

Assessing the impacts of Climate Change

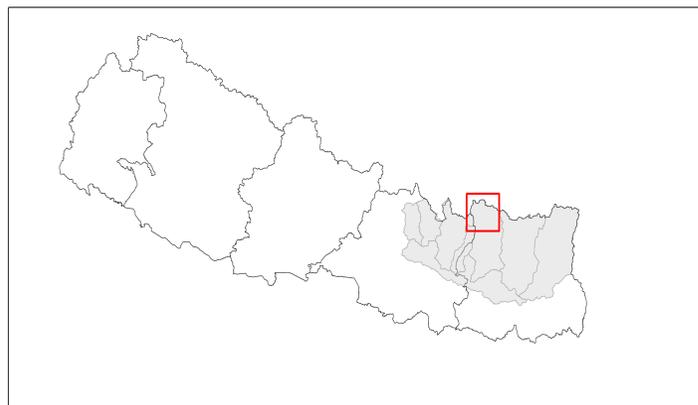
A Spatio-Temporal Analysis of change in Glaciers and Glacial Lake of Koshi River Basin of Nepal in three decades (1990, 2000 and 2010)

INTRODUCTION

It is unequivocal that Global Warming and Climate Change are happening and have multiple impacts on human beings, plants, animals, ecosystems and the environment of the earth. One the major of impacts of Climate Change is observed in the mountains and glaciers.

The retreating of mountains and glaciers is at an increasing trend leading to formation of glacial lakes. This phenomenon is well pronounced in the Hindu Kush Himalayan Range (HKH), which is a 2175 mile long range of high altitude mountains which extends from Afghanistan in the west to Myanmar in the east over all or part of the eight countries along the HKH range. Scientific studies show that there has been a significant increase (0.104 °C /decade) in the annual mean surface air temperature in HKH as a whole during 1901-2014.

Nepal, a south Asia mountainous country, covers about 497 miles of the HKH. The Koshi River Basin is a transboundary river basin that extends from China in the North, through Nepal to India in the south. The Himalayan Range in this basin has numerous Glaciers and Glacier Lakes. Studies of these areas have revealed that there has been changes in area and volume of glacier and glacier lakes as a result of climate change. This study aims to analyze the Spatio-temporal change in the glacier and glacial lakes and present the result in maps, tables and provide conclusions accordingly.



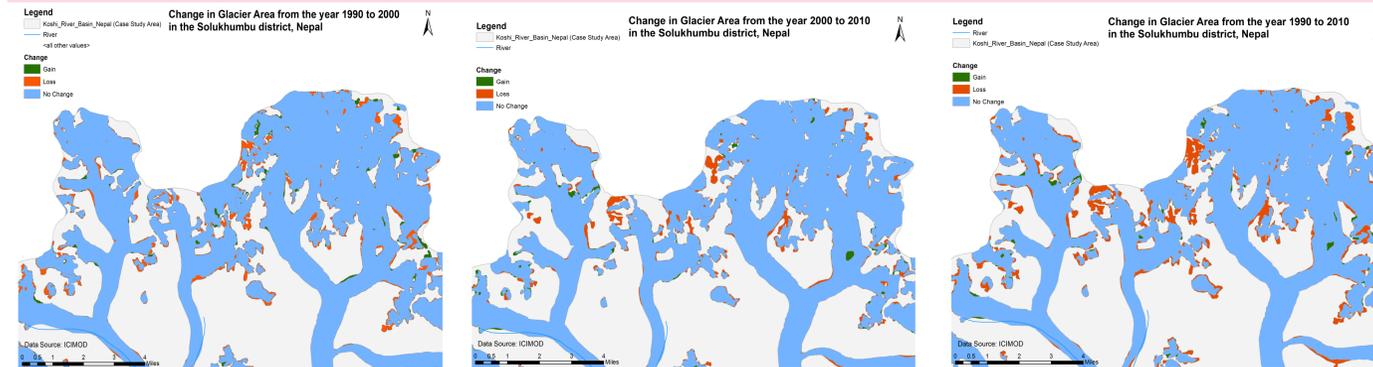
METHODOLOGY

Data for this analysis were obtained from the International Center of International Development (ICIMOD), Nepal. The shape files having the area and relevant details of Glaciers and Glacial Lakes of the year 1990, 2000 and 2010 of the study area as well as Digital Elevation Model (DEM) raster data set were the primary data sets used in this analysis.

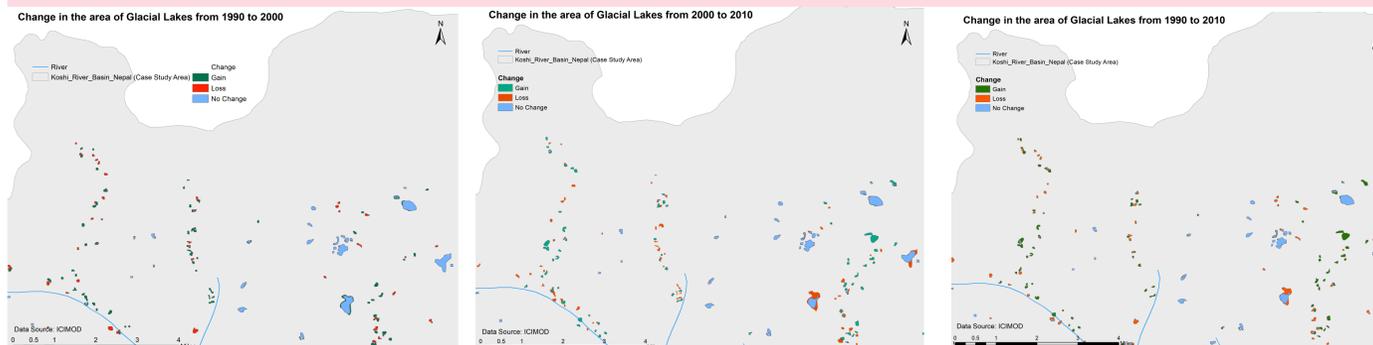
To analyze the comparative change of shape and area of Glacier and Glacial Lakes of any two particular year (decade in this case), at first a union layer was created. Then using the 'Select by Attributes' and 'Field Calculator' tool the three criteria/conditions, Gain, Loss and No



Comparative Change in Shape and Area of Glacier between the year 1990, 2000 and 2010



Comparative Change in Shape and Area of Glacial Lake between the year 1990, 2000 and 2010

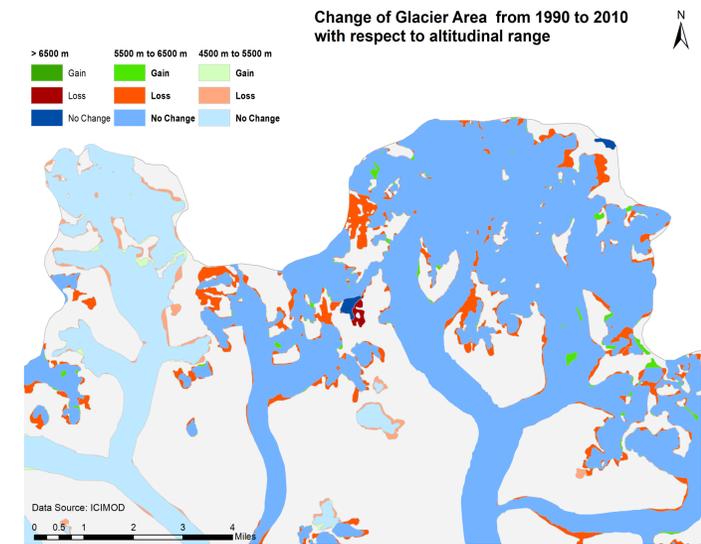


change in the area of glacier/glacial lake was created and executed accordingly to finally get a map depicting the change in the area of Glacier or Glacial Lake.

Similarly, three different maps depicting the changes in glacier area at different range of elevations were generated and finally based on them, a final map showing the changes in area (i.e., gain, loss or no change) in all those range of elevation was generated.

RESULTS

The result of the study showed that in the study area there has been increase in the number of glaciers from 1990 through 2000 to 2010. However, the total area



Glaciers				
Year	Number	Area (in Sq. Kms)	Change in Number (w.r.t. 1990)	Change in Area (in Sq. kms; w.r.t. 1990)
1990	807	1294.29		
2000	829	1212.62	22	- 81.68
2010	845	1102.62	38	- 191.68

Glacial Lakes				
Year	Number	Area (in Sq. Kms)	Change in Number (w.r.t. 1990)	Change in Area (in Sq. kms; wrt 1990)
1990	862	30.61		
2000	879	32.29	17	1.68
2010	953	33.96	91	3.36

covered by these glaciers has decreased gradually over the decades. Similarly, there has been increase in both the number as well as area of the glacial lakes in the past three decades. The tables above and maps displayed in the poster depict these changes.

CONCLUSION

The study showed that there has been decrease in glacier area and increase in glacial lake area due to global warming and climate change. Such analyses can be used in the mountainous regions of the world to assess the risk of Glacial Lake Outburst Floods (GLOFs) as well predict any potential GLOFs in the near future which could save thousands of lives and millions worth of property in the downstream area.



Data Source: ICIMOD
Projection: WGS_1984_UTM_Zone_45N

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