e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

WATER FLOW CHANGE ANALYSIS AFTER FLASH FLOODS: SONOGHUR, CHITRAL

Muhammad Jawwad[*1]

[*1]Student, Computer Systems Engineering, University of Engineering and Technology Peshawar, Peshawar, Khyber Pakhtunkhwa, Pakistan.

ABSTRACT

In this paper author has used Remote Sensing (RS) to analyze the after effects of a glacial break down causing massive destruction in district Chitral located in the northern region of Khyber Pakhtunkhwa province of Pakistan. Area of Interest (AoI) in this paper is a valley of Chitral named Sonoghur located between the area of Shandur and Mastuj areas. Results show that 28% of the cultivation land of Sonoghur valley was completely destroyed with no possibility of re-cultivation. After the flood, big flood channels were created by the glacial melt which created water channels increasing the soil erosion and causing continuous damage to the land.

Keywords: Water flow, Remote Sensing, Sonoghur, Google Earth Pro, Glacier, floods.

I. INTRODUCTION

Different types atmospheric changes as well as morphological changes cause various unrelenting landforms transformations. These transformations also include the denudation process of earth surface caused by weather changes and erosion. Recent climatic changes have caused most of the wear and tear in our natural atmospheric and anthropological agents of Earth. These changes occur in various types of fields that may include Glacial, Arid, Wind and Coastal due to the dynamics in phenomena of Earth. The most effective force driving our socioeconomic changes is most probably the land use change. If looking into urban areas, increasing population, waste disposal, transportation and industries is putting a burden on natural ecosystem [1-5]. This causes the unpredictable climatic changes and it comes with devastation to our environment. In rural areas, there also exist some natural phenomenon that play vital role in land use change such as unpredictable heavy rainfalls, soil erosion due to deforestation for different purposes and many others. Such type of disturbance are open invitation to vast disturbance in the eco system further causing long term problems and no stone unturned changes to out ecosystem[6]. Due to the increase in climatic changes to Planet Earth over time a land use change pattern has been developed which plays vital role in the adaptation and mitigation of changes [7]. Now at any area new plantation or irrigation developments are carried which puts an emphasis on the land use change counselling as a scientific tool [8-10]. The aforesaid is also a necessary component for the study of other aspects of environmental ecosystem[11, 12].

Forest and other agricultural bodies paly a keen role of climatic change and are necessary to be preserved rather than destroyed on daily basis. For this a proper management should be is require for conservation and mitigation of biodiversity [13, 14]. Land use change is a phenomenon that is undoubtably very unique in its nature of appearance at every stage of Earth. If deforestation is taken into consider for cultivation it may also result in high amount of global warming rather than using them for biofuel plants [13]

Another major factor of land use change are the environmental hazards that are most common in both urban and rural areas with weather conditions changing drastically. The warm weather patterns of Pakistan are distinctive for various areas where environmental changes stretch over the country. Atmospheric changes in this region are mother of heavy rainfall periods. These various events consecutively form a flow chart of possible dangerous events such as rise in sea level, glaciers meltdown and flash floods.

The present work contributes to the extreme weather diagnosis of atmospheric conditions causing extreme flash floods in the Northern region of Khyber Pakhtunkhwa, district of Pakistan. More specifically an area of Chitral valley is observed named Sonoghur, that faced tremendous glacial breakdown that was resting above the valley for more than a thousand years. Google Earth pro was the source of imagery of our area of interest. Data from USGS website was also acquired of LandSat 8 satellite but due to very weak resolution i.e. 30m ppi, it was not suitable for our research purpose [15]. Envi software is used in this research using image processing paradigms [16-19].

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

This paper is divided into different sections where section 1 introduces about the concept of land use change, while section 2 describes the area of study on which classification methods are applied for the case study which itself is explained in section 3. Section 4 contains the results and at the end paper is concluded.

II. AREA OF STUDY

Chitral lie between the longitude 71° and 74° East and parallels of latitude 35° and 37° North. The valley about which the Chitral River of glacial origin flows is narrow, begin not more than one mile broad at any location. Both sides of the river are covered by high walls of mountains ranging from 10,000 to 15000 feet in height. At each intersection of ranges of mountains there lies a valley having its own source of water stream coming from the melting glaciers at high elevations above the valleys. At the end of these valley alluvial fans extend with a gentle slope towards the main river. These alluvial are the major part of habitat able portion of these mountains' terrain populating villages and noticeable amount of cultivation around itself.

Sonoghur, also known as "The Paradise: Sonoghur" by locals, is an individual valley shown in Figure 1 lying on the lap of a 1000 years old glacier. It is the only valley that lies in the intersection of mountainous intersection. Sonoghur valley covers an area of 1.81 km2 and has parameter of 7.15 km. Valley's highest point is at the elevation of 8500 ft from sea level while the lowest point is 7440 ft. In June, 2007 this valley was swept away by a Glacial meltdown causing damage to almost half of the village. 112 homes were destroyed out of 320 homes in this village.

Figure 1. Sonoghur, Chitral, Khyber Pakhtunkhwa, Pakistan.

This paper is an analysis report on the flash flood effects on village Sonoghur, Chitral. Multispectral imagery was obtained using Google Earth Pro. LandSat 8 Images were also acquired but due to the very low spatial resolution i.e. 30m ppi, were not used in classification. Two very high-resolution images were downloaded, Pre-Flood Images, dated 25th May, 2004 and Post-Flood Image, dated 28th July, 2009.

III. METHODOLOGY

The imagery obtained from the Google Earth Pro was a mixture of many redundant and unnecessary points and areas which needed to be removed. For this reason, first the Region of Interests (ROI) were defined and then Supervised Classification was applied on the image on the basis of ROIs defined before. The classification algorithm used was maximum likelihood classifier due to its accuracy of object detection being better than other algorithms such as mahalanobis distances algorithm, also tried. After classification of Pre-Flood images of the village same techniques were applied on Post-Flood images and results were generated containing the percentages of each ROI on both of the images. These states are shown in results section of this paper for further analysis.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

IV. RESULTS

After the simulations of pre-flood and post-flood images of study area, results were generated showing three major parameters; Cultivation Land, Bushes and Trees and water area in the village. According to the results simulated through supervised classification of pre and post-flood images of the AOI, loss of cultivation land in the flood was 28.8%. Water level between pre and post-flood imagery noticeably increased 1.5% after the flood. This water level increase indicates the after effects of glacial break down due to climatic changes.

Table 1-ROI Analysis

Area of Study (Sonoghur)	Points of Interest		
	Cultivations	***Trees and Bushes***	***Water Bodies***
Pre-Flood Report	47.65%	28.37%	1.12%
Post-Flood Report	18.80%	35.08%	2.68%

Figure 2. Post flood image

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

Figure 3. Pre-Flood Image

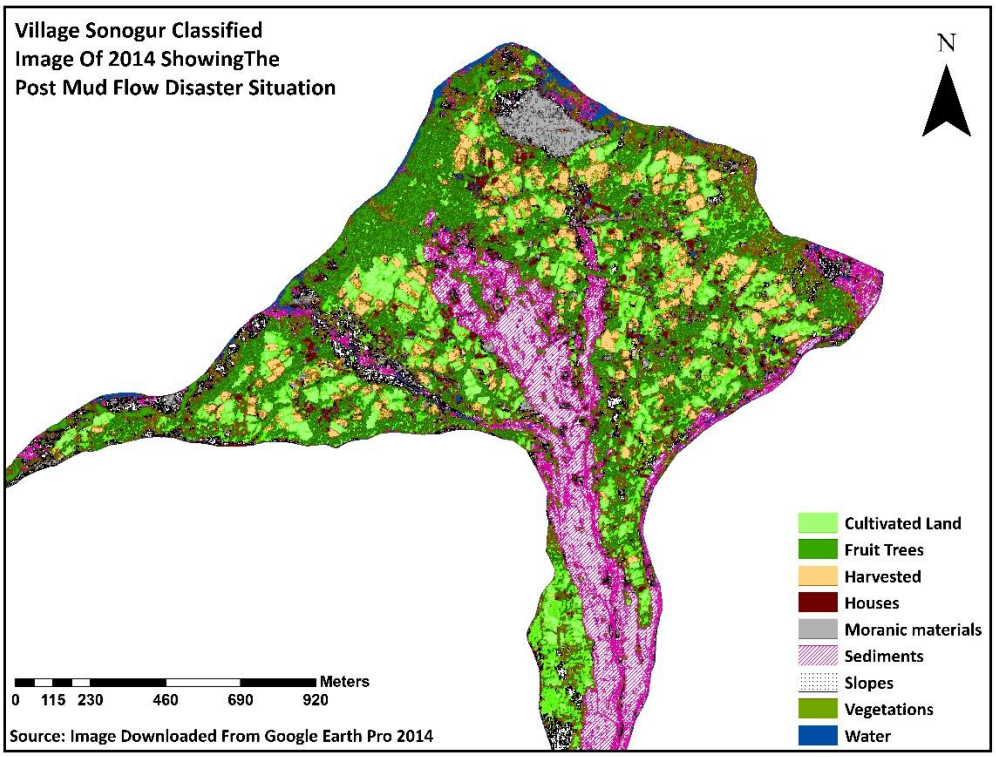

Figure 4. Post-Flood classified image

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

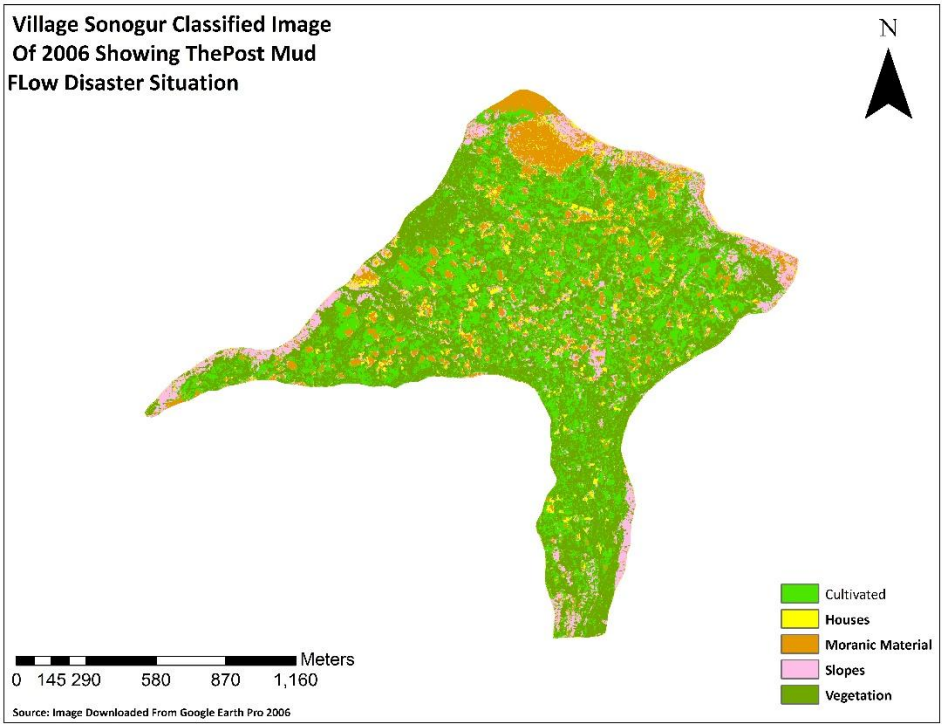

Figure 5. Pre-Flood classified image

V. CONCLUSION

By the employment of RS techniques and applications to acquire results for specific research purposes it came to knowledge that the land use change in the area of study has changed significantly after the floods of 2007. According to the analysis of the results from RS classification of pre-flood and post-flood images, it was concluded that almost 40% of the area of study was affected by floods causing major damage to the cultivation lands on the west bank of the valley. The percentage of cultivation lands decreased from 47.6% to 18.8% showing drastic decline of 28.8%. One of the major side effects of the floods include the increase of soil erosion from the water channels developed by the flood passing right through the valley and going into the main Chitral river to the north bank of the valley. These water channels are fed by the glaciers on the high end of the valley due to climatic temperature increase. These water channels have increased from 1.2% to 2.68%, showing a total increase of 1.5%.

VI. REFERENCES

[1] H. Malik, K. S. Khattak, T. Wiqar, Z. H. Khan, and A. B. Altamimi, "Low Cost Internet of Things Platform for Structural Health Monitoring," in 2019 22nd International Multitopic Conference (INMIC), 2019: IEEE, pp. 1-7.

[2] A. M. Sohail, K. S. Khattak, A. Iqbal, Z. H. Khan, and A. Ahmad, "Cloud-based Detection of Road Bottlenecks Using OBD-II Telematics," presented at the 2019 22nd International Multitopic Conference (INMIC), Islamabad, Pakistan, Pakistan, 29-30 Nov., 2019.

[3] S. S. Hussain, K. S. Khattak, A. Khan, and Z. H. Khan, "Cyber Physical System for Solar Energy Monitoring," presented at the 2019 International Conference on Frontiers of Information Technology (FIT), Islamabad, Pakistan, Pakistan, 16-18 Dec., 2019.

[4] N. Khan, K. S. Khattak, S. Ullah, and Z. Khan, "A Low-Cost IoT Based System for Environmental Monitoring," presented at the 2019 International Conference on Frontiers of Information Technology (FIT), Islamabad, Pakistan, Pakistan, 16-18 Dec., 2019.

[5] A. Khan, K. S. Khattak, Z. H. Khan, M. A. Khan, and N. Minallah, "Cyber physical system for vehicle counting and emission monitoring," International Journal of Advanced Computer Research, vol. 10, no. 50, pp. 181-193, 2020.

[6] J. Wu, "Land use changes: Economic, social, and environmental impacts," Choices. 23 (4): 6-10, vol. 23, no. 4, pp. 6-10, 2008.

[7] M. Rutten, M. Van Dijk, W. van Rooij, and H. Hilderink, "Land use dynamics, climate change, and food security in Vietnam: A global-to-local modeling approach," World Development, vol. 59, pp. 29-46, 2014.

[8] J. Crosthwaite, J. Callaghan, Q. Farmar-Bowers, C. Hollier, and A. Straker, "Land use change, their drivers and impacts on native biodiversity," Driver Research Phase Overview Report: drivers of land use change, 2004.

[9] R. A. Pielke Sr et al., "Land use/land cover changes and climate: modeling analysis and observational evidence," Wiley Interdisciplinary Reviews: Climate Change, vol. 2, no. 6, pp. 828-850, 2011.

[10] Z. Zhu and C. E. Woodcock, "Continuous change detection and classification of land cover using all available Landsat data," Remote sensing of Environment, vol. 144, pp. 152-171, 2014.

[11] X. Chen, J. Chen, Y. Shi, and Y. Yamaguchi, "An automated approach for updating land cover maps based on integrated change detection and classification methods," ISPRS Journal of Photogrammetry and Remote Sensing, vol. 71, pp. 86-95, 2012.

[12] B. L. Turner, D. Skole, S. Sanderson, G. Fischer, L. Fresco, and R. Leemans, "Land-use and land-cover change: science/research plan," in Unknown Host Publication Title: International Geosphere-Biosphere Programme, Stockholm; Report, 35, 1995.

[13] C. Giupponi, M. Ramanzin, E. Sturaro, and S. Fuser, "Climate and land use changes, biodiversity and agri-environmental measures in the Belluno province, Italy," Environmental Science & Policy, vol. 9, no. 2, pp. 163-173, 2006.

[14] J. Rwetabula and F. De Smedt, "Landuse and land cover mapping of the Simiyu catchment (Tanzania) using remote sensing techniques," in FIG Working Week, 2005, pp. 16-21.

[15] S. S. Maghdid and S. Ahmed, "ATVNP: ANTHROPOGENIC TEMPORAL VARIATION OF ".

[16] Z. Riaz and K. Khattak, "Classification of human face images using principal components," in 2006 International Conference on Emerging Technologies, 2006: IEEE, pp. 97-102.

[17] I. Ahmad, M. Yousaf, S. Yousaf, and M. O. Ahmad, "Fake News Detection Using Machine Learning Ensemble Methods," Complexity, vol. 2020, 2020.

[18] I. Ahmad, G. Ahmed, S. A. A. Shah, and E. Ahmed, "A decade of big data literature: analysis of trends in light of bibliometrics," The Journal of Supercomputing, vol. 76, no. 5, pp. 3555-3571, 2020.

[19] I. Ahmad, M. A. Alqarni, A. A. Almazroi, and A. Tariq, "Experimental Evaluation of Clickbait Detection Using Machine Learning Models," Intelligent Automation And Soft Computing, vol. 26, no. 6, pp. 1335-1344, 2020.