

## GEOMORPHIC CHARACTERISTICS OF BHANGLA CHANNEL AND ITS IMPACT ON REGIONAL DEVELOPMENT: A CASE STUDY ON PURBA GOPALPUR VILLAGE

Sahina Khatun\*and Sahajahan Mollick\*\*

### ABSTRACT

Initially, it was flowing as a small and narrow 'nala' and since then it has been widening, deepening & lengthening also by severe flood occurrences. As a result the morphometry, hydraulic geometry, ferocity etc also experience change. Such evolution of the 'Bhangla' the said nala has modified the land use/ land cover pattern of the concerned area and has immense impact on agriculture, irrigation, pisciculture etc. But at same time it also causes of miseries in terms of flood event, transportation problem, maltreatment, maniac due to unscientific use of the channel. So, this work is endowed to convey the message that if human being is able to cultivate its economic potentialities, ecological justification, 'Bhangla' would dedicate itself for human as well as regional development.

**Keywords:** *Geomorphogenesis, Morphometry, Hydraulic regime & Hydraulic geometry, Regional Development.*

### INTRODUCTION

Each and every tributary (channel) plays an important role in economy, social and cultural lives and the modification of it also modifies the life. The Bhangla is not exception of that. Due to changing geomorphic characteristic of Bhangla, land use & land cover of its adjoining areas have witnessed dramatical changes and also different problems. All such shift & modification of the Bhangla have been documented on village Purba Gopalpur as case study. So in this paper, an attempt has been made to assess the problem and prospect of channel and to propose some remedies for bringing out longterm profit for human being without hampering channel sustainability.

### OBJECTIVES

The prime objectives of this micro level study are-

- To explore the historical background of the Genesis, Geomorphogenesis ,Morphometry of Bhangla channel.
- To examine the nature and pattern of flood characteristics and to structurise the factors responsible for flood.
- To bring out the changing land use pattern with the channel evolution.
- To highlight the agriculture, pisciculture, irrigation of the village and impact of the channel on such patterns.
- To identify the problem series facing by the villagers.
- To detect human interference on channel landscape.
- To focus on what types of government initiatives have been adopted to mitigate the problems.
- Lastly, an attempt has been made to formulate some remedies in respect of the concerned problems with the help of local wisdom and to find out the better prospects to amplify the status of these resources.

### STUDY AREA

The study area, Purba Gopalpur is situated at the left bank of Bhangla channel. The latitudinal extension is 24°11'40"N-24°12'11"N and longitudinal extension is 87°56'44"E to 87°57'26"E. The village is located about 20km away from Rampurhat, town of Birbhum District, West Bengal. The study area is located in the Birbhum district. Therefore, the general set up is almost same as the district. Geologically, the region is characterised by Chotonagpur plateau character and physiographically it is characterised by undulated plain land with an average elevation of 34 mts. from MSL. The study area slopes from east, north-east to west, south-west direction. The area enjoys subtropical humid climate with hot-wet summer & cool-dry winter. The soils are mainly alluvial and natural vegetation is generally deciduous type.

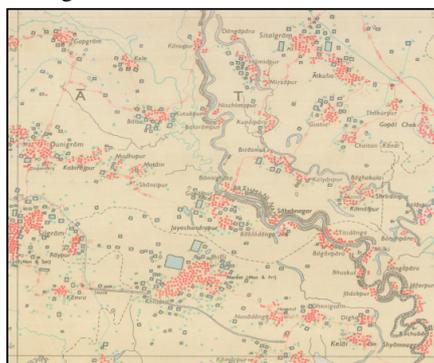


Plate-1: Location of Purba Gopalpur on Toposheet 72 P/16

\*Research Scholar, Dept. Of Geography, Visva Bharati, Santiniketan

\*\* Research Scholar, Dept. Of Geography, Visva Bharati, Santiniketan

**DATA BASE & METHODOLOGY**

Data for the present study has been collected from both primary and secondary sources. Information relating to the Channel is mainly collected by extensive field survey, Empirical & questionnaire survey have been conducted to get land use, agricultural irrigation data etc. Apart from that the Panchayet & B.L.L R Office Records, District Census books, etc. are also important as secondary sources. For calculating discharge the simple equation ( $Q = w \times d \times v$  Where  $w$  = channel width,  $d$  = channel depth,  $v$  = average velocity) is used and for computing co-relation, Pearson’s Product moment correlation is applied.

**HISTORICAL BACKGROUND OF BHANGLA CHANNEL**

An aroma of interesting history is concerned with the genesis of Bhangla channel. Before 1978, the Bhangla was flowing as a fragmented and narrow nala with an average width of about 7-10 mts and villagers used to cross the channel by putting a six tires ladder across the channel. It was July, 1978, a severe flood was appeared in Brahmani river and such devastating flood broke the southern bank of Brahmani. So, flood water with huge volume and swift velocity breached the embankment and the nala was widened and deepened significantly. From that time, the channel is locally known as Bhangla as it was accentuated by the ‘Bhagan’. Still today, floods have been playing important role in the changing faces of Bhangla channel morphology

**GEOMORPHIC SCENARIO OF THE BHANGLA CHANNEL**

*i) Geomorphogenesis:* The Bhangla is gradually extending, widening and deepening itself through different geomorphological processes. The processes which are responsible for shaping the Bhangla are –

<i>Broad Process</i>	<i>Micro Process</i>
Channel deepening	Vertical corrosion by peak discharge, water eddies or whirling
Channel widening	Lateral erosion by mechanical weathering, collapsion & slumping of valley walls
Channel lenthening	Mouthward erosion

*ii) Morphometry:* ‘Measurement of the shape, or geometry of any natural form-be it plant, animal or relief features- is termed as morphometry.’(Strahler, 1969).The morphometric characteristics of the Bhangla channel within Purba Gopalpur mouza are described here:

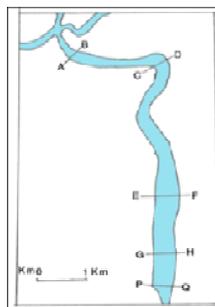


Plate-2: Different Cross-section Stations along Bhangla Channel

**Table -1: Channel Geometry of the Bhangla within Purba Gopalpur Mouza**

Sl. No.	Gauging Station	Width (m) Bank to bank[W]	Wetted part (m)	Dry part (m)	Depth (m) from bank top to channel bed [D]	Water depth (m)	D/W ratio	D×W (sq.m)
1.	At the east of Motain village where three tributaries merge with Bhangla (north of PurbaGopalpur)	25.40	5.60	10.20	3.80	0.22	0.1496	96.52
2.	500 mts. downstream from 1 <sup>st</sup> station	47.00	27.00	9.20	3.60	0.30	0.0766	169.20
3.	770 mts. downstream from 2 <sup>nd</sup>	70.4	42.95	9.78	7.15	3.00	0.1112	459.74

	station							
4.	420 mts. downstream from 3 <sup>rd</sup> station	62.45	29.95	26.40	3.87	0.40	0.0619	241.68
5.	290 mts. downstream from 4 <sup>th</sup> station (south of PurbaGopalpur)	58.26	12.30	28.50	4.93	1.53	0.0846	287.22

Source: Field Survey and Laboratory Analysis, January 2011

**Table -2: Hydraulic geometry of Bhangla channel**

Sl. No.	Gauging Station	Cross-sectional area of wetted portion (m <sup>2</sup> )	Velocity (m/sec.)	Discharge (m <sup>3</sup> /sec.)
1.	1 <sup>st</sup> Station	1.23	0.07	0.086
2.	2 <sup>nd</sup> Station	8.10	0.065	0.53
3.	3 <sup>rd</sup> Station	119.7	0.076	9.09
4.	4 <sup>th</sup> Station	11.98	0.059	0.71
5.	5 <sup>th</sup> Station	18.82	0.05	0.94

Source: Field Survey and Laboratory Analysis, January, 2011

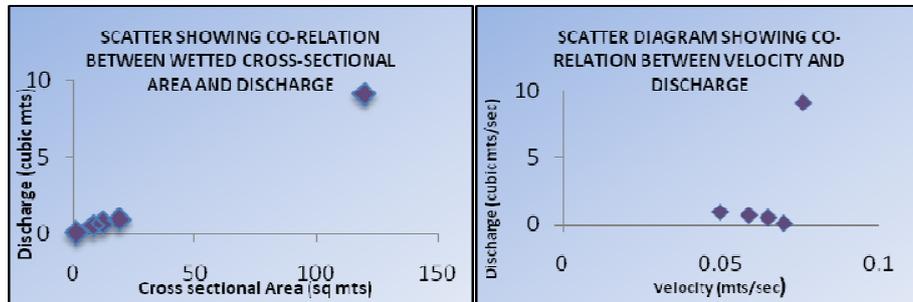


Fig.-1: Correlation of Discharge with Crossectional Area and Velocity

**Table -3: Hydraulic regime of Bhangla channel within Purba Gopalpur**

Sl. No.	Parameter	Pre-monsoon	Monsoon	Post-monsoon
1.	Wetted channel length (km)	1-1.5	2-2.5	1.5-2
2.	Flow character	Almost stagnant	Ferocious	Moderate
3.	Average discharge (m <sup>3</sup> /sec.)	1.85	16.26	2.27

Source: Field Survey, January, 2011

**iii) Bank & Bed materials:** An intensive field study at five stations reveals that materials of both banks are clayey soil with friable silt while bed materials consist of thick mud; some patches of blackish silt. As the both bed and bank materials are non-cohesive and easily erodible, the width and depth of the channel is increasing.

**CHANGING SCENARIO OF THE BHANGLA CHANNEL – COMPARATIVE STUDY**

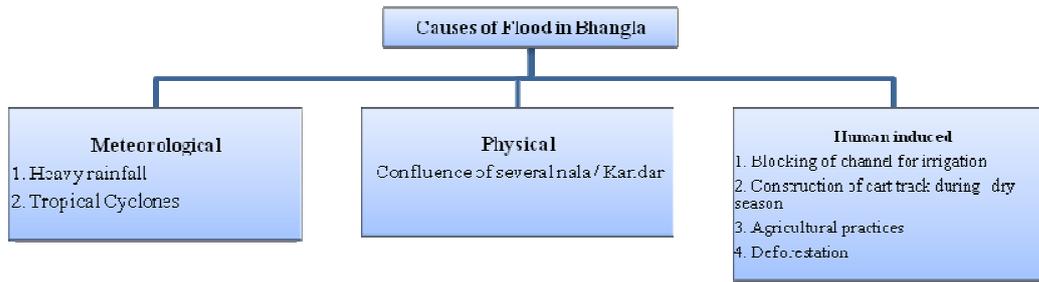
Some noteworthy changing characters of the Bhangla channel are –

- i. Before 1963, as said by an older villager, there was a unmetalled road connecting Purba Gopalpur and Motain in the place of Bhangla channel. But after the flood of 1963, it becomes a narrow nala of 5-6 mts wide. But over the years, the channel has got intensive change. Now, the width of the channel varies from 30-70 mts. as well as depth is also increasing.
- ii. In past, flood was seldom occurred but recent study reveals that ferocious and devastating flood occurrences become a common phenomenon in every monsoon.
- iii. In past period, the entire area was characterised by cultivable waste land and grassland but due to multifacet uppliments of Bhangla channel, waste lands are turned into mulberry and paddy dominating cultivated land.

Recently, man induced change is found in the channel. The perennality of the channel is directed by human action through blocking, digging for irrigation and fishing purposes.

**FLOOD REVIEW**

Basically Bhangla is a flood induced channel and origin of Bhangla is related with a devastating flood. So flood has a huge impact on the channel itself & its surrounding areas.



According to the perception of local people, the frequency of flood is increasing day by day (from 1 time to 2-3 times within a year). Though flood is not a new phenomenon in the Bhangla, but, the flood of 2000 was most devastating, ferocity of which agitates the memory of experienced persons.

**Table -4: Flood Review of 2000**

Sl. No.	Particular	Details
1.	Flood height	7 ft.
2.	Flood duration	9 days
3.	Loss of lives	Nil
4.	Loss of livestock	N.A.
5.	Damage of mud built houses	Fully-43 Partly-76
6.	Loss of agricultural land due to invasion of Bhangla	Almost 2-3 bigha
7.	Other damages	A building up bridge was wash down.

Source: Dunigram Panchayet Office

**ASSESSMENT OF DEVELOPMENT**

Regional development can be obtained through different parameters. Here, the impact of Bhangla channel on regional development particularly on Purba Gopalpur village can be perceived through following indicators-

**Occupational structure**

Because of alluvial soils, irrigation facilities, farming is the prime occupation of the villagers.

**Table -5: Occupational Structure**

Sl. No.	Occupation	No. of engaged person	Percentage
1.	Farming	77	55.00
2.	Daily labour	42	30.00
3.	Business	9	6.43
4.	Animal husbandry	6	4.28
5.	Self-help group	3	2.14
6.	Services	2	1.43
7.	Others (priest)	1	0.714
8.	TOTAL	140	100%

Source: Questionnaire Report, January, 2011

A spatio-temporal change of landuse/ landcover due to changing character of the 'Bhangla' has been highlighted.

**Table -6: Land use/Landcover Pattern& its temporal Changes**

Sl. No.	Land Use Category	Before 1978		2010-11	
		Area in sq.km.	Area in Percentage	Area in sq.km.	Area in Percentage
1.	Residential	2.3	10.91	3.75	17.79
2.	Agricultural	11.37	53.94	13.21	62.67
3.	Drainage and water bodies	1.31	6.21	2.06	9.77
4.	Cultivable waste	5.75	27.28	1.75	8.30
5.	Roads	0.35	1.66	0.31	1.47
		21.08	100	21.08	100

Source: Field study and laboratory analysis, January, 2011

### Agriculture

Agricultural land use pattern of the study area includes net kharif cultivated land, rabi & Boro land, pre-kharif or Ausland and current fallow land. Due to the evolution of the Bhangla, mulberry cultivation has increased on both banks of the channel and boro cultivation has been newly introduced and non-monsoon crop cultivation has been also increased.

### Irrigation and Bhangla Channel

According to the people's perception (95%), the Bhangla is the most efficient means of irrigation than other means available in the area.

**Table – 7: A Comparison of Irrigation from Bhangla and Other Sources:**

Sl. No.	Source of Irrigation	Irrigated land	
		Bigha	Percentage
1.	River and canal	75	38.26
2.	Ponds	8	4.08
3.	Submershal	16	8.16
4.	Bhangla	97	49.50
5.	TOTAL	196	100

Source: Questionnaire report, January, 2011

### Pisciculture and Bhangla Channel

Another important economic setup of Bhangla channel is pisciculture. Though no concrete data is available about the past condition of fishing even today also, but, it is clear from the survey that large degree of fishes are available in the channel.

- Different types of carp fish, retail fish, cat fish are found available and deep doahs are the storages of fishes.
- Different types of equipments like various types of nets, hook, boat, donga are used to catch fish.
- During monsoon and flood period, fishing potentiality is increased to a reasonable level.
- The deep 'doahs' are the storages of fishes.
- As the channel is not permanent and maximum water is used for irrigation, so there is no organised fishing. Lack of finance and technological expertise is another obstruction.
- People of the area take fishing as secondary occupation but during monsoon time, it becomes main source of earning or supplementary occupation for few families.
- As per human perception, fishing environment was conducive enough even before 30 years ago.

Lastly, it can be said that if justified plan is seeded for wise use of channel for pisciculture; it will yield great economic outlay without hampering natural ecology and environment.

**Table -8: Educational Status**

Total population	Total literate	%	Total illiterate	%	% of literate of Birbhumi Dist. (Census, 2001)
140	62	44.28	78	55.71	62.16

Questionnaire Report, January, 2011 & Census, 2001

### PROBLEM OF THE STUDY AREA

- Due to frequency of flood with greater magnitude on one hand inversion of Bhangla towards agriculture land increases and on the other hand monsoon crops become washed down.
- Lack of knowledge of Farmers about Environment based suitable crop.
- The village Gopalpur is totally detached from the other villages because there is no bridge over Bhangla.
- Physical barrier have made this village as remote and therefore very low rate of Educational Status is found.
- Improper implementation of govt. schemes i.e. after sanction of 14 lakh rupees (1996) no bridge is constructed.

### REMEDIAL MEASURES

1. Flood is natural phenomena therefore, it cannot be alleviated rather some structural and non-structural adjustment should be taken.

2. 'Profit Pond means a water unit from which both ecological and economic profit will be drawn.'(Pal, 2011) which can be implemented for non-monsoon irrigation as well as ground water recharge.
3. Jaladhi, Jaya, Kajal etc. flood resistant species of paddy should be recalled.
4. Economically profitable but less water claiming crops like onion, potato, mustard seed, vegetables, til, pulses etc. should be given priority than Boro cultivation.

#### **CONCLUSION**

Bhangla is one of the prosperous channels of the region and it has made the region concerned to its zone of influence. Such developmental scenario has been proved by the case study on Purba Gopalpur village which is situated at the left bank of the channel. As the size of Bhangla channel is increased, the water content is also increased and it provided opportunity to human being for economic use of the channel by means of agriculture, irrigation, pisciculture etc. It reduces the cultivable wasteland as well as increases the production and productivity of crops. But at the same time, it often lashes the village by hazardous flood, makes the village isolated from other facilities and communications and it is galloping the agricultural land gradually. In this connection, most of the channel dependent people have clearly expressed that they are maximally gained by the Bhangla rather than losses. Their view points are that, if a bridge is built across the channel, the Bhangla will be the driver of development from all around direction. But from deep ecological point of view such intensive and over interference human activities into the channel, have been detrimental for the channel survivability.

So, for long term sustenance of the channel and long term profit gaining, abridgement is necessary between human interest and nature. Therefore, the Govt. or non-govt. authorities and dwellers, those are directly or indirectly involved with the channel, should approach towards channel resources with an integrated consciousness and deep ecological sense.

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