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# Assessment of Socio-Economic Impacts of Surma River Bank Erosion Using GIS & Statistical Study

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## Abstract:

Sylhet city is located on the bank of the Surma River is the most beautiful city with natural bounty. Bank erosion is a common problem for city dwellers and land owners due to unsupported bank. The purpose of this research was to identify socio-economic impacts of riverbank erosion on people of Mugholgaon union includes Lalargaon, Talukpara, Fatehpur & Khalpar villages. It was hypothesized that the socio-economic impacts of riverbank erosion on affected people are quite significant and enormous. Satellite Images for the year of 1990 to 2018 were used to delineate the changes of the river. A comprehensive analysis was carried out in this study using the state of the ARC-GIS (Geographical Information System) technology to assess the river bank shifting of the Surma River in respect of bank erosion and accretion at Lamakazi union. The study revealed that for long time this area has been suffering with the erosion problem & shifting characteristics of Surma River.

**Keywords:** ***River bank erosion, Accretion, Socio-economic impact, Geographical Information System (GIS).***

## 1 INTRODUCTION

Bangladesh, a riverine country, is suffering from acquit riverbank erosion which compels millions of her population to be displaced from their place of origin. As such, 283 locations, 85 towns and growth centers, along with 2400 kilometers of riverbank line in Bangladesh are vulnerable to erosion [1]. Every monsoon season, a huge number of people become landless and lose their livelihood. So, their demand to the government for the reallocation is much more than the available land resources with the government. Therefore, victims have to search land themselves, and it creates neo-refugees with many social problems [2]. River bank erosion is a natural geomorphic process which occurs in all channels as adjustments of channel size and shape are made to convey the discharge and sediment supplied from the stream catchment. This erosion has been emerged as one of the most important environmental hazards [3]. Riverbank erosion has both direct and indirect effects on human life and socio-economy of Bangladesh. Bangladesh is the largest delta in the world formed by the Padma, the Jamuna & the Meghna river system. This delta is characterized by flat terrain interlaced with an intricate system of 700 rivers, canals & streams with a total length of approximately 22,155 km (BBS 1979, 1984) which carry an enormous quantity of sediment-laden water downstream. Over 92 percent of the annual runoff generated in the river area flows through Bangladesh. Which is only about 7 percent of the total catchment's area. Bank erosion and channel shifting if the untrained alluvial rivers of Bangladesh are big problems to the socio-economic & environmental sector of the country. Along with the flood water, the rivers of Bangladesh carry huge amounts of sediments, an estimated 2.4 billion tons/year [4].Riverbank erosion is a common issue to many countries in all parts of the world; though the nature and impact of erosion may vary. It is a big problem to the socio-economic sector of our country too [6].River bank erosion is one of the natural disasters that causes displacement of inhabitants who previously lived near river banks. Many of those erosion distressed people loose not only their homes, means of livelihood and assets but also their previous identity, and they, therefore, often try hard for recognition of an identity [7]. River bank erosion is not a serious problem so far as no human settlement is present. But this natural hazard becomes a disaster when riparian buffers are not maintained, and human settlements are situated too close to eroding banks [7]. The severe impact of flood and erosion is the loss of homestead that makes the people more vulnerable to live a decent life. For better livelihood the displaced people usually moved to nearby areas but migration to distant places are also common. Displacement is the immediate impact of flood and erosion. [8]. On the Surma River, significant river erosion has taken place due to slope failure. These causes widen the river channel, filling the river channel, losing the land, property, etc. As we know that Sylhet City is situated on the bank of the Surma River, it may hamper the safe living for the people who live near the bank [9].

## 2 STUDY AREA

The focus is on the area on the bank line of Surma within Mugholgaon union beside Lamakazi admiral MA Khan Bridge are considered. The study area lies between latitude 24º54'34.88 ''N to 24º55'07.53''N and longitude 91º44'02.70''E to 91º 43'17.05''E from Lalargaon to Khalpar village.


**Figure 1: Study Area**

## 3 METHODS AND METHODOLOGY

This chapter contains the research methodology of the study. The chapter deals with various steps- study area selection, channel shifting, sample design and procedure, sample size determination, data processing, analysis- for completion of the research. Actually it focuses on the methodologies followed for conducting the research work from selection of the study area to analysis of the final report. For the present work data collection methods and techniques were mainly household questionnaire survey and informal discussion with the aged people who have experienced erosion.

### 3.1 Data analysis and interpretation from collected image:

This study is carried out using Landsat imagery. The spatial resolution of Landsat imagery is sufficient to identify and monitor the dynamics of river systems such as migration of the confluence point of rivers, movement of river channels and eroded and deposited riverbanks. All images are downloaded from November to February because that time images were cloud free. So analysis was much easier than other time. Initially purposes was to download satellite image about 10 years interval but in practical approach that seems to be difficult as same time interval images were too cloudy or too unfit for extracting information from them that's why suitable images were collected at different time interval.

**Table 1: Satellite Data**

| Year | Acquisition Date | Satellite | Source |
|---|---|---|---|
| 1990 | 16.01.1990 | LT05 | USGS |
| 1999 | 19.12.1999 | LE07 | USGS |
| 2018 | 12.31.2018 | LC08 | USGS |

### 3.2 Determination of erosion & accretion:

Geographic information system (GIS) & Remote Sensing (RS) are used in data encoding and analyzing purposes. ArcGIS 9.1, ERDAS Imagine 2014 version software have been used in extracting the data from the high resolution remote sensing image. The data of river bank line is extracted from the available satellite imagery in different time period, based on spatial overlays techniques.

#### 3.2.1 Image collection

The years were chosen on the basis of availability of imagery as well as for better understanding of the frequency of river bank migration or bank line shifting. The river banks could be mapped precisely that enabled local characterization in more detail. All the images were collected between the time period of November to February as this time period was suitable for analyzing image because images were cloud free and water level was not high that time. Images were downloaded from https://earthexplorer.usgs.gov/ website.

#### 3.2.2 Image preprocessing

Geographic Information systems (GIS) and Remote Sensing (RS) are used in data encoding and extracting the data from the high resolution remote sensing image.

#### 3.2.3 Subset of images

All portion of an image is not necessary for analysis that's why subset image were carried out for finding desire specific study area. The area of the Landsat imagery is 29,224 km². Approximately 2.13 km² area are taken as subset for the study. It makes it easier to compare the riverbanks, deposited sandbanks, riverbanks erosion and movement of channel.

#### 3.2.4 Change detection

Change detection is used to detect the variation of the nature and state of an object, area or phenomenon in time, remotely sensed images are frequently used to detect the difference of nature and state of an object, area or phenomenon over time. Change detection involves the use of multi date image to identify the change of land covers between two dated images. Several methods are used to detect the changes. On-screen digitizing is the most appropriate technique for the study that's why on screen digitizing was carried out for change detection purposes. Shape file was created after on screen digitizing.

**3.2.5 Determining erosion accretion area:**
Putting one shape file over another, erosion accretion area were selected by human interpretation & determined by measuring tool.

**3.3 Sampling Procedures and Methods**
The study area covers four villages of Mugholgaon union. From the village's individual household are selected randomly. The sample design and procedures are presented in the following manner.

**Table 3: Number of Respondents**

| Name of the villages | Total no. of households | Sample of households |
|---|---|---|
| Lalargaon | 111 | 6 |
| Talukpara | 230 | 8 |
| Fatehpur | 148 | 7 |
| Khalpar | 347 | 9 |
| Total | 836 | 30 |

**3.3 Data Collection Method**

Data collection has been done for a week from 14.03.2019 to 21.03.2019 and information for this study has been collected through primary sources. In addition to secondary data has been collected from various organizations, Newspapers, Journals and other published literary works on Riverbank erosion.

- **Primary Data**
  Primary data has been collected from the local people – both victims and people who have witnessed Riverbank erosion-using both methods of formal and informal interviews with the households and key informants through the questionnaires. Informal discussions with various classes of people and direct field visits have also been done.
- **Household Questionnaire Survey**
  In order to carry out household survey a detailed pre-structured questionnaire for individual respondents with both open and close ended questions has been formed as the key instrument for primary data collection.
- **Informal Group Discussion**

While conducting the survey in the study area informal group discussion was carried out with different kinds of people. This informal meeting has been conducted in the gathering places of the locality. The issues related to riverbank erosion and its impacts were discussed and problems of the victims were identified.

**The interview focused on:**

- Erosion experience
- Measures they have observed to protect erosion
- Nature erosion and how the river shifting its channel
- Peoples sufferings and impacts of erosion
- Change of Surma river course
- Impacts on society

**3.5 Method of Data Processing and Analysis**
Data have been processed through tabulation with the help of SPSS software before analysis. Later this data have been presented with tables & graphs.

## 4. RESULT AND DISCUSSION:

**Table 2: Population Data of the Selected Villages**

| Name of the Vilage | Population | Households |
|---|---|---|
| Lalargaon | 535 | 111 |
| Talukpara | 1075 | 230 |
| Fatehpur | 812 | 148 |
| Khalpar | 1973 | 347 |

Source: (Data provided by Upazila Statistics office, Mugholgaon)

**4.1 Determination of total area of Erosion and Accretion:**
Information's were extracting by digitizing the images of different years found that severe erosion occurred at Lalargaon, Talupara, Fatehpur & Khalpar villages with amount of 1,07,500 m², whereas accretion were taken place with amount of 1,31,388 m².

**Table 4: Overall Erosion & Accretion between 1990 & 2018**

| Year | Erosion (m²) | Accretion (m²) |
|---|---|---|
| 1990-1999 | 107500 | 131388 |

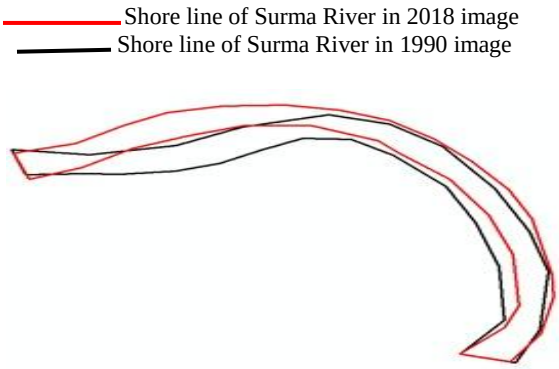


**Figure 2: Overall erosion & accretion between 1990 & 2018**

**4.2 Field Study Result:**

Surma riverbank erosion at Mugholgaon union is not a recent phenomenon. The people of Lalargaon, Talukpara, Fatehpur, Khalpar villages have been experiencing this for the last fifty years. According to the elderly people due to some manmade reasons erosion took severe form. Personally the victims have fought against riverbank erosion. But that was not enough against natural calamity like riverbank erosion. Total erosion & accretion area was 107500 m² & 131388 m² respectively between 1990 & 2018. Being compelled they moved to various places for shelter. They lost homesteads, cultivable lands and as well as lost their livelihood. They were compelled to change their profession; they were compelled to untie their social bond. Their horrible sufferings and miseries conveyed to from generation to generation.

Actually weak-planned and interest-driven attempts to control riverbank erosion have failed to reduce the socio-economic vulnerability of the people; moreover it has wasted huge national resources.

## 5. CONCLUSIONS

According to the opinion of the elderly people of the locality they are fighting against riverbank erosion for the last half century. A large area between Lalargaon to Khalpar has been destroyed to Surma. Many people and families are affected and have gone

through untold miseries. A long time research work can give vivid picture of the miseries, sufferings and social changes the local people have gone through. In this short and time-bound research to do something meaningful is really tough. With all the limitations following are some important findings of riverbank erosion at Mugholgaon union has been identified. Bad governance has acted as a catalyst for the miseries of the affected. General people believe that only honest political leaders could work efficiently to control calamity like riverbank erosion.

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