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From Climate Finance to Climate Resilience: A Critical Review of Climate Change, Cryosphere Hazards, Disaster Risk Reduction and Financing Lessons from the 2026 Bhotekoshi Flash Flood in Nepal

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Abstract

Nepal's Himalayan region is facing growing threats from climate change melting glaciers shifting snow patterns and unpredictable rainfall. As the ice melts and the weather changes the mountains become more unstable. At the time more people are living and building homes and roads in areas that are naturally at risk. This mix of human factors is creating a much more dangerous situation, for the communities that live in these valleys. The catastrophic flash flood and debris-flow event that struck Bhotekoshi and downstream areas on 26 August 2026 provides an opportunity to examine these interconnected risks. Importantly it raises questions about whether existing climate-finance and disaster-risk-financing systems are sufficiently prepared to reduce such risks. The Bhotekoshi flood has been devastating, in the context. It has brought the nation to a state of distress.

This paper presents a review of the relationship between climate change cryosphere hazards, disaster risk reduction, climate finance and long-term resilience in Nepal. The study uses the 2026 Bhotekoshi disaster as a contemporary case lens to explore how climate change drives cryosphere hazards that increase disaster risk reduction challenges. The authors also discuss how climate finance can build long-term resilience in Nepal. Peer-reviewed literature was examined with evidence, from international climate-finance institutions, disaster-management agencies and scientific assessments. GLOF, flash floods and cascading mountain hazards; The review focuses on five themes: (1) climate and cryosphere change; (2) GLOF, flash-flood and cascading mountain hazards; (3) climate adaptation and disaster-risk reduction; (3) climate adaptation and disaster risk reduction; (4) climate and disaster risk financing; and (5) post disaster recovery, loss and damage and Build Better.

The review points out that Nepal has taken steps in creating climate and disaster-risk groups and in getting international adaptation money. The Green Climate Fund programme that tackles glacier lake outburst floods and climate-driven flooding marks a move, toward planning and investing in adaptation before disasters hit. However, the research also shows that there are still differences between what happens during disasters and the money that is available to deal with them. There is no use of financial tools that come before a disaster happens. Also, there are problems with how different organizations work. It is hard to get climate money down to the level. The Bhotekoshi disaster shows how hard it is to handle disasters that happen one, after another. These kinds of disasters can involve glaciers, rocks, dirt and rivers all at the time.

The paper says that Nepal problem is not about getting more money for climate issues but about making sure the money leads to real reductions in risks. An idea called the Climate Finance–DRR–Resilience Nexus is suggested. This idea

connects things like watching for dangers giving warnings getting communities ready building strong buildings having money set aside before a disaster responding quickly when something happens rebuilding after making things better, than before and planning for the future. The study ends by saying Nepal needs to stop reacting after disasters happen and instead start planning ahead. This means looking at risks having money ready stopping problems before they get bad getting ready acting early rebuilding in a strong way and thinking about the long term.

Keywords: Climate Finance, Climate Change, Bhotekoshi, Flash Flood, Glacier Collapse, Glof, Disaster Risk Reduction, Adaptation, Resilience, Disaster-Risk Financing, Nepal Himalaya, Loss and Damage

1. Introduction

The Himalaya is experiencing environmental change. Warm temperatures, shrinking glaciers, different snow patterns, new rain and snow amounts and unstable high places are altering the conditions that cause mountain dangers. These shifts matter a lot, for Nepal, where groups of people, roads, big power plants, tourist sites and homes sit inside very linked river valleys. Nepal is often described as one of the countries that's highly vulnerable to climate change even though Nepal contributes very little to global greenhouse-gas emissions. This apparent contradiction matters a lot. Climate change is not seen through a rise in average temperature. Climate change effects are now shown by hazards like floods, landslides, droughts, extreme rainfall, glacier-related dangers and the social and economic problems that follow.

The problem is even worse in the Himalaya, where different hazards can mix together. When a glacier breaks it can start an avalanche or a debris flow. That avalanche or debris flow can rush into a river. Cause a sudden flood downstream. The flood can smash bridges and roads cut electricity and communications cut off communities and make it hard for people to get help. So, a small change, in the ice can turn into a social and economic disaster.

The catastrophic event in Bhotekoshi on 26 August 2026 is a modern example. The U.S. Geological Survey says that a glacial collapse probably set off a debris flow and flood that moved 100 kilometres and struck places along the Bhote Koshi and Trishuli rivers. Satellite images and expert reviews now show that an ice-rock collapse happened close, to the border and made a very destructive flood full of debris.

The importance of this point is that the catastrophic event should not simply be called "caused by climate change." The physical event is linked to a collapse while how much human-made climate change helped the collapse is still being studied. This distinction matters because climate change can change the background risk of hazards even if climate change does not directly start an event. The Bhotekoshi disaster gives us a chance to think about an issue. How can climate finance be changed into steps to reduce disaster risks? How can it help build long-term strength, for Nepal changing area?

1.2. Statement of the Problem

Nepal Himalayan region is dealing with climate and cryospheric dangers every day. These include glaciers, GLOFs and sudden floods. The 2026 Bhotekoshi flood showed how vulnerable the

people living in the Himalayas are. It also showed how vulnerable the important structures in the region are. Climate finance and disaster-risk financing are not well organized. They are about reacting to problems after they happen. Not enough money is getting to local-level efforts. These efforts include being ready for disasters, early warning systems and building infrastructure. After a disaster happens people focus more on helping than on preventing problems before they occur. There is not attention given to preparing ahead of time. The money from climate finance is not leading to better local resilience. Not enough research is being done. This research looks at how climate finance, disaster risk reduction, emergency aid, recovery and long-term changes work in Nepal. Because of this there is a need for a way to use money better. This approach should help build resilience. It should help reduce the risks of disasters, in the Himalayas in the future.

1.3. Objectives of the Review

The main objective of this paper is to critically review the relationship between climate finance, climate change, Himalayan hazards, disaster-risk reduction and resilience in Nepal using the 2026 Bhotekoshi disaster as a contemporary case lens.

The specific objectives are to:

1. The objective is to look at how climate change and new cold-area dangers linked in Nepal.
2. The objective is to review what science says about glaciers, GLOF, flash-flood and cascading mountain risks.
3. The objective is to examine Nepal climate-finance and disaster-risk-financing architecture.
4. The objective is to assess how international adaptation finance, including the Green Climate Fund, operates.
5. The objective is to examine how DRR, warning, monitoring, preparedness and resilient infrastructure help.
6. The objective is to evaluate the relationship between finance, recovery and Build Back Better.
7. The objective is to identify financing and institutional gaps.
8. The objective is to propose an integrated climate-finance framework, for Himalayan resilience.

1.4. Literature Review

1. Climate Change and Himalayan Hazards: Climate Change brings dangers to the Himalayas and the Himalayas suffer from these Climate Change impacts.
2. Glacier Instability, GLOFs and Flash Floods: Glacier Instability can cause GLOFs and GLOFs trigger flash floods, which harm the region.

3. Vulnerability of Himalayan Communities: The Vulnerability of Himalayan Communities rises when natural hazards hit and Himalayan Communities need protection.
4. Climate Finance and Adaptation in Nepal: Climate Finance supports adaptation in Nepal and adaptation gains from Climate Finance resources.
5. Disaster Risk Reduction and Financing: Disaster Risk Reduction requires financing and financing helps Disaster Risk Reduction succeed.
6. Early Warning and Community Preparedness: Early Warning systems improve community preparedness and community preparedness depends on Early Warning alerts.
7. Build Back Resilient Infrastructure: Building back better calls for resilient infrastructure and resilient infrastructure strengthens Build Back Better efforts.
8. Climate Finance, Loss and Damage: Climate Finance tackles loss and damage and loss and damage is reduced by Climate Finance.
9. Lessons from the 2026 Bhotekoshi Flood: Lessons from the 2026 Bhotekoshi Flood guide planning and future planning uses Lessons from the 2026 Bhotekoshi Flood.
10. Research Gap: Climate Finance–DRR–Resilience Nexus: The research gap shows a missing link, between Climate Finance, DRR and resilience and the missing link is highlighted in the Climate Finance–DRR–Resilience Nexus.

3. Review Methodology

3.1. Review approach

The review brings together studies from experts and important groups because details about money for climate issues and money for disaster risks are not always found in articles. The review was split into five areas of evidence:

- changes, in climate and frozen areas
- GLOF and fast flooding dangers
- adapting to climate and reducing risks
- money for climate and disaster risks
- Recovery, strength and loss and damage.

Relevant literature was found by searching databases and publisher websites like Scopus, Web of Science, ScienceDirect, SpringerLink, Wiley Online Library, Taylor & Francis and Google Scholar.

Extra information came from sources such as the Green Climate Fund, UNDP, Government of Nepal National Disaster Risk Reduction and Management Authority, ICIMOD, UNFCCC, World Bank and U.S. Geological Survey.

3.2. Inclusion and exclusion criteria

Studies were included if they focused on Nepal or the Hindu Kush Himalaya. They had to address climate change, adaptation, disaster risk reduction, GLOF, flood, climate finance or resilience. Peer-reviewed studies, systematic reviews or credible institutional publications were accepted. The studies needed to provide analytical or policy-relevant evidence. They also had to contribute

to one or more themes of the review.

Studies were excluded if they were unrelated, to the thematic scope. Duplicate records were removed. Studies that lacked methodological information were not included. Purely opinion-based studies were also excluded.

4. Results and Discussion

4.1. Climate Change and Emerging Himalayan Risks

Climate change is changing the conditions of the Himalaya. Among the clear changes is glacier retreat. Studies have shown a lot of glacier loss across Nepal and the larger Hindu Kush Himalaya. Khadka et al. (2023) in their look at climate impacts on Nepal glaciers and glacial lakes found that glaciers are getting smaller and there are changes in the conditions of lakes [1].

Also sensing studies by Hu et al. (2022) Showed changes in the number, size and water storage of lakes in Nepal between 2000 and 2020 [2]. These changes matter because bigger or unstable glacial lakes can lead to risk of GLOFs. However, the new risk is more, than GLOFs.

4.2. Glacier and Cryosphere Instability

Glaciers are living systems that react to changes in temperature, precipitation and energy. When glaciers retreat, they can change how water is available. Alter the land itself. Permafrost also plays a role in keeping mountains stable. Even though Nepal has some permafrost scientists have not studied it much. The few studies that exist show we still do not know enough about where permafrost's how it changes over time or how it responds to warming. This lack of knowledge is a concern. Mountain instability can happen without a glacial lake, which means we must pay attention to more than just lakes.

The Bhotekoshi event shows that disaster research, in Nepal needs to shift. It should not focus on glacial lake outburst floods or GLOFs anymore. We need to consider multiple hazards tied to the cryosphere. Current science says the 2026 disaster began with a glacial collapse that led to a debris flow and flood. The USGS calls it a glacial-collapse-triggered debris flow and flood. That means future risk studies must include glacier monitoring, ice-rock avalanche analysis, permafrost tracking, slope stability checks, remote sensing, river flow observation and models that predict cascading hazards.

4.3. The 2026 Bhotekoshi Flash Flood as a Case Lens

On August 26 2026 the Bhotekoshi Flash Flood was an example of how climate change can trigger a chain of disasters and expose weak places in the high Himalayas. The Bhotekoshi Flash Flood began near the border between Nepal and Tibet where a huge collapse of ice and rock released a 5.2-meter quake. The Bhotekoshi Flash Flood created a dam, in the Lhende river but the dam failed suddenly pouring a huge torrent of mud, stones and waves that were 8 to 10 meters tall. The Bhotekoshi Flash Flood sent this flow down the Bhote Koshi and Trishuli rivers. The surge turned mountain geography into a weapon directly attacking

economic infrastructure. It caused damage to 14 hydropower and solar projects knocking out almost 748 MW of power capacity. Key trade routes also fell apart—Gyirong Port complex, Timure Customs Office and the Miteri (Friendship) Bridge were all reduced to ruins. The Bhotekoshi disaster revealed a flaw in regional disaster preparedness. The flash flood destroyed bridges that carried monitoring sensors shutting down early warning systems overnight. At the time the absence of automated, cross-border data-sharing, with China meant Nepali authorities and local communities had no advance notice. They were caught completely off guard by the surge. There was no time to act no information to prepare. The disaster highlighted how fragile the region’s response systems truly are.

Downstream flooding and debris impacts caused damage to settlements and key infrastructure like roads and bridges. These problems show that dangers did not stop after the first flood wave passed. River blockages and new water bodies keep creating risks. This means disaster planning must account for hazards not just the initial event. Response efforts and funding need to be ready, for

changing threats over time not just a single moment of disaster.

4.4. Climate Finance and Nepal Resilience Challenge

Climate finance is often thought of as money used for climate mitigation and adaptation. In Nepal adaptation matters a lot because the effects of climate change are already clear. The real test of climate finance is not just how much money is raised.

A better way to look at it is through five steps: i. Finance ii. Investment iii. Implementation iv. Risk reduction v. Resilience

This order matters. Just because a country has a big adaptation budget doesn't mean people are safer. The money must be used wisely invested properly and actually reach the people who need it. Without that even the largest sum of climate finance can fail to build resilience.

4.5. Nepal Climate-Finance Architecture

Nepal climate-finance system involves sources.

Domestic sources	International sources	Emerging financial instruments
Federal government budget	Green Climate Fund and Humanitarian financing	Insurance
Provincial budgets	Bilateral development assistance	Risk pooling
Local government resources	Development banks	Credit
Disaster-management funds	UN agencies	Parametric financing
	International NGOs	Catastrophe-risk financing

Table 1

The challenge is that sources often operate through institutional systems. Consequently, a community may simultaneously experience, because fragmentation reduces the potential, for resilience several issues:

- 1. climate vulnerability
- 2. disaster risk
- 3. infrastructure vulnerability
- 4. livelihood vulnerability

4.6. Green Climate Fund and Nepal

One of the important changes is Nepal GCF-supported program dealing with GLOF and climate caused flooding. The GCF project FP272: Protecting livelihoods and assets at risk from GLOFs and climate-change-induced flooding in glacial river basins of Nepal was approved in July 2025 with UNDP, as the entity. The importance of this project lies in its orientation [3]. Than waiting for a GLOF or flood to happen adaptation finance is directed toward:

- 1. resilience
- 2. monitoring
- 3. preparedness
- 4. protection of livelihoods and assets

However, the 2026 Bhotekoshi event also raises an implementation question: How quickly can internationally finance adaptation programmes translate into operational protection, for communities exposed to rapidly changing mountain hazards? Because the GCF project predates the Bhotekoshi disaster by about one year it would be inappropriate to judge its effectiveness based on this event alone. Instead Bhotekoshi provides an opportunity to strengthen implementation and monitoring. Climate finance and disaster-risk finance are Distinct.

Climate adaptation finance mainly cuts long-term climate risk. Disaster-risk finance makes sure money is ready when a disaster strikes. Recent research that focuses on Nepal is very important. Adhikari (2025) looked at flood losses [4]. Compared them with money from the government and from abroad from 2003 to 2023. This research found that Nepal still has gaps, in disaster financing. The study says that Nepal still relies a lot on money and does not use many forward-looking financial tools. Adhikari and Rajkarnikar found the same [5]. They saw that Nepal has put disaster-risk-financing ideas into its plans. It still struggles because of weak implementation, split institutions, low skill and low awareness. The point is that humanitarian money must be backed by pre-disaster financing.

5. Disaster Risk Reduction, Early Warning and Resilient Infrastructure

Early warning is one of the cost-effective parts of disaster-risk reduction. Early warning should not be seen just as putting up sensors. A working warning system needs steps. It needs hazard detection, forecasting, issuing warnings, communication helping people understand the message, evacuation plans and safe shelters. So, climate finance must support the warning chain.

For hazards like those, in Bhotekoshi future warning systems could include:

1. satellite monitoring
2. glacier observation
3. river gauges
4. rainfall monitoring
5. seismic information
6. slope monitoring
7. community-based warning
8. mobile communication
9. sirens
10. evacuation planning

The challenge is especially severe for mountain events because the available warning time may be extremely short. Bhotekoshi also highlights the vulnerability of infrastructure located in Himalayan valleys.

Roads and bridges are not merely structures. Roads and bridges are lifelines, for:

- emergency response
- trade
- tourism
- health services
- food supply
- communication
- livelihoods

When one bridge fails the consequence can extend beyond the bridge itself. Therefore, future infrastructure investment should consider infrastructure and infrastructure should be designed according to risk not only historical hazard records.

- debris-flow pathways
- flood levels
- river migration
- slope instability
- climate projections
- cascading hazards
- alternative access routes

5.1 Build Back Better

The idea of Build Back Better is especially important in mountain areas that're prone, to hazards especially after disasters. Rebuilding the structures exactly where they were before without changes can bring back the same dangers. A strong recovery process must include: assessing damage reviewing hazards looking at climate risks redesigning engineering plans moving to safer locations when needed and rebuilding in a way that is stronger and more resilient.

In Bhotekoshi this approach should be used for:

1. bridges
2. roads
3. housing
4. schools
5. health facilities
6. hydropower infrastructure
7. border facilities
8. riverbank settlements

5.2. Loss and Damage

Adaptation cannot stop every climate-related loss. With strong DRR measures loss will still happen. These include:

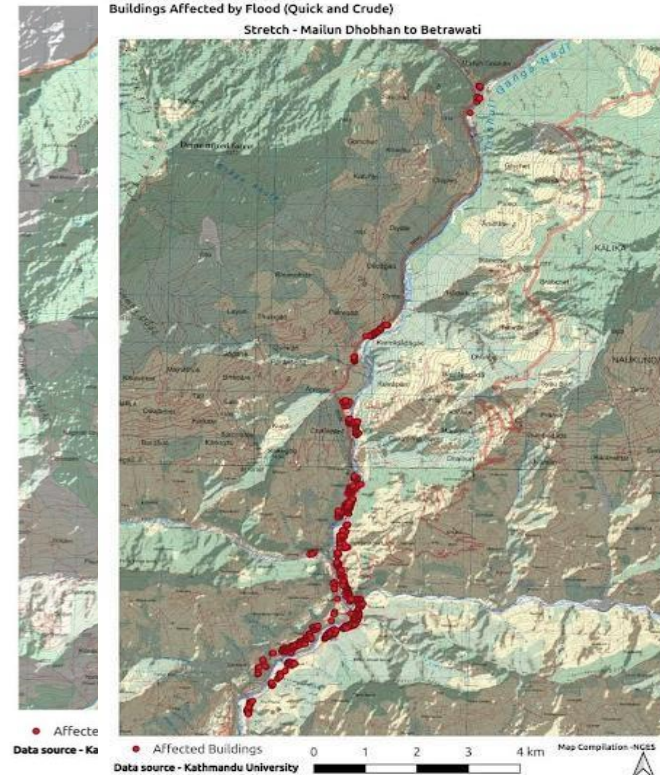
 Economic losses	 Non-economic losses
Houses	Human Lives
Roads and Bridges	Heritage
Hydropower	Community Networks
Businesses and Agriculture	Ecosystem
Tourism	Displacement and Psychological Impacts

Table 2

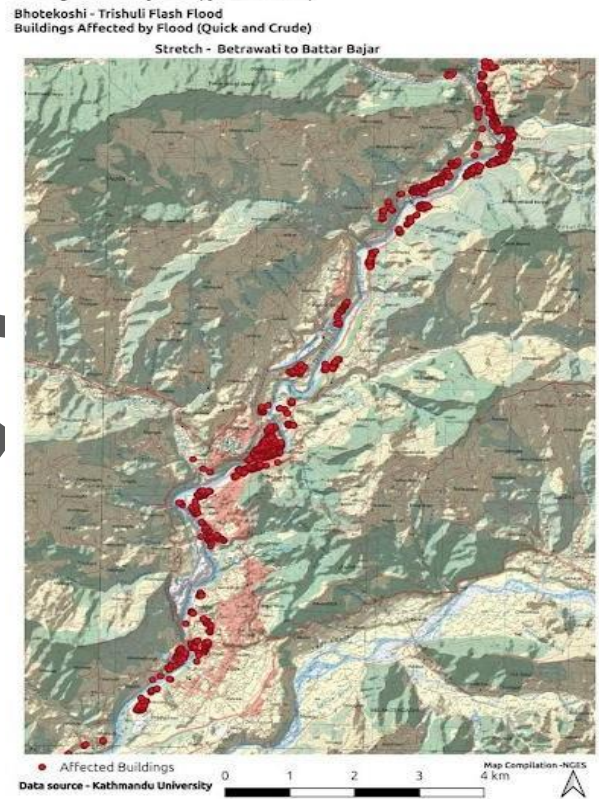
Nepal therefore needs systems to document both economic and non-economic losses. This is also important for accessing

international loss-and-damage finance.

**Bhotekoshi - Trishuli Flash Flood
Buildings Affected**



**Bhotekoshi - Trishuli Flash Flood
Buildings Affected by Flood (Quick and Crude)**

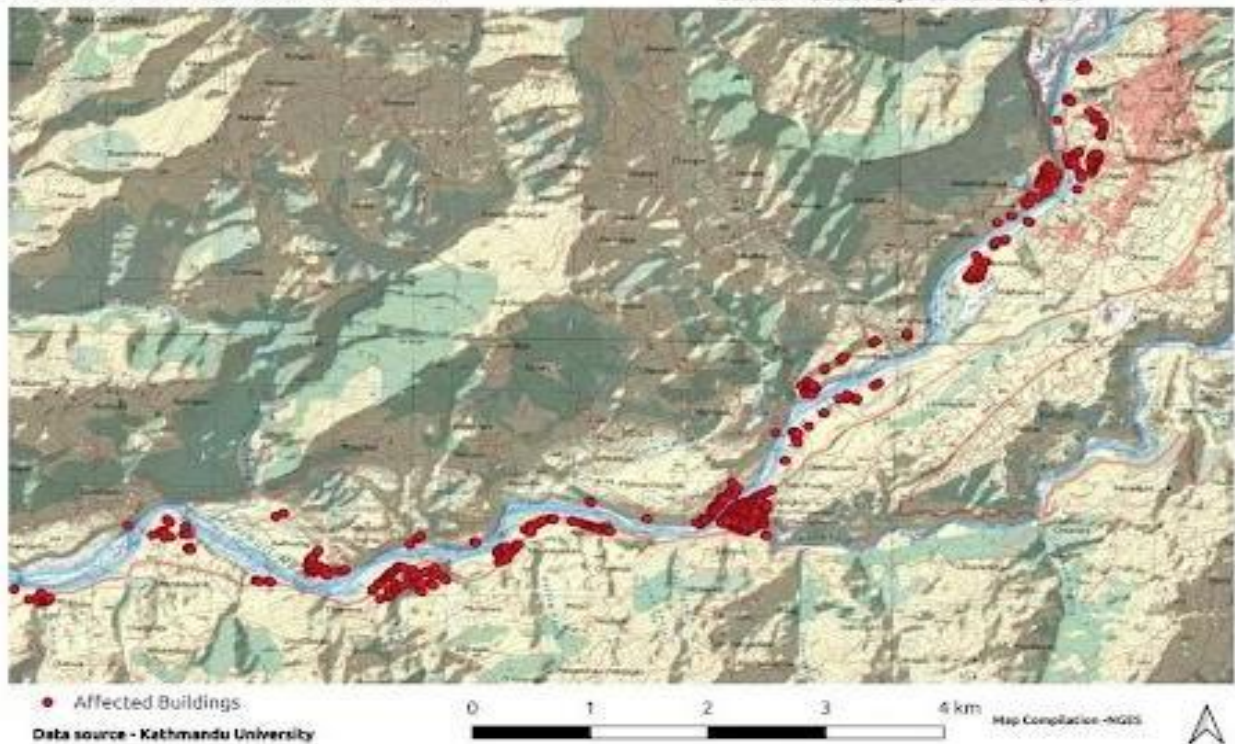


**Bhotekoshi - Trishuli Flash Flood
Buildings Affected by Flood (Quick and Crude)**



Bhotekoshi - Trishuli Flash Flood
Buildings Affected by Flood (Quick and Crude)

Stretch - Battar Bajar to Mahadevphat



5.3. Climate Justice

Climate finance has a justice dimension. At the level Nepal contribution to global greenhouse-gas emissions is very small compared with its vulnerability. At the level however climate impacts are not equally distributed.

Remote mountain communities may have:

1. infrastructure

2. limited access, to emergency services
3. weaker communication
4. fewer livelihood alternatives
5. lower financial capacity

Therefore, climate finance should prioritize vulnerability well as hazard. A resilient financing system should ask not "Where is the hazard?" but "Who is least able to cope with it?"

5.4. Conceptual Framework

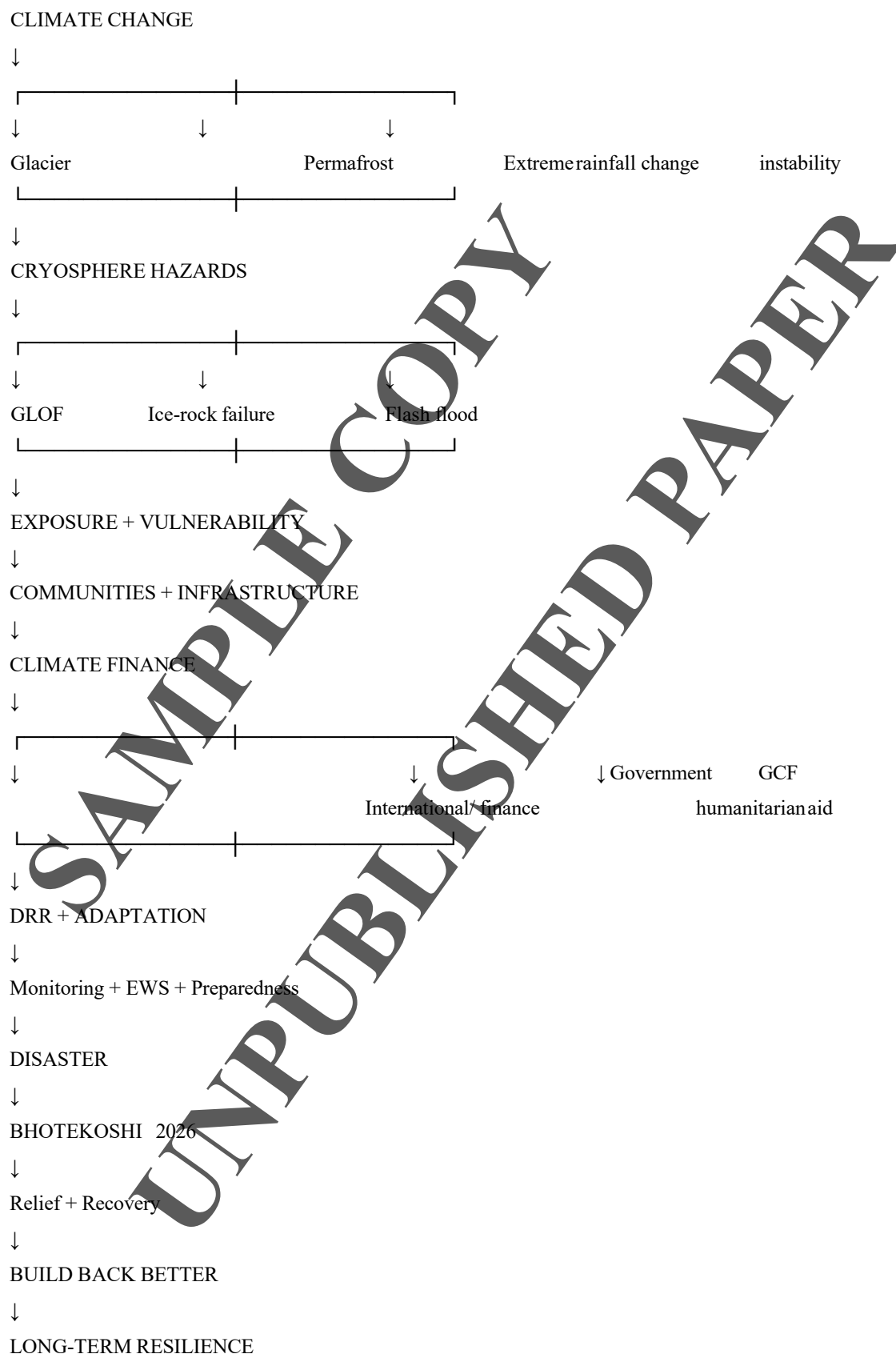


Figure 1: Climate Finance–DRR–Resilience Nexus

5.5. Proposed Climate-Finance Flow

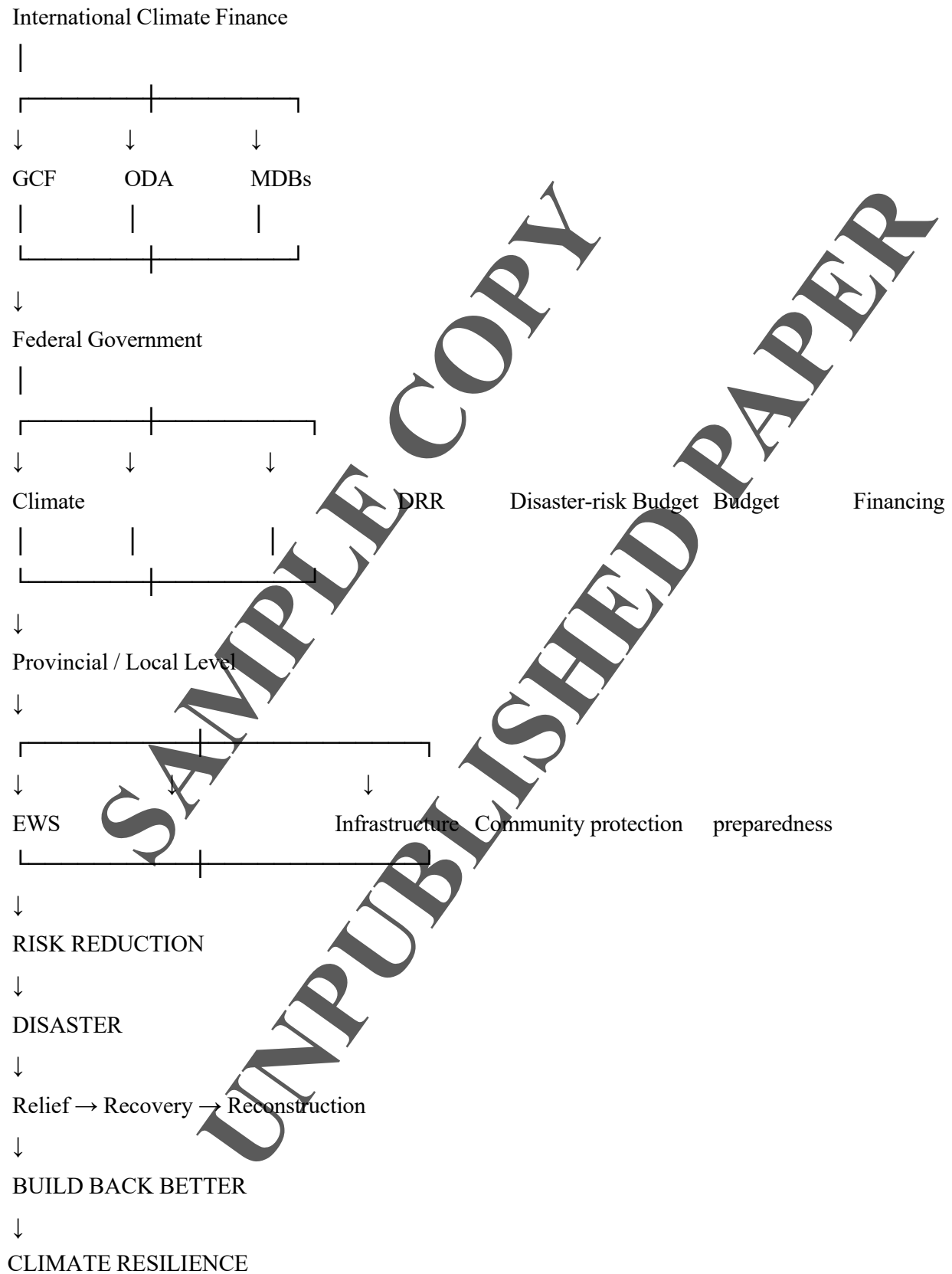


Figure 2: From international climate finance to local resilience

5.6. Literature Synthesis

Theme	Major evidence	Implication
Glacier change	Glacier retreat and changing ice conditions	Increase cryosphere monitoring
Glacial lakes	Expansion and changing susceptibility	Strengthen GLOF assessment
Permafrost	Major knowledge gaps	Expand high-altitude monitoring
GLOF adaptation	Structural and non-structural measures	Integrate DRR
Climate finance	Financing remains fragmented	Improve coordination
Disaster finance	Financing gaps remain significant	Expand ex-ante mechanisms
Early warning	Technology must connect with communities	Invest in complete warning chains
Local adaptation	Planning does not automatically reduce vulnerability	Measure outcomes
Infrastructure	Mountain lifelines remain exposed	Apply climate-risk screening
Humanitarian finance	Essential after disasters	Link relief to recovery
Loss and damage	Data and institutional gaps	Strengthen national systems
Climate justice	Vulnerability is uneven	Target finance equitably

Table 3

6. Discussion

The literature reviewed in this study highlights a recurring issue: Nepal's climate and disaster institutions are growing in strength. The various parts do not always work together as a unified resilience system. This lack of coordination creates key gaps.

First climate finance and disaster finance remain disconnected. Adaptation projects often focus on long-term risk reduction while disaster funds are only released after a crisis occurs. Second international finance does not automatically build resilience. Communities that face the risks often lack the technical knowledge or institutional support needed to access major climate funding. Third preventive investments are still weaker than spending. Data from Nepal's flood financing sector shows a mismatch between past losses and the amount of money available to prevent future damage. Fourth building infrastructure does not always mean greater resilience. A new road or bridge can still be highly vulnerable if it is not designed with climate risks and cascading hazards in mind. Fifth local adaptation planning does not automatically reduce vulnerability. Planning only becomes effective when it leads to changes, in exposure, sensitivity and adaptive capacity.

These findings suggest that Nepal should move toward a risk-informed financing approach.

7. Research Gaps

The review identifies several areas requiring further research.

1. Scientific attribution of the Bhotekoshi event
2. Effectiveness of climate finance
3. Local climate-finance access
4. Ex-ante disaster-risk financing
5. Loss and damage vi. Resilient reconstruction

Future studies should examine whether post-disaster reconstruction actually reduces future vulnerability.

8. Policy Recommendations

1. Establish an integrated Himalayan climate-risk financing mechanism
2. Increase ex-ante disaster-risk financing
3. Strengthen local access to climate finance
4. Integrate CCA and DRR financing
5. Make climate-risk screening compulsory for major infrastructure
6. Develop integrated mountain early-warning systems
7. Establish community resilience funds
8. Connect humanitarian finance with recovery
9. Institutionalize Build Back Better
10. Strengthen loss-and-damage readiness

9. Conclusion

The 2026 Bhotekoshi flash flood has brought renewed attention to the changing nature of disaster risk in the region. According to scientific assessments the disaster was most likely triggered by a glacial collapse that produced a debris flow and a flood, which cut through a long downstream corridor. This disaster shows how a disturbance in a high-altitude cryosphere environment can quickly turn into a humanitarian, infrastructure and economic disaster.

The event should be taken as proof that climate change directly caused the collapse. Instead, it should be understood within the context of a warming Himalaya, where changes, in glaciers and mountain systems can alter the conditions that allow hazardous processes to happen.

The central finding of this review is that climate finance and disaster-risk reduction cannot be treated as agendas. Finance is needed before the disaster to support:

- monitoring;
- hazard assessment;
- early warning;

- community preparedness;
- resilient infrastructure;
- land-use planning.

During Disaster	After Disaster
Rescue	Recovery
Humanitarian Assistance	Reconstructions
Emergency Communications	Livelihood Restorations
Evacuations and Shelter	Build Back Better and Long Term Adaptation

Table 4

Nepal has already taken steps in this direction. The GCF-supported programme that addresses GLOFs and climate-induced flooding shows a move toward adaptation finance. At the time recent research shows big gaps in Nepal disaster-risk financing and points out the lack of ex-ante financial instruments.

The key lesson from Bhotekoshi is therefore not simply that Nepal needs money after disasters. Nepal needs finance before during and, after disasters. The required transition can be summarized as: From disaster response to risk anticipation; from finance to integrated finance; from rebuilding what was lost to building what is safer; and from climate finance as an expense to climate finance as a measurable risk reduction. In the end climate resilience must be judged not by how much money's raised but by whether that climate finance makes communities, ecosystems, infrastructure and livelihoods safer than they were, before the investment [6-15].

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