

Flood and Bank Erosion Induced Population Displacement Along Lower Reach of Beki River in Barpeta District, Assam

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Abstract:

Flood havoc accompanied by river bank erosion have become twin trouble over the years owing to both natural and anthropogenic activities. Every monsoon awakens India to struggle with the havoc causing massive destruction to life and livelihood of human as well as livestock. Assam, being crisscrossed by tributaries of Brahmaputra and Barak rivers have displaced people annually, specifically in floodplain regions. In this respect, the Beki river of Barpeta district also causes severe loss to human lives settling along the banks due to its flood havoc and bank erosion every year. The present research work aims to analyse the problem of flood and bank erosion and its implications on population displacement in the villages near lower reach of Beki river.

Keywords: Flood, river bank erosion, displacement, Beki River

Introduction:

Flood is one of the disastrous and frequent natural calamities disrupting the life and livelihood of many in various parts of the world. Flooding, especially in the floodplain region of India, has been a recurring phenomenon for decades (Sarma, 2013). Assam is criss-crossed by numerous stream networks, causing a severe impact on the economy of the region. Flood is immensely painful and leaves unequal effects on different social groups. The agrarian society is primarily affected more specifically in the char areas of the region during monsoon season (Deka & Talukdar, 2016). The river is one of the most powerful and dynamic geographical agents. They are the most dynamic and increasingly essential parts of the physical environment. The river has a great influence on the people living in its floodplain. It affects adversely the settlement, land use, culture and economy of the country (Nabi et al., 2016). As already mentioned, due to the availability of fertile lands for agriculture and other facilities, floodplain always attracts people to settle on them. They create natural calamities, e.g. flood, bank erosion when the river is insufficient

to carry a large amount of water, and it overflows its bank and low-laying areas. Flood, in combination with bank erosion, aggravates the situation to a great extent (Karim, 2014). Flood and erosion are powerful and interrelated fluvial processes that can bring about significant landscape changes. A flood is a high river period caused by incessant rainfall, rapid snow melt, or the breaching of a barrier (Amangabara & Obenade, 2015). It may exceed a channel's capacity and lead to inundation of adjacent low-lying land (Iqbal, 2010). Flooding is one of the most critical natural activities affecting human and animal life. Flood has been evoked as the most dynamic and recurrent hydrological phenomena leading to widespread destruction since millennia.

Bank line shift or bank line migration is a normal morphological behaviour of a river. River banks can move away (erosion) or can advance (deposition), which can result in meandering migration, channel avulsion and change in channel width (Kotoky et al., 2005). Most bank line migration or channel shifting occurs during severe flood and extreme tectonic movements in a basin. The frequently occurring erosional and depositional processes along the concave and convex banks of the river have caused shifting of the banks. Bank-line migration is a direct consequence of the interaction and interrelationships between various aspects like the extent of river activities (erosion, transportation, and deposition), volume of river water, soil, and geological structure including human interference with the river.

Flood is a very common natural hazard for the people of the Brahmaputra valley of Assam. The Assam valley is a fertile belt, which is affected seriously by flood havocs. Heavy rainfall during the rainy season in North-East India is the chief cause of floods. The Brahmaputra, which drains this valley, receives a large amount of water heavily laden with silt from its tributaries. The silt, which is deposited in the river channel, makes it shallow. Thus the capacity of the rivers to carry the load is reduced. It is well established from the fact that most of the northern tributaries of the Brahmaputra have shifted their course during the flood. It happens mostly due to the bank erosion caused by the excessive flowing of water during the summer season. In this regard, the Beki River, a perennial tributary, is also not an exception. This kind of bankline migration is commonly seen in rivers like Beki, Ai, Manas and Pagladiya river of Barpeta district. The meandering course

of these rivers carries excessive water from Bhutan hills, resulting in a large amount of bank erosion in the lowermost course (Devi & Bora, 2016). The flood and riverbank erosion has serious impacts on society, causing permanent displacement and impoverishment of many people. The inhabitants of the villages on both banks along the Beki River are also facing the same situation. Hence, each year, thousands of people in neighbouring areas have been threatened by massive floods and river erosion by the Beki River. Most of the affected people are suffering a lot of problems, i.e., people lose their homestead area and house, face economic problems, shift their occupation also and migrate from one place to another place, and a considerable number of people are unable to get back to their homestead or even any new places. Against this backdrop, the present study intends to examine the pattern and intensity of twin menace, viz., flood havoc and river bank erosion causing displacement of the inhabitants residing along the Beki River in Barpeta district of Assam.

Location of the study area:

The Beki River is a northern tributary of the gigantic Brahmaputra River originating from the mountainous terrain of Bhutan. It is the major southward draining interstate river basin with a transboundary counterpart called Kurichu in Bhutan. The river and its drainage channels flow through the plains of Assam for about 85 km and drain an area of 26, 243 sq.km. The study area incorporates the villages along the banks of the lower reach Beki River in Barpeta district. Though all 47 villages have been chiefly affected by flood havoc, a total number of 13 villages which are severely prone to flood and river bank erosion has been mainly considered.

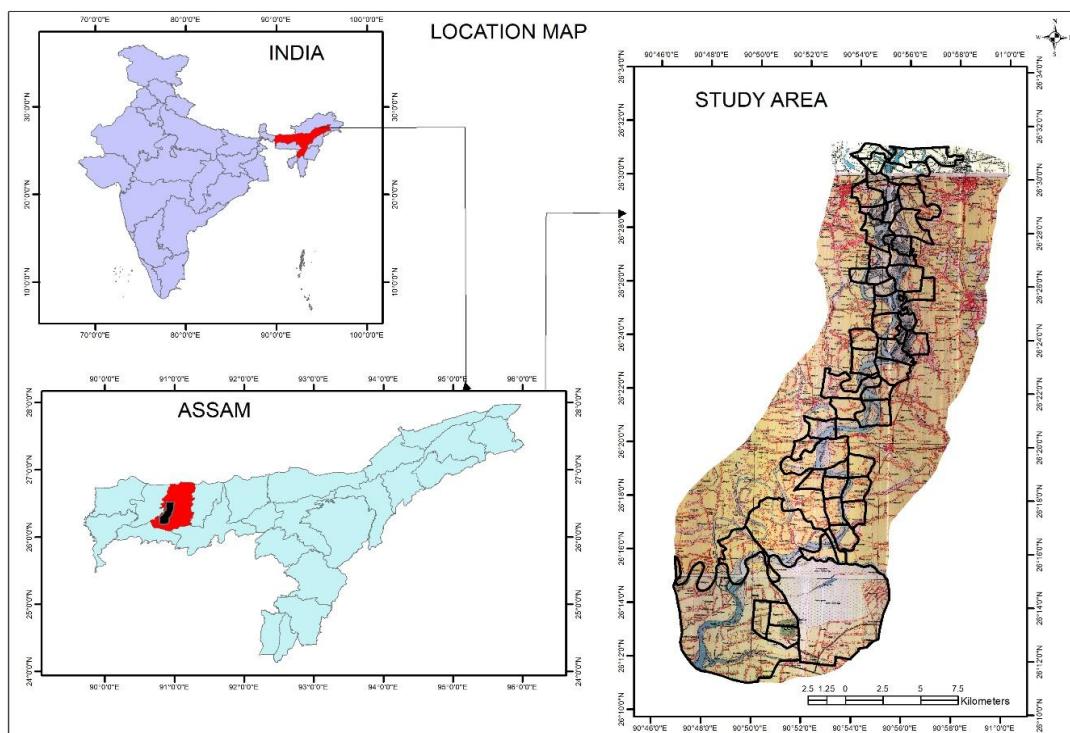


Fig-1: Location map of the study area

Methodology:

The study was carried out using primary and secondary information supplemented with satellite database work in GIS environment. Relevant secondary data related to water discharge, flood havoc and estimated overall damage have been collected from the disaster management office of the Barpeta district. Landsat satellite data have been downloaded from freely available sources for years. 2000, 2007 and 2017. The Beki River channel has been digitized manually for the year 2000 in GIS software, and the same layer has been superimposed in the satellite data for consecutive years. Thus, the river course has been delineated and therefrom, the channel shifting has been calculated. Moreover, a sample survey has been conducted in the affected villages to understand the pattern of damages that occurred due to flood and bank erosion and the relationship between the hazard and the displaced population.

Analysis and Results:

Occurrence of Flood Hazard

The study reveals that flood is a recurring problem in the adjacent floodplains of Brahmaputra and other rivers in Barpeta district. It occurs during peak monsoon season. The monsoon season starts in June and in the first part of July up to August, the peak occurs. As a result, the rivers are in a bank-full stage, and a flood occurs when it cannot carry the excessive water caused due to heavy rain upstream. Almost every year, devastating floods affect the villages near the main rivers. Beki, Ai, Manas and Pagladiya in the district. The following tables (Tables 1 & 2) show the rainfall pattern in Barpeta during 2015-2017 and discharge in the Beki river from 2013 to 2016. It has been observed that the discharge become very high due to high rainfall in the monsoon months. As a results, the intensity of flood in the neighbouring floodplain areas during that period was very severe.

Table-1: Mean Monthly Rainfall at Barpeta (2015-2017)

Months/Year	2015	2016	2017
	Rainfall in mm		
Jan	7.6	6.2	4.5
Feb	5.4	5.4	28.3
Mar	37.3	26.3	16.9
Apr	108.4	97.8	69.7
May	466	501.2	557.2
Jun	907.4	878.2	601.2
Jul	341.6	349.8	564.8
Aug	861.7	832.5	671.1
Sep	328.6	346.2	321.6
Oct	21	19.5	11.3
Nov	22.8	3.6	2.7
Dec	11.1	3.1	2.6

Source: IMD

Table-2: Mean Monthly Discharge at Beki River from 2013 to 2016

(Station: NH Crossing)

Months/Year	2013	2014	2015	2016
	Discharge in cumec			
Jan	359	209.7	260.71	253.58
Feb	352.75	336.71	301.82	333.07
Mar	516	341.8	324.22	353.48
Apr	681.6	449.23	407.3	573.7
May	894.09	706.06	499.35	538.19
Jun	1073	1075.73	654.36	1053.63
Jul	1526	1618.96	569.26	2319.29
Aug	1510	1564.14	612.16	1632.33
Sep	1240	934.53	442.43	719.63
Oct	1307	457.09	331.71	526.06
Nov	395.13	236.16	286.3	169.43
Dec	315.12	329.38	219.32	176.64

Source: Water Resource Department, Govt. of Assam

The secondary data also reveals that the devastating flood during 2016 and 2017 caused a tremendous loss in the villages of the Barpeta district, particularly in the 39 villages near the Beki River. A vast crop stretch has been submerged under flood water for many days. As per the report, around nine people lost their lives, and 107 livestock were drowned during the year 2016. In addition to that, many roads and bridges have been damaged and washed away. A total 14 numbers of embankments were breached in 2016, and hundreds of schools and individual fisheries have also been affected. Moreover, 2857 households were entirely or partially washed away in 2016; a similar situation happened in 2017. Though the total population and area under crop was higher than 2016, the impact was less than in 2016 (Table 3).

Table 3: Flood Hazard and its Impact in Barpeta District (2016-17)

Year	2016	2017
Circle (Nos)	8	8
Village	431	456
Crop Area	25537	33144
Total Population	499069	626619
Human Life Lost	9	2
Animal waste away (Big)	107	14
Roads Damaged	237	212
Bridge Damaged	65	17
Number of embankment damaged	14	1
Individual fishery	3922	2357
Schools effected	881	679
Irrigation Projects damaged	5	NA
House Damaged	2857	463

Source: Disaster management office, Barpeta

River bank shifting

A channel shifts when water overtops during floods by cutting its bunds and accompanied by extreme tectonic movements. Channel change is primarily attributed to the combined effects of both natural and injudicious anthropogenic activities (Kotoky et al., 2003). In the study of river flow dynamics, the magnitude of channel changes plays a crucial role in proper channel design, river restoration, watershed planning and management (Goswami, 1985). Satellite imageries of three different years (2000, 2007 and 2017) were considered to understand the pattern of river bank migration of the Beki River. Six cross-sections near Puthimari, Dakhin Ganakkari, Bordonga, Kalgachia, Satra kuhra and Pachim Dewaldi have been selected to calculate the magnitude of channel migration in the river. It has been observed from the study that during the period 2000-2007, most the bank line migration occurred in the lower reach along the cross sections viz. D-D/ near Kalgachia, E-E/ near Satra kuhra and F-F/ near Pachim Dewaldi and Dolagaon. During 2007-2017, bank line shifting was recorded high along the cross sections viz. B-B/ near Ganakgari, C-C/ near Bordonga, and E-E/ near Balikuri (Fig. 2). The estimated calculation

shows that the right bank of Beki River has shifted up to 1.92 km towards the right side. In contrast, the left bank shifted up to 1 km towards the east side along D-D/cross-section. Similarly, at E-E/cross-section, the right bank has shifted towards the east direction up to 1.28 km, and the left bank shifted towards the east up to 0.77 km. Along the cross-section F-F/, the right bank shifted towards the west up to 1.41 km, and the left bank moved towards the west up to 1.56 km. During 2007-2017, a remarkable change was observed along the cross section C-C/ where the right bank migrated up to 1.1 km towards the west and the left bank towards the west for about 1.6 km. Similarly, along E-E/ cross section, the right bank shifted towards the east for about 1.77 km, whereas the left bank shifted towards the east for about 1.87 km. The following table (Table no. 4) presents a detailed overview of the bank line shifting pattern of the Beki River during 2000 to 2017. The study reveals that the Beki River during this period was highly dynamic, causing remarkable consequences upon life, livestock, property, infrastructure, etc.

Table 4: Bank line shifting of Beki River during 2007-2017

	2000-2007		2007-2017	
Cross Section	Right Bank (KM)	Left Bank (KM)	Right Bank (KM)	Left Bank (KM)
A - A'	0.855 E	0.479 E	0.899 W	0.383 W
B - B'	0.089 W	0.603 E	0.239 W	0.588 W
C - C'	0.515 W	0.017 E	1.100 W	1.619 W
D - D'	1.922 E	1.009 E	0.720 W	0.133 E
E - E'	1.287 E	0.773 E	1.776 E	1.875 E
F - F'	1.415 W	1.564 W	0.550 E	1.080 E

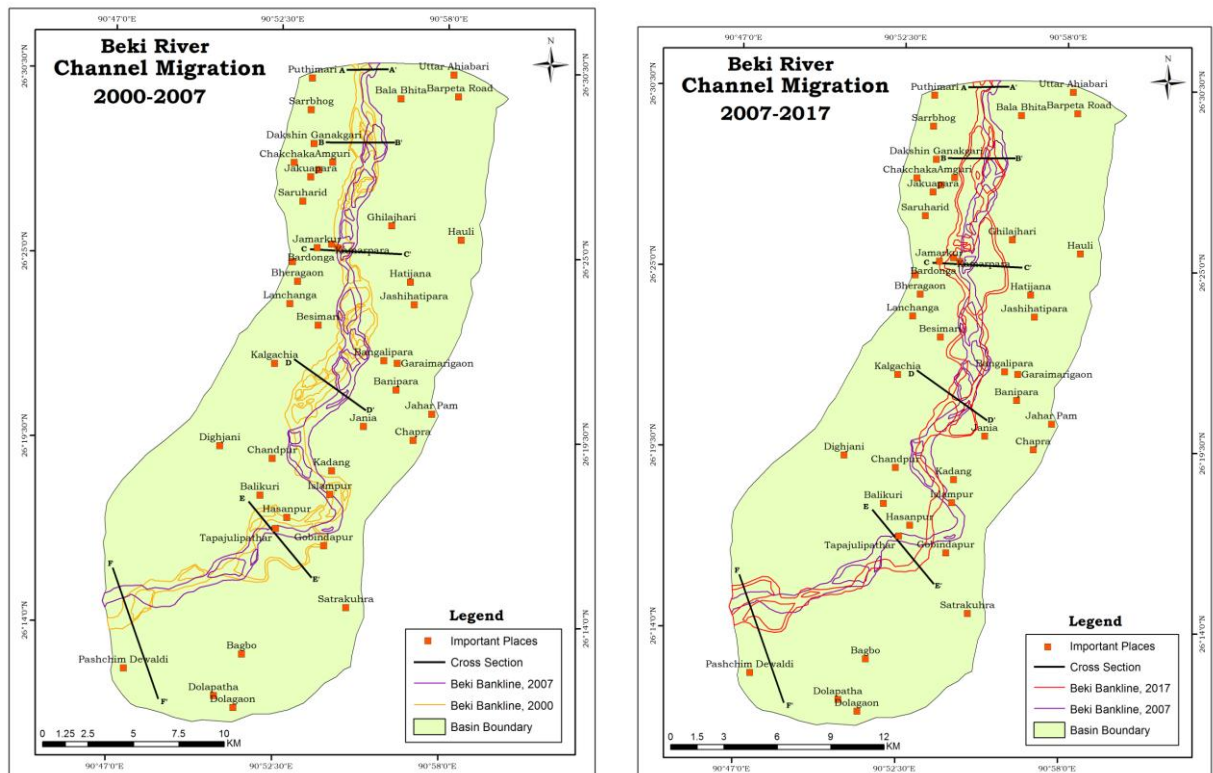


Fig-2: Bank line shifting of lower reach of Beki River (2000-2017)

Population displacement in flood and bank erosion-prone areas

For the present research, from the viewpoint of extreme flood and erosion-prone villages witnessed annually, 47 villages have been considered. These villages are located along the Beki River beside both banks. The analysis revealed that based on the population statistics during the 2001-2011 census period, villages like Borbhaluki, Bhogdia, Helanarpam, Khandakarpara, Maripur, Pathaliapara and Tapajuli Pathar have been acutely affected by the twin menace. This has resulted in the population's displacement and the dislocation of various households and villages. Field investigation also revealed that many inhabitants of the villages prone to bank line shifting viz. Ganakgari, Bordonga, Kalgachia, Satrakuhra, Balikuri and Pachim Dewaldi have also faced the situation of displacement during 2016 and 2017 (Fig. 3). It has been observed from the study that 117 numbers of families have been displaced permanently during the flood and bank line shifting of Beki River during 2016-17 whereas 471 numbers of families have been temporarily displaced. The permanently displaced families have either shifted to other villages or shifted to new char areas of Brahmaputra River. The temporarily displaced families either took shelter in embankments or in schools and other government set up. Flood hazard is primarily

responsible for temporarily displaced populations, while bank erosion is chiefly responsible for permanent displacement in the study area. During the havoc, the inhabitants received relief, but it was inadequate to support the victims.

Table 5. Households displaced during flood and river shifting (2016-17)

Village name	Households displaced permanently	Household displaced temporarily
Borbhaluki	11	39
Bhogdia	9	15
Helenarpam	7	22
Khandakarpara	2	31
Maripur	7	32
Pathalipara	3	14
Tapajulipathar	11	18
Kalgacchia	12	52
Ganakgari	9	69
Bordonga	9	52
Satrakurha	11	49
Balikuri	13	33
Pachim Dewaldi	13	45

Source: Field Survey, 2017

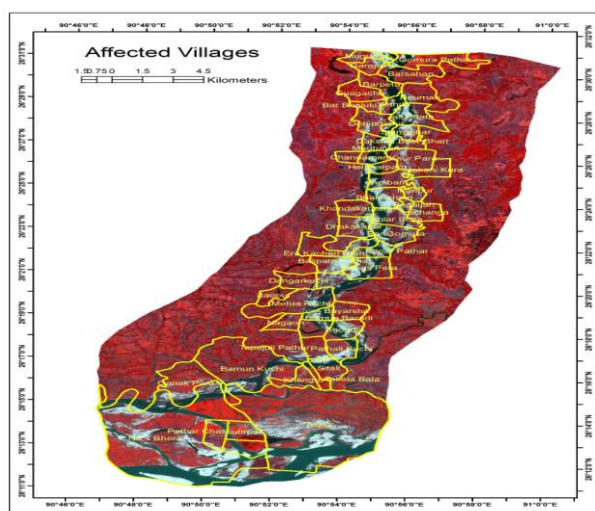


Fig. 3 Flood and Erosion affected villages along lower reach of Beki river

Resettlement and rehabilitation of the sufferers are the major problems after the flood

havoc and bank erosion (Chatterjee & Mistri, 2013). As the villages' economy near Beki River is dominated by primary activity, patches of land devoted to agriculture and cropland were destroyed, where the rural people suffered immensely. These landless cultivators engaged themselves in the alternate source of income viz. petty traders, rickshaw/thela pullers in the nearby urban centres or as daily wage labourers in agricultural sectors of Zamindars' for their livelihood. Besides, people still in their original paternal property are facing distress.

Conclusion

The present study elucidates that the Beki River have been continuously disrupting and displacing human lives along with livestock resulting in multifarious implications in Barpeta district of Assam. Temporary and permanent displacement of people owing to river bank erosion and flood have seriously threatened the occupants. Abrupt floods during the monsoon period have inundated and washed away vast plots of land making the medium and smallholders helpless. Similarly, bank erosion has some prolonged consequences by displacing the residents as they become destitute. The occupants have also lost their source of livelihood due to frequent bank erosion along the Beki River. During 2007-2017, a remarkable change was observed along the cross section C-C/ where the right bank migrated up to 1.1 km towards the west and the left bank towards west for about 1.6 km. Similarly, along E-E/ cross section, the right bank shifted towards east for about 1.77 km, whereas the left bank shifted towards east for about 1.87 km. Balikuri and Pachim Dewaldi villages have witnessed the maximum permanent displacement of its households due to flood, while Ganakgari followed by Kalgacchia and Bordonga have recorded the most temporary displacement of its households owing to bank erosion during the study period. Though such catastrophes cannot be stopped permanently but its repercussion can be prevented to a certain extent by adopting comprehensive strategies. Scientific studies are required for the construction of micro dams and taming of rivers in favourable locations applying geospatial technologies. The foremost initiative would be to

map and demarcate the flood and bank erosion-prone regions and to develop plans and policies to mitigate the same. Hence, this research study will act as a preliminary investigation for the researchers, academicians, NGOs, Govt. officials to further work on it.

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