**Himalayan Disaster – Nature's Fury or Man-made Calamity?**

A look at Himalayan floods in recent memory

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On night of 15-16 June 2013, scientists at Wadia Institute's weather stations recorded 315 mm of rain in Kedarnath valley, which is extremely rare for this part of the year. The rain soon brought down huge avalanches from the glacier slopes of Kedarnath peak and the nearby 'Rock Tower' peak. These peaks form the backdrop of the Kedarnath temple on a long ridge, behind which lies the Gangotri glacier. The huge avalanches crashed down into the Chorabari lake at its foot forcing the lake to burst at its banks. This wide lake had never had much water and was thus not capable of storing vast amounts of water and debris. Water rushed down from the lake with great fury, towards the Kedarnath temple bringing with it huge stones and debris. In its normal course, the Manadakini river flows on both sides of the temple plateau. But this time, the flow was so furious that it breached the plateau on which the temple is built and rushed towards the temple complex. A huge stone rolled towards the temple, smashing the memorial built for Adi Shankracharyya behind the temple and came to a stop. This event possibly saved the temple from destruction as stones and flood following this passed around it, burying the shops in bazaar and burying many pilgrims there.

The devastation caused in the lower areas was staggering, making the Uttarakhand catastrophe 'one of the most extreme events of the century'. In the lower valleys more than 70,000 pilgrims were trapped and many died. Unplanned roads, makeshift constructions on river banks and an overwhelming number of pilgrims were victims of the disaster. Nature's fury certainly started it but later it turned into a man-made disaster. It will take years before we are able to enjoy the Himalayan mountains in the Kedarnath area.

With traditional wisdom, villagers had built homes far above reach of the river. Their houses were safe from rains and flood. Those villagers who had not followed the traditional wisdom and built homes near the river and road for commercial reasons were wiped out. Although cut off as a result of destruction of roads and lack of supplies, these traditional habitations have been relatively safe.

This devastation was caused by just two glaciers and one lake. The Indian Himalayan region is home to over 7,000 glaciers, covering an area of 8,500 km. They play a crucial role in shaping and influencing the environmental conditions in India. Siachen, Gangotri, Zemu, Milam, Bhagirath Kharak and Satopanth are some of the important glaciers located in the Indian Himalayan region. Approximately 968 glaciers drain into the Ganga basin in Uttarakhand and over 4,660 glaciers feed the Indus, Shyok, Jhelum and Chenab river systems. The Ravi, Beas, Chenab and Sutlej river systems are fed by 1,375 glaciers and 611 glaciers drain into the Teesta and Brahmaputra basins and contribute between 50 – 70 per cent of the annual discharge. If the higher Himalayan region is not treated with due respect any of these glaciers can cause havoc anytime.

Himalayan glaciers and natural dams have caused havoc in the past. It may be interesting to recall just a few of these events.

**Gona Tal**

Gona tal was a largish lake created by natural landslide in the early part of the last century. It was serene lake with clear green water. Situated in the Birehi valley, about 24 km from Pipalkoti, it is on the banks of the Alaknanda and a popular halting place for pilgrims to Badrinath.

Two of us as young students trekked to this lake in 1966. This is what I wrote in my diary:

*"5th June 1966:* We left at 7 a.m. for Gona tal (13 km; 1710 m) where we intended to spend a few days. The path we followed went through thick forest and kept going downwards. After covering nearly 12 km we were in the hot valley near the Gona village from where the lake was three km ahead. It had been a horrid, hot, sweltering journey, at the end of which we found a beautifully located Forest Rest House facing the green, clear water of Gona tal. Two days passed quickly; mostly boating and swimming in the lake."

"Three days of paradise were not enough but we had to leave mainly because our food stock was over and we had to eat the local food which we did not relish. On the 8th, we left Gona tal for Birehi, 16 km away. We could see the forests burning in the distance in the darkness of the night. After our 170 km trek over 16 days, we were psychologically drained. There was no question of walking even a kilometre more, and Pipalkoti was 8 km away. It sounded like eternity. Providence was on our side, for the Engineer whom we had met at Gona tal was going to Pipalkoti in his jeep and he was kind enough to give us a lift. We spent a day at Pipalkoti, on the banks of Alaknanda."

Five years later we heard tragic news. In 1971, at the peak of summer the natural dam which had created the Gona tal, suddenly burst, causing floods and havoc. Fortunately only half the retaining wall had broken, or else tragedy would have been far greater. Water rushed down the valley where we had walked and in a flash it reached Alaknanda, luckily below Pipalkoti. The impact was the same - roads were wiped out, many pilgrims who were on the road were killed and their bodies carried down to Rishikesh. But then there were not the hordes of tourist and pilgrims that were there in 2013. Thus the devastation in terms of human deaths was far less. After about a decade the engineers allowed controlled bursting of the remaining wall and the lake's water was allowed to drain out without causing more fury.

Now only an empty bowl exists at the 'paradise' where we had enjoyed three wonderful days!

**SIKKIM**

In 1976, Zerksis Boga and I were camping at the foot of Kangchenjunga. It was at the head of the Zemu glacier. This was the spot where many explorers had camped in the 1930s. Douglas Freshfield (see his book *Round Kanchenjunga*), Paul Bauer and his German team, G.O. Dyhrenfurth, John Hunt, H.W. Tilman amongst others. Everything was the same, except that the 'Green Lake' they all had camped at had disappeared and we were staying next to an empty crater.

Sikkim, amongst other natural beauties is a land of glaciers. The main glaciers of Sikkim are Zemu glacier, Rathong glacier and Lhonak glacier. These glaciers surrounded by potentially dangerous glacial lakes that can burst and cause floods any time; scientists say that Sikkim is a ticking time bomb. The famous Green Lake in west Sikkim was a moraine dammed lake that had formed due to the retreat of long Zemu and its subsidiary glaciers. Another glacial lake is in formation behind the terminal moraines due to blockage of the melt. These glacial lakes are formed by melting glaciers and a sudden discharge of large volumes of water and debris from them. This phenomenon is termed 'glacial lake outburst flood' or 'GLOF'.

In North Sikkim the area of one of the lakes in the Gurudongmar complex has increased nearly four times between 1965 and 1989. The Khanchung Chho, origin of the river Teesta is another moraine dammed lake which has grown noticeably over past few years. The Chho Lhamo, a glacial lake situated on 'The Plateau', near the border of Sikkim and Tibet, had grown significantly in size. Dr. Alexander Kellas, T. H. Braham and John Claude-White have written about the Chholamo as one of the most beautiful place on earth. Now only a small portion remains, as we photographed it in 2012.

'Teesta floods' are a regular phenomenon in the area. The Green lake and glacial lakes of the Zemu glacier breach natural dams and cause misery downstream. The devastation of lower Zemu glacier is to be seen to be believed, the stone-bed going on for several kilometres. The glaciers in the northern areas contribute to the floods with the level of water increasing to wipe out roads and habitations. The effects have been felt until the Bengal plains and Bangladesh. A severe earthquake hit the region in September 2011. But the epicentre near Talung gompa was about 10 km below the surface. Hence it caused destruction of ridges faraway but the Talung gompa, near the epicentre was not totally destroyed! Thus a major catastrophe was avoided.

**Leh Floods**

Leh and Ladakh situated at around 3500 m usually receives very little rainfall (around 100 mm/yr). Described as a 'high altitude cold desert', the area has sparse rainfall and a heavy downpour is a rare occurrence. The average rainfall in Leh for the month of August is 15.4 mm, with highest rainfall ever recorded during a single 24 hour period being 51.3 mm, recorded on 22 August 1933.

But then the unbelievable happened on the night of 6 August 2010. In space of 30 minutes Leh received 75 mm of rain due to a cloud burst. This implies that it received around a year's worth of rainfall in half an hour! Moreover the intensity was concentrated within a six km band. Suddenly debris were falling and Leh, not used to

such rain was in disarray. Homes were destroyed, hospitals, schools and many buildings were damaged. The death toll was about 250. Much of the destruction was caused by debris flowing from the rocky sidewalls of the valleys, not by the flooding itself.

The village of Choglamsar at the outskirts of the city was particularly badly hit. This settlement had sprung up in the last few decades, in the direct line of walls of mud. Thus the traditional wisdom of the Ladakhi village building was violated and they paid a heavy price for it. The traditional villages, on the plateau, did not suffer much damage. Though the cloud burst was a natural calamity, but again by not respecting Nature's laws, men had paid a price.

**Chong Kumdan Glacier Dam**

One of the earliest bursting of the glacier dams recorded were in the East Karakoram. There are several huge glaciers in this area that records extreme temperatures.

Over a century ago and repeatedly later, a large dam was created at the junction where the Chong Kumdan glacier meets the Chip Chap river. The word itself in Yarkandi language, means 'big dam' (Chong - big, Kumdan - dam)

The Chong Kumdan glacier had advanced rapidly over the years, pressing against the opposite eastern walls. The glacier takes a sharp turn here; the movement of mass was so forceful that the pressure on the walls was tremendous. This blocked the flow of the Chip Chap river. However, a glacier is liable to retreat and weakened by the retreat, water broke the dams and bursts occurred.

Such dam-bursts have occurred in 1780, 1826, 1835 and 1839. It had been a regular feature for many years then on. The dam-waters rose for about 125 m at the peak and the water marks can still be seen. The dam was studied by Ney Elias and Godwin-Austen in 1877.

All the dammed water rushed out and death and destruction was caused right up to Attock Fort, about 1200 km downstream. A battalion of Sikh soldiers stationed there suffered many casualties. Hence, the river acquired the name Shyok—'the river of death'.

Kenneth Mason, the first editor of the *Himalayan Journal,* took keen interest in this dam. He collected large amount of material, and recorded observations and diagrams. In 1926, floods released by the Chong Kumdan dam destroyed Abudan village and the surrounding land which were at a distance of 400 km from the outburst.

Another major dam-burst occurred in 1929. Mr. T. Durgi of the Public Works Department was then posted at the dam-site to warn against a future burst. In 1932 he sent two runners to Khalsar over the Saser Pass to warn people about the oncoming floods. Flood waters had already reached Khalsar, but by this phenomenal fast trek (130 km in 28 hours) they did manage to pass on a warning. Kenneth

Mason calculated the frequency of advance and retreat of Kichik ('small dam') and Chong Kumdan glaciers. He predicted:

> As I shall not be here to be proved wrong, I will be precise. The Chong Kumdan will advance rapidly during the winter of 1968-69; the Shyok valley be blocked; a lake will form above it, some 10 miles long; and there will be floods caused by the collapse of the dam in autumns (July to September) of 1971, 1974 and 1977, the first one occurring probably in the autumn 2½ years after the glacier has advanced.

However as per all the available records the last major burst which caused destruction occurred on 16 August 1929. We camped at this lake in 1991, exactly 62 years to the date. The line created by height of lake was seen clearly on the retaining wall. The huge vacant area was sometimes filled with ice-penitents. Little lower the Kichik Kumdan dam ('smaller dam') was still active but not enough to cause damage. We could compare our photos with those published in the *Himalayan Journal* in 1930.

Since then minor bursts have taken place in 1932-33 and 1937-39. The dam waters escaped slowly in these cases and no major damage was caused. But no bursts of dams have occurred after that. The Karakoram glaciers in this region are in a state of retreat. Indian forces are stationed in the area since long and their records of the Shyok water-level do not speak of any floods.

Is it likely Mason may still prove correct about the future? Curiously he gave the current year, 2013, for the last advance of the glacier and its dam. But perhaps the 'global warming' phenomenon has nullified his prediction.

As these examples indicate, the Himalayan and Karakoram glaciers are prone to floods. This has probably been accentuated by the phenomena of global warming causing cloud bursts.

But what about roads that are built on a wrong axis, dams that change the course of rivers, uncontrolled and unplanned building of hotels and habitation on river banks, loads of pilgrims and tourists on fragile valleys? This is far more than Nature can bear - therefore disasters like the recent one in Uttarakhand (2013) are bound to happen. It is best to understand the Himalaya and its glaciers and respect them.