

MELTING GLACIERS IN HIMALAYAN MOUNTAINS AND ITS ENVIRONMENTAL AND POLITICAL IMPLICATIONS FOR SOUTH ASIA

By Jasmin Mehovic & Janaki Blum

Abstract

Melting glaciers in the Himalayas are creating new lakes all over this mountain range and swelling the existing ones, increasing the volume of water in rivers and triggering flash-flooding in the narrow valleys below. In 1994, a glacier-lake outburst in the Lunana region of Bhutan flooded a number of villages, endangering the lives of thousands of people. The burst of the Dudh Koshi Lake in Nepal in 1997 had similar repercussions. This trend, experts warn, will accelerate in the next half decade. As the Himalayas range over six countries (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan) as well as extending into China and Myanmar, it will create catastrophic social and economic problems not only for the villages in the Himalayan foothills but also for the entire South Asian region. This paper presents a critical overview of the situation and possible outcomes of the problem, based on current research and disaster prevention approaches.

Introduction: Hazardous Glacier Lakes

In Nepal, data from 49 United Nations Environment Programme (UNEP) monitoring stations reveals a clear increase in temperature since the mid-1970s with highest temperatures found at higher altitudes. On average, air temperatures here are one degree C higher than in the 1970s rising by 0.06 degrees C per year. Scientists with UNEP and the International Centre for Integrated Mountain Development (ICIMOD) have found at least 44 glacial lakes that are filling so rapidly they could burst their banks in as little as five years' time. [1]. Scientists warn that a number of precarious lakes are still uncounted for [2].

As the glaciers retreat, they leave behind moraine dams, comprising of piles of rock, dirt, and ice that act like water barriers. These dams, capable of holding large volumes of water, are quickly filled up with streams coming from the ice-covered mountains above. Although they look like solid natural walls, the moraine dams lack the mechanical strength to restrain the water for more than a few decades. As soon as these dams are formed, water starts carving tunnels within the walls, melting the ice within its structure and gradually destabilizes the dam. As these lakes swell, and the fragile dams become prone to bursting, it is often a heavy rainstorm, avalanche, or rockfall, that trigger dam's collapse, sending muddy streams down the narrow valleys [3]. In addition to life and property - including bridges, hydro-electric plants and tourist facilities - the flood, laden with massive boulders and sediment, devastates agricultural lands and irrigation systems in the valleys below.

As the Himalayan glacial lakes are the source of the major rivers in Asia, including the Ganges, the Indus, and the Brahmaputra, the meltdown of glaciers represents a danger not only to the immediate surroundings, which have mainly small human settlements, but also to the neighboring countries, such as India, Bangladesh and China, where far larger human populations could be at risk. Last year, fearing that water from a 38km long, 804 metres wide glacier lake in China could spill over into northern Indian Territory, the authorities in the Indian states of Himachal Pradesh and Punjab evacuated thousands of people from high-risk areas [4]. A month earlier, a sudden release of floodwater from a water reservoir in Bhutan caused floods that endangered the lives of people in Assam and West Bengal [5]. Scientists warn that a number of lakes are still unexplored, especially in India (where most of the Himalayas lie), Pakistan, and Afghanistan.

Far Reaching Effects

Flooding is not the only problem. Glaciers meltdown, experts argue, will increase the levels of water in the rivers in the short term. However, by the end of the century the water reservoir may eventually run dry, ceasing their year-around water supply to the glacier-fed rivers [6]. This would cut the potentials of the hydroelectric power plants in South and Central Asia, what, in turn, will lead to blackouts and the shortage of the power in this part of the world [7]. For countries that rely heavily on this kind of energy, decline of hydroelectric production can have serious economic consequences on many different levels. It would limit supply to the growing urban populations, as well as to the growing industry sectors in this part of the world [8]. This would greatly affect Nepal and Bhutan -- countries where hydroelectric production represent the biggest portion of the national income. Decline of the hydroelectric energy would also revive use of the traditional energy, such as fuel burning, what would increase the air and land pollution in South Asia.

Wildlife, fisheries, and agriculture will also suffer. Himalayans are a highly sensitive and fragile ecosystem that is home to a variety of birds and mammals, such as the snow leopard and brown bear, which can be easily exterminated if the meltdown of glaciers continues. The glacier meltdown would also jeopardize aquatic life that is highly adapted to existence in the mountain streams. Agricultural productivity is also likely to suffer severely due to high temperature, severe drought, soil degradation, and lack of irrigation. The lack of water will degrade the swamp wetlands, and decimate the livestock, leaving thousands without source of their existence. For many small farmers in this mountain range it would mean the end of their self-sustainability, forcing them to search income from some other industry sector.

Ultimately, glaciers meltdown will decrease reserves of drinking water in the region, what will affect hundreds of millions of people, including those in New Delhi, Karachi and Calcutta [9]. Needless to say, as the population in the region grows, and growing industrialization improves living standards, there will be widespread demand more water throughout the subcontinent (UN projects that in the 21st century's largest countries will be: India, China, Pakistan, the United States and Nigeria). Within 50 years, population of South Asia and China - some of 40 percent of human population -- could well be living with little drinking water. This issue will become not only the focus of environmental and public health debates, but also the cause of serious political conflict among the countries of the subcontinent. Disturbances to glacial lakes located in the sensitive border regions such as Kashmir, between India and Pakistan, may also have serious military consequences.

Global Warming

Accelerating glacier loss, scientists argue, is the outcome of the global warming, which is an result of human activity. Although many argue that the worldwide rise in temperature is a naturally occurring climate variation, whose scope is exaggerated for political reasons, a growing number of scientists concur that it is an outcome of raised levels of greenhouse gases, mainly carbon dioxide and methane, in the atmosphere [10]. As the earth's surface absorbs the sun's rays, the heat bounces back, and a part of it ultimately escapes into space. On its way through the atmosphere the heat is absorbed by carbon dioxide and methane molecules; this process raises the temperature on the earth's surface. The more carbon dioxide there is in the atmosphere, the more heat is entrapped. This phenomenon is called the "greenhouse effect," named for the way the glass panes of a greenhouse capture heat and warm the space inside.

The increasing amount of greenhouse gases is a result of the industrial nations' incremental use of fossil fuels over the past two centuries. Current concentration of concentration of carbon dioxide in the atmosphere is 350ppm. During the industrial revolution, in the mid 19th century, it ranged from 260 to 290 ppm (particles per million). If the situation goes unchecked, scientists warn, the level could reach 450 ppm by 2030 [11]. As a result, average global temperatures are expected to rise 1.4 - 5.8 degrees Celsius by the end of the 21st century. Scientists unequivocally agree that it is possible to slow, or even halt the rise of the greenhouse in the atmosphere. The

only way to prevent this relentless warming would be to limit deforestation and the burning of fossil fuels.

Climate Treaties

Governments and research institutions have recognized the global warming as a growing problem. The Earth Summit in Rio in 1992 (which was attended by 35,000 people and 106 national leaders) was the result of an agreement on climate that called for limitation of use of fossil fuels. The summit set up a system of governing policies, obliging industrialized nations to stabilize their emissions of carbon dioxide and other greenhouse gases by the year 2000 while giving financial aid to developing countries to support energy efficiency and develop sources of clean energy. The 1997 Kyoto Treaty legally bound industrial nations to reduce worldwide emission of greenhouse gases by an average of 5.2% below their 1990 levels over a ten-year period, as well as to start implementing environmentally sound sources of energy, such as gas, wind, hydrogen, and solar energy [12].

A number of energy companies, such as BP, chemical giants, such as DuPont, as well as car manufactures, such as Toyota, Ford, and Volkswagen, have recognized the gravity of situation and started investing in alternative energy technologies. Unfortunately, most of the world is still heavily dependent on energy from fossil fuels, which are still easily available and much cheaper than alternatives. Many governments are also under heavy pressure from various industrial lobbies and political think-thanks not interfere in prevailing business practices and disregard goals set up by international treaties on global warming. Consequently, many of the world largest emitters of greenhouse gases have not complied with Kyoto Treaty bindings. The current global economic situation, marked by fierce competition and aggressive outsourcing practices, is likely to make the recommendations of the Kyoto agreement even less significant among global business policymakers in the years to come.

Coping with the Existing Situation

Among South Asians there is consensus that global warming is a problem that needs an urgent attention and that its impact on South Asian countries can be unprecedented. The Nepali government is calling on rich nations to reduce their carbon dioxide emissions, actively lobbying for implementation of Kyoto Treaty. India is among leading countries developing technology to harness wind and solar power as well as use of hydrogen as a fuel source. Pakistan is also embarking upon a comprehensive program searching for clean sources of energy, such as hydro, solar and wind. A growing number of environmental activist throughout the continent are calling for urgent and radical encounter with the problem.

Experts warn that as much as changes on the macro-level will successfully combat global warming, changes on the micro level are also crucial for the future of Himalayan glaciers. In their reports, they note that uncontrolled development in the Himalayan Mountains, as well as deforestation, pollution, and increased use of water for irrigation are contributing to the precarious state of the glaciers. Satellite images reveal that deforestation and unsustainable agriculture in the mountains has increased, making the regions susceptible to the long-term climate changes [13]. It claims that unchecked and piecemeal development are likely to increase rates of forest loss triggering increased levels of erosion, pollution and other potentially harmful effects [14].

Increasing awareness may reduce the effects of global warming over time. However, for the people living in the foothills of the Himalayas, the meltdown of glacier lakes represents a problem that demands immediate attention. Some Himalayan villages have already installed primitive warning systems, such as a system of horns, designed to alert local residents in the case of flooding [15]. Others have engaged in reforestation and the construction of drainage works to prevent lake outbursts. It is clear that there is need for early warning system Accurate and timely

information on the spatial locations and regular monitoring of the glacier lakes' behavior is needed, to identifying potential risk and prevent and monitor the GLOF hazards and assess the damages to be occurred in the near future.

These efforts by local authorities have been supported by a number of projects initiated by the United Nations to provide advice on recognizing potential dangers and immediate threats. Modern information tools such as remote sensing, topographic maps, aerial photographs and satellite images could play a crucial role in identifying potential risk areas and monitoring the behavior of hazardous lakes. UNEP through its facilities at Environment Assessment Program for Asia-Pacific (EAP.AP), Asian Institute of Technology, Bangkok, is trying to establish an operational early warning system to monitor GLOF hazards in the Hindu Kush Himalayan region. EAP.AP will implement the project in collaboration with the International Center for Integrated Mountain Development (ICIMOD), Nepal. The United Nations agencies also promote the work of South Asian communities throughout the world, channeling material and financial aid from foreign donors.

Concluding Remarks: Regional Cooperation is Vital

The enhanced cooperation with the United Nations is important but insufficient. The gravity of Himalayan deglaciation points to the necessity of an urgent and comprehensive action in order for the South Asian countries to avert catastrophe in the years to come. This primarily means putting in place mechanism that includes developing new institutions or modifying existing ones to promote adoption to climate change.

Indian Space Research Organisation (ISRO), based in Ahmedabad, is one of several regional organizations actively involved in glacial behavior studies. However, at this point there is no a regional system for the collective monitoring of glaciated regions as well as a reliable alert system embracing all countries affected. A year ago, when it was learned that a glacial lake in Tibet could burst and flood villages in the Indian state of Himachal Pradesh, Chinese scientists had to use diplomatic channels to warn India about the danger. It must start with closer collaboration between scientific and academic institutions that are studying the impact of changing climate on the behavior of glacial lakes in the Himalayan range. The lack of more recent data is a cause for concern among the scientist. We urgently need to update our glaciological data," said Dr Bhakta Shrestha, "otherwise we won't have any warning when disaster strikes" [16].

South Asian countries also must set up a comprehensive monitoring system, as well as a disaster response and disaster management mechanism which would activate immediate and efficient action across national borders. Recent tragedy caused by Tsunamis in South Asia, as well as the tragedy caused by hurricane Katrina in the Gulf of Mexico, have pointed to the need for a comprehensive dealings with the disaster areas. This plan must address the impacts of climate change to the resources and infrastructure constraints among the South Asian countries, as well as disaster preparedness and disaster management in the case of a tragedy. These efforts should be followed by long term intra- and inter-governmental planning involving diverse agencies responsible for conservation, construction, energy, foreign affairs, water, and tourism.

* * *

1. UN Environment Programme, UNEP (2002) Global Warming Triggers Glacial Lakes Flood Threat. UNEP's site (website accessed April 16, 2005): <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=245&ArticleID=3042&l=en>
2. Curtis, A (2002) Meltdown, New Scientist, November 2nd, p 44.
3. Clauge J. J. and Evans, G. S. (2000). A review of catastrophic drainage of moraine-dammed

- lakes in British Columbia. *Quaternary Science Reviews*, 19, 1763-1783.
4. Abdi S.N.M. (2004) Fears of flash floods from Lake. *S. China Morning Post*, August 10, pg. 4.
 5. Devraj R. (2004) South Asia: Regional Approach Needed To Manage Rivers, Expert Says. *IPS-Inter Press Service/Global Information Network*, August 12.
 6. Morgan, J. (2005) Himalayan glaciers 'melting fast' *BBC News*, *BBC News Website*: <http://news.bbc.co.uk/2/hi/science/nature/4346211.stm> (website accessed September 20, 2005)
 7. Simons C. (2005) Beware of Falling Ice. *New Scientist*, June 6, pg. 82.
 8. Sakai A., K. Chikita, T. Yamada (2000) Expansion of a Moraine-dammed Glacial Lake, Tsho Rolpa, in Rolwaling Himal, Nepal Himalaya. *Limnology and Oceanography*, 45: 6, 1401-1409.
 9. Himalayan glaciers 'melting fast' *BBC News*, *BBC Website*: <http://news.bbc.co.uk/2/hi/science/nature/4346211.stm> (Website accessed August 30, 2005)
 10. Bender D. & Leone B. (1997) *Global Warming: Opposing Viewpoints*, Freehaven Press, Inc.
 11. Newton D.E. (1993) *Global Warming: A Reference Handbook*, BBC-CLIO Press, pg.73.
 12. United Nations Framework Convention of Climate Change, *UN Website*: <http://unfccc.int/resource/docs/convkp/conveng.pdf> (accessed September 20, 2005).
 13. Parkinson C. (1997) *Earth from Above: Using Color-Coded Satellite Images to Examine the Global Environment*. University Science Books.
 14. Burroughs W. J. (1997) *Does the Weather Really Matter? The Social Implication of Climate Change*, Cambridge University Press, 85-87.
 15. Brown P. (2002) Scientists warn of Himalayan floods, *The Guardian*, April 17, pg. 13. Also in: Kirby, A. (2002) Himalayan warming 'may trigger floods,' *BBC News*, *BBC Website*: <http://news.bbc.co.uk/2/hi/science/nature/1926667.stm> (website accessed September 17, 2005).
 16. Khadka N. S. (2004) The day after tomorrow in the Himalaya. *Nepali Times*, July 15.

* * *

Jasmin Mehovic holds an MA in Communication, Culture & Technology from Georgetown University, Washington DC. His research and writing interests include globalization, intercultural dialogue, and the use of information and communications technologies in teaching and learning. His experience includes work within the private, public and nonprofit sectors, including Georgetown College and Harvard University. Currently, he is the Head of Communications at The South Asia Research Institute for Policy and Development, SARID.

Janaki Blum has more than 20 years experience in science research and education, laboratory and project management, data curation, writing and consultation, in both public and private sectors, including The Swiss Federal Institute of Technology (ETH), Switzerland and The Massachusetts Institute of Technology (MIT), USA. She holds an MPhil in Biotechnology/Chemical Engineering from Imperial College, University of London and PhD in Biochemistry from the University of Zurich, Switzerland. She is currently the managing editor at The South Asia Research Institute for Policy and Development, SARID.