

# Retreating the Himalayas Glaciers: Alarming Situation in Nepal

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## Background

Nepal is a landlocked Himalayan country, divided into three physiographic region i.e. Terai (Lowland), Mid-hills and the Himalaya from South to North respectively. It is home to more than five-dozen ethnic groups and majority of them depend on the subsistence farming. Altitudinal variation from 60 m to the highest point on earth i.e. Mt. Everest (8848 m), provides suitable habitats for enormous floral and faunal species. It lies between 80 degree 12' east longitude and 26 degree 22' and 30 degree 27' north latitude. Challenging peaks, attractive rivers, threatened species and cultural diversity are the major magnetism of the mystical Himalayan country.

The glaciers are the major attraction of the Himalaya and add the energy, the Water Tower of Asia covers about 33 000 Sq Km area (Dyrugerov et al., 1997), are the largest glaciers coverage outside the polar caps. These Himalayan glaciers, reservoir of ice, are the source of fresh water for billions of people in Indian sub-continent and China. Seven great rivers of the Asia; the Ganga, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang Ho are feed up on these glaciers. The Himalaya of Nepal consists of 3252 glaciers with an area 5322 Km<sup>2</sup> and reserved about 481 Km<sup>3</sup> ice above 3500 mean sea level (Bajracharya et al., 2002), discharge water regularly to the First Category Nepalese River i.e. rivers originated from above the snow line.

The major occupation of the region is agriculture, which is fully dependent on the water from the glaciers-fed rivers. In addition, these rivers are the source of hydro power, which is accounted as a source of National income. Moreover, they are major tourism attraction for water sports like rafting and canoeing. Some indigenous tribes earn their livelihood from fishing and boating. Due to the various services provided from the Himalayan Rivers, people worship these sacred rivers and lakes.

The Glaciers carry the debris during their movement with eroding the surface on its route and modify the landscape. The Himalayan glaciers are the one which created steep slopes in the high Himalayan region. These attractive and peculiar landforms are always major tourism attraction and generate local employment as well as contribution to national economy. Furthermore, mountaineering and trekking in the Himalaya with Sherpa culture are not only the source of foreign currency income but also the identity of Nepal.

## Melting Glaciers and bursting lakes

Climate change is the most challenging environmental crisis in the present 21<sup>st</sup> century world. Human activities like excessive use of fossil fuels and land use change (deforestation and forest degradation) are fueling the global warming process. Non-linear changes in the natural system and species extinction have been increasing as a result of anthropogenic influence on the global climate. The snow ball effect of the green house gas emission is fueling the global warming, has severe impact on the existing ecosystem.

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Nepal, the highest place on the earth was not worrying too much due to the sea level rising as a result of global warming. Sea level is just a one level of growing threat cause by the global warming. Even in this remote area of the globe, which has negligible share on CO<sub>2</sub> emission has worrying signs due to the climate change. Dramatically shift in the region's weather pattern and some catastrophic incidents are enough to create fear among the neighboring villages. Crop threatening, meager snowfall, sudden unseasonable rain storm, drought and increasing temperature have been experiencing by local people, which are the cause of snow melt down.

Glaciers are sensitive to the climate change and several studies have shown that the worldwide glacier cover has declined significantly as a result of increasing temperature. Glacial cycles are mainly affected by the localized cooling and warming, during which glaciers advance and retreat (WWF-N, 2005). The Himalayan Glaciers have been declining over at least the past 150 years (Wake, 2000) and increased in temperature i.e. 1 degree Celsius over the past two decades (Hasnain, 2000) in the Himalayan region, is accelerating the rate of glaciers melting significantly. There are several evidences of the glaciers melting, for instance the Khumbu Glacier has receded over 5 km since the first climb of Mt. Everest in 1953 (WWF-N, 2005).

The rate of melting does not only influenced by the changing climate but also affected by the size and aspect of the glaciers. Smaller glaciers fragment and melt faster than the bigger ones, and those facing south are also receding more quickly (BBC, 2005). So, chance of disappearing small glaciers and disturbance in their ecosystem is very high. In addition, the glaciers receding also influenced the resizing of glacial lakes and formation of the new lakes. Moreover, warming up does not only melt the glaciers, but also reduce the ice formation process.

### **Disastrous future**

The Himalaya region is experiencing the global warming and so is the impact. According to the Department of Hydrology and Meteorology, Nepal (DHM, 1997) the temperature in the Himalayas of Nepal is increasing at the rate of 0.12 degree Celsius annually, while it is 0.03 degree and 0.06 degree Celsius for the mid-hills and the Terai region, respectively. Hence, the Himalayan region, which stored the freshwater in the form of glaciers and ice caps, will react the warming more than other region. The Himalaya, geologically Young and Active Mountain with fragile rock and steep topography will face more geological problem.

It is anticipated that glaciers and ice caps will continue their widespread retreat during the 21st century (IPCC, 2001). The rate of the Himalayan Glaciers receding is accelerating very fast. Intergovernmental Panel on Climate Change (IPCC) in 1996 had predicted that up to a quarter of the present mountain glacier mass could disappear by 2050 due to global warming. But in 2007 (quoted in Johnson, 2007), it stated the likelihood of the Himalayan Glaciers disappearing by the year 2035 and perhaps sooner is very high if the Earth keeps getting warmer at the current rate, it will shrink from 193 051 square miles to 38 600 square miles by that year.

Many tiny glacier lakes are forming and existing lakes are resizing as a result of climate alteration. If this process continued, there may chance to merge those newly formed small lakes and formation of larger one, which may exacerbate the threats. About 20 glacial lakes are potentially dangerous, including 17 that appear not to have experienced a prior GLOF (Mool et.

al. 2001) and their spreading may have chance to burst in future. Both increasing rate of melting and decreasing rate of ice formation will reduce the amount of snow drastically, which will have feedback effect on global warming. The sirens throughout the Tsho Rolpa watershed are creating the catastrophic fear and people living in uncertain future.

### **Associated Impacts of glacier retreat**

Nepal is an agrarian country; about two-third population depend on the subsistence farming. The Himalayan Rivers and streams supply the water throughout the year. Nepalese rural community is totally depends on forest i.e. fodder for cattle, firewood for cooking and heating and leaf litter for manuring. In addition, hydro-power is the major energy source and white water sports are the major tourism attraction. The Khumbu Region, home of Mt. Everest (the worlds' highest peak) is the trekker's paradise. Now, local people and mountaineers have observed that snow is melting along the trekking routes and have only rocks.

Local mountaineers have experienced that the base camp of the Mt. Everest used to be half an hour trek from the village but now, glaciers have shifted and moved and camp is now three hours take a way because snow is melting. In addition, climbing Mt. Everest is also being easier and takes short duration than before. It is mainly due to the increasing temperature and changing climatic pattern.

Rivers mothered by the Himalaya Glaciers of Nepal are the life of million people living in the Indian subcontinent. Glaciers melting may cause overflow in the Himalayan Rivers in short term. People living in the watershed of the Himalayas and other nearby mountain ranges along the Tibetan Plateau, glacial melt could have catastrophic consequences (Johnson, 2007). In long-run, it is sure that the region will face severe drought problem than present. Afterwards, farmland will dry up, no more drinking water and famine exacerbate.

Glacial lake outburst floods (GLOF) are the disastrous resulting from the glaciers retreat. Glacial lakes are increasing their size due to the snow melting. In addition, formation of the tiny lakes and chance of their merge may increase the chance of bursting in future. Several incidents of GLOFs have already killed a number of people and destroyed the property worth of millions US dollar. However, Nepal has experienced more than 30 GLOFs since 1964 (Shrestha et. al. 2006), the cataclysm in the year 1985 in Khumbu region grasps the attention of the scientific community about the forthcoming situation. The villagers of Khumbu region were the witness of the flowing down their own property by Dig Tsho lake flood. Moreover, the warning of Tsho Rolpa Lake explosion created a catastrophic fear among the inhabitants of Koshi basin and threat to a Hydroelectricity project.

As a result of the drastic change in the environment, it is possible that people in the Himalayan region and those living downstream, will change their farming system and daily life adapt to new environment. The housing pattern in the Khumbu Region has been changing since few years. In general, the wall of building in this region used to be 20 cm thick but nowadays it is decreased up to 8 cm because of the warmer winter and less snowfall.

The drought is reducing the area and quality of the pastureland in the Himalaya Region. Less grazing land means decrease in the milk production and affects the livelihood of the local farmers as well as tourism industry. Furthermore, water deficit in the Rivers have adverse effect on the tourist activities based on water. Similarly, mountaineers have experienced that due to the warming Mt. Everest expedition is being shorter and easier than before.

People residing in the Himalayan region are experience the global warming, however, Nepal is the one of the lowest per capita energy consumer country. Although, it has negative impact on the ecosystem as well as livelihood, inhabitants of the High Himalaya were happy because of the milder winter and more production during the summer. They enjoyed the benefits for a short duration but now, they experienced that trees have been died and potato fields are spoiling due to the drier.

Environment around the glacial lakes are supposed to be fragile. Threatening of the nearly bursting glacial lakes on their top insisting them to think either they have to move or live in the field. Mountain people are being innocent victims from the free riders. Two third people in Nepal, who are totally depend on so called carbon neutral fuel wood for heating and cooking, no access to the transportation and depending on their own subsistence farming with conserving bio-diversity through the community based forest management, are suffering from the carbon emission and living with uncertain future.

If the rate of warming and snow melting continues, definitely Nepal will face socio-economic disaster. In addition, India, China and other Asian nations will share the adverse impact, in fact whole bioregion. The nation like Bangladesh will suffer more from both sea level rise and drought, although it is facing severe flooding problem from the Himalaya Rivers.

### **Need global effort**

Prof. Syed Hasnain, then Chairman of the International Commission for Snow and Ice's (ICSI), expressed that the Himalaya glaciers will vanish within 40 years and that the flow of Himalayan Rivers will eventually diminish, resulting in widespread water shortages (New Scientists, 1999). The linkages of climate change impacts to Poverty are dynamic and context specific – reflecting geographic location; economic, social, and cultural characteristics; prioritization and concerns of individuals, households, and social groups; as well as institutional and political constraints (World Bank, 2002) and poor people are vulnerable. As a result billions people in the Himalaya and downstream will suffer from the hunger and may be the chances of collapsing economy of this region.

The increasing rate of glaciers retreat in the Himalaya region is causing the flood and may create water scarcity in the long run. Both upstream and downstream people are facing the problem and effecting adversely. Although, people in this remote part of the world do not have significant contribution in the global climate change, they are suffering from the problem. In future, the situation may exist that flowing of mountains with melting ice will fuel the sea level rise and sink all the plain lands. The local level efforts may not be able to resolve this problem but boost up the eco-region level and global level attempt to fight against climate change.

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