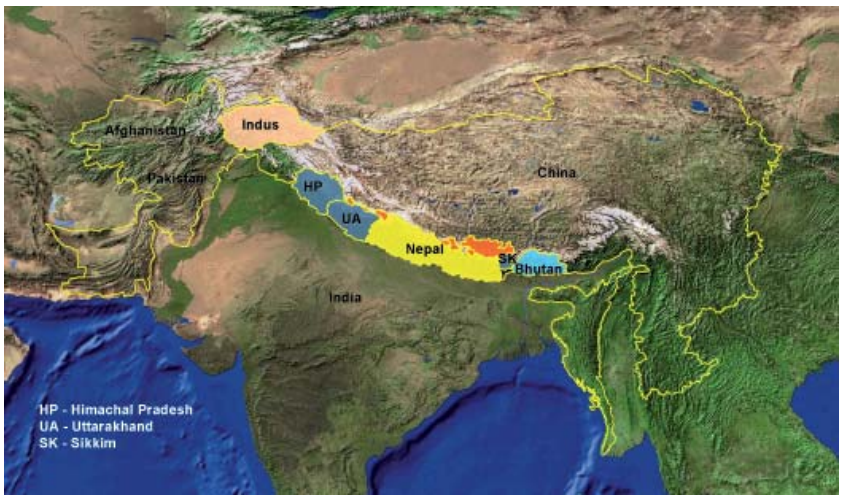
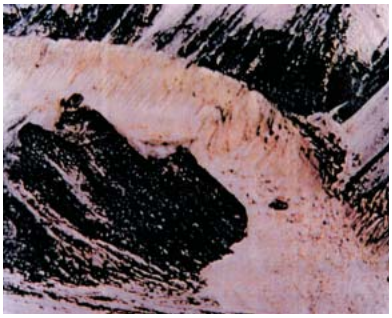
Glaciers and Glacial Lakes
Indicators of Global Climate Change

The International Centre for Integrated Mountain Development (ICIMOD) in collaboration with the United Nations Environment Programme (UNEP), the Asia-Pacific Network for Global Change Research (APN), the global change SysTem for Analysis, Research and Training (START), and different national partner organisations is preparing a digital database of glaciers and glacial lakes in the Hindu Kush-Himalayan (HKH) region using remote sensing (RS) and geographical information system (GIS). So far numerous glaciers and glacial lakes and several potentially dangerous lakes have been identified in the region.



Hindu Kush-Himalayan region showing the areas covered by the inventory of glaciers and glacial lakes
(Background Image: ESRI)



4 August 1985 GLOF from Dig Tsho glacial lake in Nepal destroyed the nearly completed Namche small hydropower plant
(Photo: WECS 1987)

Reports on glaciers and glacial lakes of Nepal, Bhutan, India, Pakistan and TAR/China

Lugge Tsho glacial lake in Bhutan which burst out in 1994
(Photo: Phuntso Norbu 1994)

GLOF debris from Gelhaipucho lake in 1964 in China
(Photo: PK Mool 1987)

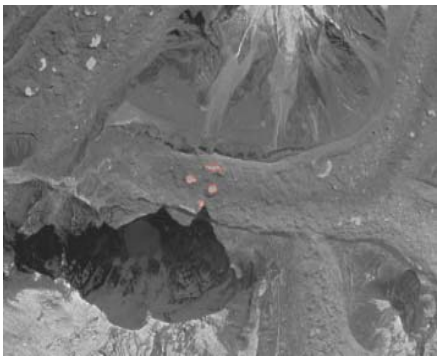
Imja Tsho Glacial Lake viewed towards the south-east from lower part of right lateral moraine
(Photo: Govinda Joshi 2007)

Raphstreng Tsho lake in contact with actively retreating glacial and mitigation by manual excavation on end moraine
(Photo: Karma 2004)

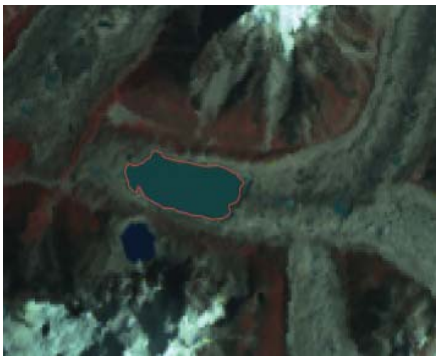
The impact of climate change on Himalayan glaciers is becoming apparent. Studies show that most valley glaciers are retreating. Vertical shifts of up to 100m have been recorded during the last fifty years with retreat rates of 50m per year. There is evidence that glaciers have been melting faster in recent decades. If the present trend continues, it is estimated that most valley glacier trunks and smaller glaciers will disappear by 2050 AD. As valley glaciers retreat, glacial lakes can form and many are observed at elevations of around 4500m. With increasing amounts of water in these lakes, glacial lake outburst floods (GLOFs) are inevitable. Precautionary measures are needed so that loss due to such events can be avoided. Climate change in general and retreating glaciers and GLOFs in particular will effect water resources, the economy and livelihoods downstream.

Examples from Nepal, Bhutan and China

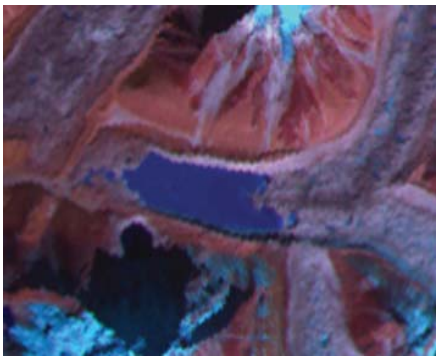
The Imja glacier in the Dudh Koshi valley south of Mount Everest in the Nepal Himalaya is retreating at a rate as high as 70m per year. A marked retreat of this glacier has been observed since 1990, accompanied by rapid growth of Imja Lake.



1962 Corona Image

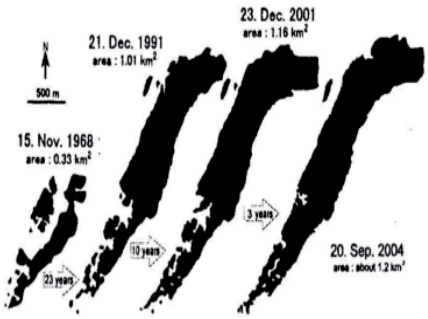


1992 Landsat Image

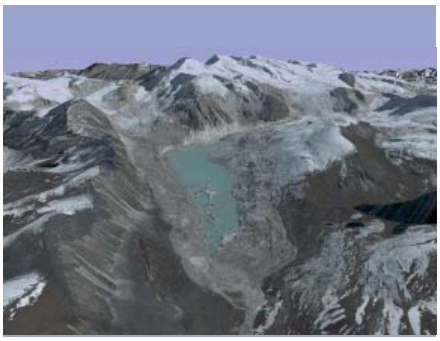


2005 IRS LISS3 Image

In the Bhutan Himalaya most glaciers shrank by around eight per cent between 1963 and 1993. The Luggye Glacier retreated by 160m per year from 1988 to 1993 resulting in a high growth rate of Lake Luggye Tsho. The Raphstreng Glacier retreated 35m per year on average from 1984 to 1998 and 60m per year from 1988 to 1993. The area of the Chubda Tsho glacial lake increased by 0.027 km^2/yr from 1968 to 2001.



Development of Chubda Tsho glacial lake from 1968 to 2004 (Source: Bhutan Geology 2005 Newsletter S. No. 8)

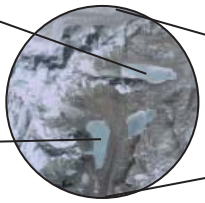


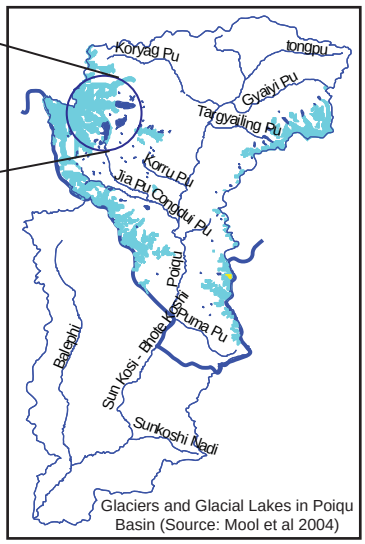
Satellite image showing Chubda Tsho (Source: Google Earth 2007)

Gangxi Co lake at the tongue of glacier 50191C0009 in 1987 (Photo: PK Mool 1987)

Lower part of Chubda Tsho from right lateral moraine (Photo: Deo Raj Gurung, 2004)

Lumu Chimi lake at the tongue of glacier 50191B0029 in 1987 (Photo: PK Mool 1987)





Glaciers and Glacial Lakes in Poiqu Basin (Source: Mool et al 2004)

In the Poiqu basin of Tibet AR in China (the upper catchment of the Sun Koshi-Bhote Koshi basin of Nepal) the glacier area decreased by around five per cent during the 12 year period between 1988 and 2000. The valley glaciers on the right flank of the Poiqu basin on the eastern slope of the Xixiabangma mountain are retreating at a rate of 45m to 68m per year with about 100m shift upslope in elevation of the glaciers' termini during the last quarter of a century. Lakes Lumu Chimi and Gangxi Co formed in these glaciers have doubled in size since 1977, which poses a potential danger of GLOF events in downstream areas with impacts even across the border in Nepal.

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