Information Sheet 3: Flash Flood Risk in Sun Koshi Basin

Introduction

As mentioned in Information Sheet 1, the glaciers in the headwater area of the Sun Khoshi basin in TAR China are retreating rapidly leading to the formation and growth of an increased number of glacial lakes. Nine glacial lakes in the basin were identified as potentially dangerous in 2005 (Ives et al., 2010), and this number may have increased. Thus GLOFs are a potential risk in the Sun Koshi basin.

Past flash floods in the basin

Three major GLOF events have been recorded in the basin. The first occurred in 1935 when the Tara Cho lake burst out. The flood event damaged a wide area of cultivation and livestock, mainly in the headwaters close to the lake in TAR, and no cultivation has been possible since then in the valley just downstream of the lake because of the debris deposits. In 1964, the Zhangzangbo lake burst out but did not cause much damage. This was perhaps because it was only a partial outburst due to piping in the moraine dam. The same lake burst out on 11 July 1981. This GLOF lasted for about one hour and caused significant damage downstream in the Nepalese part of the basin. The amount of water released was estimated at 6.3 million m3. The flood washed away a large portion of the highway linking China and Nepal, damaged three bridges along the highway, including the Friendship Bridge at the China-Nepal border, and severely damaged the diversion weir of the Sun Koshi hydropower plant. The total damage in Nepal amounted to about USD 3 million.

Other flash flood events

The basin is also frequently affected by intense rainfall floods. In 1987, one such flood caused severe damage to the Arniko Highway. Landslide dam outburst floods (LDOFs) are also common, LDOFs were recorded in the Bhairab Kunda in 1996, 1998, and 1999, and the Devisthan Khola in 1999, 2002, and 2005. These LDOFs caused some damage to the Upper Bhote Khosi hydropower plant facilities. The most extreme LDOF event in this area in recent times was the Larcha LDOF on 22 July 1996. Larcha is a small settlement near the confluence of the Bhairab Kunda stream and the Bhote Koshi. Rainfall of 80 mm was recorded in a 24 period at Gumthang which led to several landslides along the Bhairab Kunda, one of which dammed the stream. The subsequent outburst of the dam caused a flood and debris flow which wiped out Larcha village. The event occurred around midnight, and 22 houses were washed away or damaged and 54 people killed in a matter of minutes. Around 150 m of the Arniko Highway was also damaged by the flood.

GLOF risk in the basin

In 2009, ICIMOD conducted a comprehensive GLOF risk assessment of the Sun Koshi basin. This included a dam break scenario and socio-economic impact assessment taking an outburst of the Lumu Chimi lake in the headwaters of the basin as the basis for calculations (Shrestha et al., 2010). The peak flood at the China-Nepal border was estimated to be more than 9,600 m3/s. The flood was routed along the river valley to derive the inundation scenario and to estimate potential impacts. It was calculated that close to

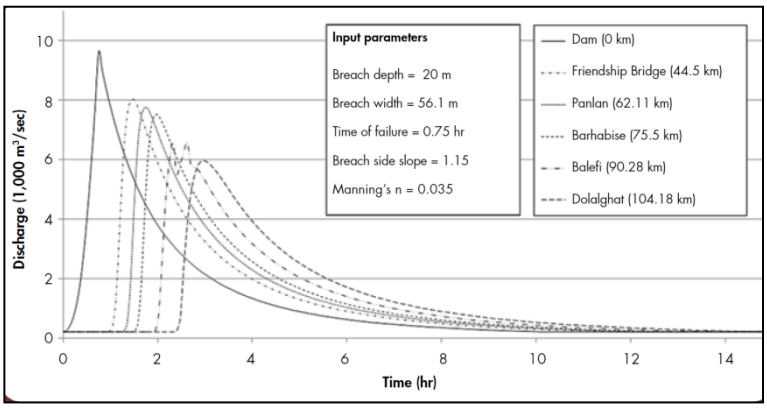

Figure 1: GLOF hydrograph along the river valley

5,800 people in 900 households would be directly affected by a GLOF of the same magnitude as that which occurred in 1981 as they either live within or have property within the GLOF hazard zone. This figure increased to 2,519 households with 16,313 people if the GLOF were to be 10 m higher than the 1981 GLOF. A GLOF would affect the flow of vehicles, goods, and people along the Arniko and Lamosangu-Jiri highways, spreading the indirect impact to many VDCs in Dolakha, Ramechhap, and Solukhumbu districts. Based on the 2001 population census (Central Bureau of Statistics 2001), a total of 639,000 people could be indirectly affected by damage to the two highways.

Many more people involved in international trade with China and tourism activities to Tatopani and the Khumbu region would probably also be affected. The livelihood support system of more than 3,800 families living inside and outside the GLOF hazard areas would probably be severely affected, including wholesale and retail traders, hotels, industry, transport services, government services, and tourism. The Sun Koshi river is one of the world's top ten rafting rivers, with about six rafting spots along a 28 km reach of the river. A GLOF would affect seven hotels and numerous rafting operators, river guides, and tourism operators that serve the rafting tourism industry along the river. The transport sector would also probably be affected. More than 60 jeeps, 50 buses and minibuses, and 60 trucks shuttle daily along the Arnico Highway. Tatopani, which is located near the Nepal-China Friendship Bridge, is an international trade hub with China.

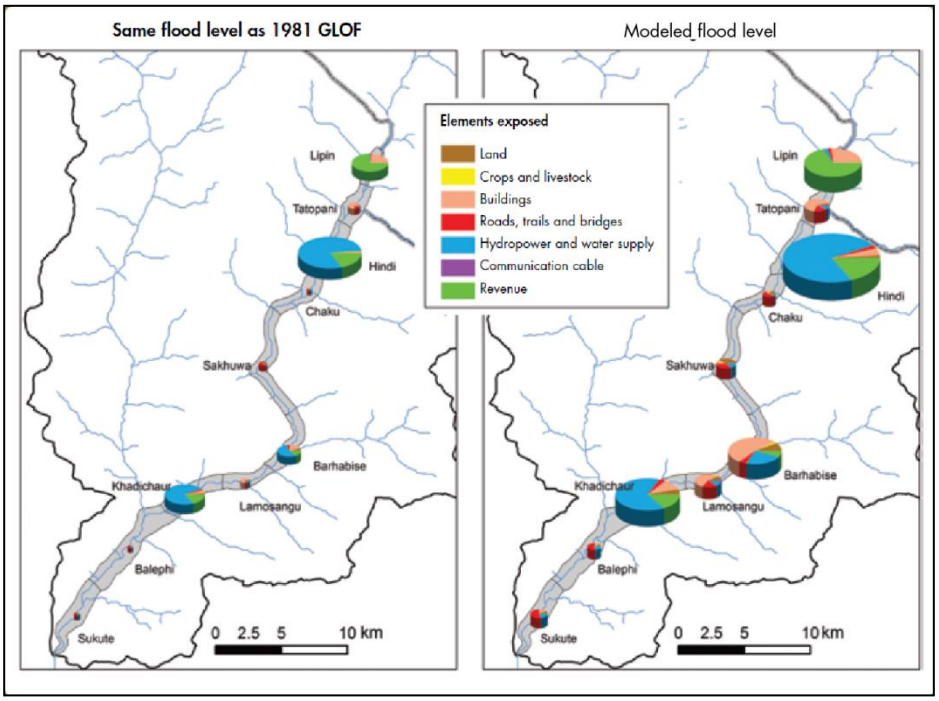

Figure 2: GLOF risk map of the Bhote Koshi/Sun Koshi basin, Nepal

The volume of international trade, including the amount of revenue collected by the government, would be affected by GLOF damage to bridges and roads and the consequent disruption in the flow of goods and services. The estimated total value of property at risk from a GLOF was USD 153 million under Scenario 1 (a GLOF level the same as in 1981) and USD 189 million under Scenario 2 (a GLOF level based on the model.). There would be a drastic increase in the share of private property (buildings, land, crops) and roads affected.

References

Central Bureau of Statistics. (2001). *Nepal – National Population Census 2001.* Retrieved from http://cbs.gov.np/nada/index.php/catalog/42

Ives, J. D., Shrestha, R. B., & Mool, P. K. (2010). *Formation of glacial lakes in the Hindu Kush-Himalayas and GLOF risk assessment.* Kathmandu: ICIMOD

Shrestha, A. B., Eriksson, M., Mool, P., Ghimire, P., Mishra, B., & Khanal, N. R. (2010). Glacial lake outburst flood risk assessment of Sun Koshi basin, Nepal. *Geomatics, Natural Hazards and Risk, 1*(2), 157-169.