Jamuna Riverbank Shifting Analyses: A Case Study of Dhunat Upazila, Bogura District, Bangladesh

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Abstract: Riverbank erosion is a common geomorphological process of alluvial floodplain rivers. Bangladesh is mainly formed by alluvial deposits in which riverbank erosion very often due to regular shifting of river channels. The study area lies in north-western part of Bangladesh under Dhunat Upazila, Bogra District. Total studied area is about 248.15 km^2. The works aim mainly river shifting detection analyses of Jamuna River in the study area. It is carried out to know the land and river position in different time periods, mode of shifting and present bank bar position. The present investigation based on multispectral satellite imagery (SPOT, Landsat-MSS, Landsat-TM, Landsat-ETM+ Rapid Eye, Google Earth) interpretations which were used by means of ArcGIS and Erdas Imagine software followed by field check. Based on texture, tone, association, shape, size and pattern of each unit features of images and field checking. The overall trend of the present right bank line migration is in a westward direction. The right bank of the Jamuna River shifted 4.80 kilometer since 1952 to 2018 toward Dhunat Upazila at the average rate of 43.00 meters per year. The output of the present research work may be helpful to the decision makers to take the proper mitigation measure regarding riverbank erosion.

Keywords: ***Shifting, Erosion, Geomorphology, River.***

Introduction

The river Jamuna is one of the three main rivers of Bangladesh. The river is one major contributor to the building up of the Bengal delta. Because of its inherent alluvium nature, the rivers of Bangladesh are morphologically dynamic characterized by erosion and sedimentation, which results in change in hydraulic geometry, plan form and longitudinal profile of the rivers (Habibullah, 1987). Every year due to engulfing, huge quantity of lands captured by the river due to bank erosion, displaced people are bound to migrate and settle in other places. Developments like sand mining, infrastructure building on the riverbank, artificial cutoffs, bank revetment and land use alterations have changed the natural geomorphological dynamics of rivers (Lane and Richards, 1997; Surian, 1999; Rinaldi, 2003). As a consequence, channel stability is often threatened. This happens to a channel due to morphological adjustments to accommodate the range of flows and sediment loads from upstream. (Khan et al., 2003). Due to the riverbank erosion, poor floodplain inhabitants not only lose their properties but also experience socioeconomic deprivation through income–loss, asset loss and physical injury. Every year landlessness, unemployment as well as poverty drastically increases due to the river bank erosion. Satellite remote sensing technique is very effective in examining fluvial channels dynamics over a large area. This technique has been widely used to examine fluvial channel migration and to identify paleo-braided channels on terrace surfaces and also to investigate the long-term trends and rates of bank erosion and accretion. The present work is carried out for Jamuna Riverbank shifting, river morpho dynamics as well as geomorphological at Dhunat Upazila, Bogra District.

Methodology

The present investigation is based on multispectral satellite imagery (SPOT, Landsat-MSS, Landsat-TM, Landsat-ETM+ Rapid Eye, Google Earth) interpretations which were used by means of ArcGIS and Erdas Imagine software followed by field check. Firstly, a base map is prepared by analyses of topographic map, aerial photographs and different satellite images. ArcGIS software was used to prepare the map. And then the base map was checked with ground, taking GPS data to check the present river bank line. Moreover, erosion prone and vulnerable to bank erosion area is also demarcated by analyses of satellite imagery as well as field observation. Finally, the layers of maps which extracted from different images overlay to obtain the erosion rate, eroded and deposited landmass of the area of each union since 50's decade of the last century.

Result

The overall trend of the present right bank line migration is in northwest-southeast direction. The right bank of the Jamuna River shifted 4.8 kilometers (km) from 1952 to 2018 toward Dhunat Upazila at an average rate of 43 meters per year. The shifting of the river is not always at the same rate or intensity. The river entered the study area around 1990. From 1990 to 1995 the river captured 3.10 sq. km. flood plain in the study area in which flood plain converted into channel and new bar. The area of converted bar was then 4.08 sq. km. During 1995 to 2000, total 4.87 sq.km. flood plain was captured by the river. This captured flood plain had been converted into channel and new bar in which channel area was 1.54 sq. km. and new bar area was 3.23 sq. km. During 2010-2015 total 0.68 sq. km. flood plain converted into channel and new bar. During 2015-2018 total 1.10 sq.

km. flood plain area was converted into channel only. Comparative study of flood plain losses and bar development shows that after 1995 the flood plain had been lost sequentially but bar development had not been followed the sequence.

Conclusion

The Jamuna Riverbank of the area is severely affected by erosion. Erosion is influenced by water flow velocity, bank sediments composition and compaction, vegetation and anthropogenic activities. The river continuously has been changed its course from East to West since 1952 to 2018. Jamuna River is strongly braided. It has multiple channels separated by sand bar. The channels are frequently shifting because of erosion of old bar and formation of new bar. Bars are beginning as sandy shoals within or alongside a channel. They usually are linear or roughly elliptical in shape. Their formation diverts the channel flow against the opposite bank of the channel, which it undercuts and erodes. The unconsolidated sandy and silty Jamuna sediments provide little resistance to such erosion.

Recommendations

The output of the present research work may be helpful to the decision makers to take the proper mitigation measure regarding riverbank erosion. The following recommendations should be required in the study area for future riverbank protection:

i) Right bank of the Jamuna River in the study area is protected by river embankment (paved) but bar development should monitor timely and threaten bar should remove immediately.

ii) Riverbank protection should be constructed considering geomorphology and geology in study area.

iii) Before the construction of riverbank protection river flow trend should consider and divert the river flow in upstream suitable area.

There is a requirement of further studies to evaluate precisely the channel patterns and morpho-dynamics of the Jamuna River using the digital elevation model (DEM) in the study area.

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