



Dangerous Glacial Lakes in Apolobamba Protected Area, Bolivia: Inventory and Management Perspectives

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Climate change is a reality in the Bolivian Andes. Temperature, precipitation, and humidity have changed considerably over the last 50 years (Vuille et al., 2008). Temperature increase is now about 0.3° C per decade.

Accelerated melting of glaciers due to global warming is a worldwide phenomenon and tropical glaciers are especially vulnerable. Due to global warming, tropical glaciers in the Bolivian Andes have lost about half of their volume and surface area since 1975 (Sorucu et al. 2009).

Mountain protected areas such as ANMIN-A, with its core area above 4,000 m.a.s.l. and peaks going up to 6,000 meters, are the most vulnerable to above average temperature rise at higher elevations as a consequence of accelerated climate change, especially due to the presence of glaciers and the region's already fragile ecology.

There are numerous studies on the rate of glacial retreat as well as the impact melting glaciers have on urban water supplies. However, studies highlighting the risks associated with climate change in mountain areas are still scarce. Glacial retreat increases the risk of climate hazards such as glacier lake overflows (GLOFs). Considering that the Cordillera de Apolobamba holds the largest continuous glaciated area in Bolivia, which measured 220 km² in the 1980s, there is a legitimate concern regarding the dangers that might affect this mountain region. Throughout the Apolobamba mountain range, the retreat of glaciers has resulted in the formation of small and medium sized lakes on the glacial terminus. Many of the glacial lakes are contained only by loose moraine debris, posing a significant threat to human settlements and infrastructure downstream.

Yet, there is still little awareness of the related risks. Only recently has glacial retreat, as well as impact of climate change in the region, been discussed in the planning and management of the Apolobamba National Area for Integrated Management (ANMIN-A), initiating a much needed discourse on natural hazard threats and the development of adaptation strategies aimed at minimizing risks for human populations and local infrastructure.

For over two years, SERNAP and WCS have been working to establish an integrated monitoring program for ANMIN Apolobamba. The program incorporates glacial lakes into its "social monitoring" system, placing local populations within the discourse of how to manage the increasing risks associated with glacial lakes.

This paper presents documentation of glacial retreat and the forming of glacial lakes in the Cordillera of Apolobamba over the last 35 years. In addition, the potential risks of GLOFs and the local populations' awareness of flood risks will be analyzed in relation to park management options and provide a framework for future studies of glacial lake floods in Bolivia.