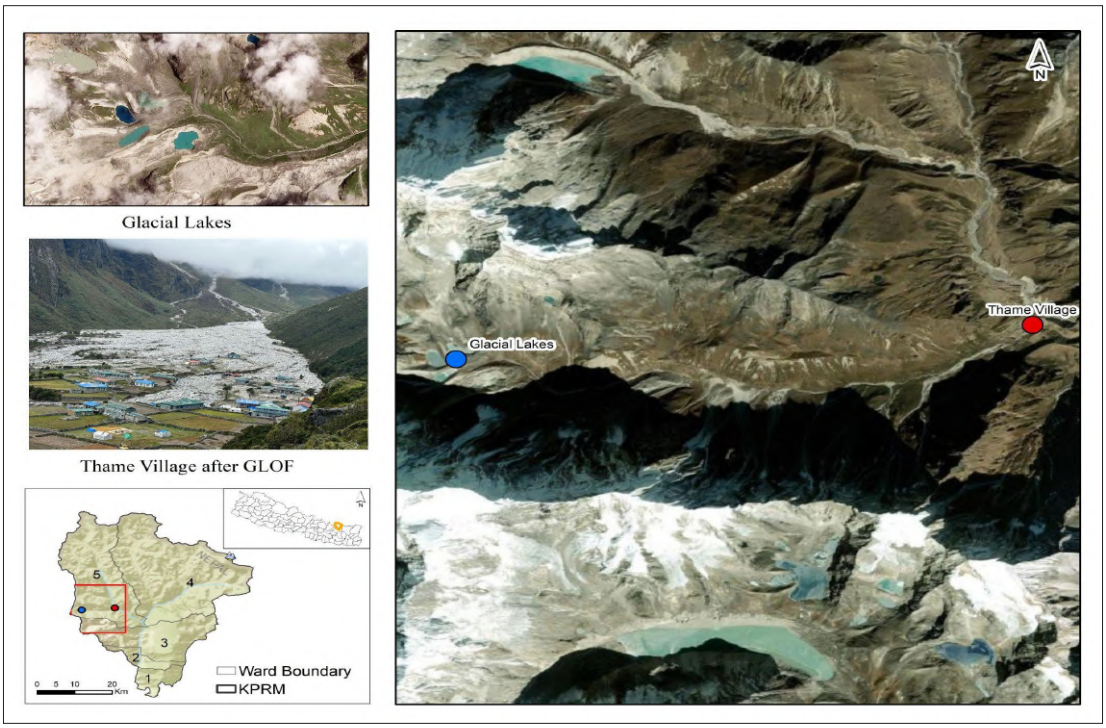


Figure 5: *Thame Village*

2.2 METHODOLOGICAL APPROACH

The methodological approach was designed based on the national loss and damage framework. Both the qualitative and quantitative data collection and analysis through different primary and secondary sources was performed. A field visit to Thame village was conducted immediately within a month following the incident. The data sources included households, institutions, and government officials. The economic losses and damages were quantified and the total residual gap was estimated based on the existing gaps between needs and support provided. A flowchart of the methodological approach is presented in figure 6.

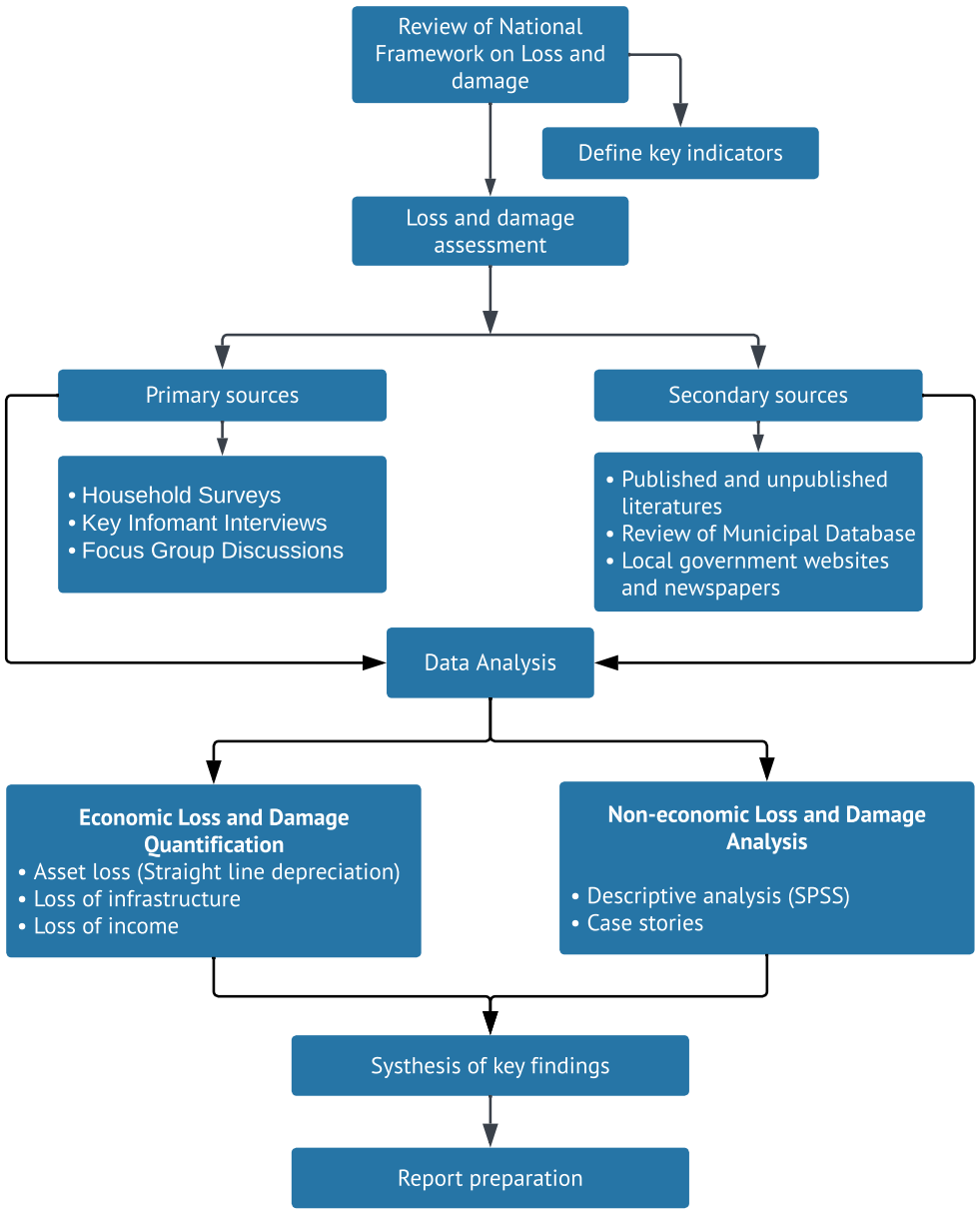


Figure 6: *Methodological Flowchart*

DATA COLLECTION AND ANALYSIS

2.3.1 PRIMARY DATA COLLECTION

Primary data on loss and damage from the GLOF incident were collected through a field observation in Thame village from 8th to 17th September, 2024. The field activities included a household survey, Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). The details of the data collection are provided below.

Household survey: The survey was conducted with 46 households of the Thame village that were severely impacted by GLOF. As per the local government's initial assessment, 54 households incurred losses and damages. However, eight households had temporarily migrated to other places and were not considered for the survey. The survey respondents represented both male and female sexes of varied age groups, with one participant from each household.

A structured questionnaire survey was conducted through Kobo Toolbox, which incorporated questions on socio-economic background, economic losses and damages, non-economic losses and damages, and financial compensation and support received. The economic L&D included loss and damage of assets, infrastructure, and sources of income. In contrast, the non-economic L&D included health impacts, cultural losses, impact on mobility and access, and losses on biodiversity and the natural environment.

Focus Group Discussion (FGD): FGDs were conducted with the community people representing the age group of 18-65 years with both male and female participants from different socio-economic backgrounds. A total of two FGDs were conducted, one in a community space under a tent and the other in an open space where women were harvesting buckwheat. Each FGD had eight participants on average and lasted for about 45 minutes. The participants' voices were captured through a voice recorder with their prior consent for proper documentation of insights from all the participants. However, the recordings were used solely for documentation and deleted afterward.

The group discussion was based on a semi-structured checklist with open-ended questions, which helped gather essential information and data on both economic and non-economic L&D faced by the community. The specific focus of the discussion was on the non-economic impacts, such as cultural loss, impacts on access and mobility, and community-led initiatives, especially during and after the incident. This information further provided a basis for validation and analysis of the data from the survey.

Key Informant Interviews (KII): Eight KII were conducted with personnel from the rural municipality, including the municipal chairperson, administration assistant, ward chairperson of ward number 5, administration chief of Khumbu Electricity Company, owners of Hotel Yak and Hotel Everest Summiteer in Thame village, a socially active local person, and a doctor from Thame village. The interview followed a semi-structured checklist that provided key information, a historical timeline, and data on the community's economic and non-economic L&D.

2.3.2 SECONDARY DATA COLLECTION

The secondary data on the GLOF incident, as well as information on associated losses and damages, was collected from a variety of sources. A thorough review of both published and unpublished literature was carried out to understand the context of the GLOF. A sentinel image with a 10 m resolution was used to analyze the incident and its impact. Similarly, the rainfall and temperature trend analysis carried out by the DHM was reviewed, followed by an analysis of the average annual temperature trend from 1980 to 2023 of a point near the glacial lake, accessed from the ECMWF.

Furthermore, municipal databases on loss and damage assessment and statistics relevant to the affected areas were gathered to validate the data from primary sources. In addition, information from local government websites and newspapers was reviewed for official records on specific details of the event and capturing immediate impacts, community responses, relief support, and other interventions.

2.3.3 LOSS AND DAMAGE ASSESSMENT

Both economic and non-economic L&D were assessed to understand the overall losses and damages. The economic L&D assessment included quantifying asset losses, infrastructural and agricultural losses, and loss of income sources. Similarly, the non-economic L&D assessment included a descriptive analysis of the impacts and highlights of case stories.

Economic L&D Assessment: Data collected from household surveys estimated the household-level economic valuation of house, land, and crop loss. The loss of each attribute was estimated based on municipal and local rates. Furthermore, the total economic valuation of the damage was calculated using household information and the extent of damage observed from the field survey.

The loss valuation of these assets was further validated with the municipal estimation. Municipal estimation for house loss was based on a straight line depreciation method where the total amount of house was calculated by multiplying its area by the per unit rate. Further, the salvage value was calculated as 20% of the total amount. Finally, the depreciation rate per year was calculated by subtracting salvage value from the total amount divided by the average lifespan of the house (50 years). The calculation resulted in a depreciation rate of 1.6%. Similarly, the land valuation by the municipality was estimated by multiplying the municipal defined rate per square meter by the land area (in square meters) of respondents.

Economic valuation of assets provided a detailed overview of losses at the household level, showing the specific impact on individual families. In contrast, the estimation at the municipal level provided an overall picture of the losses across the entire village, giving a broader perspective of the economic impact of the GLOF incident. This approach allowed us to understand the specific losses for each household and the total losses affecting the municipality. In addition, the loss estimation performed by the municipality was used to calculate the residual gap and understand the funding requirements.

Furthermore, the average loss of income of the community members to date and the loss of income for the upcoming tourism season (September to November) were also estimated by evaluating respondent's income sources and annual income. The valuation was done in Nepali rupees (NPR) and converted into United States Dollars (USD) as per the rate by Nepal Rastra Bank on 5 November 2024, with 1 NPR equal to 134.29 USD.

Non-economic L&D Assessment: The data on non-economic L&D generated from household surveys was analyzed using descriptive analysis in the Statistical Package for the Social Sciences (SPSS) and presented graphically. The study was further triangulated with information from KIIs and FGDs. Moreover, case stories of local porters, hotel owners, and health workers were documented, which provided an in-depth understanding of the personalized and differential impact of the incident. Tables 1 and 2 provide a summary of data collection tools and their methods of analysis.

Table 1: *Tools and methods for data collection and analysis for economic loss and damage*

Economic Losses and Damages			
Indicators	**Data sources**	**Analysis methods**	**Tools**
• Loss of assets • Agricultural losses • Infrastructural damages • Income loss	• Household Survey • Municipal Database • KII • FGD	• Descriptive Analysis • Economic Valuation	• Cost estimation • References from municipal assessment

Table 2: *Tools and methods for data collection and analysis for non-economic loss and damage for GLOF*

Non-economic Losses and Damages			
Indicators	**Data sources**	**Analysis methods**	**Tools**
• Emotional and physical health • Mobility and access • Socio-cultural • Displacement • Natural environment	• Household Survey • FGD • KII	• Descriptive analysis • Comparative analysis	• Case Story

2.4 LIMITATIONS OF THE STUDY

- The assessment was conducted between 8th and 17th September, just after the 16th August incident. As the situation is unstable, additional damage and assistance needs are not covered.
- This study uses both primary and secondary data sources for the economic valuation and calculation of the residual gap. The household economic calculations are based on construction costs, survey data, and market values. Meanwhile, the municipality's estimation is based on the government rate, which is lower than the actual values and may be subjected to underestimation. Furthermore, asset loss (houses) is estimated using straight-line depreciation, with a 20% salvage value and a 1.6% yearly depreciation over 50 years. These estimates may change with market values and calculation methods.
- The economic calculations and valuation consider simple economic equations and current market values, which may not reflect the actual financial impact of the incident. The cost of rebuilding their homes could increase in the near future, so the rehabilitation intervention should consider the market inflation, indirect costs and cost of delay.

- The estimation does not include Khumbu Hydropower's economic valuation, as it requires a detailed assessment of infrastructure, production, transmission, and future risks. However, the impact on communities and businesses due to a disrupted electricity supply has been considered.
- As the region stays fragile, there might be more losses, damages, and interventions by the governments, individuals, and civil societies, which this study might still need to document.
- The methodologies and tools are developed based on the national framework. Still, it should be noted that the broad scope of the framework allowed possibilities of using differently available methods in evaluating losses and damages, which may, in the future, create disparities if a similar study is carried out based on the same framework but different methodologies.

03

FINDINGS AND DISCUSSION

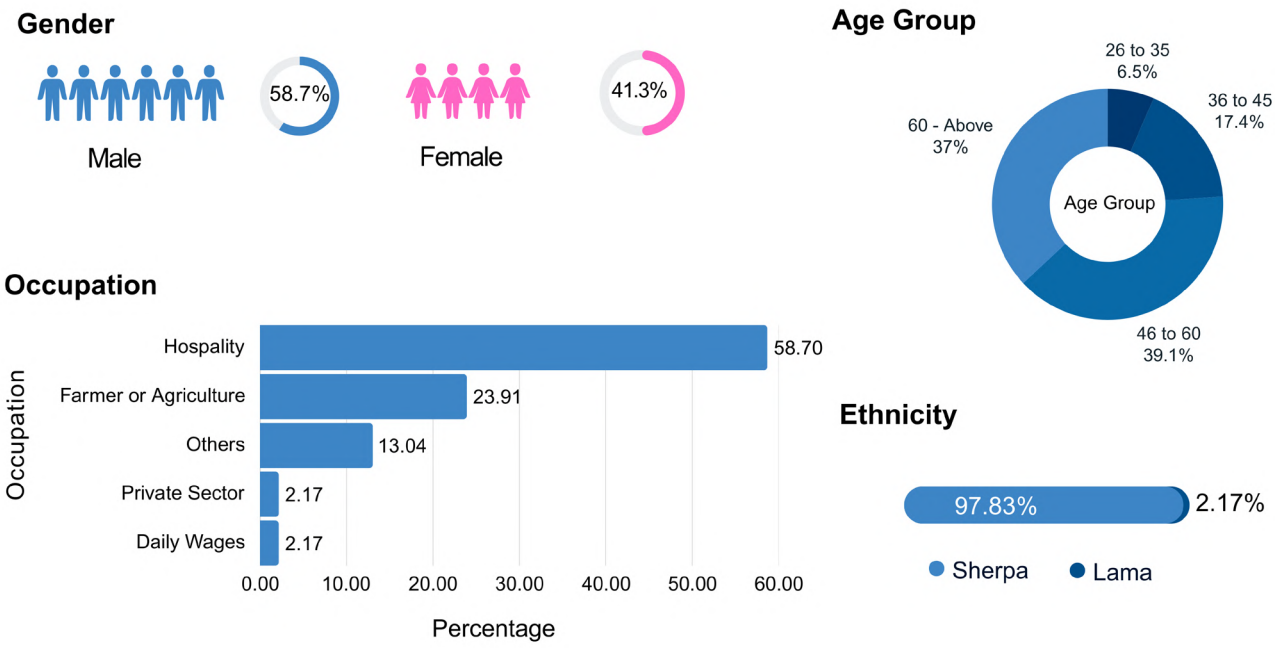
The findings are drawn based on 10 days of field work, observations, municipal consultation, interaction with the communities, and 46 household surveys with fully and partially damaged households. The insights are further strengthened with key informant interviews and validation from the results provided by the municipality based on their field-based assessment.

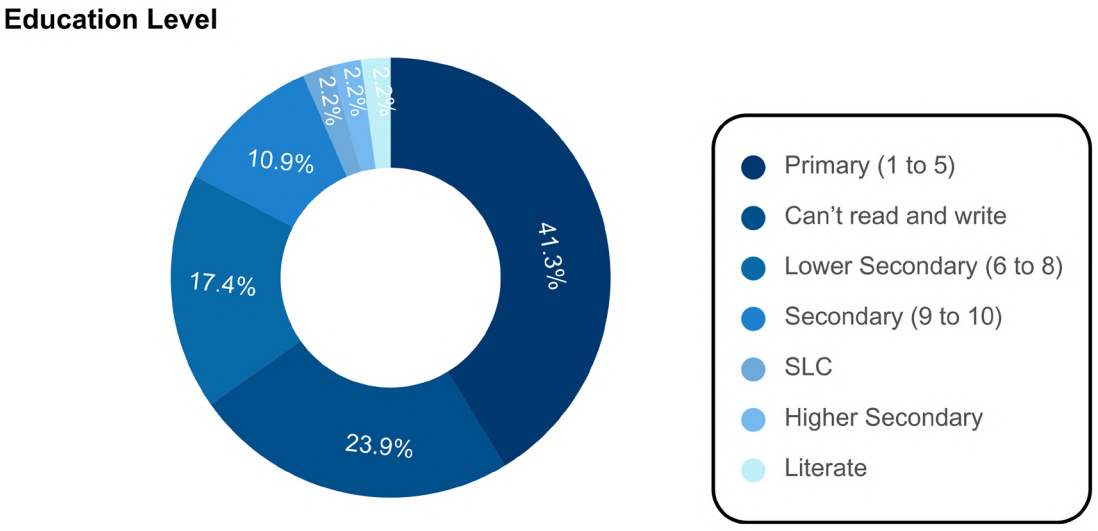
3.1 SOCIO-ECONOMIC BACKGROUND

Thame Village is located in the west of Namche bazaar in the Khumbu Valley of the Everest region. The Sherpa community primarily inhabits the village, which has a rich culture and the unique beauty of the Himalayas. The town is referred to as a powerhouse of the mountain to which the famous mountaineers were born and belong. Thame's economy has primarily depended on the tourism business, with the local people running lodges and hotels and being involved in mountaineering guides.

> **The business assets, agricultural land, and houses of these local people were heavily damaged due to the GLOF. The reduced lodging capacity and destroyed infrastructure have impacted the people's economy, further delaying recovery.**

The respondents from the household survey represented 97.63% Sherpa and 2.17% Lama ethnic groups, with 41.30% female and 58.70% male. Most respondents (39.13%) were 45-60 years of age, followed by 37% of the respondents above 60 years of age. Nearly 40% had attended primary schools, and only a few had passed the higher secondary level. Similarly, 58.70% of the respondents were engaged in hospitality businesses (hotels, resorts, and restaurants), 23.90 % in agriculture, and 2.17% in daily wage earners and the private sector. The remaining 13.04% of respondents were involved in mountaineering, "Lama" worshipers of monasteries, and few were retired. The income sources of most respondents (39.1%) were above 3,700 USD, and the average annual income of all the respondents was around 3,500 USD. Figure 7 provides charts with the socioeconomic background of the respondents.





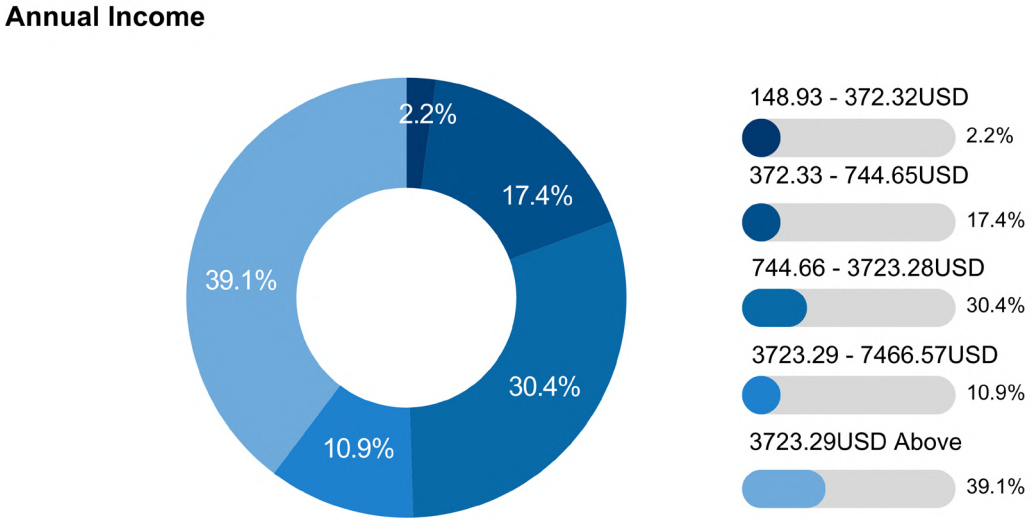


Figure 7: *Socio-economic background of the respondents*

3.2 ECONOMIC LOSSES AND DAMAGES

The GLOF significantly affected agriculture, infrastructure, tourism, and local shopkeepers, resulting in extensive economic losses and damages. It caused substantial damage to homes, cropland, schools, trails, and bridges, which isolated communities and disrupted essential services. The tourism industry is a primary source of income for the people of Thame but has been adversely impacted. Multiple lodges and hotels suffered substantial losses, affecting their physical structures and their services.

3.2.1 LOSS OF ASSETS

According to the municipality's initial assessment, the incident damaged 24 households fully, 14 partially, and 16 minorly. The villagers lost their valuable personal belongings, including jewelry, electronics, and important documents. Eight hotels and lodges and other small businesses were among the damaged houses. The loss of these assets has caused financial loss and emotional distress for the affected communities.

> **Mingma Yanji Sherpa, the owner of Hotel Yak, reported that the flood caused damage to half of the hotel's rooms, as well as to the furniture and household items. She referred to her loss to be between NPR 2 to 3 crores (USD 150,000 to 225,000)**

Furthermore, 9.51 hectares of land were severely damaged. The land is mainly used for agriculture and is vital for local food production and income. Vegetables and cereals, including potatoes, beans, maize, millet, and buckwheat, are the major agricultural products in the village. The erosion has permanently altered the riverbed, reducing the arable land available to farmers. In addition, the GLOF washed away eight livestock (yaks and cows).

According to the survey respondents, 87% of the respondents reported some extent of loss and damages to their assets, where they had single or multiple losses of assets. Among them, 95% of the respondents mentioned having their land affected and 90% having their houses damaged. Since many of the homes and buildings in this area are primarily used as hotels and lodges for tourism, 40% of the respondents mentioned having their business assets lost. Additionally, 80% of the respondents had their crops impacted, with the major crops being potatoes and beans, and 17.5% had lost their livestock (figure 8). Thame, being a tourist destination, experienced higher economic losses from the damage to these structures as a whole.

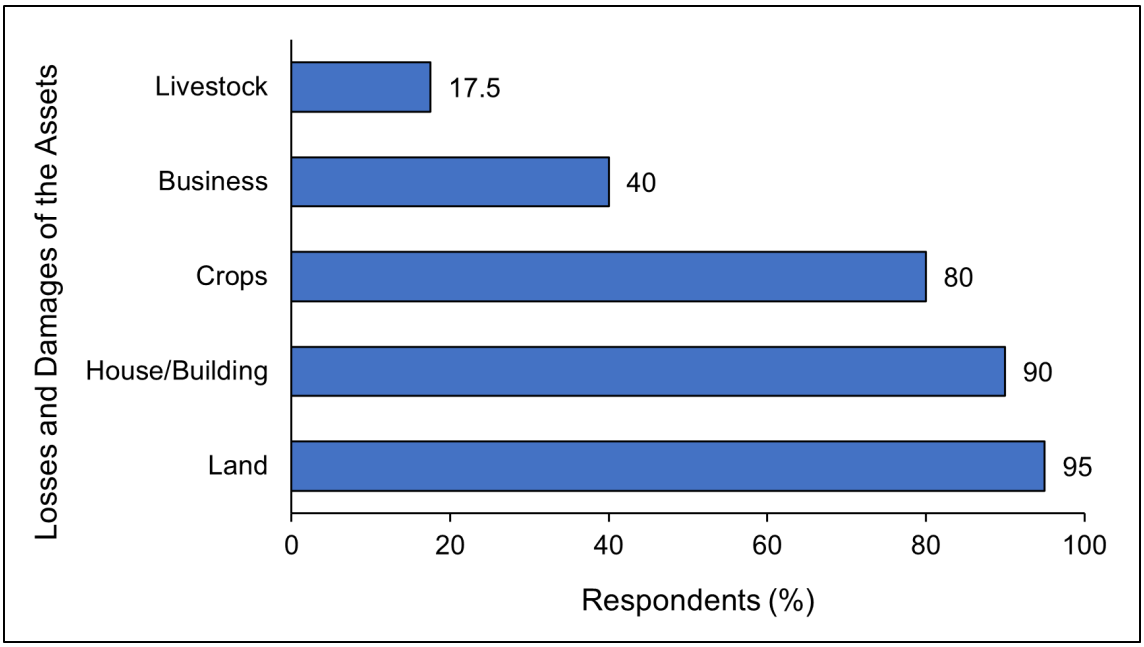


Figure 8: *Economic Losses and Damages faced due to GLOF*

The economic valuation of houses, land, and crops was estimated for survey respondents.

> **The total loss for these three significant assets was calculated to be 4.13 million USD, out of which the valuation of house loss was 3.17 million USD (Table 3).**

Table 3: *Economic valuation of the assets loss of survey respondents*

Assets	Loss	Cost (NPR)	Cost (USD)
House	36 households (90% mentioned their house to be impacted)	42.63 crores	3.17 million
Land	6.082 hectares	12.04 crore	896.74 thousand
Crop	Expressed in monetary terms	84.40 lakhs	62.85 thousand
Total loss		**55.51 crores**	**4.13 million**

On average, each household suffered from an economic loss of 103,342.319 USD while maximum loss faced at household level was up to 311,862.387 USD and minimum loss was 8,861.419 USD (Table 4) (Figure 9).

Table 4 : *Household level loss*

Statistic	Household level loss (USD)
No. of observations	46
Minimum	8,861.419
Maximum	311,862.387
1st Quartile	35,373.446
Median	68,808.549
3rd Quartile	157,792.836
Mean	103,342.319

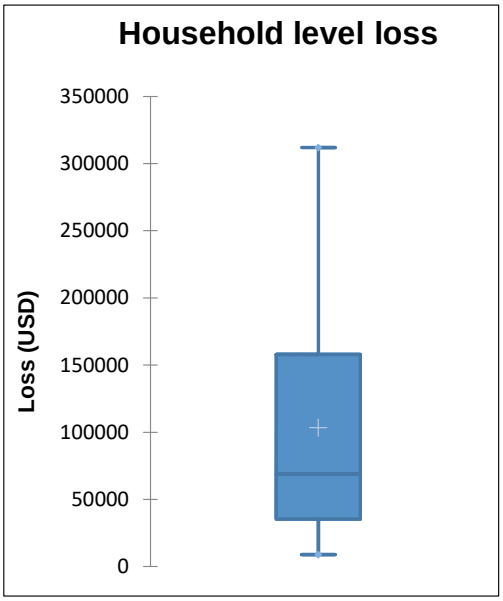


Figure 9: *Boxplot showing household level loss with outliers*

Similarly, the Khumbu Pasanglhamu Rural Municipality also provided economic loss estimation for 43 households in Thame village, with an additional two households from the downstream villages. According to the assessment, loss due to the destruction of houses, hotels, lodges, and household assets, especially furniture, was estimated to be 4.18 million USD. Furthermore, the land loss was valued at 1.47 million USD for 9.51 hectares, totaling 5.65 USD. The damaged structures included 20 stone masonry houses, 25 mud masonry houses, and four plain sheet houses. Among the damaged properties were eight hotels and lodges, one containing ten small cottages with plain sheet roofs.

3.2.2 INFRASTRUCTURAL LOSSES AND DAMAGES

The Thame community faced significant losses and infrastructure damage, including houses, hotels, lodges, and, most importantly, trekking trails, which further impacted nearby villages. The trails in areas such as Jorsalle, Banker, Toktok, and Ghat were disrupted, limiting access to the region. The local government carried out the economic valuation of the trail damage, which provides a total estimation of 22,484 USD. The valuation was carried out for the trail's damage and maintenance costs, where the trail's length, breadth, and height were evaluated, and the municipal rate was multiplied.

Furthermore, the Thame school, the only school in the village, was fully damaged, leaving students unable to access education. As per the assessment carried out by the local government, a total loss of 503,121 USD was estimated for the school alone. The estimation included the damages to the stone masonry school buildings, canteen, gate, toilet, ground, fencing, solar, quarter, library book, kitchen, and room set with clothes.

Similarly, the hydropower dam of Khumbu Electricity Company, which provides electricity to Thame, was heavily damaged. The essential infrastructure, such as water sources, transformers, and electricity poles, was also damaged. These destructions led to network issues and communication disruption for more than three months. Furthermore, as reported in the FGD, the disruptions to such basic utilities have made their daily life challenging and added further costs for repair and replacement. According to Dhan Prasad Acharya, administration assistant of KPRM,

> **Although temporary repairs have restored some functionality, the facility's long-term stability is uncertain, and frequent landslides further risk its operational status.**

Furthermore, there are several cracks on the ground near the dam of the hydropower which further puts the dam in danger. Moreover, in the worst case scenario, failure of the dam may further induce erosion and flash floods in the downstreams.

3.2.3 IMPACT ON THE SOURCE OF INCOME

Tourism and agriculture are the primary sources of income for the people of Thame. The disaster occurred just before the tourist season (September to November), adversely impacting the income of hospitality workers. The tourism income further involved hiking/trekking, tourist guides and porters, mountaineering, and rock climbing. Many hotels and lodges were destroyed by the GLOF, which significantly reduced the village's capacity to accommodate the tourists. This directly links with the people's diminished income source. During a FGD, a hotel owner and trekking guide concerned about the issue of income loss mentioned:

> **We already lost huge savings in the off-season and are concerned about losing more during the upcoming tourist season"- Pasang Tshering Sherpa, Respondent of Thame Village.**

Similarly, the agricultural production in the village, especially the vegetables, was sufficient to feed the community; however, after the incident, the agricultural income was significantly reduced.

The household survey revealed that agricultural income was lost for most respondents (85.37%), followed by business income loss for 70.73%, and tourism income for 63.41%. The loss of job/employment was reported by 4.88% only, and the loss of daily wages by 2.44% (figure 10).

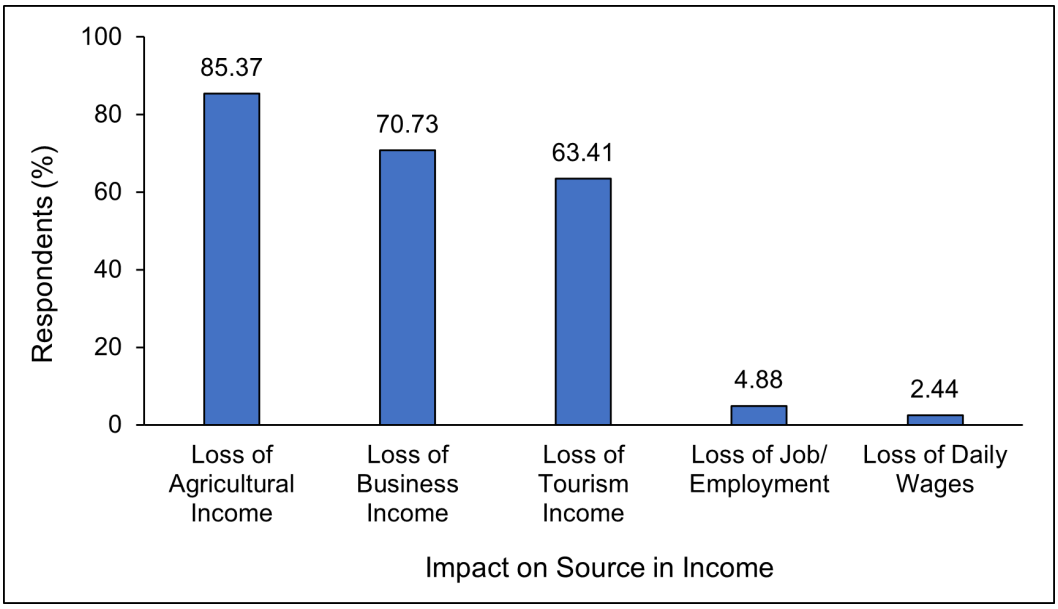


***Figure 10**: Impact of GLOF on sources of income*

The total loss of a source of income for the survey respondents till the data collection date was estimated to be 199,717 USD. Furthermore, the respondents were asked about the projected income loss for the upcoming tourism season (September to November). This accounted for 250,160 USD and, on average, 6,328 USD per household. To cope with the income loss from GLOF in the short term, the majority of the people (95.6%) used personal savings, whereas few households (17.78%) also used support from government and Civil Society Organizations (CSOs) for a limited time (figure 11). The respondents further mentioned using savings between 125 USD and 740 USD. Furthermore, a few people also mentioned taking debt of 370 USD to 750 USD to cope with the Impact.

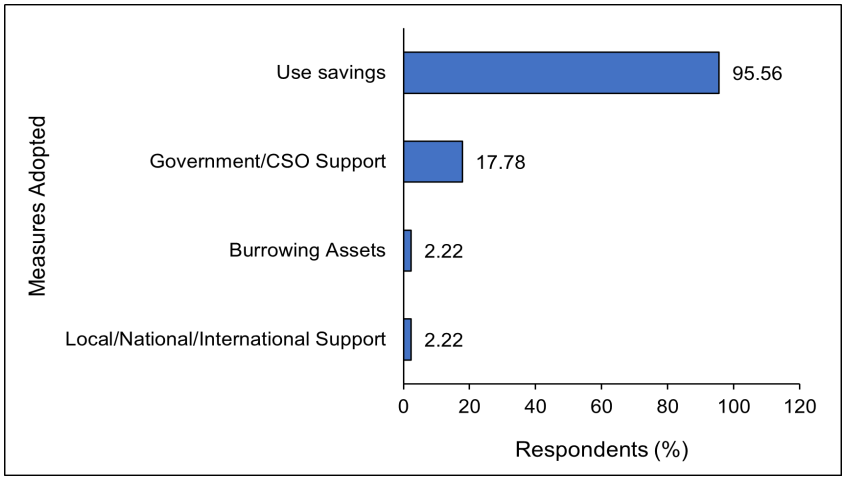


***Figure 11:** Measures adopted by respondents after the incident*

Ang Dorje Sherpa lost his house, land and hotel in the Thame GLOF. His house was built in 2003 for NPR 20-30 lakhs (USD 14,891 to 22,337) and the land itself was worth NPR one crore (USD 74,456). The hotel was his primary source of income, and now he has lost everything with no enough resources to recover. Furthermore, he had a watermill used for local grinding which generated NPR 3 - 4 lakhs (USD 2,233 to 2,978) per year and a hotel that earned up to NPR 10 lakhs (USD 7,445.69) during a peak tourist season.

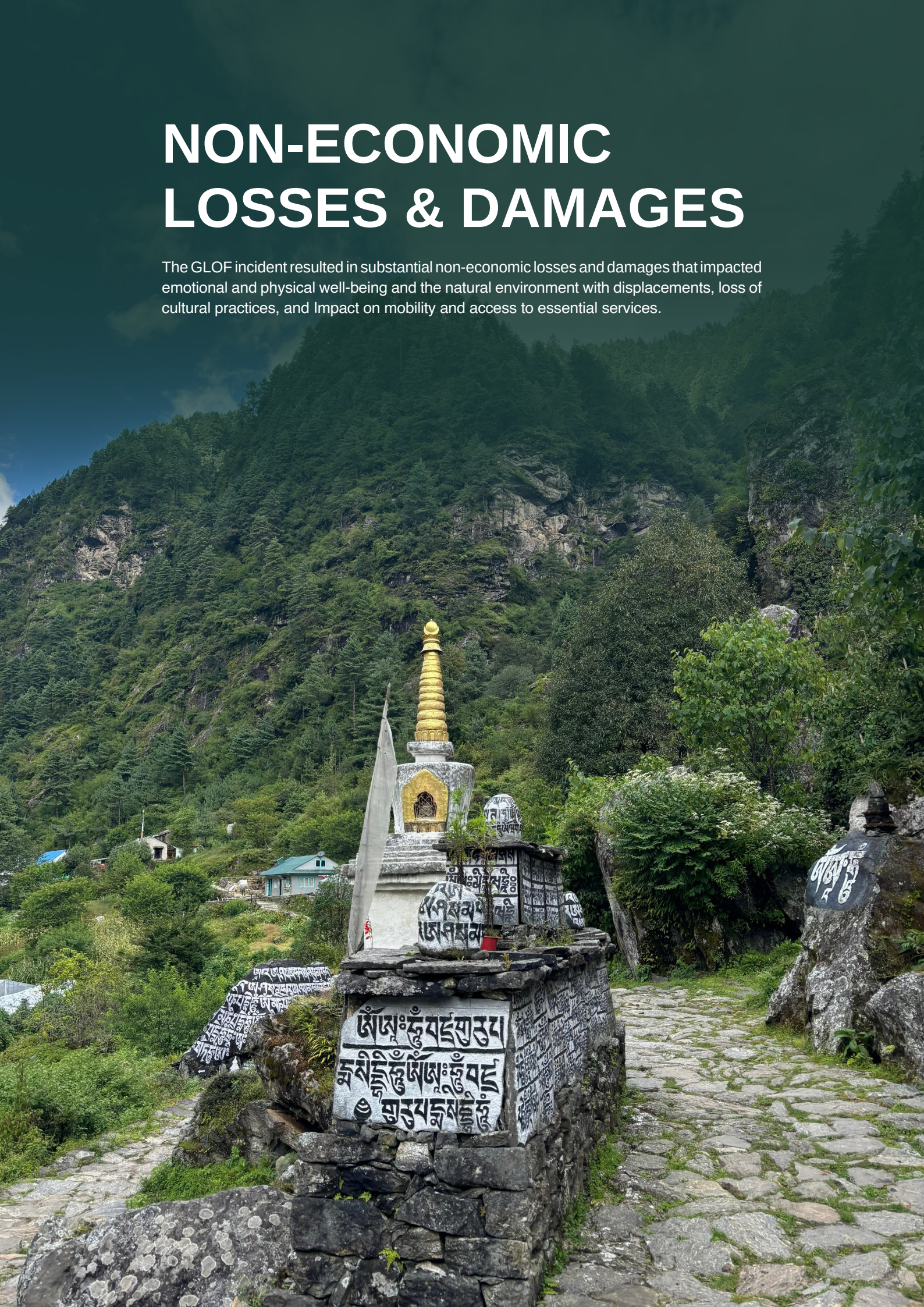
Mingma Yangjee Sherpa, 47, owns Hotel Yak, a commercial hotel in Thame, which was severely damaged by GLOF. Mingma's home was completely destroyed, with loss of kitchenware, clothing, jewelry, and around 0.1345 hectares of her land.

Mingma recalls the incident as she was cooking when she heard neighbors screaming. Initially, she assumed the GLOF would not affect her property, but the massive debris suddenly engulfed half part of her lodge. Fortunately, she and her elder daughter managed to escape from the lodge to a safer place. Since then, she has been traumatized and the sounds of wind, rain, and even the buzz of a phone triggers flashbacks of that day. As she collects remains from her damaged lodge, she urges the government to initiate research in order to assess the region's geological safety and monitor nearby glacial lakes so that she could peacefully sleep at night.

In response, Mingma received total financial support of 782 USD, where 372 USD was provided by Khumbu Pasanglhamu Rural Municipality and 409 USD from Solu Dudhkunda Municipality.

NON-ECONOMIC LOSSES & DAMAGES

The GLOF incident resulted in substantial non-economic losses and damages that impacted emotional and physical well-being and the natural environment with displacements, loss of cultural practices, and Impact on mobility and access to essential services.



3.3.1 EMOTIONAL AND PHYSICAL HEALTH IMPACTS

While the GLOF has not caused any fatalities or injuries, it has had a significant impact on the mental and physical health of the communities. The destruction of homes, loss of income sources, and the landscape transformation have resulted in increased stress, anxiety, and grief among locals. The trauma inflicted by the disaster has deeply affected the emotional well-being of Thame's residents. Many people are experiencing symptoms of post-traumatic stress, with reminders of the disaster triggered by simple daily sounds of wind or rain. One of the respondents during FGD described how even the faint ringing of a phone can provide her with flashbacks of the terrifying day.

> **I would never imagine such a heavenly place to be turned into a place full of debris and sediments" added 53 years of female respondents during the discussion."**

This constant insecurity has not only impacted their emotional well-being but also hindered their ability to recover and focus on rebuilding. During the household survey, almost all of the respondents (95.65%) mentioned facing mental Impact due to the GLOF (figure 12). Most of the respondents (76% male and 72.22 % female) reported facing insomnia or sleep disorder due to GLOF. Fear, stress, and anxiety were also faced by the respondents (figure 13).

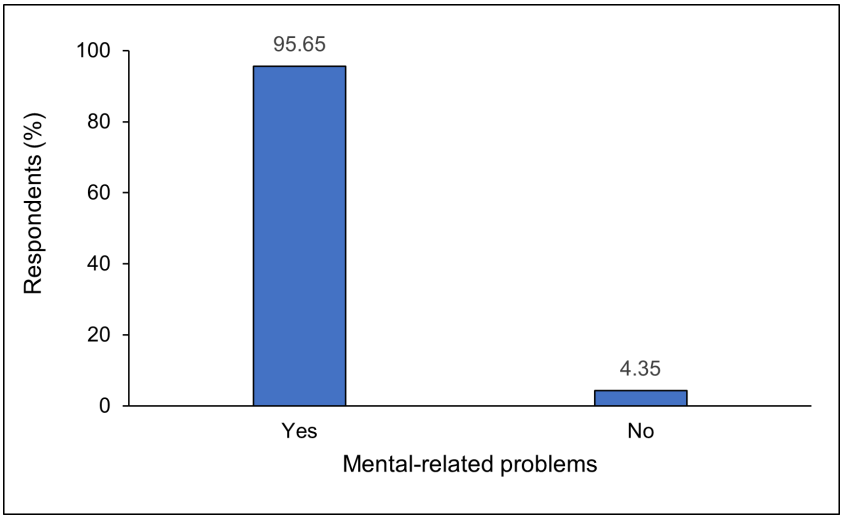


Figure 12 : *Respondents percentage on Mental related health problems*

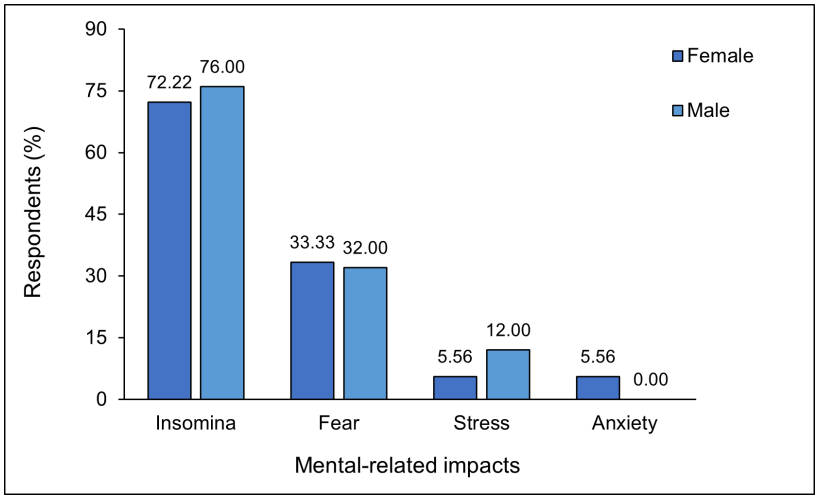


Figure 13 : *Mental health-related impacts to respondents*

Dr. Kami Temba Sherpa, 68, is a healthcare professional with 48 years of experience in the medical field. He spent 22 years as a doctor at Khunde Hospital located 5.5 km away from Thame village. Dr. Sherpa has dedicated his life to improving health services in the region. He was in Kathmandu city during the GLOF incident, and returned to the village immediately after hearing the news. Upon returning to Thame, he found that his home, agricultural land, and lodge had been destroyed. The total estimated losses amount to 60,000 USD.

Despite the losses and the trauma that came with it, Dr. Sherpa continued providing medical care and support to the community. Currently, he is working at a temporary clinic in Upper Thame, since the local health post was completely destroyed. Doctor Sherpa is also an advocate for greater attention to the region's mental healthcare, specifically to Post-Traumatic Stress Disorder (PTSD). He is cognizant of the ongoing challenges for medical services in rural areas. He continues to advocate for increased governmental support in restoring and improving healthcare facilities, as the region has to face recurring natural hazards, outmigration and a declining population.

3.3.2 IMPACT ON MOBILITY AND ACCESS

The damaged infrastructure, roads, and trails considerably impacted transportation and access to essential services, including food, education, and health. For communities such as Thame, where travel is mainly on foot or by animal, the destruction of such trails has completely isolated the village. Access to supplies for everyday needs and running tourism businesses to meet the requirements of the tourists are considerably impacted. The increased difficulty in transporting goods has led to shortages and higher prices for essential supplies, often brought in through limited means, such as porters or animals on steep, newly created trails. Sometimes, the porter price per kg has increased as the porters use longer alternative routes and sometimes gain more elevation than the usual routes. Navigating landslides, damaged trails, and steep, newly-formed trails requires more effort and presents increased physical risks for porters.

Furthermore, almost all of the survey respondents agreed with the fact that they faced difficulties in their ability to access food, water, and other necessities. 97.78% of the respondents faced problems because of a damaged trail/paths, 95.56% of respondents faced difficulties because of damages to bridges, and 73.33% of respondents faced challenges because of damages to marketplaces (figure 14). They also mentioned that the extent of impact might last for more than a year.

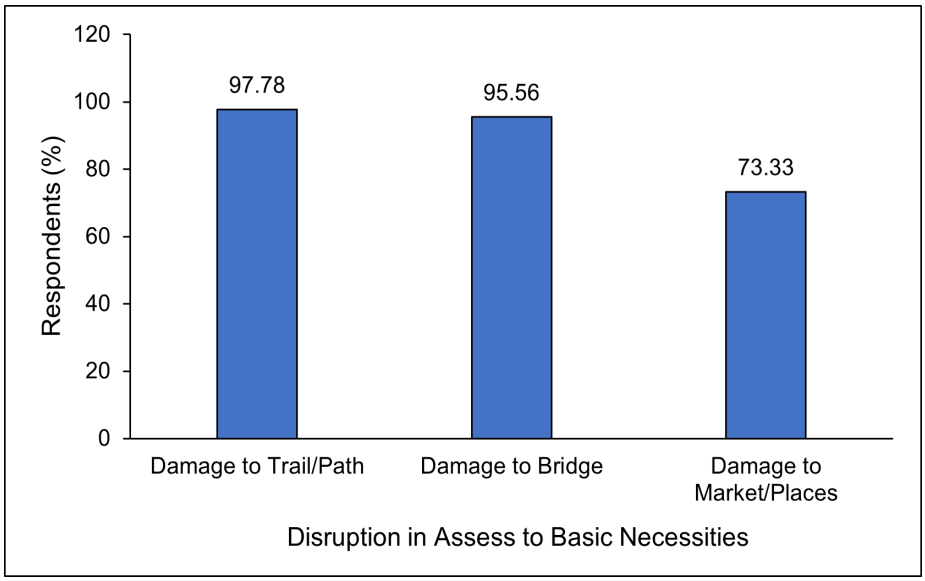


Figure 14 : *Ability to assess basic necessities because of GLOF*

Due to restricted mobility, the community is isolated and has limited access to external support networks, especially from aid workers, government representatives, and non-governmental organizations (NGOs). As of September 13, the only means of communication was through a satellite, based on Airlink wifi, which provided limited access per user and could be used for emergency communication only. The destruction of the power supply has left the villagers without electricity for more than a month. They had to travel to nearby army stations and Upper Thame to charge their phones, and the lighting was completely reliant on small solar power lamps that provided four to five hours of backup.

Although no immediate major injuries occurred, people currently have to travel farther to reach health posts in upper Thame, which requires considerable time and effort. In an emergency context, the lack of quick access to healthcare facilities can also lead to death.

Gopal Tamang, 60**,** has spent around 12 years in the trekking field as a porter, carrying loads for adventurers from around the world. During the trekking season, he carries around 75 kilograms on his back. He charges approximately 0.5 USD per kilogram of weight, just enough to save around 295 USD per season after covering his own expenses for food and lodging. Yet, for Gopal, trekking is more than a job, a lifeline that supports his family and keeps him connected to the mountains. The incident hit him harder after the trail near Bagar on the stretch from Phakding to Jorshalle became heavily damaged. This has forced Gopal and his fellow porters to take a steeper, longer and dangerous route, originally used by donkeys. The added distance requires added effort and time for him. However, his labor cost remains unchanged.

In addition, the destruction of the only school in the village has left a differential impact on children and youth, with limited access to education. According to the survey respondents, 100% reported damage to school, 95.65% reported disruption in mobility due to collapse of trail and bridge, and 67.39% mentioned fear and mental distress stopped them from attending schools (figure 15). Most of the respondents were still in dilemma whether to wait or relocate to the new location to ensure their children could access the education, while some of them had started enrolling their children in alternative schools in nearby villages. The limited access to education disrupts their learning, and the additional travel can heighten risks to their safety, especially in unpredictable weather conditions.

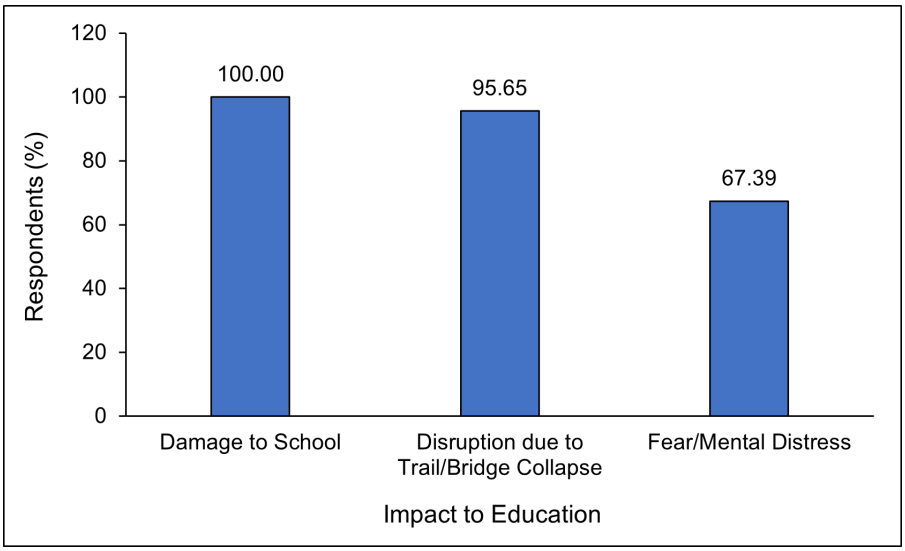


Figure 15: *Impact of GLOF to children and youth*

The peak seasons for trekking to Everest Base Camp are March to May and September to November. The GLOF has significantly reduced the influx of tourists for the later season, with uncertainties for many of the upcoming seasons. The household survey further corroborated the Impact on mobility and access. 97.70%, 95.55%, and 73.33% of the respondents reported damage to trails, bridges, and marketplaces, respectively.

Mingma Nuru Sherpa, 67, the owner of Chhyo Hotel in Thame, has spent most of his life mountaineering, hiking, and trekking. He has witnessed two GLOFs, including a Dig Tsho GLOF in 1985. The recent GLOF severely impacted his property. For four days, Mingma and his family stayed in the nearby village. Upon their return, they found that their home and hotel were completely devastated. The river has changed its course and now flows just by the side of his house due to debris deposition and erosion. He received immediate relief of tents, blankets, and mattresses. Despite the aid, the estimated cost to fully reconstruct his house is NPR 2-3 crore (USD 1,48,913.79 to 2,23,370.69). The required construction materials have to be transported using porters, helicopters, or donkeys which adds extra costs to the usual amount.

Before the incident, his hotel generated around NPR 5-6 lakhs (USD 3,722.84 to 4,467.41) during peak season, but now, tourist influx has decreased, and agricultural production is unreliable. Surrounded by these uncertainties, he is still waiting for experts to conduct a detailed assessment, so that he can decide whether to stay in the village or find alternative sources of livelihood.

> **Trails are the major components of local transportation utilized by locals, mountaineers, and porters. However, the GLOF has resulted in the loss of trails and connectivity, forcing people to find alternative routes. The new routes are longer in distance and elevation gain, making it more time-consuming and physically tiring for porters, donkeys, yaks and travelers.**

For instance, a stretch near the Thame village was damaged, and a new trail was developed. The previous length of the trail was 479 m, but now it has turned to 544m (figure 16). Similarly, a stretch near the Hillary Bridge has increased from 1.24 km to 1.77 km (figure 17). The new trail makes the route longer and forces trekkers and potters to cover more elevation differences, making it difficult to travel.

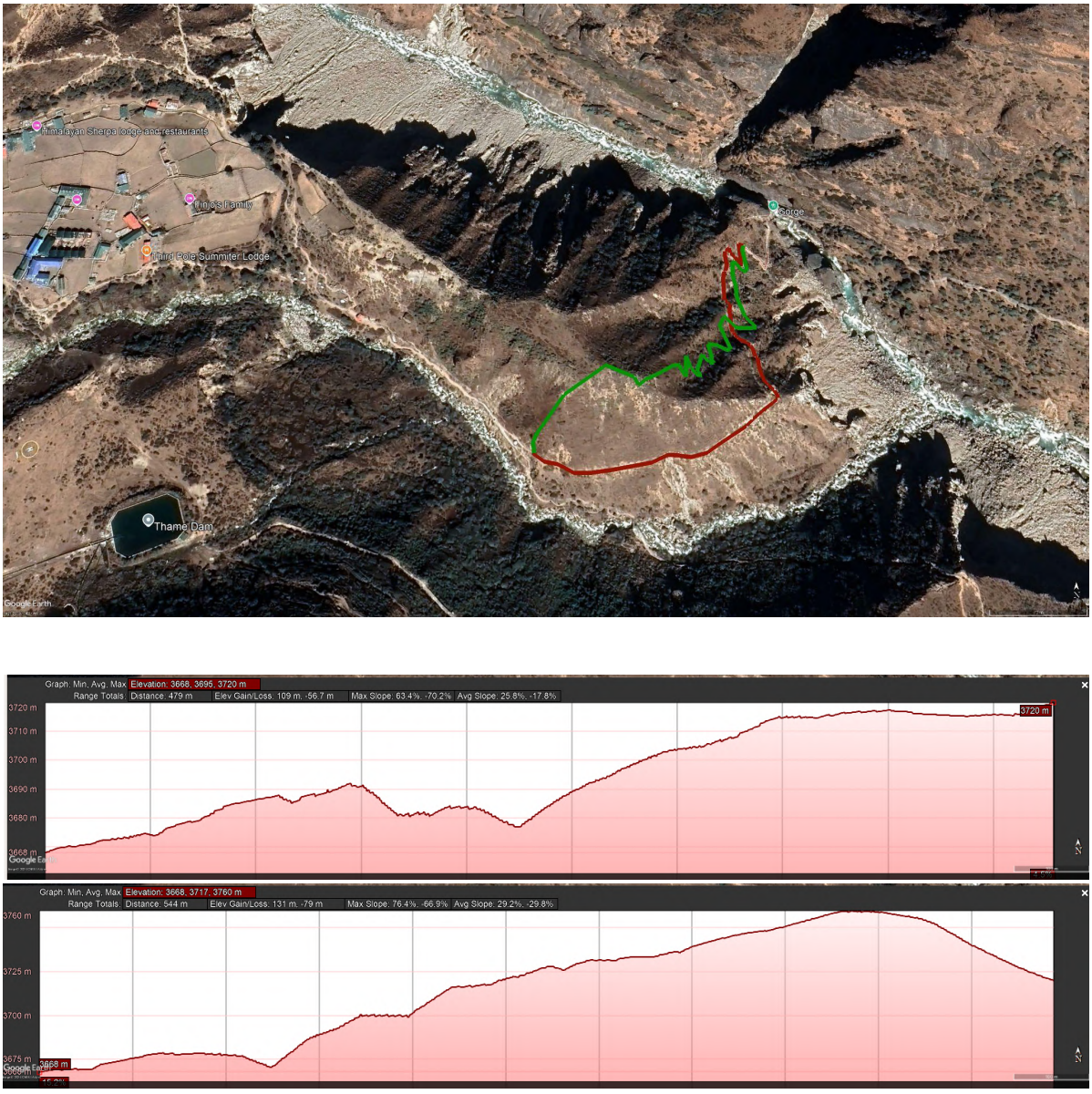


Figure 16: *(a) Change in trail due to GLOF (green line denotes new trail route and red line denotes previous trail route) (b) Changes in elevation profile due to change in route*

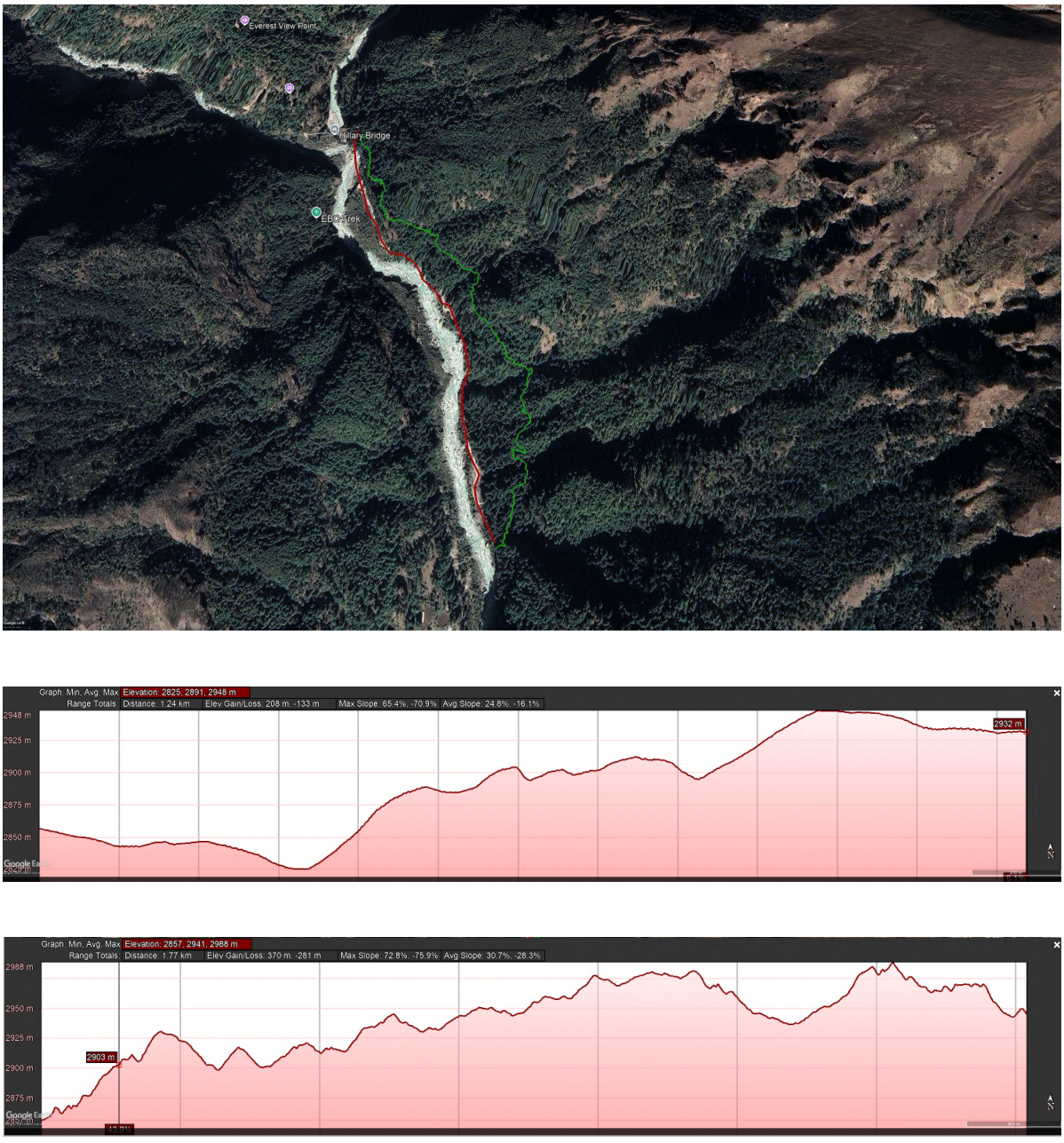


Figure 17 *(a) Change of trail route to Hillary Bridge (green line denotes new trail route and red line denotes previous trail route) (b) Changes in elevation profile due to changes in route*

3.3.3 SOCIO-CULTURAL LOSSES AND IMPACTS

Thame holds significant cultural importance due to its unique identity with the rest of the world. Thame's identity is tied to the Sherpa culture, hospitality, and mountaineering. Glacial lakes in the region are considered a sacred space where the Sherpa communities gather annually and offer celebrations from September to November. While the faith remains unchanged, there has been an increasing sense of anxiety and fear with the belief that such incidents may repeat shortly. Such a shift in perception may, in the longer term, have a significant cultural and spiritual transformation, contributing to a decrease in the frequency of celebration, modification in rituals, and sometimes avoiding the celebration due to fear.

> **This year, we are not certain if we will be able to carry out our usual offerings and celebrations in the lakes as there is a fear of recurrence of such incidents," said one of the respondents during the community consultation**

A monk residing at Thame Village mentioned;

> **The glacial lakes are not just a natural resource but hold significant cultural and spiritual values. Before the incident, around 500 people gathered to pray for glacial lakes. Due to safety concerns, they have stopped such gatherings which also disrupts the spiritual traditions of Sherpa communities.**

Sherpa communities have strong interdependence and cooperation with family and neighbor's support. While few of the community members shared a common shelter space, many have left the village to take shelter with their relatives in nearby villages. Living separately has reduced the opportunity for regular communal interactions and sharing. The community prayers and daily prayers have been impacted. During field observations, it was noted that the prayers continued but in separate small tents that belonged to the respective families. The fear of the recurrence of similar incidents has kept residents from gathering near sacred sites and lakes, minimizing their engagement in these vital socio-cultural interactions.

During the survey, 76% of the respondents mentioned decreased social interactions due to the incident. The regions for this decrease were significant damages to community buildings (as per 91.43% of respondents), disruption to daily activities and interaction (42.66%), damage to stupa/monasteries (25.71%), damage/loss of public spaces (20%) and loss of community forest (5.71%) (figure 18).

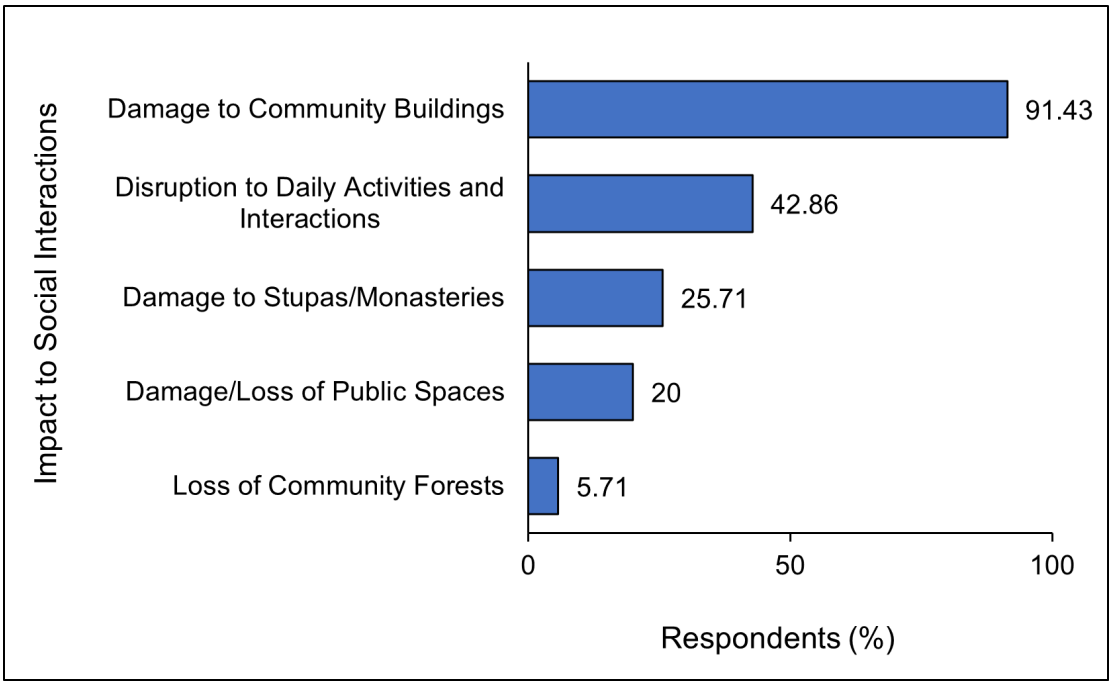


Figure 18 : *Socio-cultural losses and impacts*

Along with the impact on social interactions, almost all (93%) of the survey respondents mentioned the effect of GLOF on cultural practices. The most affected cultural practice was death rituals, with 91.11% of respondents indicating the impact. 28.89% of respondents reported that cultural events were also impacted, and 11.11% mentioned the impact on daily prayers. A few respondents (2.22%) further mentioned the impact of festivals on celebration (figure 19).

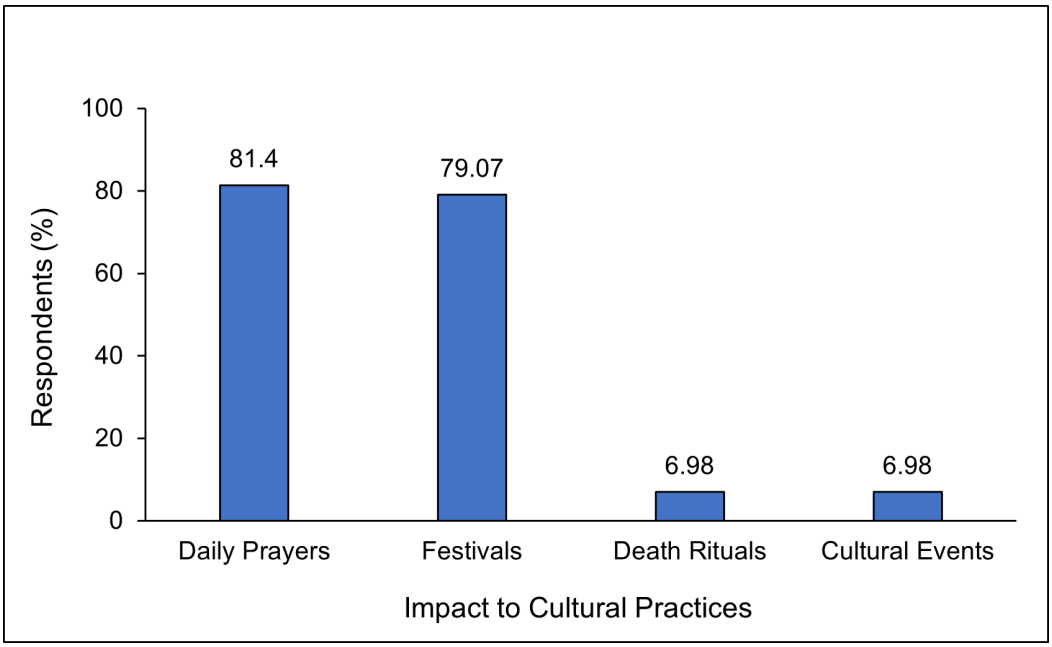


Figure 19 : *Cultural Practices impacted by GLOF*

3.3.4 RELOCATION

The GLOF incident forced people to move to nearby villages and take temporary shelter. While relocating to a newer place may be safe, many people are unwilling to leave the Thame since they are deeply connected to the place due to their ancestors, customs, and way of life. The land, mountains, and natural surroundings are deeply rooted in the rituals and cultural values. Losing their houses and relocating to a new place affects the Sherpa people's cultural continuity.

After the incident, 93.33% of the respondents said they were unwilling to relocate from the place (figure 20). However, the area was unsafe to live in, and they were shifted to upper Thame (Thametyang).

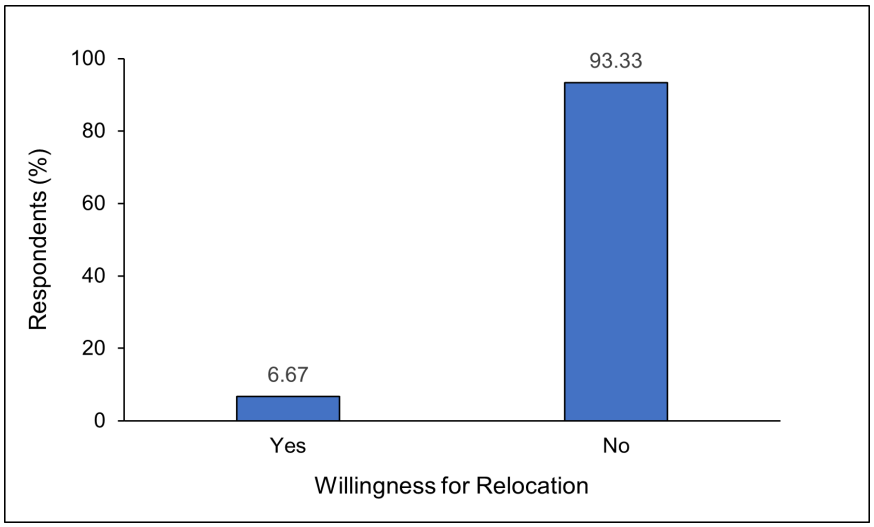


Figure 20: *Respondent willingness for Relocation*

Mingma Chhamji Sherpa, 34, started constructing the Alpine cottage to start her own business. The GOLF badly damaged the hotel. It now shows cracks, making it unreliable to stay and expensive to repair. Mingma and her two small children aged five and two are now living with her mother. Her oldest son is unable to attend the school as it has been completely destroyed. Currently, her husband is in Austria, working hard to sustain the family and repay the 75,000 USD loan they took out to build the now destroyed hotel.

Following the incident, she received a total financial support of 780 USD, insufficient to cover the damage. Her lodge, which remained intact initially, was used as a place to distribute relief items. However, in the subsequent days, cracks were seen in the foundation and interior areas of her cottage, with the property being classified as fully damaged.

3.3.5 LOSSES AND DAMAGES TO THE NATURAL ENVIRONMENT

The GLOF has impacted the vegetation and aesthetic beauty of the area. It carried rocks, debris, and mud, which altered the shape of the river and caused erosion from its banks. A lot of debris has been deposited in the agricultural fields, affecting the village's scenic beauty. The local people hear the sound of debris carried by the river, continuously eroding the bank. The land of the local residents has been eroded and converted to river banks. The village has further risks posed by the other glacial lakes. An administration staff of the KPRM mentioned;

> **There are still three more glacial lakes in that region, which may be a risk to Thame village. A detailed investigation of these places should be done to prevent future incidents, and the government should quickly assess and mitigate the risks**

He further added;

> **Fertile soils and plants were washed away by the GLOF, causing damage to the land and limiting the growth of new plants. Snowfall used to reach the knee height at 3500 m elevation, but recently there is less snowfall and more rainfall.**

Almost 90% of the respondents agreed to the Impact of GLOF on the natural environment. Everyone mentioned the Impact on spring sources and forest resources, while 84.78% also mentioned the Impact on medicinal herbs and plants (Figure 21). The major herbs of Thame are *Acorus calamus* (Bojo), *Zanthoxylum* Spp. (Timmur), *Lycopodium* Spp., *Cordyceps* Spp., and *Swertia* Spp. among others.

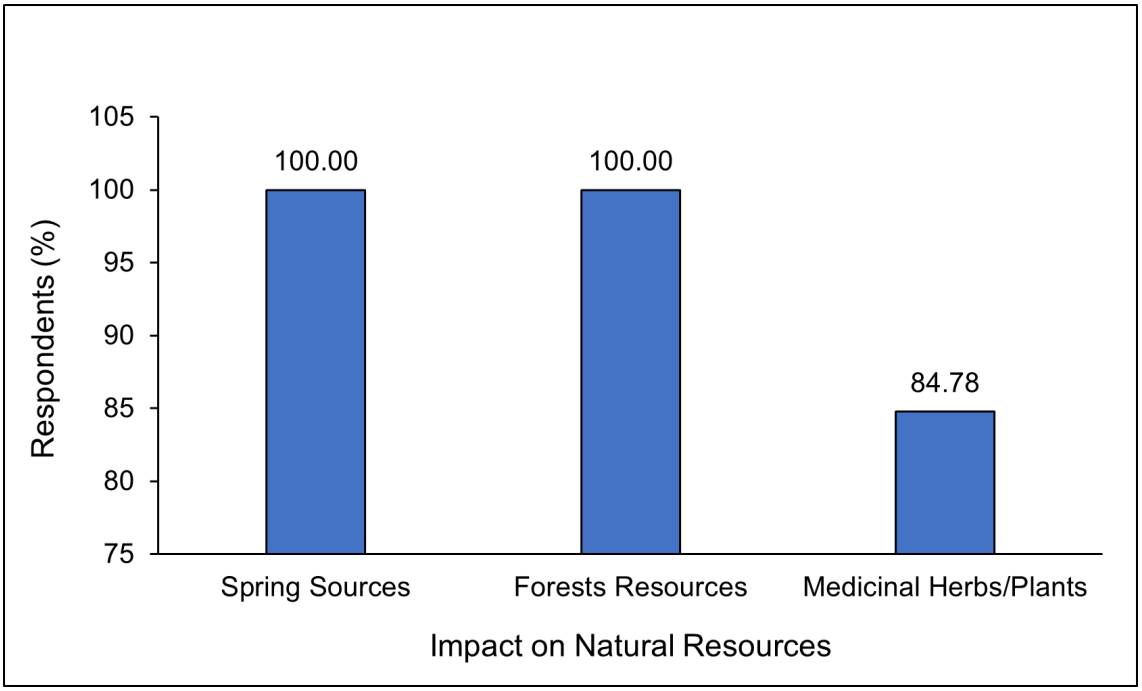


Figure 21: *Impacts to the natural resources*

3.3.6 DIFFERENTIAL IMPACTS

The majority of the respondents mentioned that they didn't face any sort of gender-related issues due to GLOF. However, the workload on women had increased post-incident. It particularly impacted single women who had to deal with the situation alone.

Ang Dami Sherpa, 54, is a marathon runner who was part of "Everest Marathon" and "Beat the GLOF Action Run." She owns the Marathon Runner Lodge. The incident washed away her livestock and damaged her farmland. However, she is emotionally attached to the place and is not willing to leave Thame. She said,

"I will die here but will not relocate"

As a single mother, she has raised four children alone. Following separation with her partner, she relies on the property she inherited from her mother.

She resumed her business with the help of her family. Today, it provides a stable income of NPR 5 lakhs (4455 USD) annually, which she spends on children's education, household needs, and loan repayments. Post-GLOF, price hikes have increased the costs of running her lodge.

3.4 LOCALLY-LED ACTIONS

The lived experience of local people has greatly helped reduce the further loss of property and infrastructures, with no casualties reported. Local people worked together to restore the damaged drinking water pipelines. Similarly, local people, in collaboration with army officials, jointly built a wooden bridge using locally available materials and restored the electricity facility downstream within 14 days of the incident together with the electricity company officials.

The less affected households offered support by providing shelter, food, and laborers to help recover their belongings from the devastated buildings and lands. The communities themselves set up communal kitchens, where they came together and shared meals, reflecting community cohesion and the communities' self-organizing capabilities to find a collective solution and resilience.

Photograph 1: *Locals reconstructing the trail after being destroyed by GLOF*

Phototograph 2: *Local people repairing drinking water pipes*

Phototograph 3: *Local engaged in reconstruction using locally available materials*

Photograph 4: *Reconstructing and clearing debris from the house with the help of labors after the GLOF*

Pasang Tshering Sherpa, 36, was painting at the Thame monastery when the incident happened. As he rushed back to see his village, he saw people moving towards upper Thame to escape. Immediately, he ran to find his family and they escaped to a higher and safer place, and looked at the flood destroying the village. The family stayed in Thametyang, Upper Thame, for the night. The next day, when the flood receded, they went back home and helped collect things from their flooded home and other homes in the village.

As a former member of the Thame Choa Youth Group, Pasang is involved in relief efforts, coordinating support from neighboring villages and foreign countries. Financial assistance has been provided from the Khumbu Pasanglhamu Rural Municipality and Solu Dudhkunda Municipality. The community has held several meetings brainstorming potential reconstruction methods, as it awaits experts to survey land and nearby glacial lakes before finalizing on rebuilding decisions.

As a painter, trekker guide, and hotel owner, the flood has made things difficult for people in the area, especially during the off-season. This has severely impacted the e local economy and people's livelihoods.

3.5 FINANCIAL SUPPORT AND COMPENSATION

In the aftermath of the incidents, financial support has been provided by the municipality, independent trusts and public support and political figures by utilizing existing resources, channelising funds and connecting with external support. As of November first week, an average of 782 USD has been received per household (Annex-I).

Table 5: Financial support and aid

Resource	Amount (USD)
Total fund raised and contributed (municipality, NGO, community, individual support, go fund me campaign)	684,331.92 USD
Total losses evaluated by municipality	6,171,649.27 USD
Residual gap	5,487,317.35 USD

The losses have been calculated at the generalized government rates, which is very minimal as compared to the market value. However, the actual valuation of loss is way higher, including the loss of properties, incomes, and sources of livelihood. The local government allocated a budget of NPR 71.1 million (approximately 0.53 million USD), through channelising the already planned budget in other 10 development plans. However, the relief support for households was allocated 3.5 million NPR (26 thousand USD). Out of the pledged amount 48% is channelised for reconstruction of public infrastructure, 37% for flood impacted household rehabilitation and reconstruction, 7% for disaster risk studies and research, and 8% for Khumbu Electricity Company reconstruction.

04

RECOMMENDATIONS AND WAY FORWARD

4.1 GENERAL RECOMMENDATIONS

- Train local community members, recognizing that they are the first responders during any hazard incidents.
- Community-based simulations and scenario planning may help locals become aware of the potential risks associated with GLOF incidents.
- Government and non-governmental organizations should proactively help improve knowledge, perform risk assessments, inform development planning, and especially develop a land zonation map to guide reconstruction of houses and key structures in areas less prone to GLOF damage.
- Social protection and other safety nets need to be scaled up to help reduce the risks of extreme weather events. The amount of compensation needs to match the extent of losses incurred.
- Leverage local and traditional knowledge to build partnership and collaborative planning and engage local communities in participatory resilience planning.
- The federal government should provide necessary support and technical guidance in assessing loss and damage resources from international partners and governments of the potential risks associated with GLOF incidents.
- Government and non-governmental organizations should proactively help improve knowledge, perform risk assessments, inform development planning, and especially develop a land zonation map to guide reconstruction of houses and key structures in areas less prone to GLOF damage.
- Social protection and other safety nets need to be scaled up to help reduce the risks of extreme weather events. The amount of compensation needs to match the level of losses incurred.
- Leverage local and traditional knowledge to build partnership and collaborative planning and engage local communities in participatory resilience planning.
- The federal government should provide necessary support and technical guidance in assessing loss and damaged resources from international partners and governments.

4.2 SPECIFIC RECOMMENDATIONS

- The total economic loss and damage due to GLOF in Thame is estimated to be 6.17 million USD. To put things in perspective, KPRM's total annual budget is only 5.58 million USD. Therefore, external support from national and international sources is needed to help communities deal with the situation and restore their livelihoods to the best extent possible.
- Provide financial support through a cash transfer scheme directly to the local people for post-disaster support and recovery.
- All forms of support that come to the community should align with cultural values and indigenous practices.
- It is crucial to provide immediate support in rehabilitating damaged houses, hotels, lodges, and trails with better design and quality so that the community can restart their economic activities.
- Provide financial and technical support for the community to build their houses, business and tourism facilities by ensuring resilience to disaster.
- Locally available construction materials should be prioritized.

4.3 POLICY RECOMMENDATIONS

- Provide financial support through a cash transfer scheme to the local people for the post-disaster support and recovery.
- All forms of support that come to the community should be in line with cultural values and indigenous practices.
- Immediately reconstruct the damaged houses, hotels, lodges, and trails with better design, high quality.
- Develop a community-managed fund to financially support communities as they rebuild their homes and businesses. This fund should prioritize the most vulnerable and assure swift and transparent distribution.
- Locally available and resourced materials should only be used for the post-recovery reconstruction.

4.4 FURTHER RESEARCH AREAS

- Investigate hydrological processes and models to accurately simulate the behavior of glacial lakes and predict potential outburst scenarios considering future climate change projections.
- Investigate the geomorphological processes associated with GLOFs, such as erosion, sedimentation, and landscape modification.
- Future research should explore trigger factors for GLOFs, such as climate change, seismic activity, lake expansion due to accelerated melting/rainfall and hydrological processes.
- Assess the socio-economic factors that influence community vulnerability to GLOFs, including poverty, education, and access to information.
- Evaluating the effectiveness of existing policies and regulations for assessing, managing, and reducing GLOF-related impacts.
- Research should engage locals and ensure indigenous knowledge and practices are documented.
- Building on existing practices, the government should document the glacial lakes across the Himalayas and undertake a risk assessment of each of the lakes.
- Downstream impact studies should be undertaken to identify crucial locations downstream of the possible GLOF so that people and critical resources can be prepared (relocated or strengthened), to prevent a disaster from occurring if a GLOF happens.

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ANNEX-I: SUPPORT AND DONATION FROM MUNICIPALITY AND EXTERNAL SOURCES

खुम्बु पासाङल्हामु गाउँपालिका

Khumbu Pasanglhamu Rural Municipality

गाउँ कार्यपालिकाको कार्यालय, चौंरीखर्क, सोलुखुम्बु कोशी प्रदेश नेपाल

Office of the Rural Municipal Executive, Chaurikharka, Solukhumbu, Koshi Province Nepal

प्रेस विज्ञप्ति

खुम्बु पासाङल्हामु गाउँपालिकाको मिति २०८१।०५।१७ गतेको गाउँसभाको विशेष अधिवेशनबाट देहायका निर्णयहरु सर्वसम्मत पारित भएको व्यहोरा सम्बन्धित सबैको जानकारीका लागि यो प्रेस विज्ञप्ति जारी गरिएको छ।

१. विपद् व्यवस्थापन कोषमा थप रकम रकमान्तर गर्ने सम्बन्धमा ।

क.स	आयोजनाको नाम	रकमान्तर रकम
१	फोहोर व्यवस्थापनका लागि उपयुक्त उपकरण तथा मेसिनरी औजार खरीद तथा व्यवस्थापन	८००,०००।००
२	दिङ्बोचे, र लबुचेमा सिजनल स्वास्थ्य शिविर संचालन	२,०००,०००।००
३	स्पोट टुरिजा एंव सहासिक पर्यटनको सम्भाव्यता अध्ययन	१,०००,०००।००
४	सडकमा झरेको पहिरो पन्छाउने काम	७००,०००।००
५	बोसुम नाम्चे रोपवे सम्भाव्यता अध्ययन र DPR	२,०००,०००।००
६	कानूनी सचेतना तालिम (जनप्रतिनिधि तथा कर्मचारी)	१,०००,०००।००
७	सबै वडामा Radio Set व्यवस्थापन	२,०००,०००।००
८	जनप्रतिनिधि तथा कर्मचारी अध्ययन अवलोकन भ्रमण	१,५००,०००।००
९	मञ्जोखोला मिनिहाइड्रो	३०,०००,०००।००
१०	अमादब्लम मिनिहाइड्रो	३०,०००,०००।००
	जम्मा	७१,०००,०००।००

उल्लेखित रकमान्तर गरिएको रकमलाइ देहाय बमोजिम खर्च गर्ने।

क. सार्वजनिक पूर्वाधारको पुनर्निर्माण — ३,४०,००,०००।-

ख. बाढी पिढितहरुको पुनस्थापना तथा पुनर्निर्माण - २,६०,००,०००।-

ग. विपत जोखिम अध्ययन अनुसन्धान — ५०,००,०००।-

घ. खुम्बु बिजुलि कम्पनि पुनर्निर्माण सहयोग - ६०,००,०००।—

२. योजना संसोधन सम्बन्धमा

मिति २०८१/०५/१४ गतेको खुम्बु पासाङल्हामु गाउँपालिका वडा नं. ०१ को वडा कार्यसमितको निर्णय बमोजिम देहायका योजना संसोधन प्रस्ताव स्विकृत गर्ने ।

Email: ito.khumbupasanglhamumun@gmail.com, info@khumbupasanglhamumun.gov.np
Phone: +97738590046

PHOTOGRAPHS

Photograph 4: Interviewing local farmers to assess flood impact on their livelihoods

Photograph 5: *Thame school building damaged by GLOF*

Photograph 6: *Erosion landform due to the GLOF*

Photograph 7: *GLOF induced land subsidence*

Photograph 8: *Hotels and lodges destroyed by GLOF*

Photograph 9: *Donkeys used as a means of transport to carry heavy loads on a muddy mountain trail*

DIGO BIKAS INSTITUTE

Digo Bikas Institute (DBI) is a research and advocacy organization focused on grassroot intervention and movement building approach to address the crisis generated from profit-driven, unequal and exploitative economic and social structures. DBI promotes real solutions and alternatives based on the ideas and experience from communities at the forefront. DBI works on climate justice, energy democracy, agroecology, rethinking development, urban justice through innovation in land use redesign.

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.