The Egyptian Journal of Remote Sensing and Space Sciences 20 (2017) 197–210

HOSTED BY

Contents lists available at ScienceDirect

The Egyptian Journal of Remote Sensing and Space Sciences

journal homepage: www.sciencedirect.com

Channel migration and its impact on land use/land cover using RS and GIS: A study on Khowai River of Tripura, North-East India

Jatan Debnath *, Nibedita Das (Pan), Istak Ahmed, Moujuri Bhowmik

Department of Geography and Disaster Management, Tripura University, Suryamaninagar 799022, India

ARTICLE INFO

Article history:
Received 6 March 2016
Revised 12 January 2017
Accepted 26 January 2017
Available online 6 February 2017

Keywords:
Channel migration
Land use
Khowai River
Vulnerability

ABSTRACT

Channel migration becomes the main characteristic of the Khowai River of Tripura. A study on bank erosion and channel migration of the present course of the Khowai River through the synclinal valley of Atharamura and Baramura Hill Ranges indicates that the area is under active erosion since long back. In this study, the rate of channel migration has been assessed and variation of sinuosity index and radius of curvature have also been calculated. The study of the active channel width and channel position from 1975 to 2014 indicates that a large portion of land along both the banks of the Khowai River has already been eroded away. This work also documented land use changes in its surrounding flood plain area using supervised image classification. Overall accuracy of the land use classification ranges between 88% and 93%. The whole study is being done utilising the remote sensing imagery (2014), SOI topographical map (1975) and GIS technology. The land use classification shows that there is an increase in built up area and decrease in net sown area. The channel migration directly affects the land use and land use change has direct effect on the flood plain dwellers of the study area. All the assessments of this study highlight a significant message of immense vulnerability of Khowai River and also provide news about geomorphological instabilities of the study area.

1. Introduction

The alluvial nature of the flood plain is valuable and important gift for human society. Floodplains are considered as one of the most endangered area worldwide as they are facing degradation by river regulations and enhanced land use pressure (Hazarika et al., 2015). The river is subjected to erosion and deposition to reach the equilibrium condition. The mapping of changed channel position are important for documenting the erosion hazard and changes in land use/land cover characteristics, as well as for understanding the reasons of those changes.

Riverbank Erosion is an endemic and recurrent natural hazard. When rivers attain the mature stage, they become sluggish and form meander bends. These oscillations cause massive riverbank erosion (Rahman, 2010; Das and Bhowmik, 2013). Lateral migration is a process that can cause catastrophic local or regional changes (Hickin and Nanson, 1984; Thakur et al., 2012), comprehensive effect of such changes become a socio-economic hazard to the flood plain dwellers of the respective river. A number of factors control the lateral migration of river along its pathway such as drainage basin area, topography, vegetation cover, tectonic activity, land use patterns and climatic factors, mainly rainfall and temperature, of that particular region.

Erosion may be caused either by undercutting of the upper bank materials by channels during the high floods producing an overhanging cantilevered block that eventually fails or by oversteepening of bank materials due to migration of the thalweg closer to the bank during the falling stages (Goswami, 2002). Various studies have been carried out for some major rivers with the help of Remote sensing and GIS technique for detecting spatio-temporal changes of river erosion (Nanson and Hickin, 1986; Yang et al., 1999; Bhakal et al., 2005; Kotoky et al., 2005; Kummu et al., 2008; Thakur et al., 2011; Sarma and Acharjee, 2012; Chakraborty and Datta, 2013; Gogoi and Goswami, 2013).

Considering the importance of LULC change on behalf of channel changes, present work tries to relate the condition of those changes using the modern techniques. In this regard, the remotely sensed data have been used, which provides a synoptic view of larger area over different time period and made possible to study the

Peer review under responsibility of National Authority for Remote Sensing and Space Sciences.

* Corresponding author.
E-mail address: jatandebnathgeo@gmail.com (J. Debnath).

http://dx.doi.org/10.1016/j.ejrs.2017.01.009
1110-9823/

LULC in less time and low cost effective manner with better accuracy (Kachhwala, 1985; Rogan and Chen, 2004; Sylla et al., 2012; Boori et al., 2015; Rawat and Kumar, 2015; Hazarika et al., 2015; Jayanth et al., 2016). Several studies have been carried out by many researchers using remote sensing data with GIS technique for multi temporal change analysis of LULC (Ahmed, 2012; Kotoky et al., 2012; Rawat et al., 2013; Yuan et al., 2005; Sun et al., 2009; Jensen, 2005; Lu et al., 2004; Murthy and Rao, 1997). Bank erosion is a natural hazard and this dynamic nature of river changes the LULC of its surrounding basin, which becomes natural phenomena in recent times.

The Khowai River, one of the major rivers of Tripura, is also known as the most disastrous river for its extreme nature, especially during rainy season. The river, after entering into the plain from the higher gradient of Atharamura hill range, spreads its enormous discharge and takes meandering course in the downstream. The Khowai River is characterized by its exceedingly large flow during rainy season, continuous changes in channel morphology, rapid bed aggradation and bank line change. The lateral migration of bank line causes failure of huge fertile land every year. The hills of Tripura are made up of semi-consolidated sedimentary rocks. Due to high precipitation (>2200 mm), steep slope, soft soil cover in the hills and alluvial formation in the valleys, there is high velocity and discharge of water laden with high silt discharge. All these factors result into meandering of the river and cause severe erosion in the concave bends (Deb et al., 2012).

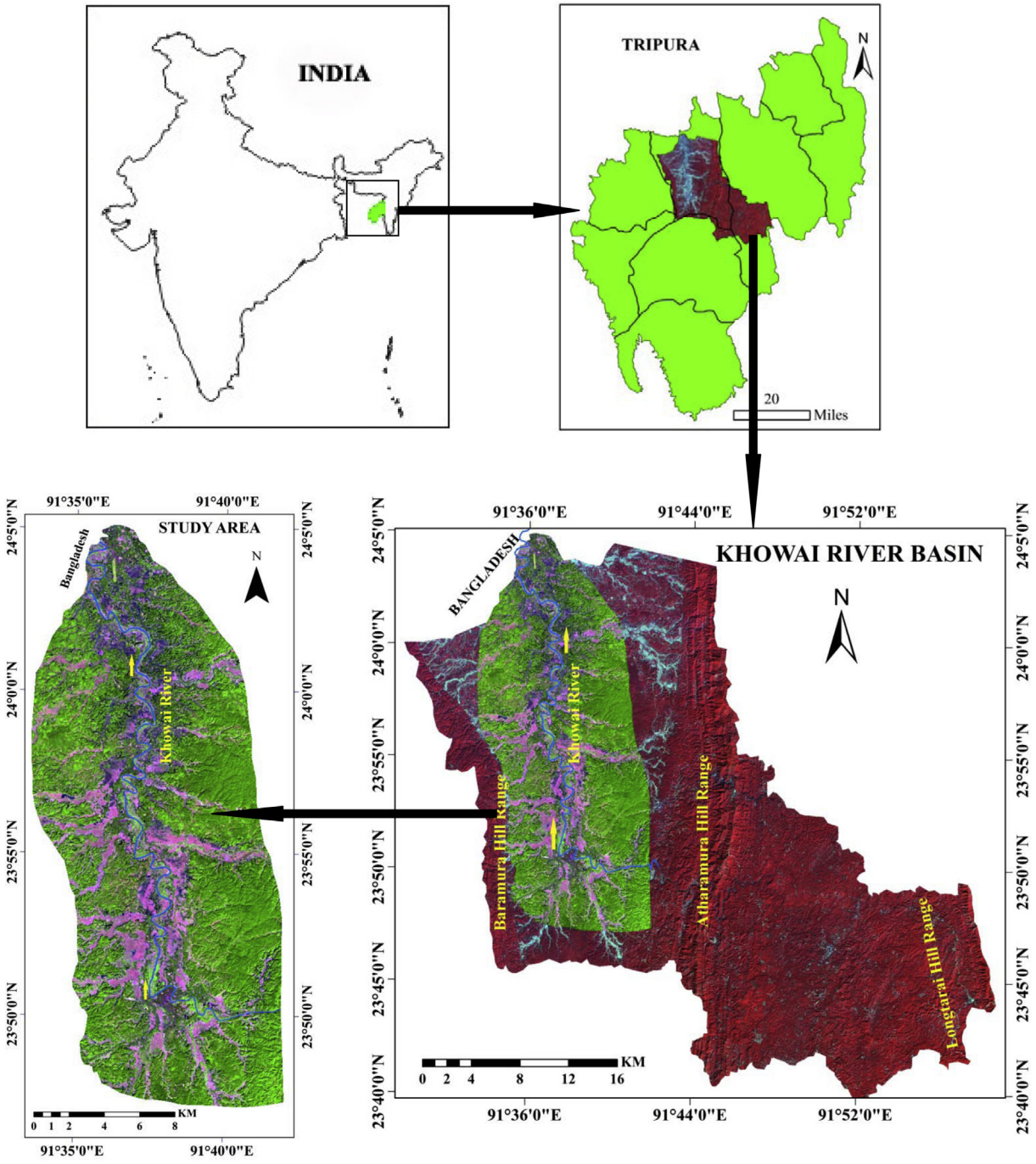

Fig. 1. Location map of the study area.