

# 6. DISPLACEMENT RISKS FROM GLACIAL MELTING IN NEPAL

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## INTRODUCTION

In December 2009, in order to highlight the threat of climate change to the Himalayas region, the Nepalese government held a meeting at a height of 5,262m and adopted a resolution on climate change. Such a symbolic meeting had already been conducted a few months earlier by the government of the Maldives, which met underwater, thus drawing the attention to the sea-level rise posing an existential threat to the island state. Like the Maldives, Nepal faces several threats from climate change-induced environmental change. The melting of glaciers results in the creation of, and additional pressure on, glacier lakes. When glacial lake outburst floods (GLOFs) take place, as, for instance, in 1985 (Dig Tsho Lake), its consequences for the population and the destruction it causes are significant (Schild 2008: 4).

Glacial lake outburst floods are but one kind of environmental disaster Nepal is likely to face as global temperatures continue to rise.<sup>27</sup> For example, the 2008 monsoon triggered major floods, causing the Saptakoshi River to break through a dyke and flood the Sunsari district in Southeast Nepal; 54,000 people were displaced (MSF 2008). Moreover, while natural disasters<sup>28</sup> are the most obvious linkages between environmental change and migration, slow-onset environmental degradation resulting from floods, landslides, and human activity can also harm livelihoods and increase the likelihood of migration and displacement (Shrestha and Bhandari 2005). At the same time, the environment is only one of several factors

that explain migration, which is a complex social process.

This case study aims to provide an overview of the progressive melting of glaciers in Nepal, a type of slow-onset environmental degradation that can lead to rapid-onset disasters such as GLOFs. This paper will examine how these processes and events affect the migration decisions of local people, as well as how policymakers and NGOs have addressed the issue of melting glaciers potentially leading to devastating GLOFs.

## 1. CONTEXT AND VULNERABILITIES

### 1.1. General description of Nepal

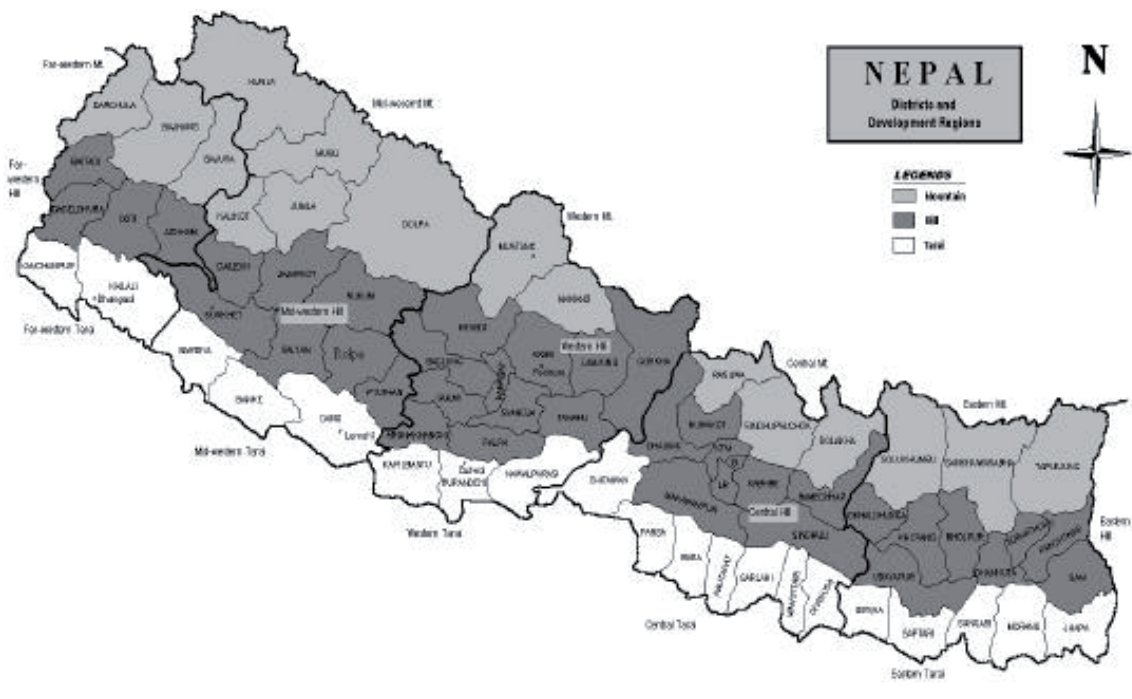
Kumar divides Nepal into three main regions, defined by “a combination of altitude, climate, district boundaries and drainage basins from South to North and East to West,” (Kumar KC 2003: 122): 1) the mountain zone (which includes 7.3% of Nepal’s 29 million people,<sup>29</sup> covers 22.7% of the country’s area and 0.3% of its arable land); 2) the hilly area (44.3% of the population, 50.2% of land area, 48.1% of arable land); and 3) the Terai area (48.4% of the population, 27.1% of land area, 51.6% of arable land). As a result, the “mountain districts are chronically deficient in the production of staple foodstuffs. This, in combination with their poor transport infrastructure, means they are also chronically food-insecure” (Gill 2003: 6). The hill area also suffers from an agricultural production deficit, while only the Terai land has a food surplus (ibid.). Environmental hazards may affect these regions differently, widening inter-regional disparities.

27. The average increase of temperature in Nepal is expected to increase by 0.6 degrees Celsius per decade—higher than the global average (Webersik and Thapa 2008: 2).

28. It should be noted that the natural/human categorization of disasters is not always straightforward. For example, the 2008 floods were caused not only by heavy rains but also by poor maintenance of the dam itself.

29. This overview is based on Gill (2003) and K. C. (2003)

Map 1. Ecological zones in Nepal



Note: White areas: Tarai; dark area: Hills; grey area: Mountains. Source: Kumar KC 2003: 122.

## 1.2. Historical description of affected areas

Glacial lake outburst floods (GLOFs) are considered one of the most imminent threats resulting from environmental change in Nepal. As glaciers melt, new glacial lakes are formed and existing lakes expand, increasing the risk of GLOFs. In 1985, a GLOF in the Dig Tsho Glacial Lake in eastern Nepal attracted international attention. An “ice avalanche” had fallen into the lake, causing a five-meter high flood wave that overcame a moraine dam and ran down mountain-sides, destroying houses, land, infrastructure, and causing \$1.5 million in damage to a hydroelectric power plant (Schild 2008: 4). The glacial lake, 1,500 metres long and 300 metres wide, was almost completely emptied by this event (Horstmann 2004: 3). In one of Asia’s poorest countries (UNDP, 2010), such events impose a heavy toll. And while the Dig Tsho GLOF was among the most devastating, such floods occur every two to five years according to the Nepalese Department of Hydrology and Meteorology (Kattel 2007).

## 1.3. Socio-economic and natural characteristics of affected area

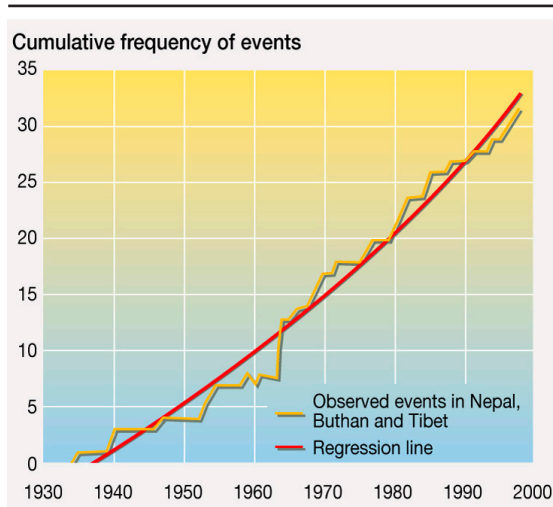
In recent years, much emphasis has been put on the notion of vulnerability as a way of anticipating

the impact of environmental changes on populations. Vulnerability is “a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.” In other words, vulnerability is equal to ‘f’ (exposure + sensitivity - adaptive capacity)” (ICIMOD 2010:1). Resilience can be defined as “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (ibid.). Finally, endowments and entitlements also need to be analyzed in order to understand vulnerability and resilience. Dulal et al. (2010: 627) define endowments and entitlements as “important resources required by every society or group to enable them achieve a sustainable livelihood. [...] This includes capital assets of individuals, households, communities, or groups, such as human, physical, natural, financial and social capital [that will define] their ability to achieve a sustainable livelihood, [which in turn will] enhance their adaptive capacity and resilience in the face of increasing climate change threat.”

“Human capital” refers to the “level of education and productive skills of the people [and which] includes knowledge, skills, competencies, and attributes embodied in people that facilitate the creation of personal, social and economic well-being.” (Dulal et al. 2010: 627) In Nepal, human



**Figure 3. Glacier Lake Outburst Floods**



Source: UNEP/GRID-Arendal 2010.

As noted above, vulnerabilities can be understood as a lack of necessary assets to realize capabilities to cope with the environment. Because Nepal suffers from a lack of endowments and entitlements needed to ensure adaptation to environmental change, and because of the country's unique geography and topography, it is particularly vulnerable to global environmental change, and thus represents an important case study for climate scientists.

## 2. MIGRATION PATTERNS OVER TIME

### 2.1. General patterns

According to figures from the 2001 census (Kumar KC 2003: 11), the most important internal migration takes places from rural to rural areas, accounting for about 68.2% of all migration activity, while rural-to-urban migration accounts for 25.5% of total internal migration. Moreover, migration takes place more often from higher to lower altitudes (Gill 2003: 11). Reasons for internal migration are marriage (23%), agriculture (18.1%), service (11.5%), study (10.3%), business (5.5%), and 'other reasons' (31.6%). The Mid-West and Far-West parts of the country experience population loss as a result of migration.

Internationally, the most prominent emigration destination from Nepal is India, where about 900,000 Nepalese (77.3% of the expatriate community) are believed to live (Kollmair et al. 2006: 153). India is a prime destination because of the open border between the two countries (Shrestha and Bhandari 2005: 21). Migration to the Gulf

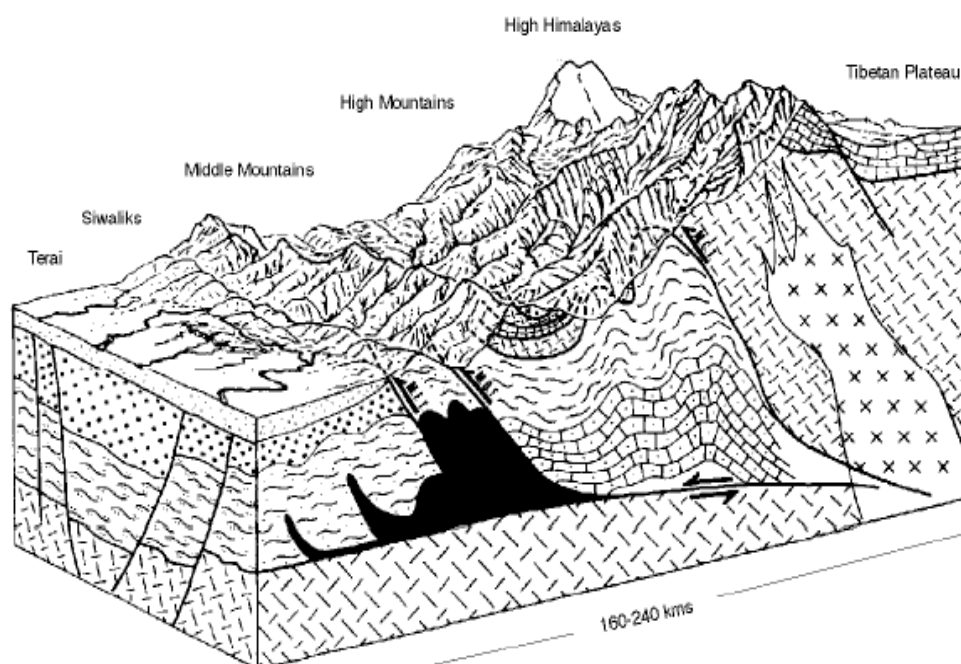
States, officially estimated at 110,000, is believed to be at around 170,000 (14.5%) while 40,000 (3.5%) are estimated to have left for Europe, the US, Japan and Australia (Kollmair et al. 2006: 153).

### 2.2. The environment-migration nexus

Two studies, Massey et al. (2007) and Shrestha and Bhandari (2005), address the environment-migration nexus in the Chitwan Valley (Terai), examining the importance of environmental deterioration on human migration. Massey et al. (2007: 6f.) identify five specific aspects of environmental change that they deem important in order to establish the link between environment and migration: 1) "higher levels of population density will be associated with higher rates of out-migration among residents of the Chitwan Valley"; 2) they anticipate that "a perceived decline in agricultural productivity will be associated with a greater likelihood of out-migration among farm households"; 3) "local areas with less open farmland will have higher rates of out-migration than those where agriculture is more abundant"; 4) "families facing less access to fodder will have higher rates of out-migration"; 5) "variations in access to fodder and firewood are expected to have different effects on the migratory behaviour of men and women." They also assume that "given that the Chitwan Valley continues to exhibit a great deal of environmental variation, local environmental changes [are expected] to have a stronger influence of local moves within the valley than on long-distance moves out of the valley". Both Massey et al. (2007) and Shrestha and Bhandari (2005) conclude that labour migration is a coping strategy to environmental degradation. However, such migrations are almost all local; there is little evidence that international migration patterns into and out of Nepal have a strong environmental component (Massey et al. 2007: 22).

In their study, "Labour migration as a response strategy to water hazards in the Hindu Kush-Himalaya", Banerjee et al. (2011) find that "nearly 80% of the migrant households surveyed considered water-related hazards as an important influence on the decision to migrate for work. But even in these households, non-environmental reasons such as lack of income, unemployment, dissatisfaction with livelihood, and lack of livelihood opportunities were significant determinants of labour migration". It should be pointed out that there is a considerable difference between the role of "rapid-onset hazards" such as floods and "slow onset hazards" such as droughts, floods playing a role in 60% of migrant households' migration decisions,



**Figure 4.** Topography of Nepal

Source: WWF 2005:6.

while droughts influenced migration behaviour in 30% of migrant households (Ibid.).

As Baherjee et al demonstrate, not all disasters have the same impact—or perceived impact. In the case of GLOFs, it is unlikely that mountain communities can engage in *in situ* adaptation. GLOF adaptation would require strong early warning systems, a change from mud to stone as the building material of choice (ICIMOD 2009: 28), and other costly interventions that only the central government (and international donors) can reasonably fund. Conversely, in the case of droughts, traditional knowledge can lead to successful local adaptation strategies (ICIMOD, 2009). In addition, since drought is a slow-onset process, it is possible for families to arrange for temporary migration out of the affected area.

### 3. POLICY RESPONSES

#### 3.1. Risk assessment and reduction

The International Centre for Integrated Mountain Development (ICIMOD) has undertaken considerable efforts to assess risks emanating from glacial lakes. In 2001, it created an inventory of glaciers, identifying more than 8,000 glacial lakes in the greater Himalaya, 200 of which are potentially

dangerous (Schild 2008: 2). A further assessment of glacial lakes in Nepal, using remotely sensed data, took place in 2009: 1,466 glacial lakes were identified, 6 of which are “potentially dangerous” (ICIMOD 2010a: 3).

Together with the Kieo University (Japan), ICIMOD has implemented a Wireless Fidelity (Wi-Fi) monitoring system of the Imja Tsho Lake, regarded as being at high risk for a GLOF. Two web cameras provide images of the area every 10 minutes, accompanied by additional data from sensors of the monitoring system (Garung et al. 2009: 6).

The threat posed by Tsho Rolpa Lake was addressed in the late 1990s after Dr. J. Reynold, a GLOF specialist, warned that the lake might burst in the summer of 1997 (Matambo and Shrestha 2010). An early warning system was installed, first in the form of Army posts in the area, which would warn population in case of a GLOF, then through a more sophisticated system that would receive signals from a GLOF sensor system and warn the population by air horns and sirens (ibid.). Furthermore, a channel system, financed by the Netherlands, was installed to lower the water level by 3 meter (Horstmann 2004: 4f.).

The United Nations Development Programme (UNDP), together with the EU’s Humanitarian Aid Agency (ECHO), also aims at strengthening GLOF risk reduction through “non-structural and community-based interventions [and through fostering] understanding of socio-economic risks

associated with GLOFs” (UNDPa). This project<sup>31</sup> includes raising awareness among the population, land use planning (through, for instance, introduction of land use management concepts and practices at the community and local administration level), preparedness planning (through, for instance, the development of contingency plans and identification of evacuation routes and safe shelters), knowledge networking (through, for instance, documenting traditional coping mechanisms and practices, and facilitating information and knowledge sharing between different stakeholders), risk mitigation, early warning systems, disaster management planning and, finally, mainstreaming disaster risk reduction into development (UNDP, ECHO).

### 3.2. Resettlement programs

Resettlement has taken place on a small scale and only with regard to the Tsho Rolpa Lake. As it was believed that an outburst would take place in June 1997, an evacuation for the population living downhill from the lake was issued. Approximately 74% of the population of 6,000 that lived downhill from the lake was evacuated for one month (Matambo and Shrestha 2010). According to reports from the area, the physical risk reduction measures put in place gave the population the impressions that they were safe and thus that there was no need to move.

### 3.3. Relief action

Relief actions are undertaken by the state and international organizations in the event of floods, including GLOF. Action takes place under different policies such as the 1982 Natural Disaster Relief Act, stipulating, for instance, that families of victims shall be provided NRS 10,000 (€160) as relief assistance (Pokharel 2004) and the National Strategy for Disaster Risk Management of 2008. The former also establishes a Central Disaster Relief Committee, under the leadership of the Minister for Home Affairs, consisting of 25 members; it also authorises the government to set up aid funds at national, regional, district and local level (Government of Nepal 2008: 21).

Following the 2008 Koshi floods that displaced 42,000 people, the government of Nepal provided a return package worth NRS 50,000 (€800) to those returning to their original places

of residence from the relief camps (IFRC 2009: 4). Moreover, it purchased land and allocated 133.8 square meters to each of 1,422 landless families (Shankar 2010). However, critics pointed out that the Chamar community, a Dalit (lowest caste) sub-caste, had been discriminated against in the reallocation process. Having been compelled to live on the borders of the Koshi river and landless because of their status, Dalits are more vulnerable to such floods (ibid.). Furthermore, the return package was provided only to those that had registered as Internally Displaced People (IDPs). Due to weak registration mechanisms, however, up to half of the IDPs were not able to register in some districts (IDMC 2010: 1). Additionally, the 2007 IDP policy<sup>32</sup> adopted by the government “has not been disseminated effectively across the country” (ibid.).

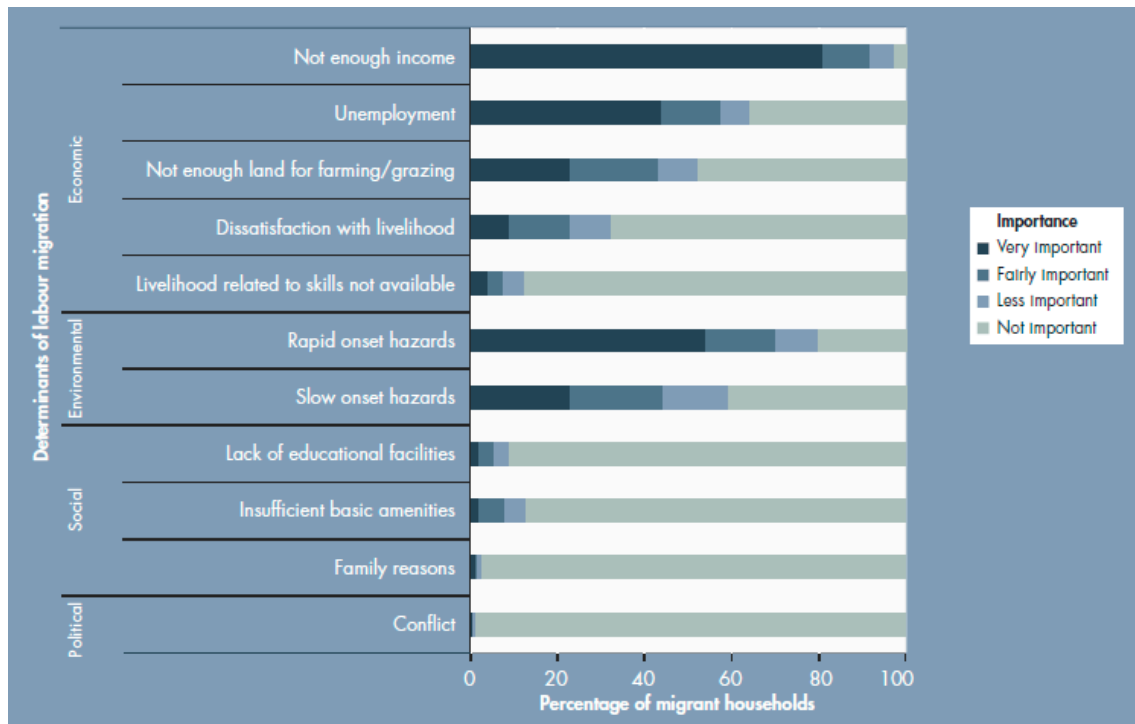
According to the International Federation of the Red Cross and Red Crescent Societies (IFRC), “throughout the response, the work of the humanitarian actors, of clusters and coordination, has been largely focused on temporary camps established in and around community buildings as well as on available unaffected land. Almost all those who fled needed housing and thus emergency shelter had an important role to play. Anecdotal evidence suggests that the response and the coordination of the response have overall been good. Throughout the disaster, with perhaps a few problematic exceptions, humanitarian need has been met.” (Kellett 2008: 5). Despite these and other measures,<sup>33</sup> Chhetri (2001: 63), focusing on the domestic landscape, points out that there is a “lack of coordination among agencies related to disaster management, and of clear-cut job descriptions for those agencies.” Other shortcomings include a lack of technical manpower.

International organizations, besides providing relief to those hit by floods, also play a role with regard to capacity building and training of authorities. The International Organization for Migration (IOM), for instance, runs a program on “Migration, Climate Change and Environmental Degradation”, in the framework of which it trains authorities in “Humanitarian Response in Emergencies, Shelter and Settlement Planning and SPHERE Standards to ensure a consolidated response to the advent of new disasters in the region” (IOM 2010).

31. A wide range of documents on the projects is available at [http://www.managingclimaterisk.org/index.php?menu\\_id=9&pagetype\\_menu=2&content\\_id=MEN-9](http://www.managingclimaterisk.org/index.php?menu_id=9&pagetype_menu=2&content_id=MEN-9)

32. For the policy document, see Government of Nepal (2007).

33. For a more comprehensive account, see the Government of Nepal, UNDP, EC (2010).

**Figure 5.** Determinants of labour migration and their perceived importance in the migration decision

Source: Banerjee et al. 2011:8.

## CONCLUSION

The forgoing overview of GLOF and their link to migration in Nepal has demonstrated that thus far, the threat of such floods has not led to people moving in anticipation of the phenomenon. Evacuation of a part of the population living downstream of the Tsho Rolpa Lake for a period of around one month has been the only movement directly linked to this slow-onset environmental change. However, the ongoing and quickening process of glacial melting is likely to increase the likelihood of GLOF which will trigger displacement (as occurred after the GLOF at the Dig Tsho Lake in 1985) if no comprehensive prevention measures are put in place.

Actions taken by the government when an outburst of the Tsho Rolpa Lake was expected in 1997 have addressed several issues, yet several shortcomings remain, especially concerning problems regarding the early warning system put in place at that time and later abandoned. Moreover, the positive role played by the ICIMOD has demonstrated the importance of strengthening local capacity for research and risk assessment.

## POLICY RECOMMENDATIONS

- Carry out more fine-tuned studies in the different regions (Terai, hills, mountains) to assess different vulnerabilities and capacities of the different communities.

*Migration patterns (and vulnerabilities to environmental change) differ from area to area, and even within districts. In order to fully understand the phenomenon, more detailed studies need to be carried out, ideally by local research institutions. Research in this area should identify different configurations of capital assets and role in both adaptation to environmental change, and migration behaviour.*

- Implement the 2007 National IDP Policy and develop an effective registration mechanism

*According to various NGOs, little progress has been made on the implementation of the 2007 National IDP Policy. The Government of Nepal needs to implement the policy and also develop effective registration mechanism for people displaced by natural disasters in order to ensure that best assistance possible is provided to victims of such events.*

- Design mechanisms to include the local communities in the decision-making process at state level
 

*Since environmental conditions and vulnerabilities are often highly localized, local actors need a role in setting State policy on environmental change, adaptation, and migration. International organizations and civil society may also contribute valuable technical knowledge and expertise to these processes.*
- Provide information on anticipated environmental change to local communities, especially to those that are in remote mountain areas
 

*Access to information depends on several factors, the most important being the ability to acquire data and reports on anticipated environmental changes and their impacts. Access to information thus requires both education and resources (such as internet access), both of which are far from universal in Nepal. International donors can help fill these gaps. Moreover, data and knowledge on environmental change should be mainstreamed into development projects in Nepal.*
- Provide funding schemes for communities to adapt houses to potential GLOFs and to allow for other capital-intensive adaptation measures
 

*Changing housing materials from mud to stone can be protective against GLOFs. However, as noted in this analysis, many mountainous areas suffer from food insecurity and a general lack of financial resources. Thus, international and national support may be necessary to fund such capital-intensive investments. However, any such program should avoid exacerbating local inequalities, including those fueled by remittance revenue.*
- Foster development of expertise through the funding of research institutions
 

*Research institutions play an important role in understanding changes in the environment and how they will affect populations. They have provided valuable data and have also carried out awareness-raising training. The activities undertaken by ICIMOD, which has mapped risks resulting from glaciers in the Hindu Kush-Himalaya region is but one example. These sorts of locally-driven research institutions should be supported and nurtured, preferably through cooperation with international actors who might benefit from lessons learnt with regard to environmental change and adaptation strategies.*
- Inter-agency cooperation in disaster response operations
 

*The different agencies responsible for disaster relief operations in Nepal do not always cooperate sufficiently, undermining efficacy. New organizational frameworks should be considered and developed. ■*



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