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FACTORS INFLUENCING MIGRATION IN RIVERBANK ERODED AREAS OF ASSAM, INDIA

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Riverbank Erosion, Migration, Population Displacement

ABSTRACT

The paper tries to investigate the factors influencing migration in the riverbank eroded areas. Logistic regression method has been used on the data collected. Primary data are collected from a household survey in Dhubri and Dhemaji districts of Assam during January-February, 2016 with the help of a semi-structured schedule. Altogether 437 household surveyed in the study districts (194 from Dhemaji district and 241 from Dhubri district). Using logistic regression approach, it is found that problems arise due to riverbank erosion such as loss of crop-land, education problem, transportation problem highly influence the migration decision of the riverbank erosion victims. It is also revealed that migration normally very high in eroded areas and riverbank erosion can be regarded as a major cause of population migration.

1. INTRODUCTION

Environmental change or environmental degradation becomes an important factor in population migration (Warner, 2010). These environmental degradations are of various forms, for example land degradation, climate change, flood and riverbank erosion, tsunamis, landslides, earthquakes, wildfires and volcanic eruptions etc. (Black et al., 2011) which are often referred to as natural disasters. Among these environmental disasters, climate change becomes a global concern due to its severe effects. Climate change mainly leads to environmental problems like dry land degradation and river bank erosion. Dry land degradation is an important form of land degradation due to climate change (Shah, 2005). Dry land degradation is a central cause of population migration in Gujarat, India. Similarly, Flood and riverbank erosion also become a common problem in some countries like India (Das *et al.*, 2013) and Bangladesh due to climate change (Uddin and Basak, 2012). All these forms of environmental change triggers population displacement. The displaced person decides to migrate in search of settlement and livelihood. In Bangladesh the effect of riverbank erosion become too severe and displaced large number of people who migrate elsewhere (Gray and Muller, 2012). The impact of riverbank erosion can be measured through loss of homestead, loss of cropland, loss of livestock, *etc.* (Uddin and Rahman, 2012). Erosion also destroys the existing mode of production (Nayak and Das, 2011). These results forced migration (Das *et al.*, 2013) or environmental refugee (Bates, 2002). Similar is the case in India where states like Bihar and Assam are highly affected by flood and riverbank erosion (NDMA, 2014).

Assam, a state of northeast India, is highly affected by flood and riverbank erosion. The mighty river Brahmaputra flows through the middle of Assam and touches many districts of the state. Every year large plots of land are eroded by the river Brahmaputra and its tributaries (Phukan *et al.*, 2008). In 2014 more than 0.16 percent of total land has been eroded (GOA, 2014). The erosion results displacement of a significant number of population. Moreover the erosion caused different types of socio-economic problems such as loss of cropland, loss of homestead area, household properties, loss of livelihood, education and transportation problems, environmental problems etc. (Mili *et al.*, 2012). These all make the existing poverty situation worse among the marginal farmers as they lost their sources of livelihood (Nayak and Das, 2011). Thus the riverbank erosion forces them to migrate in search of livelihood (Baishya, 2016). In this context the paper tries to examine the factors related to riverbank erosion that influences the migration decision of the erosion victims. The study is different from the other studies on the ground that it tries to examine both the short term (Temporary) and long term (Permanent) migration that occurred due to riverbank erosion[1] from economic point of view. The other studies show the amount and extent of riverbank erosion in Assam from geographical and geological point of view.

Literature review reveals the relation between coping mechanism and migration. Availability of coping mechanisms in the low affected areas hinders the decision to migrate (Bormudoi and Nagai, 2017). Coping mechanisms temporarily help the flood and erosion victims to incorporate their incomes

for their livelihood (Ashraf and Routray, 2013). Besides this, coping mechanisms also help the victims to manage their risks and adjust with poor economic conditions (Dercon, 2005). These coping strategies may be in the form of selling of livestock, selling of bamboos and woods, selling of homemade products, selling of land etc. (Mili *et al.*, 2012).

The paper is structured into five sections. The literature reviews are discussed in the second section. Methodology of the study is explained in the third section. The fourth section presents the results estimated and the discussions. Finally, the paper concludes with summary of findings in the fifth section.

2. LITERATURE REVIEW

According to Piesse (2014) there are various factors that influence migration decision of any territory, such as socio-political, economic, ecological etc. Studies conducted on these various ground of factors are discussed in the following:

Political Factors

Political factors can be considered as push factors that influence the decision to migrate an individual. Political conflict between states due to politicization of religious and ethnic identities is potential cause, which influences the migration decision (Piesse, 2014). The Piesse's work is the strategic analysis of the factors of migration and shows that migration is influenced by various factors such as political, economic and environmental factors.

Economic Factors

Economic factors that leads to internal migration may includes urbanization, wage differences between urban and rural areas, better employment and other recreational facilities. Most of the studies indicate that urban development or urbanization through expansion of industrial sector which raises employment opportunities is a source of rural-urban migration (Byerlee, 1974; Ledent, 1982; Roger, 1982; Bhagat, 2011). The urban growth rate in Africa are among the highest in the world, averaging about 7 percent annually, with several cities having growth rates in excess of 10.5 percent (Byerlee, 1974). Due to this high growth rate, wage rate is also higher in the urban areas. To that extent the urbanization process leads to an economy from traditional agrarian to industrial society. Moreover, the wage rate differences due to urbanization raises the differences in income earnings between the urban and rural areas. Hence people expect higher income from the urban areas by which they can improve their family condition. This concept was found by testing the hypothesis of purposeful behavior of the migrants (Schultz, 1971). It shows that people migrate because they believe that, by migrating, they can earn more income and smoothen their economic condition and that of their family. Similarly, it is also reveal that migration in LDC's undertaken in order to improve a person's position in terms of the latter income statistics (Stark, 1984). Thus it can be concludes that the people who affected by riverbank erosion loss their income earning sources and to sustain their livelihood they migrate to the nearby areas and urban areas where they can improve their economic condition (Uddin & Basak, 2012).

Socio-Economic and Demographic factors

"*Socio-economic issues are the factors that have negative influence on an individuals' economic activity including: lack of education, cultural and religious discrimination, overpopulation, unemployment and corruption*", (UN statement, 1998). These factors affect migration decisions of a household. "*The socio-cultural context in different literatures describes differently that effect migration decision"* (Taylor, 1969). Various studies also describe that age, sex, marital status, caste differences influence an individuals' decision to migrate (Haan and Rogaly, 2002; Frajeka, 1968; Lutz and Qiang 2002). Long (2005) also argue that socio-economic mobility influences the migration decision. Among the socio-economic related issues poverty can be called as another factor that influences the migration decision. This poverty situation arises due to environmental degradation (Irfan, 2007), increase in workers and lack of opportunities (Tickymyer & Duncan, 1990), loss of agricultural production, etc. (Kabubo, 2002). As a result, the poor people become more vulnerable to poor and migrate in search of a substitute livelihood system. Moreover, poverty and vulnerability are likely to have two conflicting effects on migration: by providing incentives to migrate either as strategy for livelihood or out of destitution; but also by reducing the ability to migrate, because the transfer cost involved are too high. Thus it indicates that migration play a significant role in poor peoples' livelihood strategies throughout the developing world but may not be an option to the most destitute amongst the poor (Waddington & Rachel, 2003).

There is a link between poverty, high fertility and undernourishment, on the one hand, and degradation of the local environmental- resource base and civic disconnection, on the other, in poor countries (Dasgupta**,** 1998). But among these, environmental degradation is a source of undernourishment (Rana and Nessa, 2016). Studies shows that poverty is indirectly related to environment degradation (Rana and Nessa, 2016; Uddin and Basak, 2012). In Kenya, it has been revealed that the impact of poverty of a household take place in the form of Poor health, low productivity, vulnerability to hazards, environmental degradation and unsustainable urbanization that becomes a challenge to the attainment of the Millennium Development Goals (Oluoko-Odingo, 2009).

Environmental Factors

As said earlier, migration decision is influenced by environmental degradation which occurs due to environmental change such as climate change and variability. This climate change and variability or rising temperature can lead to different forms of negative consequences like sea level rise, flooding, changing river flow, uneven distribution of rainfall, more frequent heat waves, increased insect-borne diseases and change in agricultural production (Kolstad, 2011). Among these, abnormal flooding and changing river flow due to climate change leads to riverbank erosion which in turn affect human activities. These all influences migration through population displacement, which are not explained in the standard theories of migration. The environmental factors have severe impacts on the displaced through its extreme events such as floods, tsunamis, landslides, earthquakes, wildfires and volcanic eruptions, which are well-known triggers of displacement (Black et al, 2011). These displacements tend to be relatively short distance, and are usually within a state (McMichael, 2012). Five dimensions of climate change i.e. economic, political, demographic, social and environmental drivers and variability have a potential effect on the drivers of migration, although these effects will vary between places and there is considerable uncertainty in what may happen at a place (Black et al. 2011). Thus it is argued that environmental change indirectly effect migration and causes "environmental refugee" (Bates, 2002).

Perch-Nielsen *et al.* (2008) focus on migration associated with sea-level rise and river as well as coastal floods, and outline a conceptual model of migration decision-making in the face of hazards, using inductive reasoning on evidence from a series of case studies. Their study finds that in affected areas there are a range of adaptation options that provide alternative outcomes to migration, leading them to conclude that floods, at least, will not likely be a major mechanism by which climate change and variability will trigger mass migration. But migration is a part of adaptation response to climate change and variability impacts to natural resource conditions and environmental hazards (Bardsley and Hugo, 2010). On the basis of literatures and case studies it indicates that environmental change in the form of climate change and variability severely affect the people that makes them poor for which their adaptation process at a time becomes migration as their substitute livelihood system. Hence they argued that researchers should focus on climate change and variability related migration that can help to frame planning and policies to reduce migration due to climate change. In contrast, Penning-Rawsel *et al.* (2013) with primary observation in Bangladesh shows that some of the environmental factors although forces people to move, but they can resettle in the affected areas with some substitute livelihood options. This type of environmental hazards includes cyclone and flood which are mentioned as push factors of population movement.

All the above evidences try to reveal that climate change and variability in some way influence migration. But, climate change and variability will not act alone in shaping population movement; rather, "*it produces environmental effects and exacerbates current vulnerabilities that make it difficult for people to survive where they are*" (International Organisation for Migration, 2009). A produced effect of climate change is river bank erosion that has a long term effect on population; because it displaces the people and forces them to migrate with different forms of effect such as loss of agricultural land, loss of production, loss of homestead area, destruction of transportation facility, loss of education status etc. (Uddin and Basak , 2012). In general the losses due to erosion show an increasing trend for which the displaced people migrate to nearby villages for their livelihood and survival needs (Harrington and Taylor, 1990).

Land degradation that occurs due to environmental deterioration also influences the decision to migrate. A study made by Gupta and Sarma (2010) shows that land degradation has a significant impact on outmigration. Land degradation reduces the income earnings of the farmers in the agricultural sector as people loss their agricultural land and make them landlessness. This indicates that land degradation is one of the main factors of rural outmigration, where outmigration may be short and long term (Shah, 2005). Income is the main factor of short term migration (Barbier *et al.* 1997). Most of the studies indicate that both population increase and environmental degradation impact on land degradation and raise the situation of landlessness and semi-landlessness, (Hirsh, 1990, Somathan, 1991, Lambin, 1999). This land degradation occurs in different forms like soil erosion, deforestation, desertification etc. which also arise due to changes in land use pattern. The natural disaster like riverbank erosion is another form of land degradation that creates a landlessness situation for the rural farmers and thereby loss of agricultural production for which farmers decides to migrate (Khan *et al.*, 2014).

3. METHODOLOGY

Study Area: It covers two highly river bank eroded districts of Assam, namely, Dhubri and Dhemaji. Dhubri district is located in the lower Brahmaputra Valley of Assam and Dhemaji in the Upper Brahmaputra valley of Assam. Dhubri district geographically placed between $90^0 15^{'}$ E to $90^0 20^{'}$ E longitude and $26^0 15^{'}$ N to $26^0 26^{'}$ N latitude. The district is situated at 30 meters above the sea level on average. Total geographical area of the district is 2176 sq km. The mighty river Brahmaputra is flowing through this district from east to west with its tributaries like Champabati, Gourang, Gadadhar, Gangadhar, Tipkai, Sankosh, Silai, Jinjiram etc.

The Dhemaji district emerges from the foot hills and stretches to the Brahmaputra river with Subansiri one side and the river Siang on the other. Geographically, the district situated between the 94^0 12' 18'' E and $95^0$41' 32'' E longitudes and 27^0 05' 27'' N and 27^0 57' 16'' N latitudes, the district covers an area of 3237 Sq. km and is a basically plain area lying at an altitude of 104 m above the mean sea level.

The two districts Dhubri and Dhemaji were selected as study area on the basis of erosion statistics of Assam in 2014, Revenue and Disaster Management Department, Government of Assam. Total area eroded due to erosion in Assam in 2014 was 12,579.13 ha, which is 0.16 percent of total area of Assam. In Dhemaji and Dhubri total area eroded in 2014 was 10,244 ha, which was 81.43 percent of total area eroded in Assam. This erosion displaced 22,057 families in the study districts.

The study districts are highly populated as per 2011 census. Total population of the study districts is 2.63 million, of which male population is 1.35 million and female population is 1.29 million and sex ratio is 953. Out of total population, schedule caste (SC) and schedule tribe (ST) population comprise 4.36 per cent and 12.64 percent respectively in the districts. The combined average literacy rate of the two districts is 83.15 and the combined density of population is 485 per sq. km. More than 90 percent population in the two districts lives in rural areas and agriculture is the main occupation of livelihood. Out of total main workers 33.01 percent are cultivators and 11.37 percent are agricultural labourers. There is 0.29 million ha total cropped area out of 0.54 (7.21 percent of the state) million ha in 2012-13 and area under high yielding varieties is 0.14 million ha during 2014-15. In 2014-15, the combined total net irrigated area is 1970 ha, which is only 1.10 percent of the total net irrigated area of the state. Major and Medium irrigation in the districts are low. Area under minor irrigation is 0.03 million ha in 2014-15, which is 5.23 percent of the state.

The farming system in the districts includes livestock as well as poultry farming and hence there is large number of livestock and poultry population. As per 2012 livestock census, Govt. of Assam number of total livestock in the districts is 1.65 million. Industrially both the districts are backward. During 2014-15, only 140 units of MSME (Micro Small and Medium Entrepreneurs) are registered which is 5.33 percent of the state's total MSME. Moreover, there are only 821 number of workers involved in these MSME units which is 4.01 percent of the state's workers (GOA, 2015). This low industrial and agricultural growth led the districts into far backwardness. From the perspective of backwardness, Dhemaji district emerges as the most backward district followed by Dhubri (GOA, 2015).

Sampling Technique

Multi stage random sampling methods have been used in this study. At first, Dhemaji and Dhubri district has been selected based on riverbank erosion status. Then one highly erosion affected Development Block (DB) from each district has been selected on the basis of information from circle office of each district. From each DB eight villages are selected for the purpose of this study. The villages selected as high, medium and low eroded randomly as all the villages are equally eroded and also from the non-eroded areas. From each category two villages selected considering similar socio-economic characteristics[2]. In each village 10 percent of total households interviewed randomly. In this way 194 households from Sissiborgaon DB of Dhemaji district and 242 households from South Salmara DB of Dhubri district are interviewed. Altogether 437 households are interviewed. Interviews are conducted with the head of the households when available and otherwise with any other adult member of the household. Besides acquiring socio-economic and demographic information, respondents are asked about the problems related to education and transportation caused by riverbank erosion. Respondents are asked whether their children drop out from school or couldn't attend school for long time due to river bank erosion. Questions regarding problems in transportation due to breaching of road for riverbank erosion have also been asked. Focus group discussions (FGD) are conducted in the villages to get some village level information. A semi-structured schedule has been used that comprised of river bank erosion status, migration (both short term and long term) with reasons as well as socio-economic and demographic characters of households. The schedule is translated into local language for better understanding of the respondents. The authors conduct the sample survey with the help of a local data enumerator during January - February months of 2016.

Method of Analysis

The logistic regression method has been used to analyse the problem. To see the cause and effect relationship between binary dependent variable and qualitative as well as quantitative independent variables, logistic regression is a useful method. As the study tries to see the factors influencing migration in the eroded areas, the dependent variable migration is taken as binary dependent, i.e. whether people migrate or not (1 represents at least one household member migrate and 0 represents no migration)[3]. Thus to see the effect of both qualitative and quantitative independent variables on binary dependent variable; the logistic regression model is used. The model is formulated as:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_n X_n + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, Y=1, if the migration happens and Y= 0 otherwise; β_0 is the intercept; β_1 …… β_n are the regression coefficients associated with the explanatory variables X_1…… X_n. The logistic form of the model explained below.

Regressing Y on X's using OLS will lead to three problems. First, the error-term, μ, obviously not normally distributed as we generally assumes, and more importantly, estimated probabilities can lie outside the range (0, 1). Furthermore, the error variance is not constant across the levels of the Xs. However, we can assume that 'P' follows a logistic distribution.

$$P = 1/ (1 - \exp [- (\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_n X_n)]) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$P/ (1- P) = \exp [- (\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_n X_n)] \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where, P/1–P is the odds of the outcome such as migration. It is clear from the equation that the logarithm of the odds, or simply log odds, is a linear function of the explanatory variables, X's as:

$$\text{Log } (P/1- P) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_n X_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Since P is assumed to follow a logistic distribution, maximum likelihood method is used to estimate the coefficients β_1 ….. β_n. Exp (β) represents the expected change in the odds of migration versus no migration per unit in the explanatory variable, other things being equal.

On the basis of the above explanations the model with the explanatory variables can be expressed as

$$\text{Migr} = \beta_0 + \beta_1 (Caste) + \beta_2 (\text{NAM}) + \beta_3 (\text{Occ}) + \beta_4 (\text{TPL}) + \beta_5 (\text{LVS}) + \beta_6 (\text{S\_Irr}) + \beta_7 (\text{Crr}) + \beta_8 (\text{L\_Lvs}) + \beta_9 (\text{Ed\_P}) + \beta_{10} (\text{Tr\_P}) + \beta_{11} (\text{W\_NREGA}) + \beta_{12} (F\_Inc) + \mu_i \ldots\ldots\ldots\ldots\ldots (5)$$

The explanatory variables used in the above logistic regression model are presented in the table below

4. RESULTS AND DISCUSSION

Summary of Statistics: Table-2 presents the basic statistics of the dependent and independent variables used for the analysis. Maximum, minimum and average values are used as basic statistical tools.

To see the effect of the explanatory variables on different types of migration: short term and long term migration, separate logistic regression models has been used. In all the models the explanatory variables are same but the dependent variables are taken as all migration, short term migration and long term migration. The results are presented in table-3.

All Migration: *Table-3* reveals that, number of adult members, cropland eroded, loss of livestock assets, education and transportation have greater influence on migration. The odds ratio's in case of the significant factors indicate that households with more adult members, loss of livestock, and cropland eroded are likely to migrate more. That is, the households facing these problems have higher probability to migrate. An important fact observed is the riverbank erosion induced education and transportation problem. During FGD's it has obtained that most of the households family members compelled to left the school education, unable to take admission and few others shifted to outside due to displacement. Similarly, erosion disrupts the road transportation system with the nearby locations, for which transportation problem arise in the erosion affected areas. That is why education and transportation problem considered as important problem created by riverbank erosion. Another important finding is that the families with higher number of adult members migrate more while the families with less adult

members migrate less. FGD's reveals that the families with less adult members try to adjust with the situation adopting some coping mechanism while either the responsible or the eligible adult member of families with higher adult members want to migrate to nearby towns in search of livelihood options.

Long term Migration: In case of long term migration also it has seen that crop-land eroded, loss of livestock, education and transportation problems have significant influence on migration. Besides this more adult members have effect on long term migration to some extent. The odds ratio's in case of long term migration indicate some different results. The households facing the cropland erosion problem and education problem are likely to migrate more (OR=7.94). Thus the results reveals that in case of community migration or family migration from the eroded areas Crop-land eroded and the problems related to farming have greater influence. Like this the other employment facilities also greater influence on long term migration. In this context the education problem also reveals the effect. Due to rising education problems people mostly decides to migrate urban areas. Therefore, education problem found have significant effect.

Short Term Migration: Similar the case found in case of short term migration also. It has seen that cropland eroded, education and transportation problem have greater influence on migration decision. Besides, loss of livestock also influences migration of the riverbank erosion victims. Moreover, migration also depends on number of more adult members, which is found significant in this case. The odds ratio's also indicate that households with the above mentioned problems are likely to migrate more. It is observed from the FGD's that availability of livestock assets and Irrigation facilities act as the constraint to population migration, as they act like coping strategies. But, non-availability of these facilities compels the farmers to shift their occupation to non-farming and force them to migrate elsewhere. As the erosion creates problem in acquiring education and hence people who want to take higher and better education decides to migrate towns and cities.

Thus it is observed that, in all the cases i.e. all migration, short term migration and long term migration the effect of riverbank erosion have greater influence. Therefore, the problems created by riverbank erosion directly influence migration decision of the erosion victims. Another fact is that both the individual and community migration for riverbank areas occurs due to erosion[4].

5. SUMMARY AND CONCLUSIONS

Applying the logistic analysis method in case of happening and non-happening of migration, it has observed that migration is influenced by both erosion and non-erosion related factors. However the erosion related factors have greater influence on migration. The erosion related factors such as cropland eroded, loss of livestock, lack of education and transportation problems have significant influence on overall migration as well as short term and long term migration. But, there is little difference in short term and long term migration. In case of long term migration education problem have less effect, on the other hand Education have greater effect on short term migration. Because, majority of the affected households reported that students left their schooling due to displacement by riverbank erosion. Few of the students migrate to urban area for better education and some others engaged in unskilled jobs. Most of the labours engaged in unskilled jobs like pulling *thela*, rickshaw, driver, conductor etc. (FGD). The other fact is that as a result of cropland erosion people become homeless and jobless and loss their income due to heavy erosion. Therefore, people migrate to resettle elsewhere and for better livelihood.

It is therefore want to recommend that migration can be control if the government adopts institutional measure to control riverbank erosion and to resettle the displaced population (Hoque and Hussain, 1988; Nayak and Das, 2011). Besides this government have to expand job opportunities through the schemes like NREGA and also have to provide financial grants for the losses occurred due to erosion. Further, rapid agricultural growth through encouragement to cultivation of *rabi* crops can be an effective measure that help in rural poverty reduction, which in turn reduce rural-urban migration (Janvry and Sadoulet, 2010).

6. FIGURES, TABLES AND NOTES

6.1 Figure

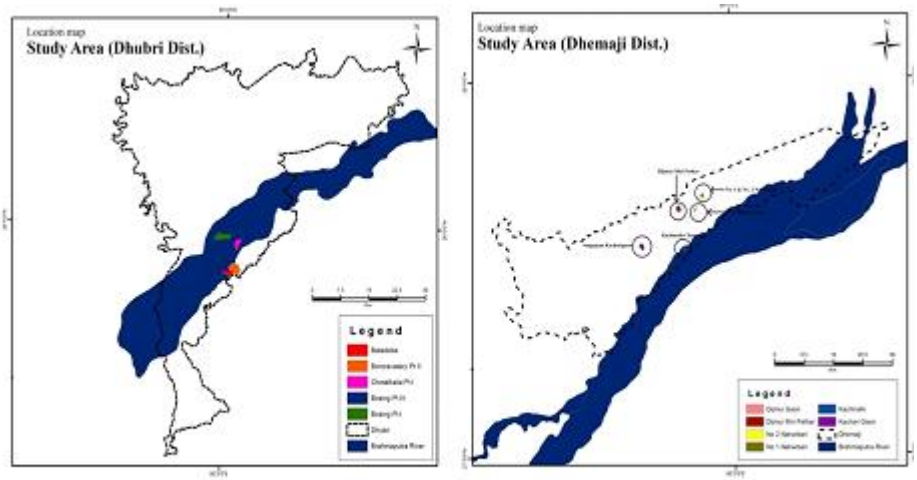

Fig-1: Location map of Dhubri and Dhemaji district of Assam, India
Source: Prepared by authors with the help of Cartographer.

6.2 Tables

Table-1: Description of the variables and their expected sign

Sl. No.	Variables	Sign		
A	**Dependent Variable**			
1	All Migration (M_i)			
2	Short term (S_M_i)			
3	Long term (L_M_i)			
B	**Independent Variables**	All Migration	Short term Migration	Long term Migration
1	Caste (1= ST, 0= Others)			
2	Number of adult members (NAM)	+	+	+
3	Occupation (Occ) { 1= Farmer, 0= Non farmer}	-	+	-
4	Total Present land (TPL)	-	-	-
5	Present Livestock (LVS)	-	-	-
6	Irrigation (S_Irr) {1= yes, 0= no}	-	-	-
7	Crop land Erroded (Crr)	+	+	+
8	Loss of livestock (L_Lvs)	+	+	+
9	Education problem (Ed_P) {1= Yes, 0= No} Dummy	+	+	+
10	Transportation Problem (Tr_P) {1= Yes, 0= No}	+	+	+
11	Members worked in NREGA (W_NREGA) {1= Yes, 0= No}	-	-	-
12	Farm Income (F_Inc) {In numbers}	-	-	-

Table -2: Summary of statistics of Dependent and Independent Variables

Variables	Maximum	Minimum	Mean
Caste/Community	1	0	0.31
Number of Adult Members	10	1	3.24
Occupation	1	0	0.47
Total Present land (in ha)	2.68	0.07	0.41
Livestock (in nos.)	20	0	6.69
Sources of Irrigation	3	0	0.12
Cropland Eroded (in ha)	1.34	0	0.17
Loss of Livestock (in Rs.)	100000	0	10351.41
Education problem	1	0	0.76
Transportation Problem	1	0	0.95
Worked in NREGA	1	0	0.32
Farm Income (In Rs.)	0	100000	4940.82
Short Term Migration	1	0	0.44
Long Term migration	1	0	0.24
All Migration	1	0	0.60

Source: Calculated by authors from primary data

Table-3: Logistic Regression Results

Variables	All Migration		Long term Migration		Short term Migration	
	B	Exp (B)	B	Exp (B)	B	Exp (B)
Constant	1.555	4.734	-4.665	.009	2.065	7.886
Caste	.439	1.552	.465	.628	.611	1.843
NAM	.932***	2.538	.350***	1.420	.379**	1.460
Occup	-.267	.766	.108	1.114	-.367	.693
TPL	.951	2.589	.478	1.612	-.377	.686
Livs	.029	.971	.027	1.028	.059	.942
Irr	-3.093	.045	-.695	.499	-.481	1.618
F_Inc	.000***	1.000	.000***	1.000	.000***	1.000
C_err	14.001***	1.204	4.089***	59.654	3.156**	1.043
Ed_Prbl	5.576***	.004	3.739**	42.057	6.233***	2.002
T_Prblm	2.899***	.055	3.420***	.033	.965*	.381
W_NREGA	-.559	1.749	-.423	1.526	-.185	.831
L_Liv	.001***	1.001	.000*	1.000	.000*	1.000
Model Chi-square (df)	408.05 (12)		163.33 (12)		373.93 (12)	
% of Correct Prediction	97.20		89.00		94.90	
-2Log-likelihood ration	50.46		222.25		108.54	
Pseudo R^2	0.942		0.557		0.877	
P-value	0.995		0.448		0.711	

*, **, *** represent level of significance at 0.10, 0.05 and 0.01 percent.

Source: Calculated by Authors from primary data.

6.3 Notes: Justification for the independent variables used in this analysis.

1. At first caste is an important variable because most of the people belong to scheduled tribe living in the riverbank areas of Dhemaji district. These scheduled tribe people largely affected and forced to migrate.
2. Number of adult members also used because, the families having more adult members migrate more.
3. Occupation in this analysis categorized into farming and non-farming. The people belong to farming category affected more and probability to migrate among these farming is high. Therefore, occupation is taken as another independent variable.
4. Total present is another important variable, because having large plot of land at present have less willingness to migrate and vice versa.
5. Present livestock also inversely proportional to migration, having large number of livestock have less willingness to migrate and vice versa. Therefore it is also taken as another independent variable.
6. Cropland eroded also important because it is positively related to migration. Increase the erosion of cropland migration may be more because cropland erosion largely affects the farmers.
7. Loss of livestock also positively related to migration like the cropland eroded. Hence it is also important variable or factor.
8. Education and transportation are two important variables in the context of riverbank erosion. Most of the people face these two problems in the riverbank eroded areas. Therefore these two qualitative variables taken as independent variable.
9. The employment facility through the employment generation schemes like NREGA inversely related to migration. Therefore it is also taken as another important variable.
10. Farm income also important variable regarding rural outmigration. Because, the rural people mostly depends on farming or agricultural activities. Due to loss of farming land or farm income most of the people in the eroded areas change their occupation to non-farming and most of them migrate elsewhere to earn money income.

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Endnotes

[1] Short term migration is defined as a people migrating outside for work during a reference year and long term migration refers to those persons who migrating out for work for more than a year during the past 10years (Shah, 2005)

[2] Similarity of socio-economic characteristics such as population, literacy rate, agricultural and industrial workers, marginal and main workers ensured on the basis of census data 2011.

[3] Both short term and long term migration concept has been used.

[4] The short term migrants are mostly individuals, while the long term migrants are communities.