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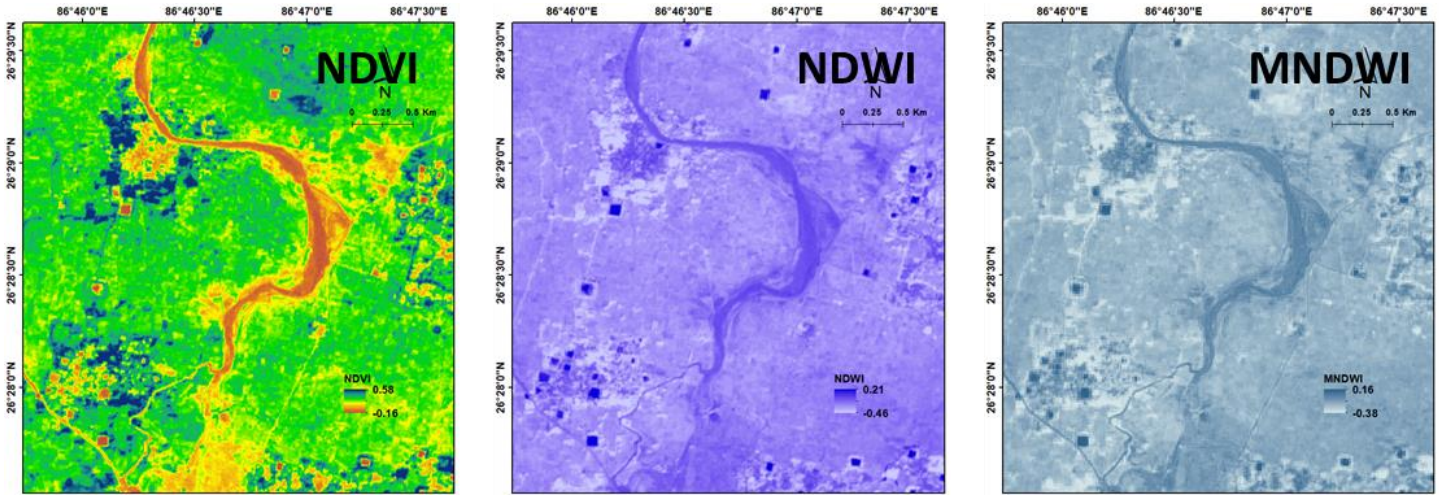
River course shifting detection aided by satellite remote sensing and GIS technique; A case study of Khando River

Background

Practically all Rivers are subjected to morphological processes. River morphology is the field of science dealing with changes in River platform and cross-section due to sedimentation erosion processes. River shifting not only alters the area of agricultural land, forest, open space and other land cover types but also affects the planning of River training works and trans-boundary issues. The major objective of this research is to identify and map the shifting courses of the Khando River. The Khando River originates from the Churiya (Siwalik) range of hills, which is supposed to be the first line of mountain ranges and of lower elevation in Nepal, and enters into the Terai from about 4 km north of the East-West highway at latitude 26º37' N and longitude 86 º43' E. Flowing through the territory of Nepal, it enters into India near Kunauli in Supaul district of Bihar. The major problem of Khado River is shifting characteristics in the plain area. The villages most frequently inundated during the monsoon are Tilathi, Sakarpura, Malhania, Belhi, Launia, Bishariya, Kajauli, Dighwa and Raypur. Even among these villages, the most adversely affected is Tilathi, which is facing a serious submergence problem from the flood water of Khando River. At present, the River has completely abandoned its old course in the Tilathi-Sakarpura area.

Methodology

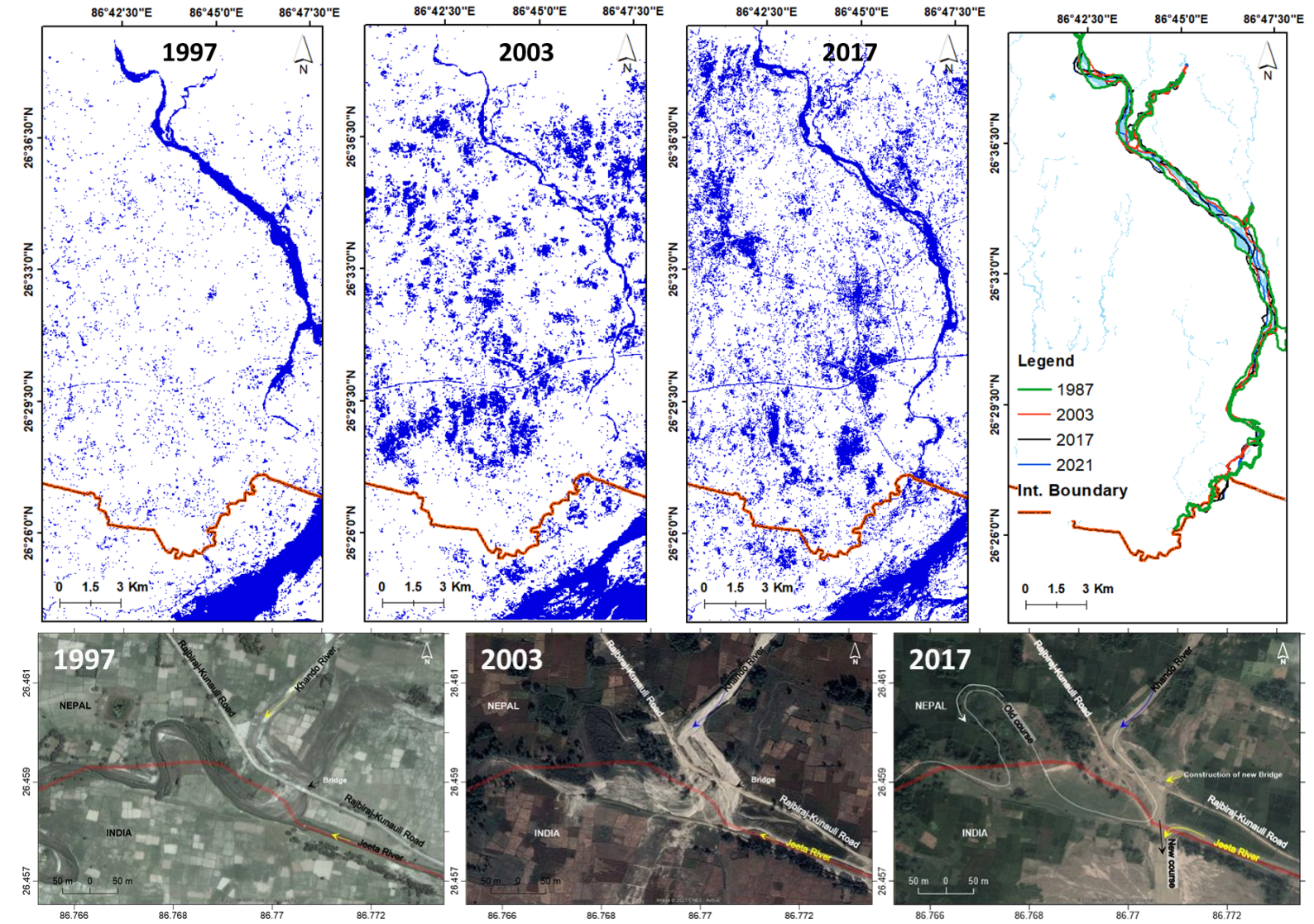
The shifts in the course of the Khando River System have been identified and mapped using remote sensing data and topographical maps and then verified through field checks by collecting fluvial geomorphological evidences. Satellite images of the Landsat5 (1987), Landsat 8 (2003-2017), Sentinel2A (2017-2021) and Ziyuan3-01 (2019-2020), have been used for this purpose. The abandoned courses of the Khando River is easily identifiable in these satellite images. The prior courses of the Rivers were confirmed from the multispectral images of Sentinel2A. The methodology employed comprised of sequential steps in order to identify the possible water segmentation in the study area. Considering the field knowledge of the study area, the set of parameters considered were: Normalized Differential Vegetation Index (NDVI), Normalized Difference Water Index (NDWI) and Modified Normalized Difference Water Index (MNDWI). The most common classifiers, namely, random forest (RF) was be applied on the three stacked composites to obtain the water segmentation (Ho, 1995).



Results

Google earth image is helpful for direct observation of the terrain with its embedded historical tool and hillshade map can help to in the analysis of the results obtained and to understand the relief of the zone. Total 1000 presence of River points were identified with the help of landuse map, google earth image and hillshed map. Similarly, 1000 points were randomly selected for absence points.

The 70% training dataset was used to train the RF models for water identification. During the training process in RF, the optimum values of the parameters for the models were applied to obtain high model predictive capability.



Conclusion

There has been oscillation of the channels. At present, the River has completely abandoned its old course in the Tilathi-Sakarpura area and is directly hitting Tilathi village. The old channel has abandoned in Nepal-India Border area. At present, there is no other solution except channelization of Khando River to pass first flood discharge, which will help for providing proper drainage of flood water during monsoon period. Mathematical modeling of the River would be the future task to be conducted for analyzing the effect of river training works.

Reference

Ho, T.K., 1995. Random decision forests. In Proceedings of the Third international Conference on Document Analysis and Recognition. Montreal, QC, Canada, 14-15 August 1995

FOR FURTHER INFORMATION:

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Water Resources Research and Development Centre

Dr. Ananta Man Singh Pradhan, Sr.Div. Engineering Geologist, ananta.pradhan@nepal.gov.np
Mahesh Khanal, Information Officer, mahesh.khanal@nepal.gov.np
Website: www.wrrdc.gov.np

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