

**RIVER BANK EROSION
AND ITS IMPACT ON DWELLERS
OF BRAHMAPUTRA VALLEY IN
MORIGAON DISTRICT OF ASSAM**

By
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*Examined
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IN PARTIAL FULFILMENT OF THE REQUIREMENT OF
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I, Mr. Pranab Jyoti Sarma, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/ institute.

This is being submitted to the North- Eastern Hill University for the degree of Doctor of Philosophy in Geography.

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CHAPTER-I

INTRODUCTION

CHAPTER-I

INTRODUCTION

The North Eastern Region of India is one of the most hazard prone regions in the Asian Continent, with different areas being prone to various natural calamities like earthquakes, floods, landslides and cyclonic storms. The rivers Brahmaputra and Barak drain the region. The Brahmaputra river has a catchments of 5,80,000 sq. km in Tibet, Bhutan, India and Bangladesh and in terms of discharge is the third largest river in the world, in terms of sediment load it is second after the yellow river of China. The river flows for a length of 918 km in India of which 720 km is ~~in~~ through the plains of Assam. In Assam about 20 major tributaries on its north bank and about 13 on its south bank joins the river Brahmaputra. The precipitation here is mainly due to the South-West monsoon. The monsoon in the region normally commences in the months of April and May and is active till the end of October. Heavy rainfall occurs from June to September. Average annual rainfall in the region is very high and ranges from 1750 mm in the plains to about 6400 mm in the hills. This huge volume of water rushes through the narrow bowl shaped valley of Assam to the Bay of Bengal ravaging the area through floods and land erosion. The recurring floods on an average devastate about 20% of the total area of the plain districts of the state of Assam and in the high floods years the devastation has been recorded to be as high as 67 % (Naik and Singh, 1996).

The region lies at the junction of the Himalayan arc to the north and the Burmese arc to the east and is one of the six most seismically active regions of the world. The entire region falls in Zone V, the most vulnerable seismic zone. Twelve

major earthquakes have occurred in the region in the last 100 years of which the devastating earthquakes of 1897 and 1950 have been recorded as two of the largest earthquakes in the country (Mukhopadhyaya, 1996). The vulnerability to natural disasters combined with socio-economic vulnerability of the people living in these area need a comprehensive plan for disaster preparedness and mitigation.

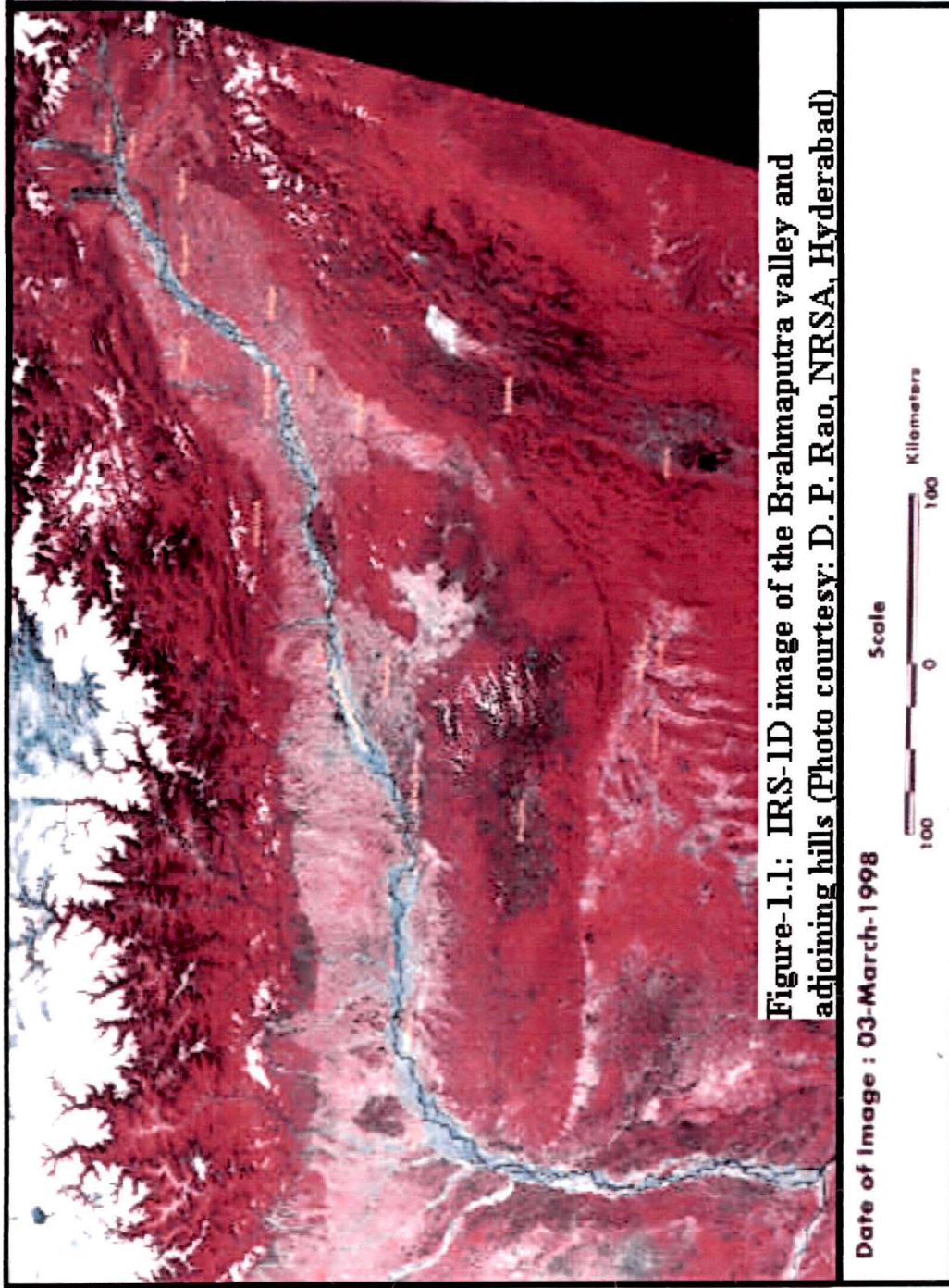
The Brahmaputra is a major river system of the world characterized by exceedingly high rates of basin erosion. In many parts of the world, mostly belonging to the developing countries of the tropics and subtropics including India, the vastly increased erosion rates have already set a difficult-to-reverse chain reactions leading to degenerated environment, reduced agricultural productivity, increased runoff and accelerated siltation in rivers, reservoirs and lakes. The Brahmaputra River in Assam provides another example in which high erosion rates of the drainage basins results in rapid aggradations of the channels and over bank flooding. It is estimated that India loses 6000 million tones of soil along with the major plant nutrients annually due to erosion, causing a production loss of 30 million tones of crops. Besides being a major threat to continued productivity of the land, soil erosion is now viewed as a major 'non-point' source of environmental pollution (Goswami, 1985).

Erosion of the banks takes away valuable land, and destroys towns built on its banks and impoverishes the people affected. Prevention of river erosion is a very difficult and costly task. It takes many years before stability can be established. Large rivers particularly the Brahmaputra, the Ganga and their tributaries causes immense annual soil loss due to erosion. In many countries of the world, erosion process of soils due to winds, and floods have increased enormously. The total land

area subjected to erosion throughout the world is estimated at 600 to 700 million hectares and this constitutes about half the total cultivated area of the world (Thorne, 1992).

Bank erosion of the river Brahmaputra is causing immense long-term destruction every year. The river Brahmaputra has been shifting slowly southward. The Brahmaputra and its tributaries comes down from the Himalayas and from its tertiary hills carrying enormous quantities of sediments and on reaching the plain these sediments are deposited on their own beds. The channels are thus filled up and the water in the following summers digs out different courses abandoning the earlier ones. Moreover, Brahmaputra valley and its adjoining region are seismically very active. The seismic instability of the region also contributes to such shifts.

The catchments of the Brahmaputra excluding the Tibetan portion form an integral part of the monsoonal regime of South East Asia. Rainfall in the valley averages 230 cm annually with a variability of 15 to 20 per cent. The Himalayan sector receives 500 cm of annual rainfall, the lower ranges receives more rain than the higher areas. Soils in the Sub-Himalayan region developed on the Tertiary sandstones consist primarily of sands with admixtures of cobbles and boulders. Alluvial soils formed on recent river deposits occur in most parts of the valley. Considerable degradation of forests has occurred in the surrounding hills of the Brahmaputra valley due to reckless deforestation, widespread practice of shifting cultivation and other harmful human interferences.



Presence of hilly protruding rocks in the middle part of the Brahmaputra valley where the Kalia-Bhumura Road Bridge is located in Silghat area, the river flow maintains a hypercritical velocity and thus do not deposit its heavy silt load. Afterwards, the river enters in to the alluvial plain and fan out in to several channels so that the velocity drops in to sub-critical state and the river deposits its silt load. Further down the protruding escarpment of the Singri hill on the north bank obstructs the flow and creates a spur action by deflecting a major flow towards the south bank. As a result, the south bank is always subjected to bank erosion.

The continuous retirements and unabated erosion causes heavy loss to the valuable homestead and fertile agricultural lands, besides evacuation of thickly populated riparian. In the process over the years from 1969 to 2001, as many as 93 nos. of revenue villages and 10256.93 ha of land got obliterated due to unabated erosion as depicted in Table-1.1 and 1.2.

Table- 1.1: Land lost due to Erosion in the Morigaon District (1969- 2001)				
(Area in Ha.)				
YEARS	BHURAGAON	LAHARIGHAT	MAYONG	TOTAL
1969-70	42.73	N/A	N/A	42.73
1970-71	61.16	N/A	N/A	61.16
1971-72	126.28	N/A	N/A	126.28
1972-73	66.93	N/A	N/A	66.93
1973-74	135.21	N/A	N/A	135.21
1974-75	147.91	N/A	N/A	147.91
1975-76	242.04	N/A	N/A	242.04
1976-77	194.90	63.80	N/A	258.70
1977-78	274.36	24.28	N/A	298.64
1978-79	261.48	21.16	N/A	282.64
1979-80	179.83	40.59	N/A	220.42
1980-81	208.43	57.14	18.47	284.04
1981-82	173.41	86.16	36.28	295.85
1982-83	246.74	Nil	24.23	270.97
1983-84	252.30	66.73	17.04	336.07
1984-85	165.72	Nil	Nil	165.72
1985-86	231.70	48.43	14.64	294.77
1986-87	198.26	74.08	Nil	272.34
1987-88	262.83	88.03	22.06	372.92
1988-89	370.91	92.28	46.30	509.49
1989-90	465.75	189.74	116.74	772.23
1990-91	398.27	161.04	103.64	662.95
1991-92	447.36	173.41	Nil	620.77
1992-93	Nil	Nil	96.13	96.13
1993-94	Nil	77.96	Nil	77.96
1994-95	266.28	160.16	84.64	511.08
1995-96	324.96	128.91	Nil	453.87
1996-97	286.67	144.11	Nil	430.78
1997-98	265.13	146.96	110.23	522.32
1998-99	247.16	140.66	78.61	543.93
1999-2000	364.16	158.14	Nil	222.17
2000-2001	242.27	106.74	86.27	403.4
TOTAL	7151.14	2250.51	855.28	10256.93

Source: Circle office of District Revenue Deptt., Morigaon

From this table it is evident that erosion has taken place in the Bhuragaon circle since 1969, and compared to other circles this circle is the worst affected one as evident from the fact that 69.72 per cent out of the total eroded areas belonged to this circle. Maximum area (772.23 Ha) in the district was eroded in the year 1989-90.

Table- 1.2: Mouza wise Erosion affected villages in the Morigaon District (2001)			
Name of the Mouza	No. of eroded villages		
	Completely	Partially	Total
Pokaria	2	5	7
Bokani	29	14	43
Bhuragaon	4	7	11
Laharighat	15	9	24
Mairabari	6	2	8
Total	56	37	93
Source: District Revenue Deptt., Morigaon			

Out of the 16 mouzas of the district 6 mouzas are situated in bank of the river Brahmaputra and are severely flood prone. All of these six mouzas are also affected by bank erosion in their northern boundaries. Among them Bokani, Bhuragaon, Laharighat, and Mairabari mouzas are worst affected as compared to the other mouzas due to bank erosion

To protect the valley dwellers from these relentless flood and erosion embankments are constructed in the year 1962. Subsequently several parts of the 42 km. stretch of the embankment from Dhing Borbeel to Mayong Hiloikhunda was washed away by the mighty river Brahmaputra. Faulty implementation of construction of rocky spur along the southern part of the valley including Dhing, Moirabari, Laharighat, and Bhuragaon and subsequent erection of bamboo spur could not prevent the erosion process of the river (Islam, 2004; Asam Bani, 27 May, 2002). Thus the gaps in the dyke enabled the flood waters to affect the adjoining villages and in fact such a flood in 1992 had made a devastating effect in 43 villages of Bokani Mouza (Alam, 1993).

The damage caused by erosion is of permanent nature. Erosion has made thousands of people homeless and most of them shifted to the E&D embankments and P.W.D. roadside. They live a perilous life in the edge of poverty. Rehabilitation of these persons is a gargantuan problem as land is a scarce commodity. Besides, socio-political factors are also there to contend with.

Prevention of river erosion is a very difficult and costly task. Various preventive measures such as construction of permanent embankments, erection of tie bunds or by adopting natural way of protection through scientific plantation of selected plants may protect the river banks from eroding.

1.2 STATEMENT OF THE PROBLEM

The Brahmaputra River, the fifth largest in the world, serves as a lifeline for Assam and other states in the northeast region. However, unpredictable shifts of the river, severe erosion, and frequent flooding have major adverse effects on the economy and ecology, affecting and threatening key urban centers, basic infrastructure, industrial and agricultural areas, and natural heritage sites. Erosion displaces a large number of the population often rendering them poor and landless. To address these problems, there is a need to develop and implement a comprehensive, cost-effective, and affordable flood and erosion mitigation management strategy. It is also felt to strengthen the policy and framework for flood control.

The riverine locations always attracted the growth and development of human settlement since time immemorial. Though river valley is advantageous in many respects for settlements and agricultural activities, it can be a mixed blessing too. In Assam most people are living in the Brahmaputra valley, where flood and bank erosions are becoming common natural phenomena. The river Brahmaputra has been shifting slowly southward due to the erosions on its southern bank. It is responsible for eroding away large tracts of valuable agricultural land as well as human settlement areas. Morigaon district is located in the south bank of river Brahmaputra, which is highly erosion prone and gets flooded almost every year, causing untold misery to countless persons. The damages caused by erosion are of permanent in nature. Large scale bank erosion occurring every year has virtually

obstructed the economic growth of the district. Table-1.3 shows the effect of flood and erosion in Morigaon district of Assam during 2000 and 2001.

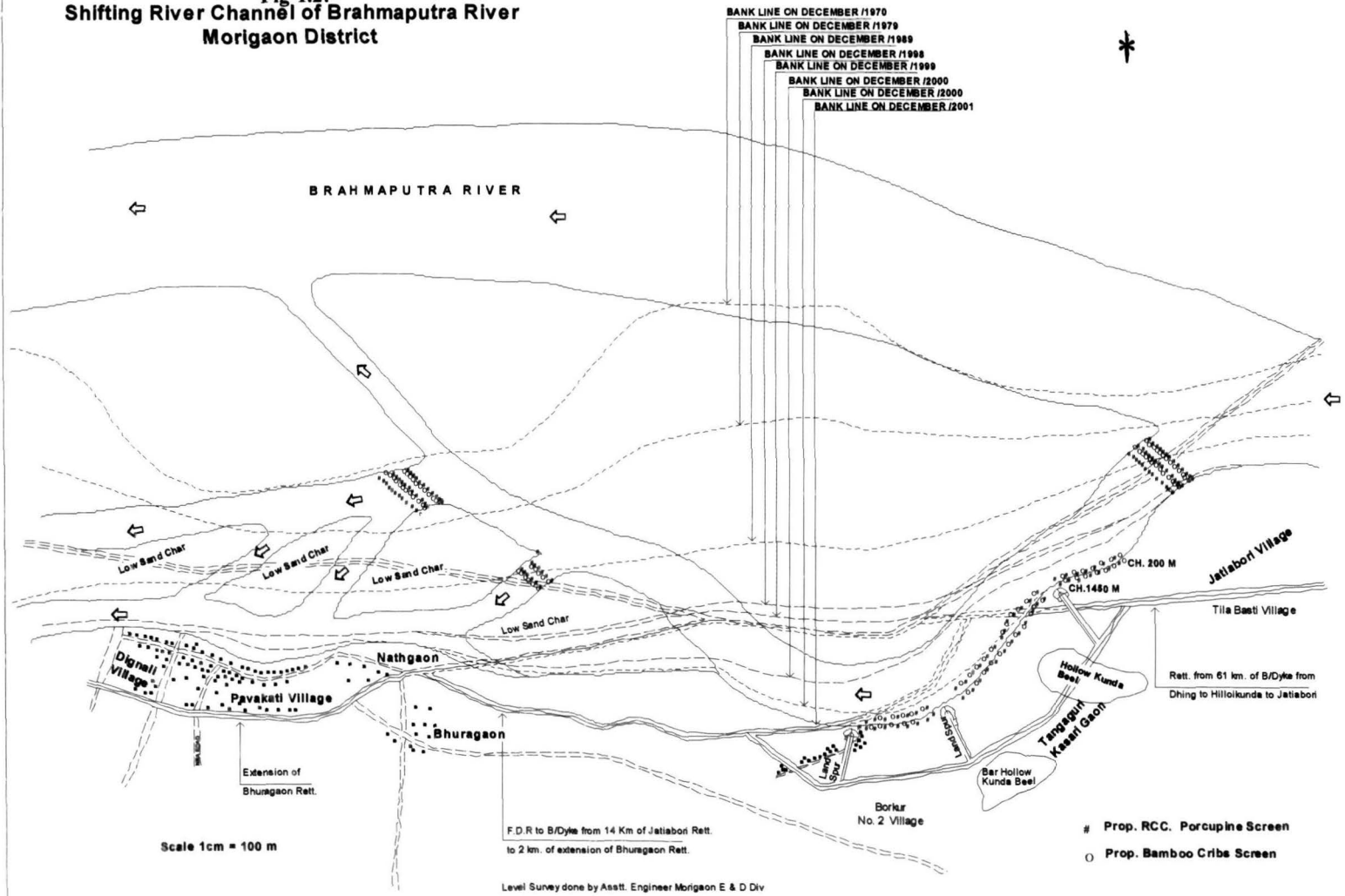
Table- 1.3: Statement showing the extent of damage caused by flood and erosion in Morigaon district and Assam (during 2000 and 2001)					
Year		Area eroded (in Ha)	No. of village affected	No of families affected	Value of property & land lost (in lakhs Rs)
2000	Morigaon	222.17	13	488	45.50
	Assam	5348.20	127	14475	377.72
2001	Morigaon	403.40	16	1070	77.27
	Assam	5607.14	142	27395	413.86
Source: Government of Assam, Revenue (general) Department, Dispur					

Besides such huge losses, the erosion of river Brahmaputra has washed away 93 villages either partially or completely under the three revenue circles of Bhuragaon, Laharighat and Mayong in the district since 1969. The width of the river bank has been increasing at the rate of 3.83 m/year due to devastating bank erosion and the affected people are compelled to migrate to other places. The people whose houses and agricultural land were washed away by the bank erosion are either staying on the road side or embankment with great hardship. Resettlement and rehabilitation of these persons are the major problem of the district. The Government sponsored minimum needs and rehabilitation programme by way of providing land was initiated from 1981, but it could cover only a few families; and most of the displaced people are still staying in the makeshift huts on the river bank or on the embankments.

Bank erosion of river Brahmaputra is causing immense long-term destruction almost every year. Besides eroding away 93 villages either partially or completely under the three revenue circles of Bhuragaon, Laharighat and Mayong in the district, the fury of the river have affected 16950 families comprising approximately 47000 persons by this relentless erosion as per an estimate made in 2001. Table-1.4 shows the extent of damage caused by relentless floods and erosion in Morigaon district of Assam.

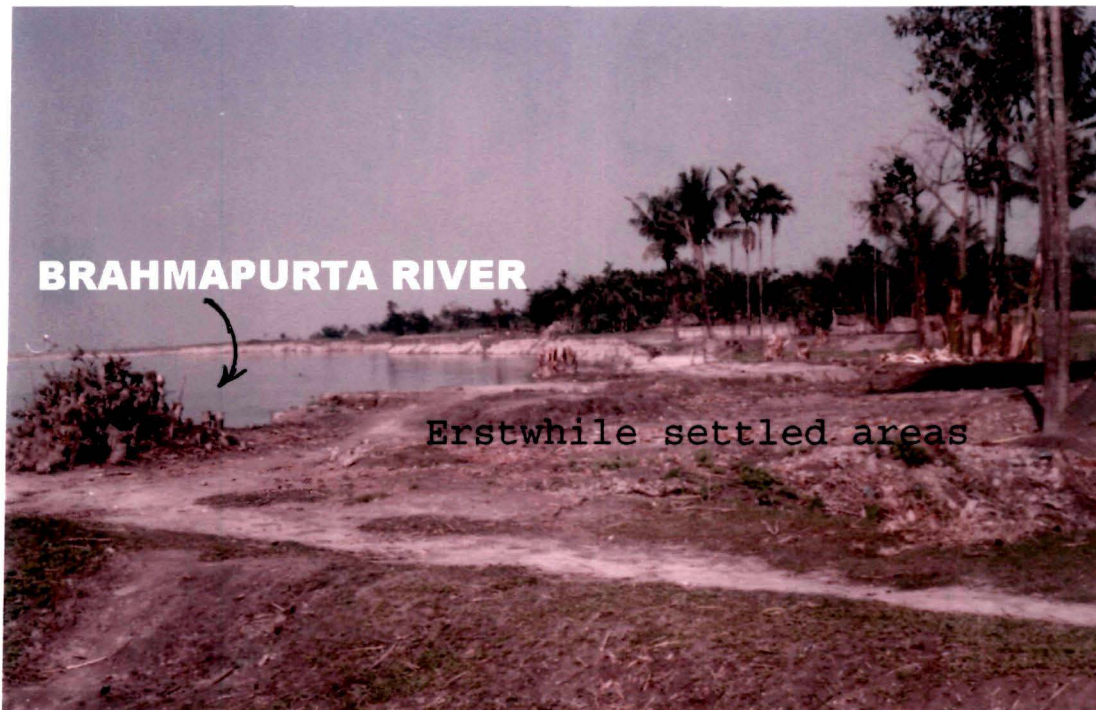
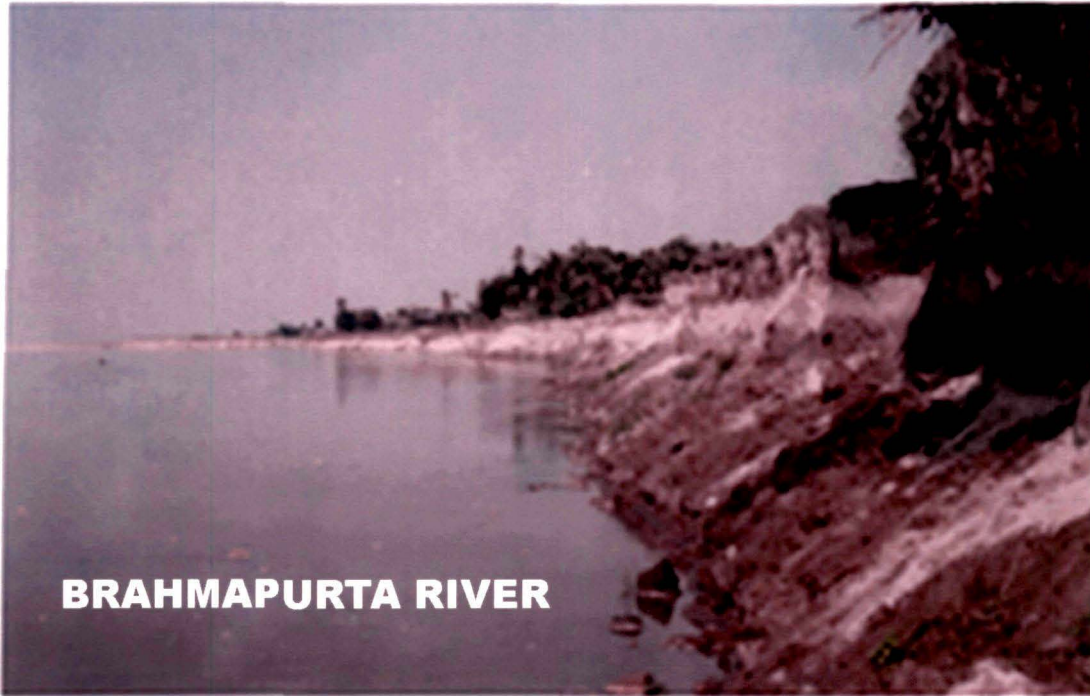
Table-1.4: REVENUE FLOOD DAMAGE REPORT (1982-2001), MORIGAON DISTRICT											
YEAR	Area affected (in Ha)	Village affected (in nos)	Population affected (in nos)	Cropped area affected (in Ha)	Value of crops damaged (Rs.in lakh.)	House damage (in Nos)	Value houses damaged in lakh Rs	No. of lives lost	No. of cattle head lost	Value of public utilities in lakh Rs	Area eroded in Ha
1982	2831	2968	53000	2131	17.00	794	1.91	-	-	-	-
1983	1055	48	6940	469	57.01	1396	7.00	-	-	-	-
1984	17650	258	103152	10286	133.48	2213	4.43	5	44	20.00	-
1985	7542	83	32388	5354	-	854	-	-	-	-	-
1986	17300	323	10000	12100	3630.00	12000	-	4	1000	-	-
1987	17300	336	10000	12100	3630.00	12000	-	12	-	-	-
1988	20400	409	87900	21000	5280.00	56350	10.67	18	2020	51.89	-
1989	60790	526	381469	54730	-	7600	-	5	-	-	-
1990	14881	140	68035	6233	-	-	-	-	-	-	-
1991	1070	532	4660	5400	1769.00	11295	0.12	28	2364	2159.64	-
1992	6550	46	2850	2010	3988.00	769	4.19	-	-	83.00	-
1993	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-
1995	44050	402	458507	82801	4921.08	50494	0.63	15	28	-	-
1996	248	29	17134	130	14.00	-	-	-	-	-	1425
1997	-	-	-	-	-	-	-	-	-	-	-
1998	47627	390	472745	25089	4013.08	31664	0.75	-	332	2157.72	994.88
1999	2500	35	35000	1799	1425.00	-	-	-	-	5.25	75.33
2000	4259	253	140720	12645	989.90	1777	0.47	-	18	1221.73	10.14
2001	6050	58	64000	2720	35.00	251	10.04	-	-	-	981
Source: Government of Assam, Revenue (General) Department, Dispur											

Fig-1.2:
Shifting River Channel of Brahmaputra River
Morigaon District

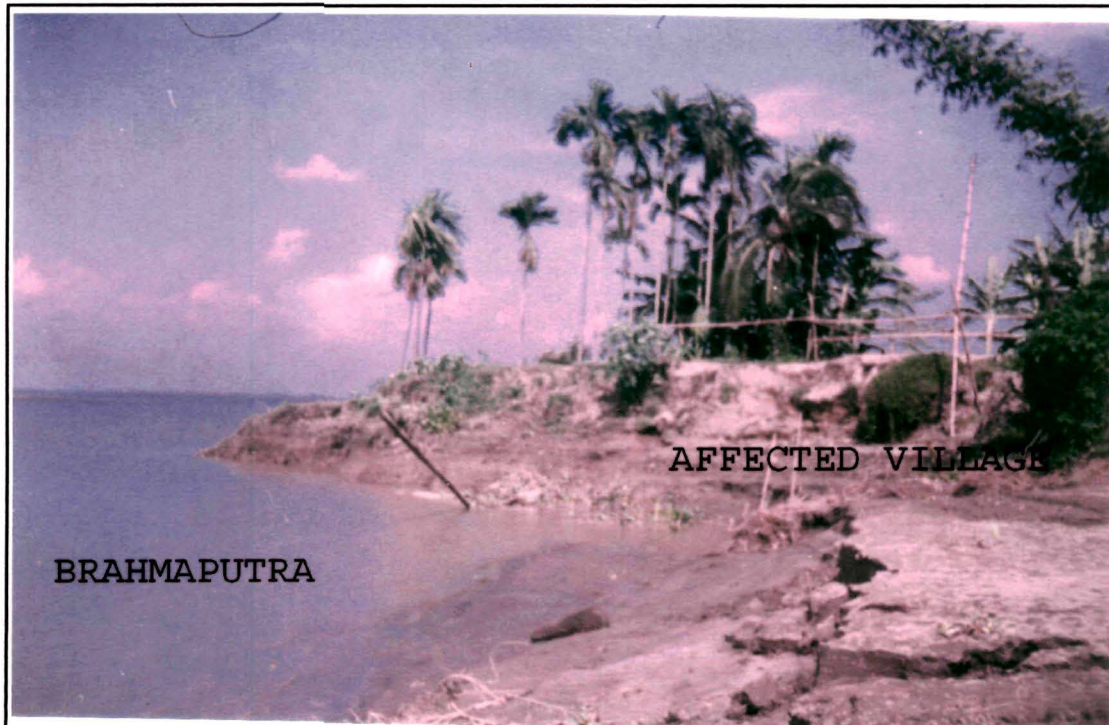


Source: Govt of Assam Flood Control Department

MASSIVE BANK EROSION NEAR BHURAGAON



BANK EROSION IN LAHARIGHAT AREA



Many villages that have submerged due to bank erosion are currently not traceable. Along these villages large areas of agricultural land are also submerged in the river. The land revenue records of Bhuragaon, Laharighat and Mayang circle show that, since 1986 a total of 10,256.93 hectares of land have been lost due to river erosion. More than 80% of the lost land was agricultural land where jute was also cultivated in large quantities. The entire region of the district was once considered as the granary of Middle Assam for production of food grains. But, due to flood and erosion, agricultural production was declining. The dislocated cultivators had to engage themselves as petty traders, rickshaw/ thela pullers in the nearby urban centres or as casual labourers in agricultural sectors for their livelihood, as they have lost their agricultural land and their permanent settlements.

Therefore, it is felt imperative to study the population redistribution pattern and the occupation structures of the dislocated persons due changing social and natural ecology and dislocation in the community network system. River bank erosion on areas of settlement and agricultural land has also changed the cropping pattern of the district as large areas of highly fertile and productive agricultural land have been completely submerged in the Brahmaputra river. Thus to have a proper understanding of the problems and consequences of bank erosion, and the changing social and economic characteristics due to rehabilitation it is felt imperative to carry out a research on the river bank erosion and its impact on dwellers of Brahmaputra valley, with special reference to the Morigaon district of Assam so that effective mitigation measures can be formulated for the benefit of the displaced people in particular and the society as a whole.

1.3 REVIEW OF LITERATURE:

The recurrence of flood and erosion continued to be the burning problems of Assam. The State of Assam covers an area of 78,438 Sq. Km. and consists of two valleys viz., the Brahmaputra Valley and the Barak Valley. The Brahmaputra and Barak are the two main rivers, which cause major problems during the monsoon period of every year in the shape of flood, bank erosion and drainage congestion (Goswami, 1985). In fact, the successive waves of devastating floods in almost every year have virtually destroyed the economy, more particularly, the rural economy of the state. The main factors causing extensive floods are the adverse physiography of the region, heavy rainfall, and excessive sedimentation, frequent occurrence of earthquakes, hill / land slides, reduction of forest area and encroachment of the riverine area (Valdiya, 1999). Usually Assam experiences incessant rainfalls during the monsoon season, which normally commence from the month of May and remain active till mid October. Apart from this, occurrence of floods in Assam has direct correlation with rainfall in the catchments areas of neighbouring states of Arunachal Pradesh, Meghalaya, Mizoram, Nagaland and the adjacent country of Bhutan.

Despite building 3647 km of embankments, 599 km of drainage channels and 431 km² area of soil conservation, Brahmaputra continues to wreck havoc by uncontrollable floods year after year (Goswami, 1998). Records show that catastrophic floods are also not uncommon in this region. The recurrent occurrence of such type of devastating floods may be due to the presence of the active faults and continuing crustal movements in this geodynamically unstable region. The width of the alluvial plains of Brahmaputra basin (less than 100 km) is also having a

significant role to play in the flood phenomenon which is much narrower than the flood plains of Sindhu and Ganga (350 to 300 km respectively).

Tectonic origin of the Himalaya as well as the Brahmaputra valley is suggested by a number of authors (Holme, 1964; Evans, 1964; Mittal and Srivastava, 1959; Tapponier and Molnar, 1977). The earthquakes of 1897 and 1950 of Richter magnitude 8.7 and 8.6 respectively caused extensive landslides and rockfalls on the hillslopes, subsidence and fissuring of the ground in the valley and changes in the course and morphology of rivers (Oldham, 1898; Poddar, 1952).

The severe deformation of the Assam region is eloquently expressed in its much faulted framework namely the E-W trending faults (Dauki Fault, Brahmaputra-Mikir Fault), and the transverse tear faults (Kopili Lineament, Dhubri Fault, Dudhnoi Fault, Chidrang Fault, Um Nagot Lineament) and thrusts (Dapsi Thrust, Barapani Thrust) are among the many that dissect the terrain of the Meghalaya-Mikir blocks (Goswami, 1998; Valdiya, 1999). Most of these faults are seismically quite active as many of the earthquake epicentres are located in this region. The deposition of great volumes of sediments in the channel has phenomenally reduced the carrying capacity of the Brahmaputra adding to the flood menace. The 1950 earthquake (M 8.7) had drastically affected the gradient of this river, stopping the flow temporarily and bringing about flooding and rapid accumulation of enormous volume of sediments in the channel.

The National Flood Commission had estimated the area vulnerable to floods in Assam as 31.60 lakh hectares against 335.16 lakh hectares for whole India.



Assam thus accounts for 9.4 per cent of total flood prone area of the country. As a result, the state has not been able to achieve the desired progress and prosperity, in spite of having vast natural resources. The damages caused by flood and erosion in the state over the last five years are depicted in Table-1.5.

TABLE- 1.5: DAMAGES CAUSED BY FLOOD IN ASSAM						
Item	Unit	2000	2001	2002	2003	2004
Area effected	Hectare	966053.0	239511.0	674148.0	932113.0	3142685.4
Population affected	No.	3888385	542634	7550581	5651954	13493392
Human lives lost	No	36	4	65	52	497
Loss of Cattle	No.	19988	15	4294	4319	65967
Villages affected	No.	5090	1277	6807	7565	12235
Area eroded	Hectare	-	5348.00	429657.0	12589.6	7829.72
Value of crop loss	Rs. in lakh	17351.57	835.79	14559.95	14700.0	-
Value of houses damaged	Rs. in lakh	1648.45	259.49	4118.65	1869.22	-
Total value of damages	Rs. in lakh	19000.02	1095.28	18678.60	16569.22	-
Source: Water Resources Department, Assam.						

Flood in Assam, characterized by their extremely large magnitude, high frequency and extensive devastation, constitute an awesome natural hazard that repeats itself almost every year and devastates the economy of the state which is overwhelmingly agrarian. The situation is worsening as erosion is accompanied by flood, which farther aggravates the problem, Goswami (1989).

Human occupation and development of alluvial river floodplains are adversely affected by river channel lateral migration. The ecology of riverine

corridors is dependent upon the processes of erosion and sedimentation, which lead to lateral migration. Multiple uses of floodplains adjacent to active rivers also influence the probability and magnitude of channel movements, with implications for habitat type distribution and ecosystem integrity (Shields *et. al.* (2000).

Riverbank erosion is an endemic and recurrent natural hazard in many parts of Brahmaputra valley of Assam including the Morigaon district. When rivers enter the mature stage (as in the case Brahmaputra) they become sluggish and meander or braid. These oscillations cause massive riverbank erosion (Alam, 1993). Every year, thousands of people are affected by erosion that destroys standing crops, farmland and homestead land. In fact, bank erosion and flood hazard has become almost a regular feature in the district.

The unstable character of the river Brahmaputra is one of the causes for its eroding nature. The river is assuming a braided pattern consisting of several channels separated by small islands (chars) in its course. During the last few decades, the channels have been swinging between the main valley walls and during the monsoon season extensive overbank spills, bank erosion and bankline shifts are typical. The erosion not only affects the rural floodplain population but also urban growth centres and infrastructures as well (Mamun and Amin, 1999).

There is involvement of a large number of variables in the process of riverbank erosion. The intensity of bank erosion varies widely from river to river as it depends on such characteristics as bank material, water level variations, near bank flow velocities, planform of the river and the supply of water and sediment into the

river. Loosely packed, recently deposited bank materials, consisting of silt and fine sand are highly susceptible to erosion and rapid recession of floods accelerates the rates of bank erosion in such materials (Kotoky *et. al.*, 2005). Moreover, in recent years, human interventions in the Brahmaputa are growing. Construction of the Kolia Bhomora Bridge and bank protection structures thereof has reduced the freedom of the river to widen through bank erosion in that area resulting in greater flow rate and when the river reaches down stream it slows down and deposits silts and causes erosion through widening process. The embankments also contributed to increased suspended loads especially during the summer months which are deposited in the riverbed contributing to the braided nature of the river. This, in turn, will contribute to directing more and more of the finer flow towards the banks accelerating the bank erosion (Kar, 1994).

The Brahmaputra valley in Assam represents a tectonosedimentary province 720 km long and 80 to 90 km wide, with elevation ranging from 120 m in the extreme east through 50.5 m at Guwahati to 28.45 m in the extreme west. The channel of the river itself occupies about one-tenth of the valley, with over 40% of its area under cultivation and housing more than 15 million people. In Assam, the river flows in a highly braided channel characterized by numerous mid-channel bars and islands. The Brahmaputra is the fourth largest river in terms of average discharge at the mouth, and second in terms of sediment transport per unit drainage area in the world (Goswami, 1985). Migration of the channel towards the south is a characteristic feature of the river.

The flow regime of the Brahmaputra possesses the seasonal rhythms of the monsoon and freeze–thaw cycle of the Himalayan snow. Along the channel of the Brahmaputra bank materials are not homogeneous in composition, and result in uneven bank slumping. This causes the flow to take a different path and the orientation of the bank -line to the direction of flow also changes and at some localities older alluvium protruding into the river offers significant resistance to the flow regime and causes changes in hydraulic conditions (Kotoky *et. al.*, 2003).

The finely divided bank material and the constant change in flow direction produce severe bank caving along the channel. When the flow approaches the bank at an angle, severe under-cutting takes place resulting in slumping of sediments. Kotoky *et. al.* (2005) observed that, slumps are more common along banks composed of clayey silt and silty clay. Quite often, the highly saturated clayey silt will liquefy and tend to flow towards the channel. As the materials flow, the overlying, less-saturated bank sediments tend to slump along well-defined shear planes. Thus, there appear to be two prominent types of slumping which cause the bank-line to recede; one operating during flood stage (undercutting), and other during falling stage (flow of highly saturated sediments). However, the intensity of slumping is more acute after the flood stage. The accumulated water level during the flood stage provides additional support to the bank material as the pore spaces of the loosely bound bank materials are occupied by water and act as a continuous system. With the fall in water level, the support diminishes abruptly and the bank materials are subjected to different degrees and nature of failure. In some localities, stratified fine sand, quite massive channel sands and silts underlie the silty clay of the natural levee deposits.

During high stage of the river, water is forced into the strata, raising the pore pressure in the strata. As the water level in the river falls rapidly and the pressure against channel wall is lessened, water moves from the formation back into the river. This causes a lateral flow of sands and silts into the channel, resulting in subaqueous failure. This normally produces a bowl-shaped shear failure in the overlying cohesive natural levee deposits (Coleman, 1969). These types of failure with semi-circular outlines of different magnitude area abundant along the Brahmaputra river channel.

Development of some waterlogged areas after the flood near the bank of the river, probably related with the construction of flood embankment, without having any direct outlets to the river is also a characteristic feature. Water from these areas moves through permeable levee materials and oozes out along the bank of the river when water level in the river recedes during the post-flood period, failure of bank materials occur (Lawler, 1992). Another type of failure is related to the subaqueous flow. Because of the braided nature of the river channel and its constant migration, many abandoned channels intersect the newly formed bank-line. This gives rise to a zone of well-sorted silt and fine sand localized in the abandoned channel fill. During rising and flood stage, the sand and silt become highly saturated. The rapid drop in water level in the channel results in rapid withdrawal of water from these sediments. The highly saturated liquefied sediments flow towards the channel. As the materials flow, the overlying less-saturated bank sediments tend to shear along well-defined planes (Lawler *et. al.*, 1997). Shear failure is one of the most effective causes of bank- line recession of the Brahmaputra. The other major cause of shear failure is over-steepening of the bank which always enhances the failure of the

bank (Coleman, 1969). Fluvial erosion, in turn, is linked to mass-failure processes through the concept of basal end-point control (Thorne, 1982). Fluvial erosion of the basal area of the bank can lead to undercutting and subsequent cantilever failure. The formation of mud cracks can directly be attributed to sub aerial processes, which include wetting and drying of soil. These are commonly thought as 'preparatory' rather than 'erosive' processes (Lower *et al*, 1999). Although sub aerial 'wakening and weathering' of the soil can occur in a number of ways, all are associated with moisture conditions within the material (Dierith and Gallinati, 1991) and with the physical state of this moisture (Thorne, 1990). Both Wolman (1959) and Simon *et al.* (1999) found that the highest rate of retreat occurs as a result of high flow during prolonged wet periods, rather than by floods. On the other hand as the cohesive soil mass dries, volumetric shrinkage results in the formation of a 'pad fabric', with blocks of soil separated by desiccation cracks (Thorne and Lewin, 1979). These desiccation cracks provide lines of weakness in the bank face, and Green *et al.* (1996) found desiccation to be one of the dominant forms of bank erosion on the tributaries of the Namoi river in Australia.

Braided river like Brahmaputra represents a high-energy fluvial environment often characterized by non-cohesive banks lacking vegetation and consequently, high rates of bank erosion and deposition. The inhomogeneity in bank materials and the constant change in flow direction have caused severe undercutting, which enhances the intensity of slumping along the banks (Mamun and Amin, 1999).

Morigaon district faces an acute erosion problem as no permanent anti-erosion measures based on proper geohydrological models have been adopted so far.

Geomorphologically, the most parts of the plains of Morigaon district falls under the flood plains of the Brahmaputra river. The district suffers from severe bank erosion on its southern side due to the erosive action of Brahmaputra river. The district is subjected to severe annual floods under the influence of the SW monsoon. The erosion is mainly attributed to extreme sediment charge to the braided river and formation of sand bar in the midst of the river (Baker *et al.*; 1988; Goswami, 1985). Along the channel of the Brahmaputra river, bank material is rarely homogeneous in composition and uneven bank-slumping is a characteristic feature. Often, highly saturated clayey silts liquefy and tend to flow towards the channel. Consequently, the overlying less saturated bank material tends to slump along well-defined shear planes. Thus, there appear two prominent types of slumping: (a) undercutting during flood stage and (b) flowage of highly saturated sediments during the falling stage of the river (Kotoky *et. al.*, 2003).

Several studies (Talukdar, 1995; Barman, 1981) have indicated that the Brahmaputra river changed its course abnormally after the earthquake of 1950 and the attendant historic flood. There was a balance between sediment supply and transport up to 1950, which was disrupted by the great earthquake which produced severe landslides within hilly tracts suddenly providing a large quantum of additional sediment. These extra sediments choked the river channel gradually and initiated bank erosion causing channel-widening. Moreover, there has been a gradual increase in channel slope since 1920 (Goswami, *et. al.*, 1999). The riverbed of Brahmaputra has also shoaled following heavy siltation due to the construction of flood embankments, deforestation, etc.

The velocity of the river diminishes when large quantities of sediments are deposited and mid-channel bars or chars are formed. Once formed, the chars locally decrease the cross-sectional area and cut the bank laterally to maintain a proper cross-sectional area that is in equilibrium with discharge (Kotoky *et. al*, 2003). Kotoky *et. al* (2003) also compared the satellite imageries of 1998 with the topographic base map of the year 1920, and found that the Brahmaputra channel has increased its width from 7.00 to 9.25 km, with significant expansion on the southern side of the river.

Bank erosion is a dynamic and natural process as rivers meander across the landscape. However, bank erosion of river Brahmaputra has attained a menacing proportion in many parts of Assam including Morigaon district of Assam. Taher and Ahmed (1998) stated that, side by side with floods, bank erosion of some major rivers also causes immense long-term destruction every year. The river Brahmaputra has been shifting slowly southward. The Brahmaputra causes bank erosion in the Bhuragaon area in the Morigaon district of Assam. Erosion and floods are a perennial problem of Morigaon district. Since the last three decades 56 revenue villages have been affected by erosion by the river Brahmaputra out of which 41 revenue villages have been completely wiped out. The rest 15 revenue villages are partially eroded. More than 80% of the lost land even rich agricultural land; this produces some of the finest variety of jute in Assam. Incidentally, the entire Bhuragaon, Laharighat belt was once considered the granary of middle Assam (Alam, 1993). Thorne (1982) stated that, the erosion of the banks takes away

valuable lands and destroys towns built on its banks and impoverishes the people affected.

Dibrugarh town protection work in 1954, the town was threatened by the erosion of the Brahmaputra. The flood forecasting and warning system was first started in India in 1959 on the river Yamuna for the benefit of the union territory of Delhi. Sarmah (1993) explained about the origin and drainage patterns of all the major rivers in Assam. The flood havoc in the Brahmaputra valley and causes of occurrence of floods in Assam was properly explained by Ahmed (1991). Deuri (1994) explains the major problem faced by the people of Morigaon district is the flood and bank erosion. Saha (1975) made the first study on agricultural development in Assam. The study of economy and farm management in Nagaon district of Assam by Goswami and Bora (1997) provided some basic information on inputs and production of crops in the Nagaon and Morigaon district. Das (1984), in his published doctoral thesis, "Peasant Agriculture in Assam", presented the structural analysis of peasant agriculture in Assam. The "Agricultural Problems in India" published by Singh and Sadhu (1991) considered flood as major problem of agricultural development in river valley areas. Goswami (1979) in his paper mentioned the nature and causes of flood in the depressed belt of southern West Bengal. The high flood proneness of the belt and the nature and development of land settlement have been studied. According to the Department of Agriculture, flood affected areas of the Brahmaputra valley is accounted for about 98.8 thousand hectares, out of which 24.5 thousand hectares of land is chronically flood affected in Assam, besides 90 thousand hectares being occasionally flood affected, Mahanta

(1979). Saikia (1992), in his unpublished doctoral thesis emphasizes the flood and soil erosion is the severe problem faced by the farmers of Assam. Problems of fluvial erosion are very severe along the river Brahmaputra and its tributaries.

Mukhopadhyaya (1996) in his "Hydro-Geomorphology of the Brahmaputra –Barak–Manipur basins with special reference to Neo-tectonics" mentions the evolution of the drainage basins including its distinct suite of landforms and peculiar drainage pattern by explaining their regional disposition and dispersion.

The river Kosi rightly is described as the "Sorrow of Bihar." Flood has itself been partially responsible for some of the observed changes particularly because of its effect on atmospheric quality due to water pollution and its influence on settlement as well as on agriculture because of land damages, Chahaukar (1995).

Davies and Walsh (1997), in their paper regarding the flood hazard at Khartoum, Sudan, explain that the 1988 floods at Khartoum were frequently described as "Unprecedented." They argued that most problems were created by complacency, lack of planning and mismanagement.

Bordoloi (1995), in his thesis stated the flood plain of the river Brahmaputra covers almost 40 KM of the valley. The river Brahmaputra not only carries a very high flow during the monsoon season but it also transports a very large sediment load.

Mahela (2001), in his seminar paper explain that, except embankment no other methods have so far been applied to minimize the damage due to flood & bank

erosion in the Brahmaputra valley. The existing embankment system has not been raised and strengthened to withstand against the pressure of increased high flood level, and as a result every year embankments are either breached or overtopped. On the other hand land use and agriculture is also affected by flood. The agricultural growth is basically related to the analysis of changes occurred in the growth components, that are, area under cultivation, crop-yield and the cropping patterns of particular area.

According to the additive growth model of Minhas and Vidyanathan (1965), the obscured increase in aggregate output has been decomposed in to four component elements, that is, the contribution of the changes in (a) cultivated area (b) crop-yield (c) cropping pattern and (d) the interaction between latter two elements.

Das and Kalita (1993) in their study on Agricultural development of North East India take the help of sampling design method and analyzed that land productivity is directly related to the physical factors.

Rahman (1994) used the formula $Y = O/A$ to find out the land production in Assam. The land productivity is the relative measure of agricultural output for areal unit of land; it is measured by dividing total agricultural output by the total cress cropped area of a particular district. Borah (1991), has shows the village size land productivity by using the formula – $Y = [(E^n Ai Yi Pi)/Ar] i=1$

Sewell (1964), Sheaffer *et. al.* (1970) formulated the model to adjust with the flood hazard. Morgan (1969) has stated that, erosion which is also a part and parcel of the activities of a river, effects greatly the flood plain occupancies, in human

terms, the most far reaching and devastating consequence of excessive uncontrolled run of is soil erosion. Studying the flood hazard of North Bihar, Choudhury and Kumar (2001) explains that, design of flood mitigation works for long return periods of flood is uneconomical and beyond the means of a developing country like ours.

Although, Assam is one of the most severely flood and erosion affected states of India, not much academic research has been done on this problems. However, geomorphologic accounts of the valley including the flood plain areas are available in several published reports (Murphy, 1968; Taher, 1975; Kar and Goswami, 1993).

The problem of flood and erosion hazard and its impact on various human activities are also studied by Goswami (1989), Bordoloi (1986), Kar (1994), Pal & Bagchi (1983), Bordoloi (1995) and Gogoi (1997).

Plains of north India support some of the highest human population densities on earth (Kar 1994). One important reason for such a high population density has been soil fertility recharged by annual alluvial deposition by the rivers flowing through them. The Brahmaputra valley in Assam is an example of such an area. In such systems, inward human migration is a common feature, an in fact it has attracted human settlement from time immemorial. But, the human settlements just adjacent to the Brahmaputra river banks are becoming worst sufferers from riverbank erosion that is taking place since last few decades.

The Brahmaputra river system is located in a seismically active area, thus have a varying geomorphologic behaviour and its erosion is causing serious and disastrous socio-economic implications. The erosion phenomenon is a serious

problem for the population residing in the bank of the braided Brahmaputra river channel (Valdiya, 1999). Riverbank erosion is one of the major causes for poverty for majority of the affected people. The impact of land loss involves primarily the loss of homestead land, housing structures, crops, cattle, trees and household utensils and communication system. Loss of homesteads forces people to move to new places without any option and puts them in disastrous situations. The displaced persons usually take shelter on roads, embankments and government lands. The big farmers are the worst affected, followed by medium farmers, and marginal groups.

Displacement is the immediate impact of riverbank erosion. The displaced usually move to nearby areas but migration to distant places is not uncommon (Guha, 1977). Most of the displaced persons turn mainly into agricultural labourers, wage labourers in other activities or in occupations like rickshaw pullers. A large proportion of the victims remain unemployed due to lack of work opportunities. However, it is observed that the female-headed households displaced by riverbank erosion and residing on embankments are the worst affected group.

A large number of studies on population redistribution relate to displacement of population due to various development activities in India as well as in whole of South Asia. Kayastha and Yadav have analysed the impact of flood including migration and redistribution of population in the Ghaghar flood plains. Ahmed (1991) has attempted redistribution of tribal population in India on account of developmental processes. The role of partition in the redistribution of population in India has been the major focus in a large number of studies by Mukherjee (1991) and Gosal and Mukherjee (1970). Premi (1974) has made a specific reference to

migration as a major focus in the population redistribution tendencies in India. Likewise, Bose (1967) uses differential growth patterns in different areas of the country as a major focus in the population redistribution.

The vulnerability of households headed by women is based in part on a past lack of access to education, training, and employment opportunities, as well as discrimination in the job market. In addition, socioeconomic and political structures exclude women from playing an active role in the functions of their own communities (Rossiasco, 2003).

The economic activities that families are involved in before being displaced (usually farming) are impossible to carry over to resettlement sites. The effects of this are felt on an individual level when displaced people are forced to make the difficult adaptation to new forms of work. The first consequences of forced displacement are a lack of access to basic necessities, as well as vulnerability and insecurity, especially for women and children (Shrivastava and Hienen, 2005).

However, migration in Assam as a whole and Morigaon district in particular, is widely recognized as having exerted a disproportionate effect on local demography relative to other parts of India. Most of the riverbank settlers, who had to migrate to other parts of the locality due to erosion of the river belonged to the immigrant settlers. Thus they have also affected the local demography of their new settlement areas. In addition to the effects of migration, recent research from the Indian Himalayas indicates that immigrants have greater resource needs than settled households (Hazarika, 1993).

THE STUDY AREA

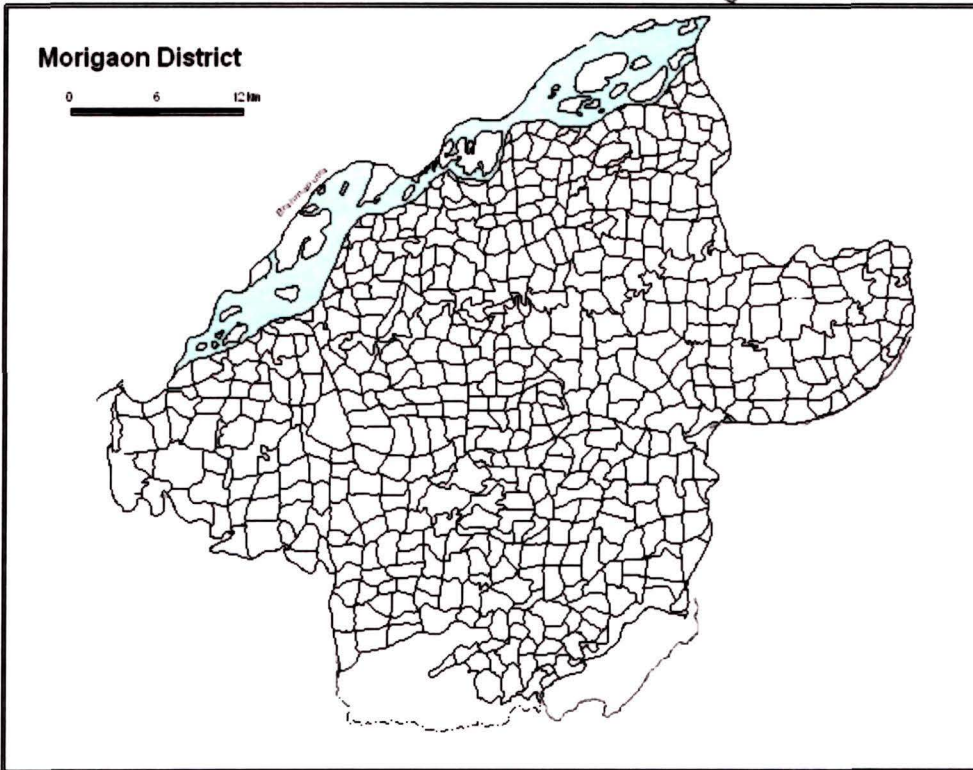
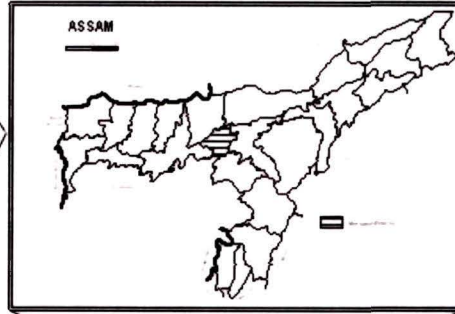
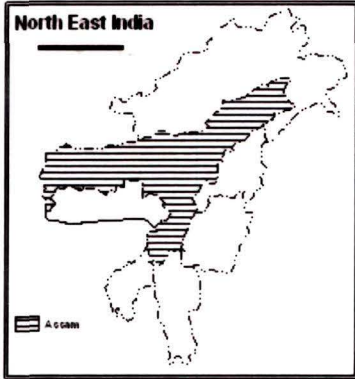
The district Morigaon is located in the central part of Assam. In the south bank of Brahmaputra between 26° 00' N and 26°40' N latitude and 91°59' E and 92°35' E longitude with a geographical area of 1431.5 sq. km. accounting 1.99% of the total area of the state. The geographical boundary comprises with Nagaon district in east, Darrang district in north, Karbi-Anglong district and Meghalaya State in the south and Kamrup district in the West Side.

The major river flowing through the district is the mighty Brahmaputra along the northern boundary and its tributaries Kolong and Kopili are along the middle of the district. Both the rivers meet at Jagibhakatgaon and eventually meet the river Brahmaputra jointly. The other tributaries of Brahmaputra viz. Sonai, Sonduba, Morasonai, Moraganga, Kalijam flow along the northern part, and Kopili, Kolong and Kiling flow along the southern part of the district.

The average annual rainfall for last five years is 1859.5 mm. and the maximum and minimum temperature recorded at 38°C and 9.0°C in June-July and in January respectively.

The soil pH varies from 5.5 to 6.0. The pH range is found to be lower in Jagiroad, Nellie, and Dharamtul area, which gradually increases towards northern part of the district.

Fig-1.3: LOCATION OF STUDY AREA



OBJECTIVES

This study proposes to examine the impact of the river erosion on the dwellers of river valley. The principal objectives of the present study are –

1] To analyse the impact of river bank erosion and changes in land use and cropping pattern in Morigaon district after and before 1989.

2] To study the consequences of bank erosion on human settlements in Morigaon district.

3] To analyse the occupational changes among the people of the displaced villages who have been rehabilitated and their adjustment under the impact of such social and ecological changes.

4] To assess the measures taken by the government through rehabilitation and resettlement policies to deal with such natural hazards with regard to the displaced people.

HYPOTHESES

1] The channel migration of the river Brahmaputra has been responsible for large scale as well as small-scale displacement of people leading to redistribution of population within the district and dislocation in their economic practices leading to unprecedented changes in the economic and social relations.

- a) Following the redistribution, new settlements emerge accompanied by depopulation of villages located in areas affected by bank erosion.
- b) The extent of bank erosion will be directly proportional to a movement of affected people to the nearby towns and other urban centres.
- c) There shall be a change in the occupational structure of the affected people characterized by a move towards non-agricultural sector in the urban areas and towards casual labour in the agricultural sector in the rural areas.

METHODOLOGY AND DATA-BASE

The study was undertaken in Morigaon district of Assam. The detailed bank line movement of the Brahmaputra river in the district and the patterns of land use and settlement of the area was delineated from satellite imagery of two time periods viz. 1987 and 2001 to perceive the changes. This information was superimposed on to the base map prepared from topographical map of Survey of India to determine the temporal changes of river courses. These data were compared with ground truth investigations to ascertain the accuracy level of the interpreted data.

As erosion became rampant after 1989, hence, it is taken as the cut off year to identify the villages that were submerged along the river course. The village level maps obtained from the circle office were used to locate the villages that were present prior to 1989, but were submerged along the river course due to river migration and capture since then.

The relocated and temporary settlement areas are identified from the village records of prior to 1989 to know the number of villages lost due to river erosion. The village revenue records of 2001 shows about 93 villages have been found lost in Morigaon district alone. Under the resettlement and rehabilitation program (1981), till 2001 Government has rehabilitated 1010 families. Out of these families 30 per cent (i.e. 300 families) sample size were selected randomly from eight (8) of the rehabilitated areas of Morigaon district to study their past and present occupational structures, to understand the tribulations faced by them due to migration and change in social and natural ecology. Another 300 (three hundred) samples were collected

from the areas where the people resettled by themselves. One hundred and fifty (150) samples from the three hundred (300) self rehabilitee families are again selected from each of the four rural and four urban villages within the district to compare their occupational structure and economic condition. The primary data for the present study was collected through personal interview with the help of household scheduled questionnaires (Appendix) for both the samples covering 600 households. The primary data thus collected was tabulated and used statistical analysis to determine the agricultural land use and cropping pattern, the resettled villager's past and present occupational structures and to understand their constraints and hardship faced due to migration and also to understand the change in social and natural ecology.

Necessary secondary data for the present study was obtained from different Government reports, documents and other published reports. Data obtained from Census tables were used to study the rural urban migration of population and were used to see the occupational structure changes.

The secondary data on agricultural land erosion and settlement patterns at circle and village level was collected from the following sources.

1. Periodical river courses of the area was studied with the help of toposheets and other relevant information and documents from various government and non-government departments, like the Brahmaputra Board, Revenue department, E & D department and Assam Remote Sensing Application Centre.
2. Data on cropping pattern was obtained from Agricultural Reports, Deptt. of Agriculture and District Statistical Department.
3. Population and settlement statistics were obtained from the Revenue Departmental offices of different circles under the district.

In the second stage, the validity of the findings was testified with secondary data by comparing the primary data collected through field survey with the help of household scheduled questionnaires. These were also used to examine the location specific factors responsible for occurrence of specific patterns and attributes.

Agro ecological information such as topography, soil type, climate, irrigation facility etc. was collected from different Government sources like Department of

Agriculture, Govt. of Assam, Regional Remote Sensing Application Centre, Guwahati and other published sources.

The data obtained was processed, tabulated and analyzed with suitable and meaningful quantitative techniques. Crop concentration, diversification and intensity were also analysed to find out the changing agricultural land use and cropping pattern. Interpretation and statistical analysis was made using χ^2 tests (Pal, 1998) and also with simple ratio of percentages. These analyses were supplemented by a number of charts, maps and diagrams to give a clear vision of the interpretations. The conclusion of the study was drawn based on results derived from the study.

CHAPTER - 2

PHYSICAL SETTING OF MORIGAON DISTRICT

CHAPTER - 2

PHYSICAL SETTING OF MORIGAON DISTRICT

Morigaon district is located in the mid part of Assam. The unique feature of the Morigaon district is that it is constituted by combination of hill and plain regions. The district is created bifurcating the Morigaon sub-division from the greater Nagaon district in the year 1986. The district has a total area of 1704 sq. km with 680 villages of which 636 are inhabited. The district has a total population of 776256 persons with a sex ratio of 945 females per thousand male and the density of population is 456 per square km. The literacy rate of the district is 58.53% (State average 63.25%) according to census (2001) reports.

2.1. LOCATION AND EXTENT OF THE DISTRICT

Morigaon district is situated between 26° 15" N and 26° 50" N latitude and 92° E and 92° 50" E longitude. The district is bounded in the north by river Brahmaputra, in the south by Karbi Anglong district in the east by Nagaon district and in the west by Kamrup district. The whole district comprised of only one subdivision and five revenue blocks. The district has a total area of 170400 hectares out of which 17626 (10.34%) hectares is covered by forest land; 20198 (11.85%) hectares of land is put to non agricultural use; 5120 (3.00%) hectares of land is barren and uncultivable.

2.2 DEMOGRAPHY

In a purely agricultural region like the Morigaon district, the human element plays a very important role in agricultural pattern and development. According to 2001 census, the total population of the district stood at 775874 accounting for 2.91 per cent of the total population of Assam and its area was 1587.7 km² accounting for 2.02 per cent of the total area of Assam. The density of population ^{has} rapidly increased in the district from 375 in the year 1991 to 455 in the year 2001. The decadal growth rate (1991-2001) of the district is higher as compared to state average i.e. 21.29 against 18.85. Sex ratio of the district (945) is also higher as compared to state average of 923 (Census, 2001). It is observed that the population distribution within the district has not been uniform because of variation in the environmental condition.

Before 1931, the distribution of population was very scanty in most parts of the district especially along the bank of the river Brahmaputra. However, after the implementation of different colonization schemes since 1931 by the then Government of India, there has been tremendous inflow of people to this highly fertile flood plain earlier left barren by the indigenous people. Therefore after the thirties the Muslim immigrants have converted this vast low-lying tract in to a prosperous agricultural area. Earlier to the thirties, though permanent settlement was not there, the indigenous peasants practiced *pam* cultivation by erecting temporary huts in the winter season to cultivate Rabi crops only without utilizing the land in the summer season when flood was reigning.

The immigrants not only settled down in the mouzas of Mairabari, Laharighat, Bhuragaon, Bokani, and Pokaria on the bank of the river Brahmaputra but also spread in to some of the interior parts of the district. The report of the Line System Committee, 1938, explains that the spread was mainly from the Mairabari to the Pokaria Mouzas in the north and the Silpukhuri and the Mikirbheta in the east, resulting in a regional variation in the distribution of population. Besides the immigrants, the indigenous tribal and non-tribal populations are also distributed unevenly in the northern, western, central and southern parts of the district.

The immigrant Muslim community has settled in the northern riverine tract towards the north of the Sonai river up to the bank of the Brahmaputra, while the other indigenous peasant communities live in the central and eastern built up region as well as in the southern and southern and south-western peripheral region, while the indigenous non-tribal group other than scheduled caste is concentrated in the central, eastern and southern part. Most of the tribal people have mixed settlement along with the non-tribal indigenous group. The scheduled caste people generally settle near the beels and rivers where there are facilities for fishing.

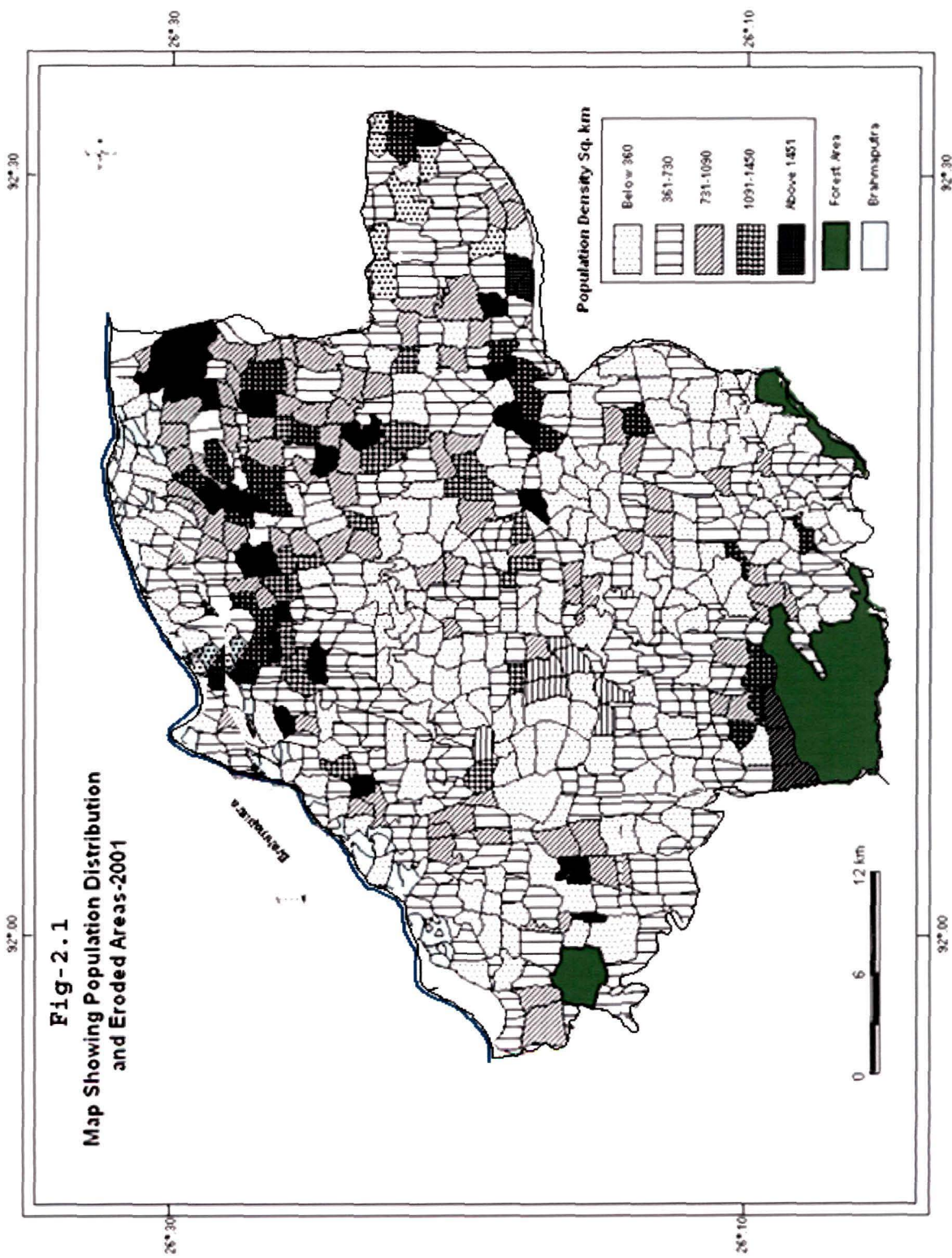
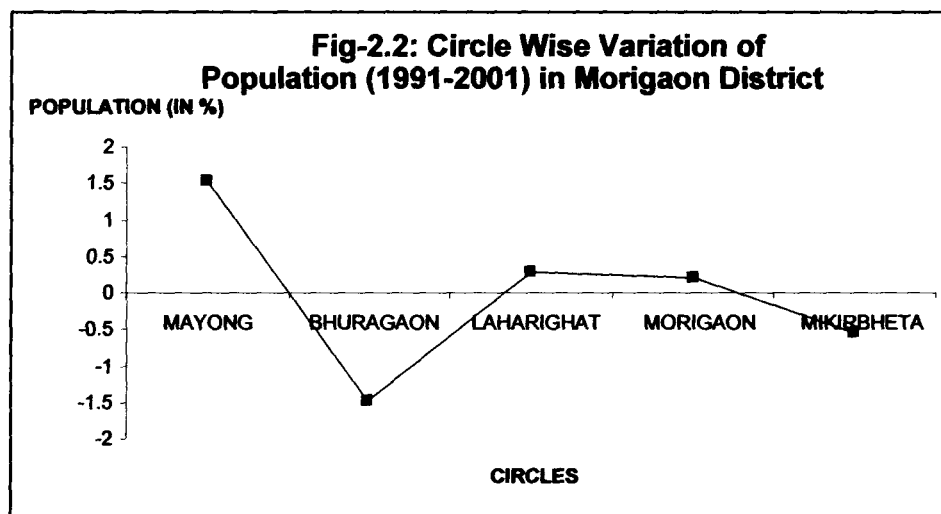


Table-2.1: Circle wise population distribution of Morigaon district (Population in percentage)						
Circles	Census Period					
	1991			2001		
	Male	Female	Total	Male	Female	Total
Bhuragaon	51.96	48.04	15.14	48.10	51.90	13.67
Laharighat	51.68	48.32	23.35	51.70	48.30	23.63
Mayong	51.94	48.06	24.70	51.60	48.40	26.60
Morigaon	51.26	48.74	21.03	50.91	49.09	21.23
Mikirbheta	50.60	49.40	15.78	50.78	49.22	15.23
District Total	51.53	48.47	100.00	51.39	48.61	100.00

Source: Census of India

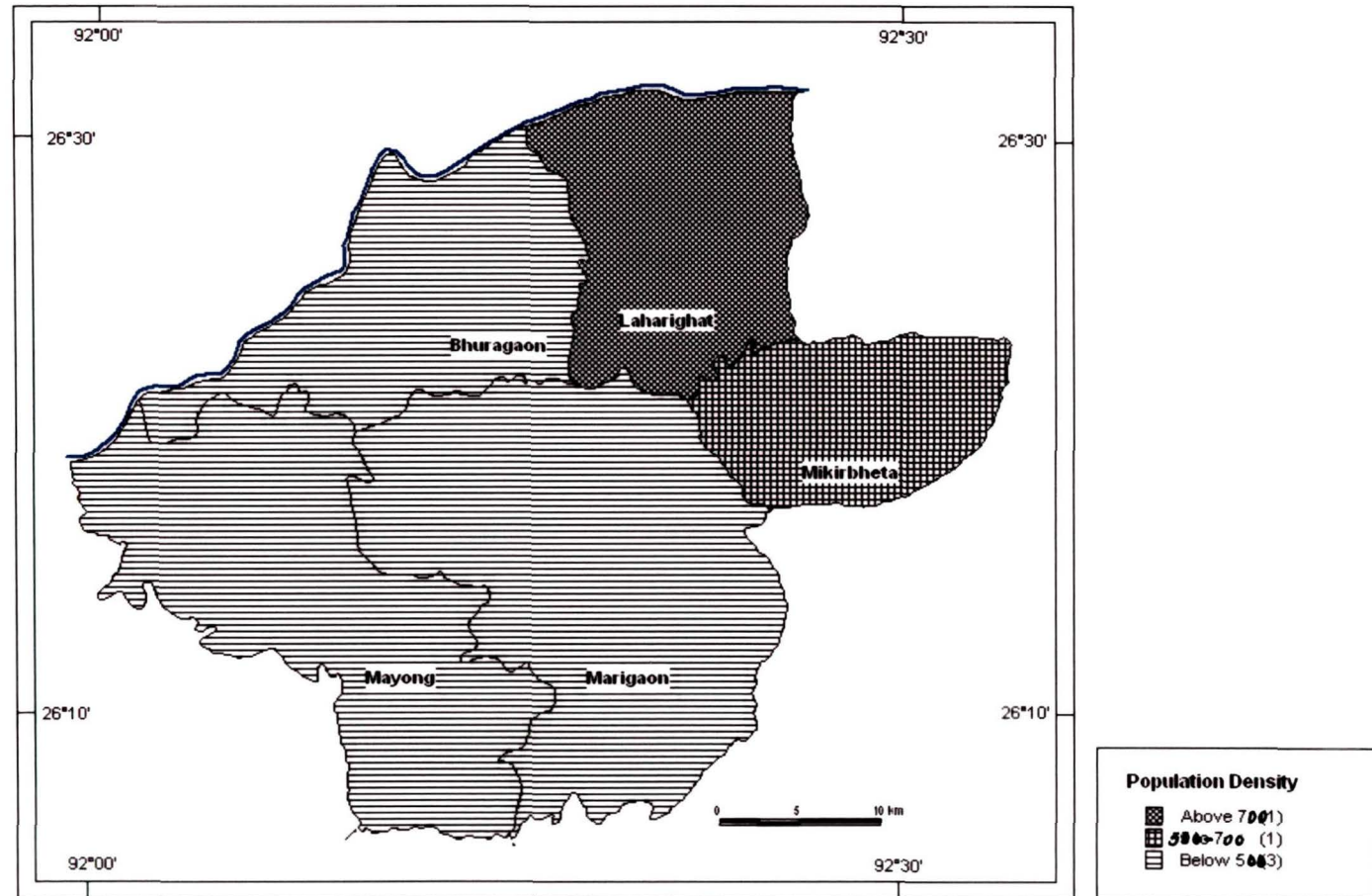


**Table-2.2: Total Population, Decadal growth, Sex ratio and Density of
Population in Assam and Morigaon district (2001)**

State/dist	Population 2001			Decadal growth rate 1991- 2001	Sex ratio		Density	
	Persons	Males	Females		1991	2001	1991	2001
Assam	26638407	13787799	12850608	18.85	923	932	286	340
Morigaon	775874	398930	376944	21.29	941	945	375	455

Source- Census of India, 2001 (Provisional Report)

**Fig-2.3 Morigaon District
Circle wise Population Density
(2001)**



2.3: LITERACY LEVEL

Literacy is one of the most important factors for determining various socio-economic parameters of a population. According to 2001 census, the district had 375465 literates accounting for 58.53 per cent of the total population as against 63.25 per cent of Assam and 65.49 per cent for the nation as a whole. Moreover, a large proportion of them have only the preliminary level of education. In such a pitiable state, one cannot expect economic growth of the district, which is mainly agro-based, at the desired pace. It is a fact that without education and training of the peasants in scientific method of farming and farm technology, agricultural modernization is a cry in wilderness. Illiterate and ignorant peasants can never be expected to adopt innovative measures for agricultural development.

State/dist.	Total/ Rural /Urban	Literates		
		Person	Male	Female
ASSAM	Total	14327540	8324077	6003463
	Rural	11736817	6873533	4863284
	Urban	2590723	1450544	1140179
MORIGAON	Total	375465	215215	160250
	Rural	346627	198904	147723
	Urban	28838	16311	12527

Source: Census of India, 2001

2.4. TRANSPORT AND COMMUNICATION

It is well recognized that various social and economic activities are inherently dependent upon transport network. However, lack of adequate and efficient transport network has become a major obstacle towards economic exploitation and utilization of potential resources of the Morigaon district.

The district is connected with the rest of the state via roads, railways and water ways. There are several waterways which links the district with the north bank of Assam. The important waterways are Sunsali-Kuruwa, Guwahati-Kuruwa and Guwahati-Kachamari, ferrying 75,000 persons, 55 tons of goods and 400 animals annually at an average. These waterways are also used for ferrying various types of vehicles also.

Roads are the major mode of communication of the district. The lifeline of the district is the National Highway (NH-37) that runs across the district. Total length of the roads in the district is 1022 km out of which 898 kms are still to be surfaced. The ratio of road per lakh population is 132.0 km (state average is 131.0 km) and 60.0 km per hundred square km as against state average of 44.8 km. Morigaon district is connected with meter gauze as well as broad gauze line of railway also. The railway line extends across the district in an east-west direction.

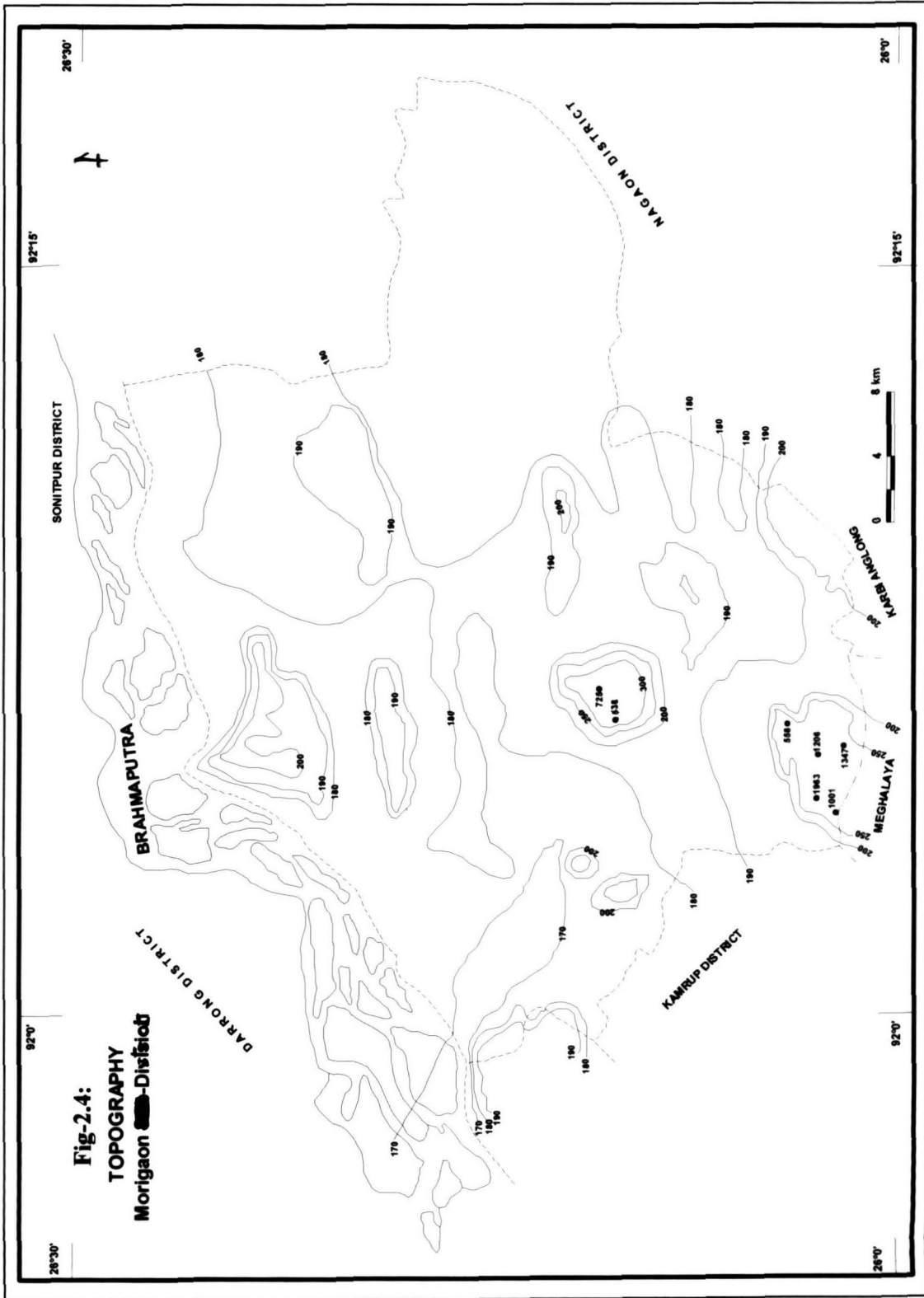
2.5: PHYSIOGRAPHY

Physiographically the district Morigaon can be divided in to three regions viz. the north-eastern low lying plain, the central and the eastern built-up plain and the south western plain interspersed with hillocks

The north-eastern low lying plain covers the northern part of the mouzas of Bhuragaon, Bokani, Pakria to the north western part of the Mayong. As there is no embankment on the south bank of Brahmaputra, this area is inundated by the floods of the river chronically during summer. The plain possesses a number of swamps and water logged area here and there.

The central and the eastern built up plain is an extensive alluvial plain covering the southern part of Bhuragaon, Laharighat, Moirabari, Mikirbhata, Silpukhuri, Dandua, Charaibahi, Niz Ghagua, part of Manaha, Tetelia and the Uttarkhola mouzas. This built up plain is drained by several river channels and dotted with beels and marshes. Between the Brahmaputra in the north and foothills of the Meghalaya plateau in the south-west, this plain is the extension of the broad plain of the Morigaon district, built up partly by the Kollong and Kopilee which flows from east to west. This plain is extremely flat with an imperceptible gradient from east to west. There are several drainage water channels between the Brahmaputra and the Kollong namely Leteri, Sonduba, Lalipara, Sonai and Pakaria flowing more or less parallel with the Kollong. These channels dry up during winter leaving a series of beels, while water flow through them during summer due to heavy rainfall in the catchments area. All these channels and the abandoned courses of rivers/ rivulets have converted the central plain in to an area of frequently occurring marshy lands and swamps.

Apart from its dead flatness, the region especially the North Eastern region lies at a level lower than that of the Brahmaputra creating a permanent risk of inundation during the high floods in the river. Although the region is protected from



the risk of flood by erection of embankment, but breach of embankment during high floods causes inundation now and then. Apart from this, the region has a chronic problem of soil erosion on the river bank which sometimes leads to submersion of many villages by the flood waters of the river Brahmaputra. Many swamps and marshes are created within this built up region due to intrusion of water from river Brahmaputra.

The geographic unit making the south western plain interspersed with hillocks of the district bordering the Meghalaya plateau covers the southern parts of Mayong, Monoha, Tetelia, Uttarkhola and the whole of the Gobha mouza. Being the extension of the Meghalaya plateau, it has many isolated hillocks surrounded by fragmented plains interspersed by numerous swamps and beels. The important isolated hillocks include the Tetelia parbat and the Hatiutha parbat with the average height of 272 metres and 219 meters respectively. The general gradient of the area is comparatively high (1 meter in 1.5 km.). The hillocks are remnants of the highly eroded parts of the Meghalaya plateau. The surrounding plains are formed partly by aggradation of the Kopilee and the Kollong and partly by degradation of the hillocks. This area is less important than the built up region from the view point of agricultural land use, because this area is covered with swamps, beels, hillocks and reserve forests. However, the low lying areas of this region are used for cultivation of spring rice and slopes of the hillocks support pineapple, ginger etc. Recently, innovative measures have been adopted to grow high yielding varieties of crops and other rabi crops in the flood affected low lying areas of the Mayong and the Monoha mouza with the help of irrigation. Earlier these areas were not used to grow crops.

2.5: SOIL TYPE

The soil of Morigaon district can be classified in to three major groups as per their physical, chemical and other qualities. They are –the sandy riverine soils of the north west along the banks of the river Brahmaputra which are chronically flood affected; the fertile alluvial soil of the central and the eastern parts; and the relatively infertile soil of the hills that spreads over the isolated hillocks and the foothills of the south-west region intervening intermittently with fertile alluvial soils affected by flash floods.

The alluvial soil found in the central, eastern and other parts of the district are mostly clayed loam and are found to be medium to fine in texture. They are slightly acidic to neutral in reaction. These soils are deficient in nitrogen and phosphoric acid. However, these soils have the capacity to hold nitrogen rapidly through the cultivation of leguminous crops and respond to the use of manures and fertilizers with ease. For these reason these soils supports the cultivation of two principal crops viz. rice and jute. Crop failure is also not uncommon in this type of soil in case of long draught period as alluvial soil cannot retain moisture for a long period of time. Such conditions can be averted by the use of irrigation. The high percentage of clay found in these alluvial soils of the central and the western parts of the district is suitable for paddy cultivation while the sandy loam variety of the alluvial soil found in the northern parts of the district is suitable for jute cultivation. The colour of these soils varies from light gray to dark gray.

The hill soils are found in the slopes and ridges of the district. These are acidic in reaction. They contain a high amount of clay derived from the parent rocks of the extended parts of the Jayantia hills and are mostly gneissic in character. These soils also possess a high proportion of plant nutrients and phosphoric acid and hence these soils are capable to support plants of citreous family specially oranges and pineapples. Among other important crops of the region rice, maize, millet and vegetables are worth mentioning. Some reserve/forests with valuable trees are also seen in the hill soils.

Bank materials of the Brahmaputra river are mostly composed of varying proportions of fine sand and silt with only occasional presence of clay (generally less than 5 percent). The intensity of bankline retreat and processes of bank erosion are strongly affected by the percentage of fines, especially of the silt and clay particles which provided the necessary cohesive strength. The bed and bank materials are mainly in the fine sand and silt fractions. High moisture content, low proportion of clay and good sorting of bank materials make the Brahmaputra bankline highly susceptible to erosion by the river.

2.7: DRAINAGE AND WATER BODIES

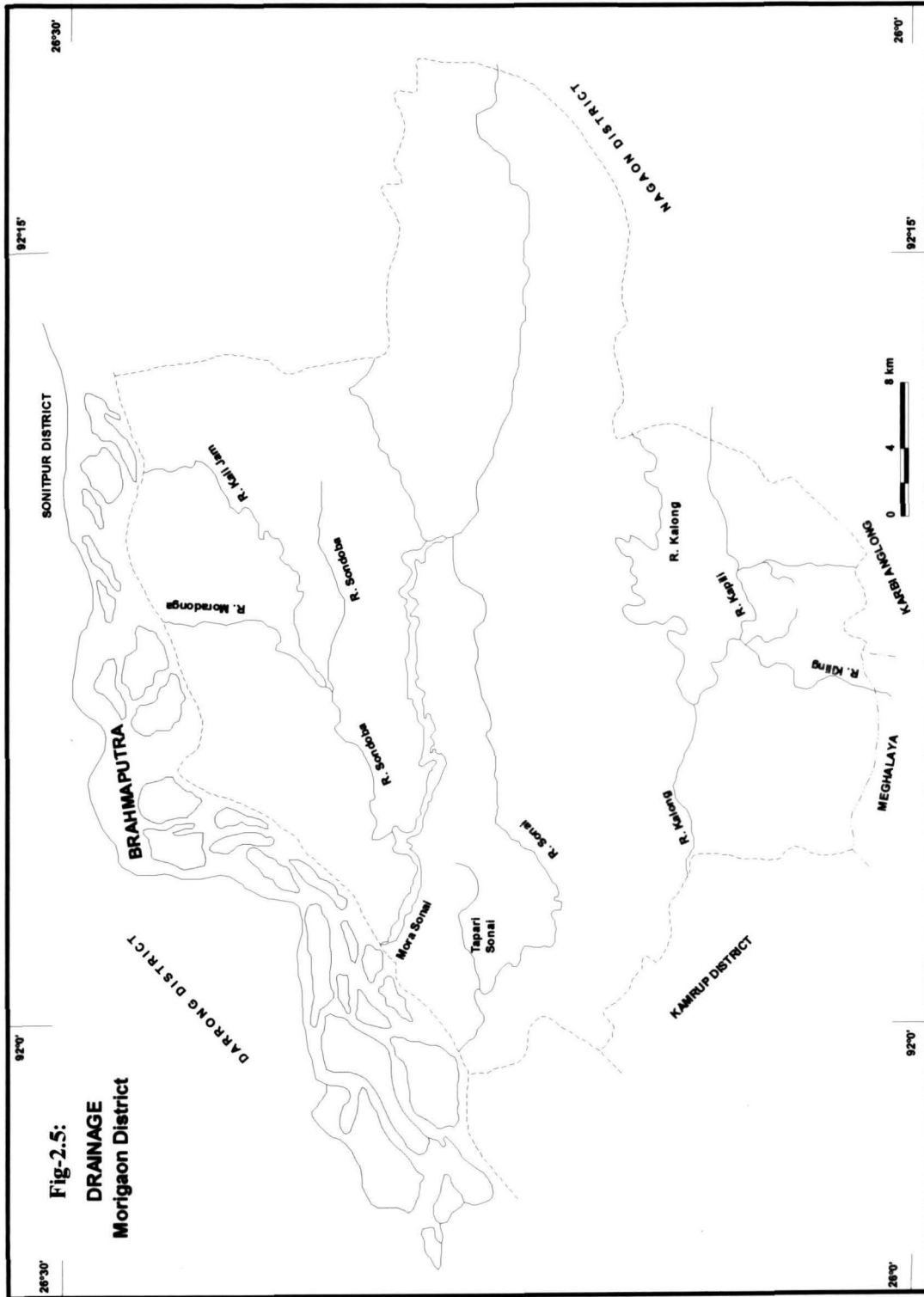
The Brahmaputra is the main river which flows along the extensive northern boundary and all the drainage of the district ultimately finds their way in to it. Its main tributaries within the district are Kollong, Kopilee, Sonai, and Pakaria.

The Kollong takes off from the river Brahmaputra and flows towards south west to meet the river Kopilee near Jagi. This river rejoins the parent river at

Kajalimukh about 24 km from Guwahati. A little to the west of Jagi the river Kollong forms the boundary between the Morigaon and the Kamrup districts. Not far from its junction with Brahmaputra it receives the river Digaru on its left bank. The region between the Kollong and the Brahmaputra is drained by a large number of water courses forming a network of intricate channels which widens out here and there into beels or swamps, the largest ones of which are known as the Sonduba and the Leteri. The river Kollong plays an important role in drainage system of the district.

The Kopilee river joins the river Kollong at Jagichaki. The combined channel after flowing North West finds its way in to the Brahmaputra near Kajalimukh. This river is navigable throughout its course in the district. The Kopilee basin of the district may be described as the rice bowl area. Besides Ahu, Sali and Bodo paddies, jute is also found to be one of the major crops of the region. As this basin is situated at a lower level it is subjected to frequent flood havocs and damages. Very high floods occurred in this basin in 1931, 1934, 1946, 1948, 1949, 1959, 1962, 1983, 1985, 1988, 1993, 1996, 1999, and in 2002. The flood of 1934 is still remembered by the people as “Balial pani” (mud flood) as it was the highest.

In addition to the rivers mentioned above, there are several other important tributaries, numerous channels and streams locally called as “Jans” and “juries”. The area between the Brahmaputra and the Kollong is drained by Leteri and Sonai in to the river Brahmaputra. On the extreme west at “Hilai-Khunda” the Pakaria joins the river Brahmaputra. The Garanga and the Chirikhanda channels are also worth mentioning.



Besides these channels there are several beels and marshy lands scattered throughout the district. Beels are often long, narrow and deep. The beels are rich in fishes. Important among them are Mora Kollong of Morigaon mouza, Gakhajua beel of Mikirbheta mouza, Goronga beel of Mayong mouza, Pakariabeel of Pakaria mouza, Udari beel of Ghagua mouza and the Dandua beel of the Dondua mouza.

Assam valley is prone to flood and it is the perennial source of natural calamity, as mighty river Brahmaputra gets flooded during monsoon due to excessive precipitation (Taher, 1975). Floods in Brahmaputra River have been aggravated due to frequent change in river course and heavy sedimentation load. The intensity of flood can be revealed from the fact that an area of 30 lakhs hectares are flood prone out of 78 lakhs hectare areas i.e. about 45% of basins in Assam is flood prone. Morigaon is one of the most flood prone district of Assam.

2.8: CLIMATE

Being a part of the Brahmaputra valley the Morigaon district also falls under the influence of the humid mesothermal Gangetic (CMG) type of climate as defined by Koppen. The climatic condition of the region is hot and humid during the summer and cold and dry during the winter. The coldest month of the year is the January with a mean daily temperature ranging from 9.9° c (minimum) to 24° c (maximum). From the month of April to September the mean daily temperature ranges between 32° c to 34° c. the month of July being the hottest month with temperature ranging from 34° c in the maximum level to 25.3°c in the minimum level. Relative humidity is also very high (80%) during this period.

This region is influence by south west monsoon in the summer and north east monsoon in winter season. Rains due to south west monsoon occur during June to September and due to north east monsoon during October to November. The district receives an annual rainfall of 1772.4mm in an average compared to state average of 2856.3mm. Season wise average rainfalls are also lower than the state average. Month wise breakup shows that the district receives maximum rainfall in the month of July and minimum in the month of December.

2.9: ECONOMY

The Economy of Morigaon district is principally agro based. Sericulture, fishing and driftwood business is carried out by people in smaller scales. However river erosion, sand deposition and other adverse effects of chronic floods on fertile agriculture land have made even affluent farmers landless. Lack of good communication system, shortage of power and lack of proper irrigation and marketing facilities add to the poverty of the district. Dearth of any major and small industry excepting the Nagaon Paper Mill are also responsible for multiplying the problem of unemployment while galloping explosion in the rate of population growth has already shown signs of negative impacts. The local economy is thus characterized by subsistence level of production and consumption.



CHAPTER-III

CHANGING AGRICULTURAL LAND USE AND CROPPING PATTERN

CHAPTER-III

CHANGING AGRICULTURAL LAND USE AND CROPPING PATTERN

Agricultural scenario in India is improving as the country had made a commendable progress in this sector. However, there still exists a challenging task of maintaining food security and providing employment for future generations as estimated annual population growth lies at about 1.8 percent. The scenario in Assam is grimmer as the state is still to cope up with the rest of India in this sector.

Agriculture occupies a vital position in the State's economy engaging about 53 per cent of the total working force, according to 2001 census. The contributions of this sector in State Domestic Product (SDP) at constant and current prices are 31.08 percent and 31.13 percent respectively in the year 2002 and 2003. All the agricultural programmes have been assigned with high priority in the successive plan periods for efficient use of available resources and to maximize production. These efforts have undoubtedly resulted in certain degree of transformation in the pace of development under this sector, but much more remains to be done to bring the situation compatible with other developed states of the country.

The state belongs to rainfall belt where rainfall varies from 80 to 1580 mm during different periods of the year. Sufficient rainfall occurs mainly during the kharif season which is beneficial for growing paddy, the principal crop of the State. Similarly Jute cultivation also gets sufficient rainfall in pre-monsoon period, which is an ideal situation. Agriculture in Assam is mainly rainfed as the state has limited irrigation facilities and land holding per family is decreasing. On the other hand, the demand for food is increasing in quantitative as well as qualitative terms. The

demand for livestock products is also increasing along with demand for fruits and vegetables. Moreover, there is an increase in export of agriculture produce, as a result of economic liberalization and it is influencing agriculture production. At the same time there is a realization of the adverse effects of over exploitation of resources as indicated by rapid increase in soil salinity, lowering of ground water levels, soil erosion, increasing incidences of chemical residues in food products etc.

Agriculture is not only the main source of employment, income and food for majority of the rural population, but is also the main culture for rural families in the Morigaon district. A major concern in Assam as well as in the district is the improvement of agricultural production from rainfed areas combined with a judicious land use pattern and diversification of agriculture. Mixed crop-livestock farming or mixed cropping may become a way of averting risks and generating sustainable family income especially in rainfed areas.

The soil, topography, rainfall and climatic condition of Assam are congenial for cultivation of paddy, which covers nearly 70 per cent of the gross cropped area and more than 90 per cent of the total area under food-grains. The soil of the state is acidic in reaction having pH value between 4.5 and 6.5 except the new alluvial soils, which are neutral in reaction (pH 6-7). The soils of the foothills are also strongly acidic (pH 4.5-5.0) whereas in the remaining areas it is less acidic (pH 5-6). In the neutral status phosphate contents are low while nitrogen and potash contents are medium. The major soil groups of the region are (i) new alluvial soil (ii) old alluvial soil, (iii) old mountain valley alluvial soil, (iv) non-laterised red soil, and (v) laterised red soil.

Physiographically the Brahmaputra valley is an alluvial plain surrounded by hills except in the western side. The Brahmaputra river entered^s the plain area of Assam near Sadiya in Tinsukia district in the east and flows westward through the middle of the State and ultimately turned^s southward to enter the plain area of Bangladesh. The Brahmaputra Valley has a gradual gradient from east to west. At Sadiya, the easternmost point of the state, the altitude is 134 meters, at Dibrugarh, it is 104 meters, at Guwahati the altitude is 50 meters and at Dhubri, the westernmost part, it is 35 meters above mean sea level.

Agricultural land use in all over Assam is characterized by a low percentage of cultivable land, extraordinarily high percentage of rice hectareage in the total area sown, low crop intensity and low yields per unit area (Das, 1984).

Agricultural land use constitutes a dominant feature of the diverse uses of land for productive purposes. The present pattern of agricultural land use in Assam is an outcome of long and continued human settlement and culture. Within the state diverse ecological setting of the valleys, hills, ridges and other micro-physiographic units combined with varying socio-economic factors have produced significant spatial variation in the pattern of agricultural land utilization (Bhagabati, 1990). In Assam agricultural land use basically means the cultivation of soil for growing crops only, leaving insignificant areas for grasslands, horticulture, pisciculture and livestock farming. The major land use/ land cover categories that are identified in the Morigaon district are built-up land, agricultural land, forestland, wasteland, water bodies and grazing land. The area occupied by each of these major categories is shown in Table-3.1.

Table-3.1: Land use pattern in Morigaon district
(Figure in parenthesis indicates the percentage of total area)

(Area in hectares)				
Sl.No.	Classification of Land	1980-81	1990-91	2000-01
1	Reserve and other forest	19389 (12.21)	18987 (11.95)	17626 (11.10)
2	Barren and uncultivable land	8800 (5.54)	6980 (4.39)	5120 (3.22)
3	Land put to non-agricultural uses	19280 (12.14)	20190 (12.71)	21698 (13.66)
4	Permanent pastures and other grazing land	9902 (6.23)	8904 (5.60)	8331 (5.24)
5	Land under Misc. crops, and groves not included in Net Area Sown	6517 (4.10)	5826 (3.66)	4489 (2.82)
6	Cultivable waste	1474 (0.92)	875 (0.55)	690 (0.43)
7	Current Fallow	1628 (1.05)	968 (0.60)	546 (0.34)
8	Other Fallow land	1379 (0.86)	798 (0.50)	527 (0.33)
9	Net Area Sown	90401 (56.93)	94481 (59.50)	95738 (60.29)
10	Area Sown more than once	26814 (16.88)	46783 (29.46)	48394 (30.48)
11	Total Cropped Area	117215 (73.82)	121164 (76.13)	140132 (88.26)
Total geographical area		158770 (100.00)	158770 (100.00)	158770 (100.00)

Source: District Economics and Statistics Deptt., Morigaon

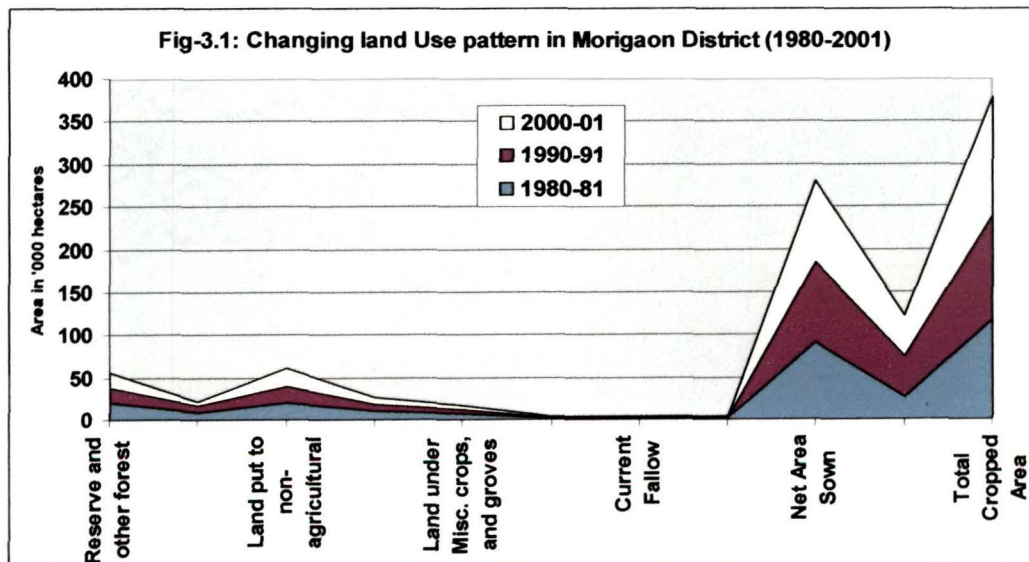
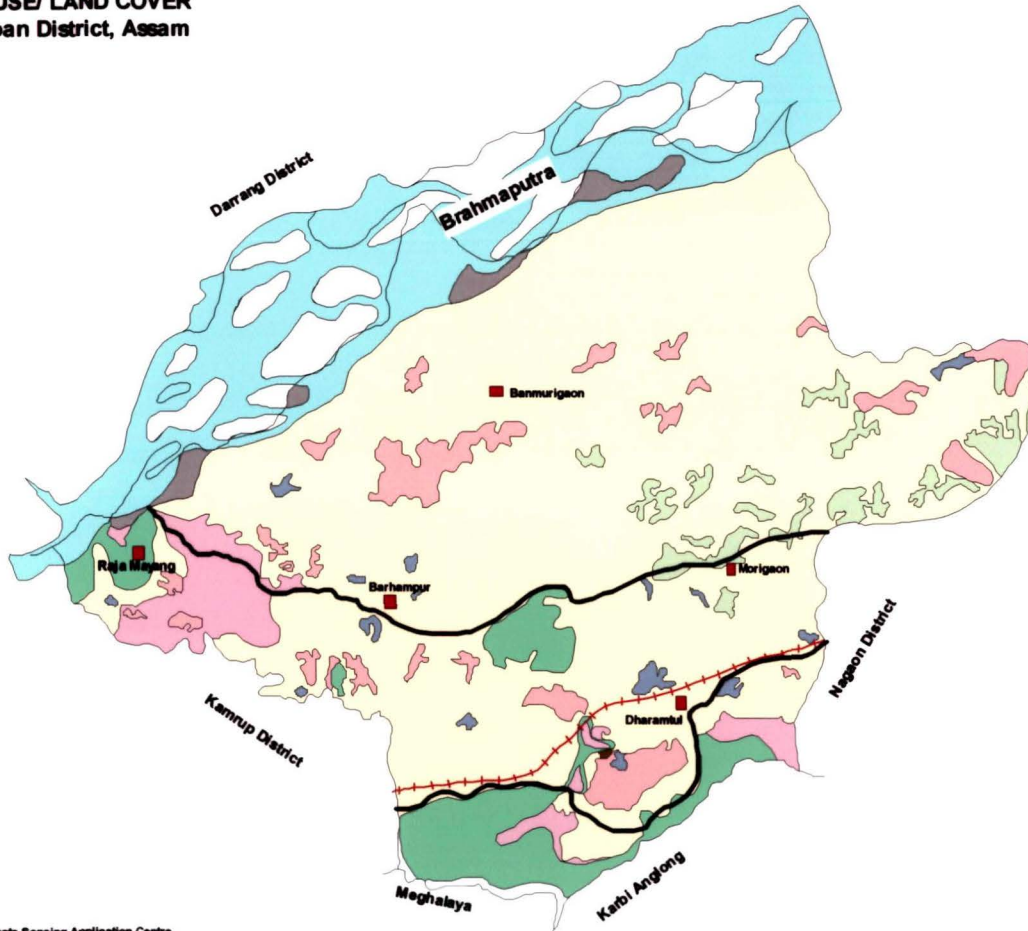


Fig-3.2:
LAND USE/ LAND COVER
Morigoan District, Assam



*
north ?

Reference

BUILT - UP LAND	
AGRICULTURE LAND	
FOREST	
WATER BODIES	
MARSHY AND SWAMPY	
GRAZING GRASSLAND	
RIVERS AND STREAMS	
ROADS	
RAILWAY LINE	

Scale ?

Grassland and grazing lands normally found along the main rivers and in the *char* areas. Crop area can be subdivided into kharif, rabi and double-cropped areas. Kharif crop is distributed throughout the district and comprise mainly of *sali* paddy.

During rabi season crops like paddy, mustard, winter vegetables etc. are also cultivated in the district. The area under rabi crop is much less than that of kharif. Rabi areas are found within the double crop areas. The plantation agriculture of the district is mainly confined to the settlement areas. The main plants include jackfruit, banana, bamboo groves, coconut and areca nut.

However, since 1969 a total of 93 villages along with their precious agricultural land have been affected by the erosion of the river Brahmaputra. Thus it has disrupted the very fabric of economy of the affected villages. Table-3.2 shows the circle wise eroded areas of Morigaon district since 1969 to 2001.

Table- 3.2: ERODED AREAS OF MORIGAON DISTRICT (SINCE 1969 TO 2001)					
Name of the circles	No. of villages eroded			Total eroded area (in ha)	Total families affected
	Fully	Partially	Total		
Bhuragaon	41	15	56	7151.14	7964
Laharighat	18	12	30	2250.51	7794
Mayong	3	4	7	855.28	1192
Total	62	31	93	10256.93	16950
Source-District Revenue Department, Morigaon.					

Of the total area of 142321.81 hectares land in the district, 10256.93 hectares (0.07%) have been lost to erosion, till 2001. More than 80 per cent of the lost land was rich agricultural land producing some of the finest variety of jute in Assam. Incidentally, the entire Bhuragaon-Laharighat belt of the district was once considered as the granary of middle Assam and was one of the sites of grow more food campaign, but are now severely affected by recurrent flood and erosion.

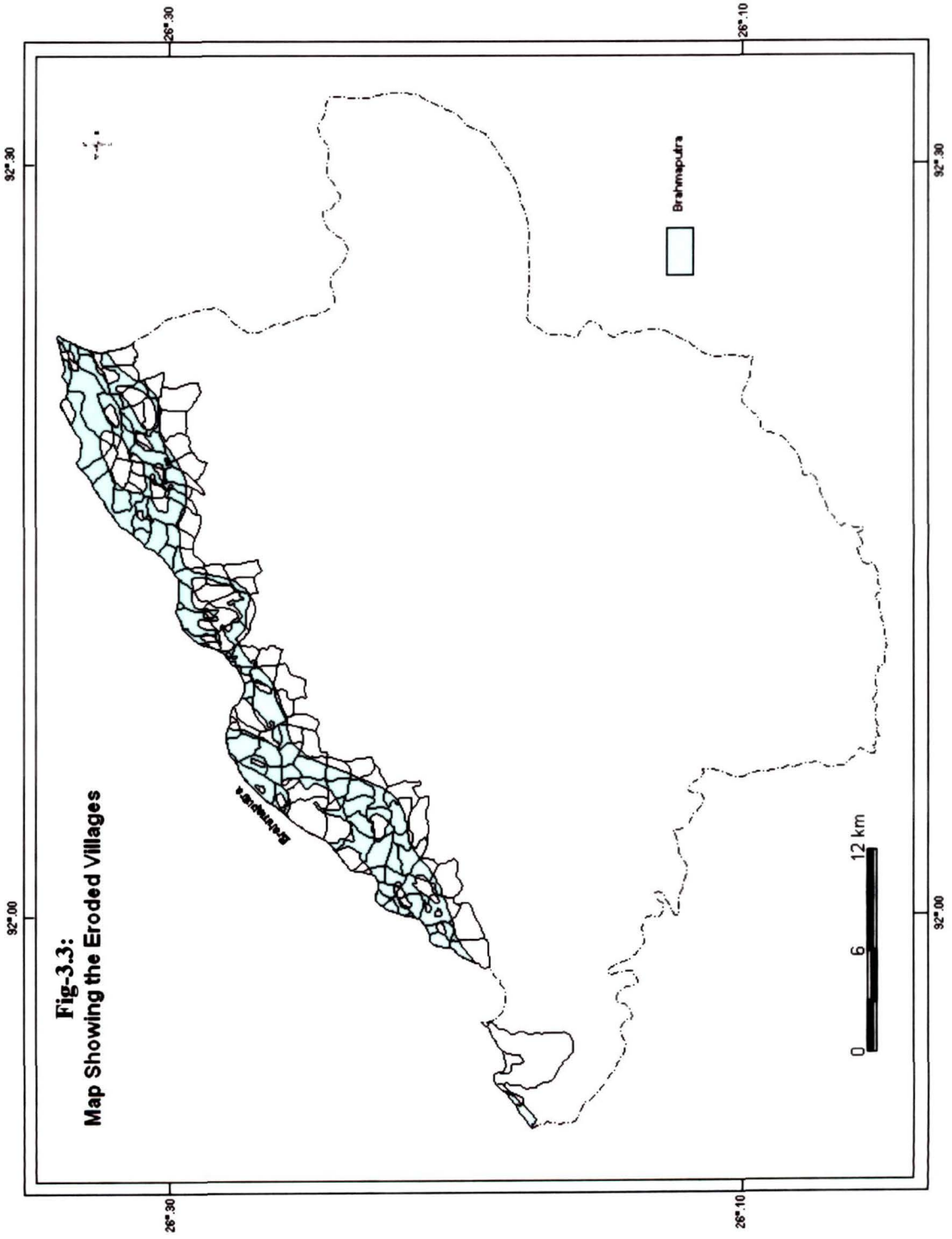


Fig-3.3:
Map Showing the Eroded Villages

Land use is a function of four variables- land, water, air and man. Each has its own role to compose its life history. Land constitutes its body, water runs through its veins like blood, air gives its life and man acts as dynamic factor to reflect its type, pattern and distribution (Singh 1981). Therefore, it is necessary to understand the inherent character of these four variables before making any attempt to find out a general pattern of land use in any area. It can also be easily observed that any mismatch of any of these four factors will lead to the adaptation of extra curative measures in order to bring out an optimal pattern of use. The preponderance of small and marginal type of land holding which is increasing due to fraternization and nuclearization of farm families also changes the land use pattern of the farmers. In Morigaon district large farmers constitute only 34.64 per cent while two third of the farmers are either landless or small or marginal farmers. Table- 3.3 shows the land holding pattern in Morigaon district.

Table-3.3: Land Holdings of Farm Families in the Morigaon District (2000-01)	
Size of the farm families	No. of families
Small farmers	35200 (27.48)
Marginal farmers	32648 (25.49)
Large farmers	44370 (34.64)
Landless farmers	15857 (12.38)
Total farm families	128075 (100.00)
(Figure in parenthesis indicates percentage of total) Source-District Revenue Department, Morigaon.	

Moreover, river erosion makes a negative impact on agriculture by way of making land unavailable for agriculture, thus making a definite changing impact on the agricultural land use pattern especially in the affected areas. Table- 3.4 shows the

changing impact in circle wise land use pattern of Morigaon district in two time period of 1987-88 and 2000-01.

Table- 3.4: CIRCLE WISE LAND USE OF MORIGAON DISTRICT									
(1987-88&2000-01) (In %)									
Circles	Year	Total geographical area	Forest	Not available for cultivation	Other uncultivated land excluding fallow land	Fallow land cultivation	Net sown area	Area sown more than once	Gross cropped area
Bhura-gaon	1987-88	16.31	0.04	1.59	3.14	0.78	10.76	4.18	14.94
	2000-01	16.31	0.04	2.81	1.82	1.21	10.43	3.96	14.39
Laharig hat	1987-88	16.81	-	1.63	2.30	0.04	12.84	4.02	16.86
	2000-01	16.81	-	1.88	1.59	1.07	12.27	6.26	18.53
Mayong	1987-88	29.84	2.63	7.21	3.16	1.48	15.36	5.28	20.64
	2000-01	29.84	2.62	6.20	2.84	2.32	15.87	6.43	22.30
Mori-gaon	1987-88	23.33	8.46	3.74	1.47	0.31	9.35	2.68	12.03
	2000-01	23.33	8.44	3.25	1.46	0.36	9.84	2.43	12.27
Mikir-bheta	1987-88	13.71	-	3.53	1.21	0.35	8.62	0.72	10.34
	2000-01	13.71	-	2.54	0.95	0.42	9.80	1.03	11.83
District Total	1987-88	100.00	11.13	17.68	11.28	2.96	56.93	16.88	73.82
	2000-01	100.00	11.10	16.64	8.66	5.38	58.21	20.11	78.32
Source- District Economics & Statistical Department, Morigaon.									

Fig-3.4: Circle wise Land Use of Morigaon District (1987-88)

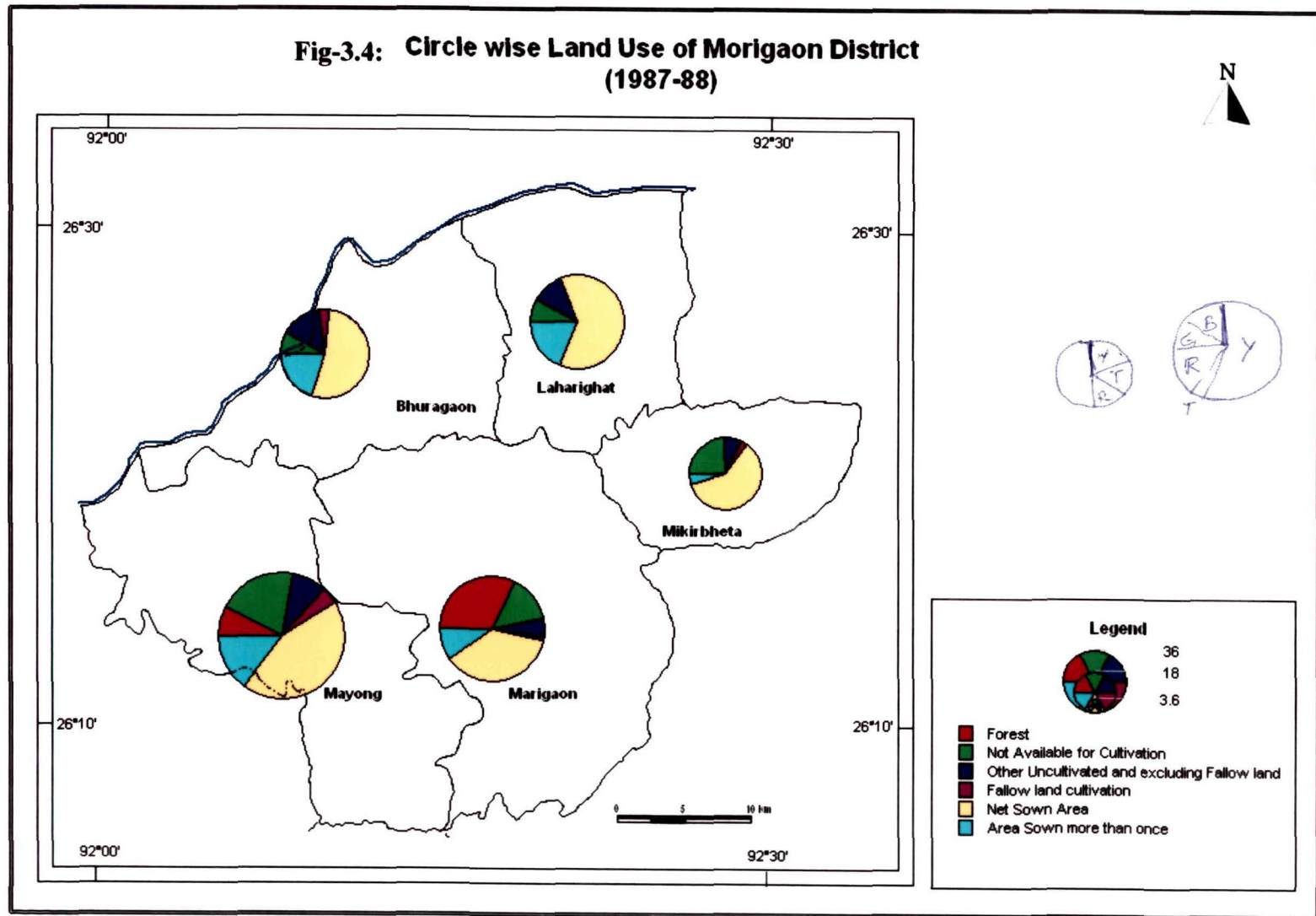
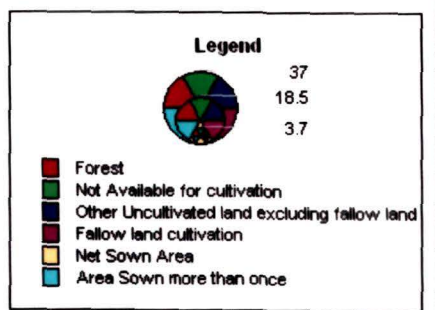
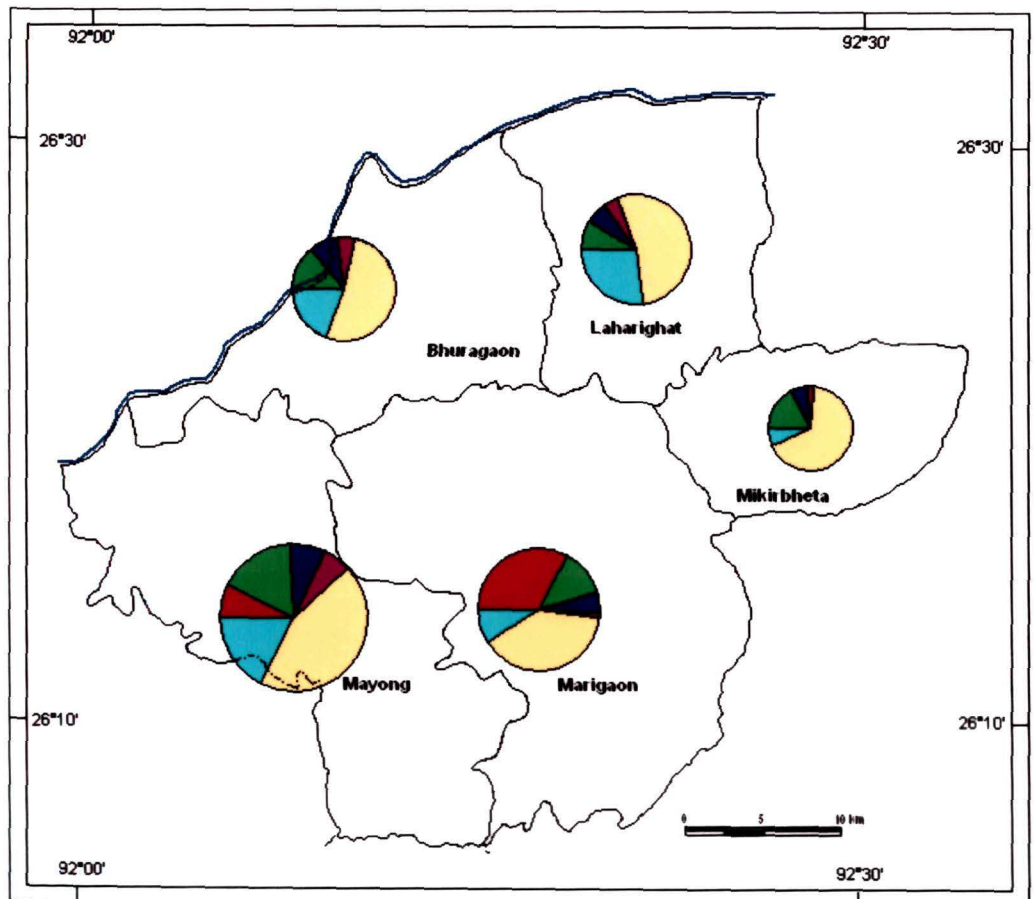


Fig-3.5: Circle wise Land Use of Morigaon District (2000-2001)



It can be observed from the table that net sown area in the Morigaon, Mikirbhata and Mayong circles have shown an increasing trend while Lahorighat and Bhuragaon circles have shown decreasing. The decrease in these two circles can be attributed partly to the erosion effect of the Brahmaputra and partly to the population pressure. On the other hand the increase in the net sown area in the erosion affected Mayong circle may be attributed to the aggradations of the tributaries of the river Brahmaputra as well as conversion of erstwhile barren cultivable land into agricultural land. Moreover, the area sown more than once had also shown an increasing trend in all the circles except in Bhuragaon and Morigaon. Most of the agricultural land of Morigaon and Bhuragaon circles are low lying and waterlogged and thus are considered to be unsuitable for double cropping by the farmers and majority of them practices traditional method of cultivation.

Thus the comparison of land use data of 1987-88 and 2000-01 makes it evident that erosion had an impact on the total availability of agricultural land. Although four circles have shown an increase in the total agricultural land however, there is a decreasing trend in the severally erosion affected Bhuragaon circle. On the other hand in the net sown area have increased in 2000-01 compared to the year 1987-88 in Morigaon, Mayong and Mikirbheta circles where bank erosion is less or not evident.

The main causes of the decrease in agricultural land in erosion affected circles may be summarized as-

1. Land submerged along the river courses.

2. Large scale deposition of sand in the agricultural field.
3. Increase of depopulated areas along the river valley.
4. Resettlement of affected people in the agricultural land.

However, migration of people towards “*Char*” areas for winter cropping and rehabilitation makes a positive impact on reclamation of fertile agricultural land and diversification of cropping pattern. Cropping pattern means both the time and space sequence of crops. The variation in the cropping pattern may result from variation in physical, economic and social factors. The physical factors like climate, topographic and soil etc. may to a greater degree dictate the suitability of various types of crops that can be grown in a particular area. The economic factors affecting the cropping pattern include the relative price of different products, cost of inputs and marketability of perishable goods. Similarly, social and cultural values also have influence on cropping pattern like farmers preferences for certain traditional crops, or crops in which they have the traditional skills to grow.

The district Morigaon like other parts of Assam produces a variety of crops such as paddy, maize, mustard, jute, pulses, sugar cane, fruits, vegetables, tobacco, etc. among which paddy occupies the largest crop hectareage of the region. Paddy consists of winter rice, summer rice and spring rice and it occupies 67.32 per cent of the total cropped area in 2000-01. Winter rice occupies 49.82 per cent, summer rice 13.12 per cent and the spring rice only 4.38 percent of the total crop hectareage of the district in 2000-01. Although rice is the primary crop for the district, different types of crops are also cultivated in many parts of the district. Among other crops wheat and maize are cultivated in many parts of the district. Among oilseeds,

mustard is most preferred one while other oilseeds like linseed, castor and sesamum are also grown in some parts of the district. Rabi pulses such as gram, lentil, saffron, black gram and peas are also becoming popular. Many farmers use to cultivate sugarcane, potato, vegetables, fruit-crops and spices like turmeric and ginger both for domestic consumption as well as for commercial purposes. Jute occupies the primary position among fibre crops of the district while cotton and mesta were also found to be cultivated in lesser extent. Tobacco and other crops like bajra and arhar were also cultivated in some isolated parts of the district

The spatial variation in the cropping pattern of the district can be best measured by crop concentration and diversification. The crop concentration is measured with the help of Location Quotient method for the year 1987-88 and 2000-01. For these purpose nine crops were selected on the basis that they occupy individually at least 1 per cent or more of the gross cropped area in the district. Table-3.5 and 3.6 shows the circle wise crop concentration index in Morigaon district in the year 1987-88 and 2000-01.

Circles	Crops										
	Summer rice	Winter rice	Spring rice	Maize	wheat	Mustard	Pulses	Sugar	Spices	Vege-table	Jute
Bhuragaon	1.61	0.38	0.29	2.82	4.03	1.41	2.16	3.17	0.85	1.49	1.98
Laharighat	0.59	0.69	0.98	0.84	0.47	1.84	1.78	2.31	0.99	2.32	2.47
Mayong	0.65	1.18	2.43	0.75	0.32	0.69	0.49	0.28	1.18	0.71	0.24
Morigaon	1.14	1.51	0.12	0.30	0.65	0.50	0.36	0.34	1.05	0.63	0.24
Mikirbheta	1.70	1.09	0.48	0.19	0.52	0.70	0.34	1.19	1.22	0.67	1.01

Source: District Economics and Statistics Deptt. Morigaon

Table- 3.6: CIRCLE-WISE CROP CONCENTRATION INDEX (2000-01)											
Circles	Crops										
	Summer rice	Winter rice	Spring rice	Maize	wheat	Mustard	Pulses	Sugar	Spices	Vegetable	Jute
Bhuragaon	0.93	0.72	1.14	4.32	2.22	1.46	1.04	1.72	1.75	1.04	1.74
Laharighat	1.64	0.94	0.78	0.78	0.30	0.65	1.16	0.80	0.72	1.27	1.32
Mayong	0.11	0.60	5.15	0.26	0.74	1.37	0.53	0.03	0.71	0.47	0.15
Morigaon	0.93	1.30	0.37	0.72	0.87	0.86	0.82	0.84	0.72	0.64	0.30
Mikirbheta	1.87	0.89	0.14	0.14	0.69	0.99	0.29	0.65	0.47	1.11	2.10

Source: District Economics and Statistics Deptt. Morigaon

Location Quotient = X/Y

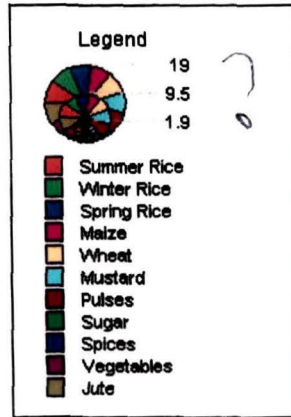
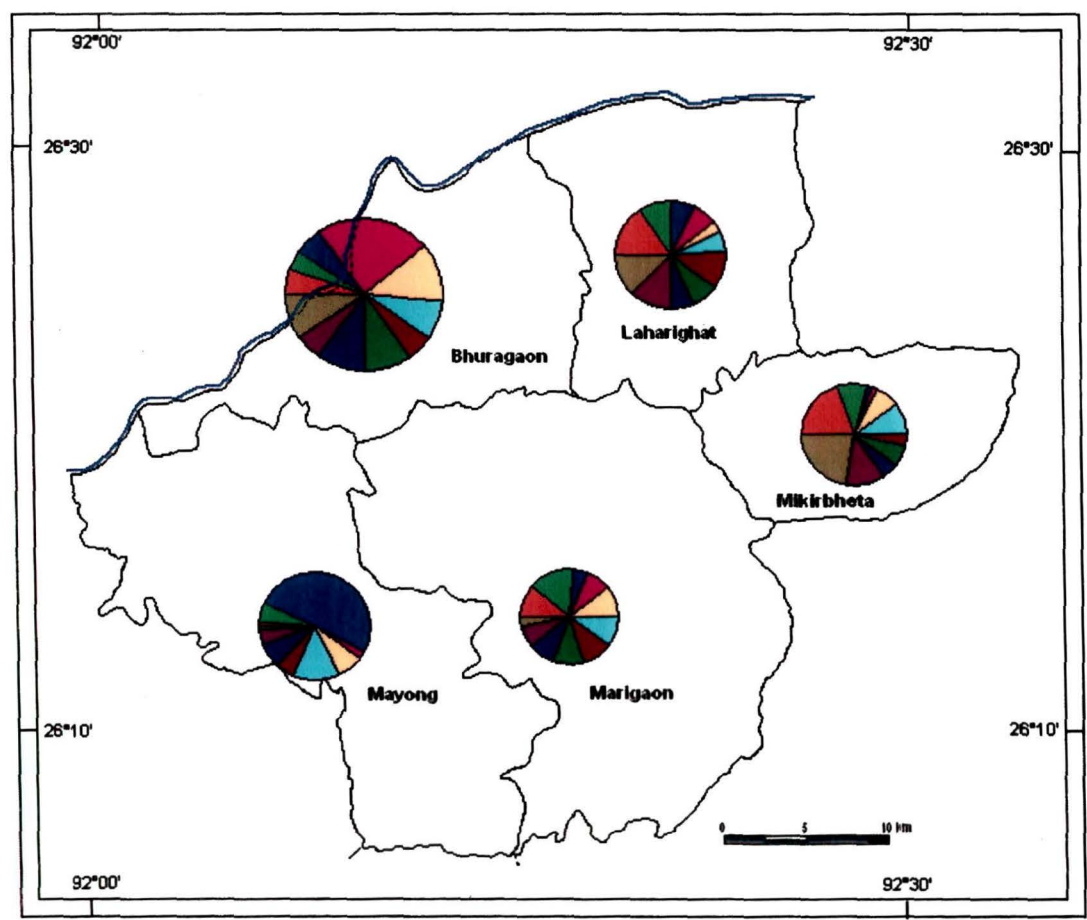
X = hactareage of crop X in a circle/ hactareage of all crops in the circles

Y = hactareage of crop X in the district/ hactareage of all crops in the district.

When L.Q. value is more than 2, it is considered as high concentration, when the value ranges from 1 to 2 it is low concentration and when it is less than 1, it is considered as a region of insignificant importance of that crop.

As winter rice was more or less uniformly distributed to all over the district there is absence of very significant concentration of this crop in a particular circle. Out of the five circles three (i.e. Mikirbheta, Bhuragaon & Mayong) have recorded statistically low concentration of winter rice. The concentration of other winter crops are increasing in the year 2000-01 as compaired to 1987-88.

Fig-3.6: Circle wise Crop Concentration Index (2000-01)

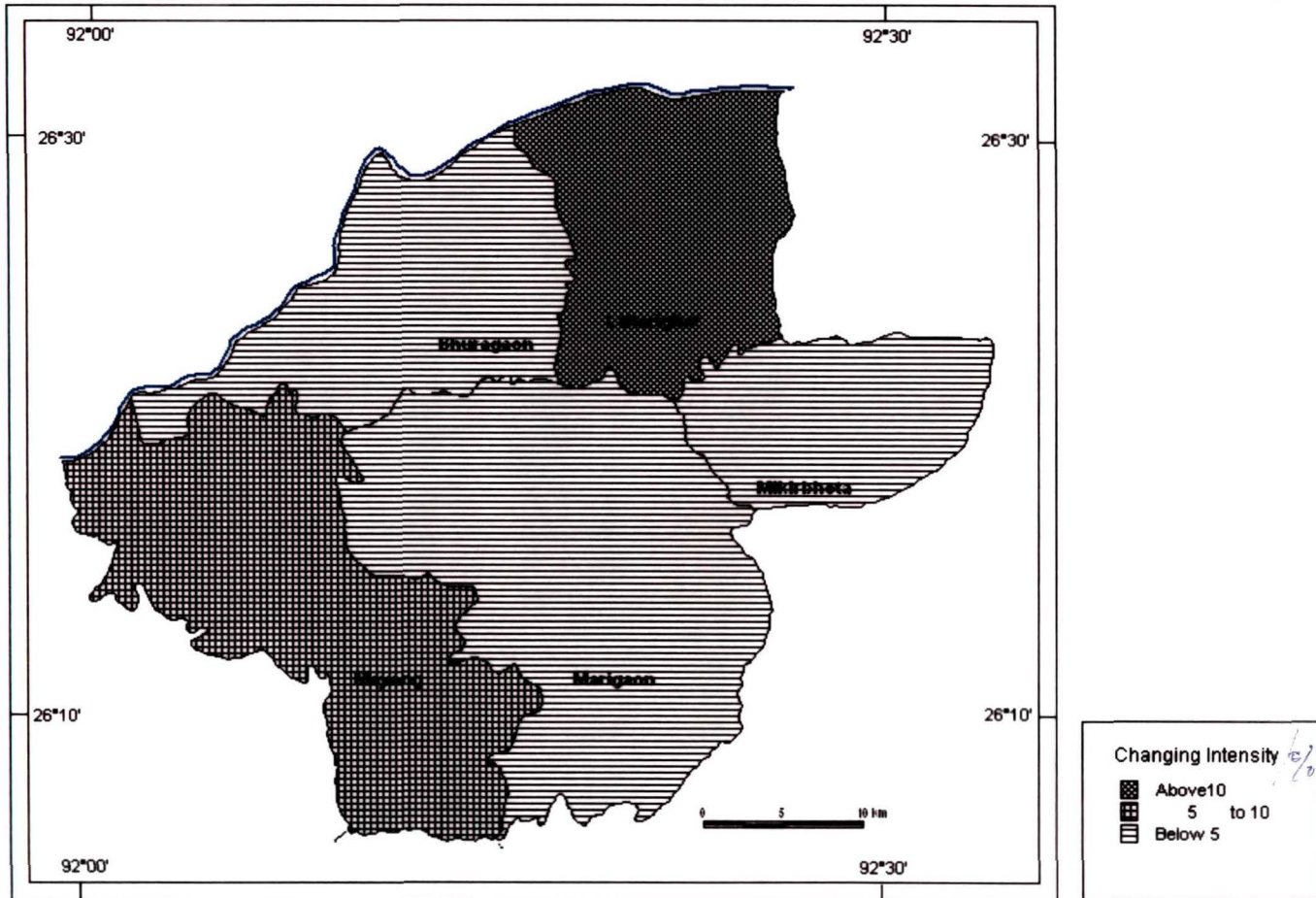


Circles	Year		Change (%)
	C.I.I. (1987-88)	C.I.I. (2000-01)	
Bhuragaon	134.37	140.52	6.14
Laharighat	131.30	151.02	19.71
Mayong	138.85	137.97	-0.88
Morigaon	128.66	124.70	-3.96
Mikirbheta	199.95	120.71	0.76
District	129.67	134.55	4.88
Source: District Economics and Statistics Deptt. Morigaon			

It is seen that there is negative change in the intensity of cropping in Mayong and Morigaon circles between these two time periods, whereas it had increased in the worst erosion affected Bhuragaon and Laharighat circles. This increase in these two circles may be attributed to the increase of population pressure and reduction of agricultural land due to erosion which forced the people to practice the double cropping.

The factors governing the cropping pattern of an area are dynamic in nature. Except the physical elements which take longer time to change, others particularly, the economic ones changes at a faster pace. Example of this kind of change can be observed in the reduction of jute acreage in response to the fall in jute price. The technological development in agriculture, such as irrigation, soil and water conservation, use of fertilizers and other scientific inputs, development of hybrid and improved varieties of crop seeds, development of quick transportation better facilities etc. have brought tremendous changes in the cropping pattern. All these causes indicate that the pressure of population is increasing in agricultural areas which eventually led to change in the land use pattern of the region.

**Fig-3.7: Circle wise Changing Crop Intensity Index
(1986-87 and 2000-01)**

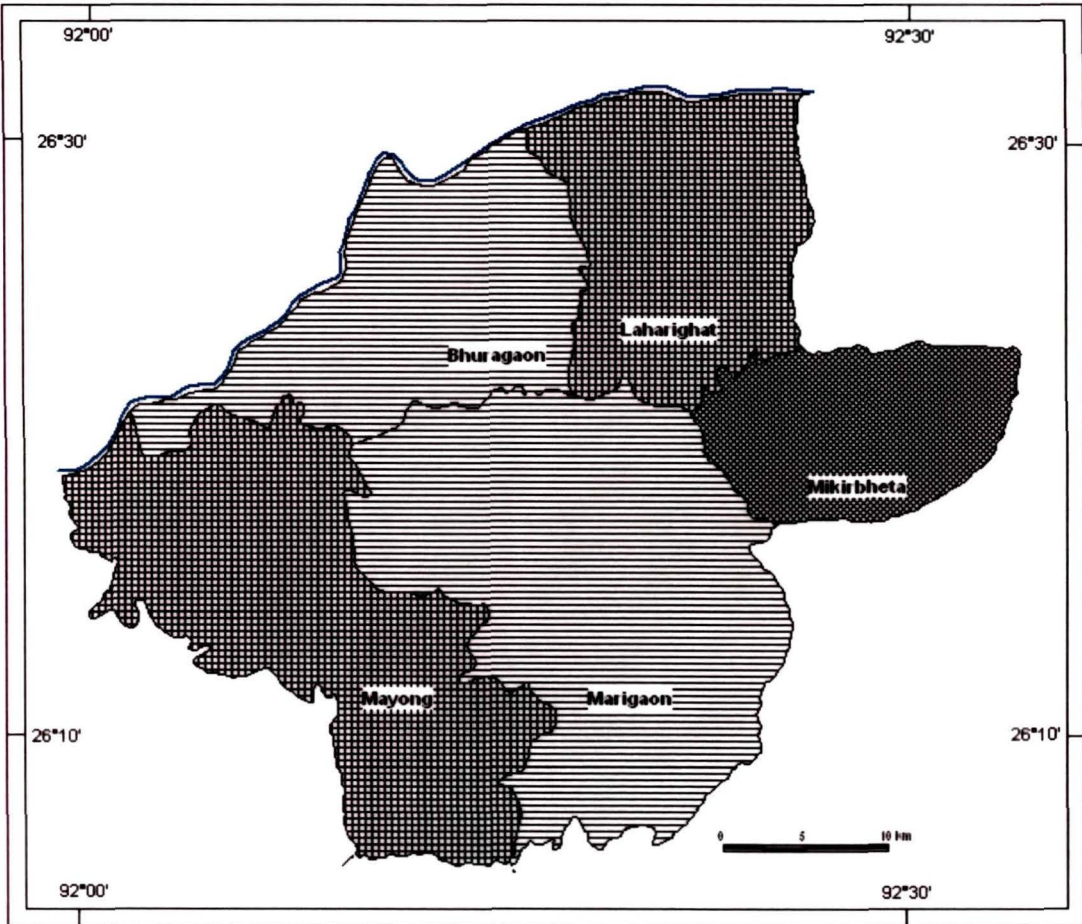


The Brahmaputra valley is dominated by agrarian system, which is basically paddy dominated cropping pattern. The same pattern is reflected in the crop concentration index as well as in the crop intensity index of Morigaon district. Despite having vast potential for irrigation, the valley, as a whole has inadequate irrigation facility. The valley, inhabited by different types of cultural and ethnic groups, are thus practicing traditional rain fed methods of cultivation. Agriculture is the mainstay of the state's economy and more than 70 per cent of its working population derives their livelihood from agriculture. In the early part of the nineteenth century there were large tracts of Government waste lands. These lands were subsequently opened up with the influx of immigrants. At the same time, the large tracts of waste lands have also been brought under cultivation. The circlewise agricultural density is depicted in table-3.8.

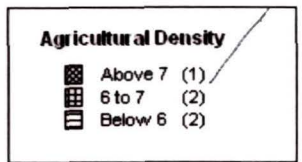
Circles	Geographical area	Population	Density of Population (Per Ha.)	Net Cropped area (in Ha)	Agricultural Population	Agricultural Density (person per ha. of Net cropped area)
Bhuragaon	21218.43	106062	4.99	13646.52	69108	5.06
Laharighat	22197.09	183496	8.26	16359.71	105972	6.47
Mayong	45255.10	203917	4.50	24187.36	166703	6.89
Morigaon	35296.72	164561	4.66	25460.44	144414	5.67
Mikirbhatta	18565.53	118220	6.36	13060.01	97516	7.46
Morigaon Dist.	142532.8	776256	5.45	92714.04	583713	6.30

Source: District Economics and Statistics Deptt. Morigaon

**Fig-3.8: Morigaon District
Circle wise Agricultural Density
(2001)**



*Persons per/h of net cropped area
per ?*



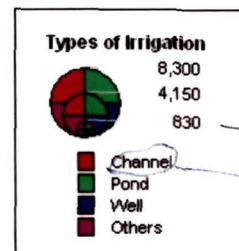
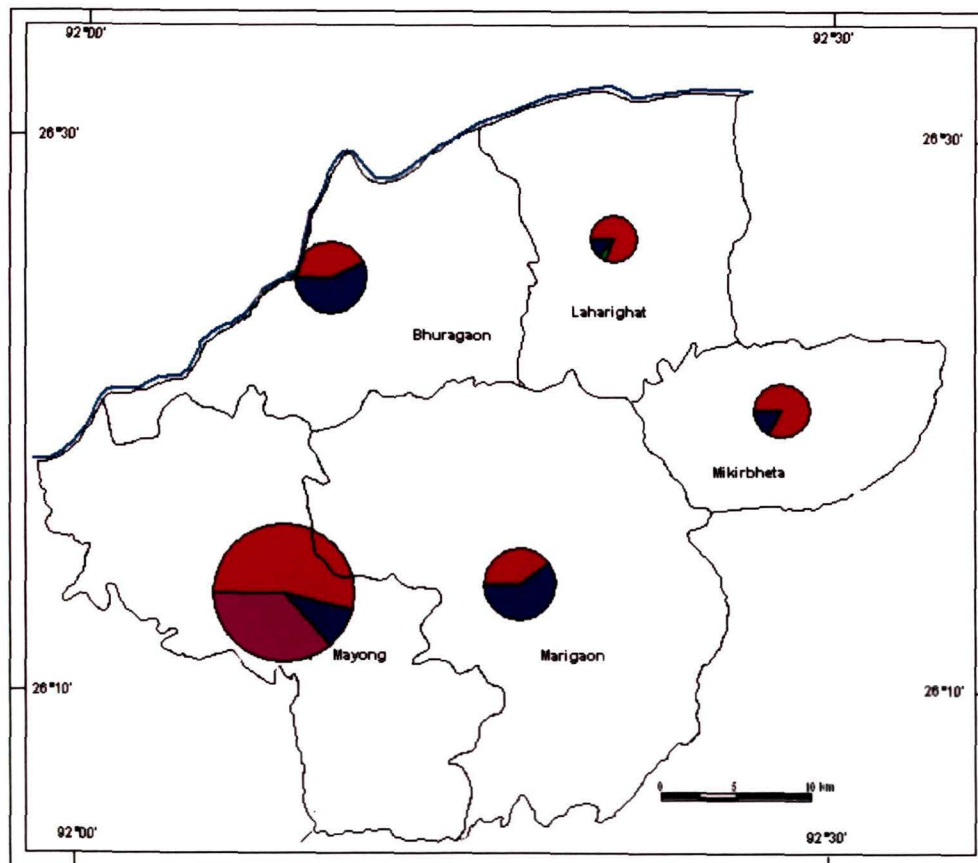
The tremendous increase of rural population as a result of natural growth and the influx of immigrant peasant from Bangladesh, who have settled in the low lying areas of the region, are responsible for the reduction of agricultural land per cultivator (Das, 1984). There is another view of agricultural scientists that the increase in population brings changes in agriculture intensification. It changes not only the growth and development of agriculture but also the cropping pattern (Nath, 1983).

Cropping pattern also depends on nature and availability of irrigation facilities. Where water is available, not only different crops can be grown, but also double or triple cropping becomes possible. Farmer may introduce new and remunerative crops, because the risks factors are considerably reduced in such crops. When new irrigation facilities are provided, the whole method of cultivation may also change (Mohammad, 1988). Table-3.9 shows the irrigation facilities available in the district.

Modes of irrigation	Circles					District total
	Bhuragaon	Laharighat	Mayong	Morigaon	Mikirbheta	
Cannel	1151.04	940.00	4452.00	1000.00	1420.00	8963.04
Pond	---	60.00	0.33	0.80	0.92	62.05
Well	1500.80	172.05	800.00	1471.00	305.00	4048.85
Others	-----	-----	3000.00	-----	-----	3000.00
Net irrigated area	451.00	172.05	800.00	471.80	420.92	1595.77
Irrigated more than once	2000.00	1000.00	7452.00	2000.00	1305.00	11957.84
Gross irrigated area	2451.84	1172.05	8252.33	2471.80	1725.92	16073.94

Source- District Economics & Statistical Department, Morigaon.

Fig-3.9: Circle wise Areas under different Method of Irrigation (2000-2001)



It becomes evident from the table that, although the district possesses tremendous potentiality for making provision for irrigation to most of the farms, but only 16.79 per cent of the net sown area of the district is covered by different modes of irrigation and most of the farmers of the district have to depend upon monsoon rains for agriculture.

Besides irrigation, it is natural that cropping pattern differs from region to region; with variations of natural conditions, the social and economic factors, farmer's motivation etc. which all explain the present cropping pattern of a region.

Annual consumption of fertilizer is also an indication of production trend of crops. The annual consumption of fertilizer in two different time period (1987-88 and 2000-01) is shown in table-3.10.

Table-3.10: Fertilizer consumption under Morigaon district in tons (1987-88 & 2000-01)			
Type of Fertilizer	Year		Changes
	1987-88	2000-01	
Urea (MT)	2182.35	11707.23	9524.88
SSP (MT)	461.92	5647.09	5185.17
MOP(MT)	355.43	1925.94	1570.51
DAP (MT)	275.80	1848.13	1572.33
Amrit (MT)	26.50	6.77	-20.27
Total	3502.00	21135.17	17633.17
Total Nutrients	1479.48	3667.37	2187.89
Nutrients Consumption (Kg/Ha)	18.49	49.70	31.21
Source- District Economics & Statistical Department, Morigaon			

It is seen that the fertilizer consumption and utilization in the district has increased almost six times from 3502 tons in 1987-88 to 21135.17 tons in the year 2000-01. Generally, increased consumption of fertilizers results in increased production of food grains. However, as the fertilizers are generally used only for production of cash crops especially vegetables, hence rice or other major food crop production trend in the district do not reflect the effect of increased use of fertilizers and due to the effect of flood and erosion the production trend of such crops actually are in a declining trend as depicted in table-3.11.

Table-3.11: Production trend of selected crops in Morigaon district (1991-2001) Average yield=Kg/ Hect.						
Years	Average Crop yield (in 00' ton)					
	Winter Rice	Summer Rice	Autumn Rice	Jute	Mustard	Wheat
1991-92	1622	2420	200	3220	520	1283
1992-93	1429	2317	104	3028	489	1178
1993-94	1624	2063	103	2192	389	757
1994-95	1196	1417	856	2018	393	731
1995-96	1160	2102	656	1831	393	915
1996-97	1297	1823	644	1929	570	929
1997-98	1207	2226	793	1785	396	1036
1998-99	1154	2590	590	1796	352	1024
1999-2000	1144	2200	790	1706	398	1106
2000-2001	1056	2008	660	1650	325	1200

Source: District Agriculture office, Morigaon

The production trend of different crops in the district though not substantial, but possess a good potential for improvement.

The land holding pattern of the erosion affected households as depicted in table- 3.12 shows that most of the displaced families are belongs to the agricultural wage labourers and small farmers. However, there are several large farming families also. The large farm households used to adopt various improved methods of agricultural practices.

Table- 3.12: Agricultural Land Holding of Erosion Affected Families							
Categories		Govt. rehabilitated Areas (8 villages)		Self Rehabilitated In Rural areas (4 Villages)		Self Rehabilitated In Urban areas (4 Villages)	
		No. of households	Percentage	No. of households	Percentage	No. of households	Percentage
A	Landless	182	60.33	114	76.00	43	28.66
B	Less than 0.25 Ha. (less than 1 bigha)	67	22.33	13	8.66	82	54.66
C	0.25-0.63 Ha (1 bigha – 2.5bigha)	48	16.00	6	4.00	21	14.00
D	0.63-1.26 Ha. (2.5-5 bigha)	3	1.00	5	3.33	0	0.00
E	1.26-1.87 Ha (5-7.5 bigha)	0	0.00	2	1.33	4	2.66
F	1.87-2.53 Ha (7.5-10 bigha)	0	0.00	7	4.66	0	0.00
G	Above 2.53 ha (Above 10 bigha)	0	0.00	3	2.00	0	0.00
	Total	300	100%	150	100%	150	100%
Source: Primary field survey data, 2002							

Poverty and environmental degradation are intrinsically linked. Ecological poverty has a crucial role to play in a country like India where the economy is based on agriculture. There can be no simplistic policies that strive either to reduce poverty at the expense of the environment or to protect the environment at the expense of the

AGRICULTURAL AREA AFFECTED BY BANK EROSION



poor. The people living in the erosion prone areas in the bank of river Brahmaputra are facing natural disasters to a great extent and have very little choice but to use the limited resources available to them. The displacement from their dwellings due to erosion further limits their income generating opportunities in the rehabilitated areas.

Preventing a river from eroding is a very difficult and costly task. The present efforts to control the river through erecting embankments, bunds, tie bunds etc. proved to be inadequate. The damages caused by the annual flooding and erosion of the river Brahmaputra can only be controlled by making systematic studies of various aspects of the river and adopting mitigation measures accordingly.

CHAPTER-IV

GOVERNMENT POLICIES, CHANGING STRUCTURE OF SETTLEMENTS

AND

REDISTRIBUTION OF POPULATION

CHAPTER-IV

GOVERNMENT POLICIES, CHANGING STRUCTURE OF SETTLEMENTS AND REDISTRIBUTION OF POPULATION

River bank erosion and the resulting sedimentation constitute a major natural hazard that creates social and economic imbalances. Although river bank erosion can occur in any type of land regardless of its use, land use pattern can also increase soil erosion including overgrazing, burning and/or exploitation of forests, certain agricultural practices, roads and rails and urban development. Erosion has three major effects: loss of support and nutrients necessary for plant growth; downstream damage from sediments generated by erosion; and depletion of water storage capacity. Moreover, erosion and subsequent sedimentation in the river bed is often the root of many water management problems. Sediment movements and their subsequent deposition in the river bed reduce the water flow rate of rivers, aggravate flood water damage, impede navigation and degrade water quality.

In Assam level of growth of income is below the average of the country. In 1950-51, Assam's per-capita income (4.1 per cent) was higher than the average of the country. But in 1980-81, Assam's per-capita income went down to 27 per cent i.e. lower than the national average, and it further slide down to 45.5 per cent in 1998-99, and the slide is continuing.

There are inter district inequality in the sense that the per capita income of the district with the highest income is more than three times than that of the district with the lowest per capita income group. According to the 1994-95 estimation, N.C.Hills

district recorded the highest per capita income of Rs. 3464.00, whereas Darrang district recorded the lowest per capita income of Rs.1100.00. Primary sector is the largest contributing sector. However, the contribution of primary sector to the Net State Domestic Product (NSDP) has declined from 47.5 per cent in 1980-81 to 40 per cent in recent years. The tertiary sector has shown relatively high rates of growth during this period, while the secondary sector has exhibited moderate growth. There is a continued and high dependency rate on the primary sector, in which the average growth was about 2 per cent in recent decade, the lowest amongst the three component sectors.

Though, agriculture accounts only one third of the State Domestic Product, it plays an important role in the economy, providing employment to 69 per cent of the total work force. About half of the male population is engaged in the agricultural work, and about one fifth of women are engaged in this as per 2001 census. The workforce participation rates for both men and women are lower than those of India.

The incidence of unemployment, measured as a percentage of labour force is increasing in Assam. Unemployment rate in Assam in 1983 was 2.2 per cent, as compared to 2.0 per cent for the country. During 1999-2000, the country's unemployment rate has risen marginally to 2.3 per cent, while Assam's unemployment rate has increased substantially at 4.6 per cent. This can only be corrected through sustainable development in the primary sector, which incidentally is the highest provider of employment and income generation in the state. However, recurrent flood and erosion problem in most parts of the state, especially in the fertile

flood plains of Assam is creating a negative impact on the overall development in this sector.

Flood plains are heavily populated since they are fertile and are easily accessible and riverine locations have always attracted human settlements. Ancient civilizations like the Indus Valley, the Nile Valley, and the Mesopotamia etc. grew up in the river valley areas. Flood plains of north India support some of the highest human population densities on earth. Egypt was developed on the flood plain of the Nile; Babylon on the plains of Tigris and North India on the plains of Ganga river. Flood plains have been the cradle of civilization and centres of population since ancient times. Even today the Mississippi plain below Ohio a thousand kilometers long and 30 to 80 kms wide is the most densely populated area in the USA. Similarly, in the Netherlands the marginal areas on the Rhine are intensively cultivated and has the heaviest density of population in Europe. In China, the lower reaches of the Yellow river have the densest population in the world.

One important reason for such a high population density has been soil fertility recharged by annual alluvial deposition by the rivers flowing through them. The Brahmaputra valley in Assam is also an example of such an area, which has attracted human settlement from time immemorial. But, the human settlements just adjacent to the Brahmaputra river banks are becoming worst sufferers from riverbank erosion that is taking place since last few decades. Thus, river banks are advantageous in many respects for settlements; though it can be mixed blessings to people.

In Assam a sizeable proportion of the population are settled in the Brahmaputra valley, where flood and bank erosion are common natural phenomena. Morigaon district is located in the south bank of river Brahmaputra, which is highly erosion prone and subjected to inundation almost every year. The flood and erosion causes untold misery to countless people every year, but erosion is the worse of the two. The damages caused by erosion are of permanent in nature. Since 1969 and after construction of the Kalia Bhomora bridge and its protective embankments, the river Brahmaputra has washed away at least 93 villages either partially or completely under the three revenue circles of Bhuragaon, Laharighat and Mayong in the district. Till 2001, 16950 families comprising of 47000 persons have been affected by this relentless erosion. The people whose houses and agricultural land were washed away by the bank erosion are either staying on the road side or embankments with great hardship. The state government has initiated a minimum needs and rehabilitation programme since 1981 that could rehabilitate only few affected families by providing land. However, most of the affected people are still staying in the makeshift huts on the river bank or on the embankments. Resettlement and rehabilitation of these persons are becoming a major problem of the district.

The redistribution of population has resulted mainly from differential natural increase since external migration is of minor importance compared to overall growth. Nevertheless, some migration flows do take place both within and without the region. The South Asian sub-continent has been experiencing uninterrupted demographic mobility since long time, which was reflected in almost unchecked



SELF SETTLED DWELLINGS ON EMBANKMENTS



EARTH CUTTING NEAR RIVER BANK CONTRIBUTING TO EROSION

transfer and resettlement of population in a number of places. Such population mobility was due to both environmental and socio-economic causes (Elahi, 1991).

The continuing devastation caused due to erosion has rendered thousands of people homeless and forced them to move out of the area. The people uprooted from their original places migrated out of the area and rehabilitated in different areas either under the rehabilitation programme of the government or on their own initiative.

Though occurrence of erosion is a yearly phenomenon, but its intensity has been increasing since the year 1989. As many as 12 villages have been completely submerged along the river bed of Brahmaputra and areas have become depopulated in the initial period. In that time rehabilitation programme which was started in 1981, ran smoothly without any problem because the density of population was not high and there were abundance of government owned vacant land and the number of affected villages ^{was} lesser compared to present situation. Then people had a choice of selecting their areas for rehabilitation. They were allotted cultivable land up to 2 acres per family. But due to continuous recession of the bank line and erosion of the riverine tracts, more and more people were rendered homeless. Moreover, pressure of population growth has also increased and vacant land for rehabilitation and resettlement became scarce or unavailable. Thus the problem of rehabilitation and resettlement became more acute. The people who have lost their villages had to wait for years for rehabilitation, occupying temporary shelters besides the existing embankments or on the top of the graveyards. Table 4.1 shows the population trend of some of the erosion affected (either partially or completely) villages of the district.

Table-4.1: Population trend of erosion affected villages of Morigaon district (1991-2001)			
Category	No. of villages	Population	
		1991	2001
District	636	639682	776256
Completely eroded	19	22696	1195
Partially eroded	27	35501	28248
Source: Census of India 1991 & 2001			

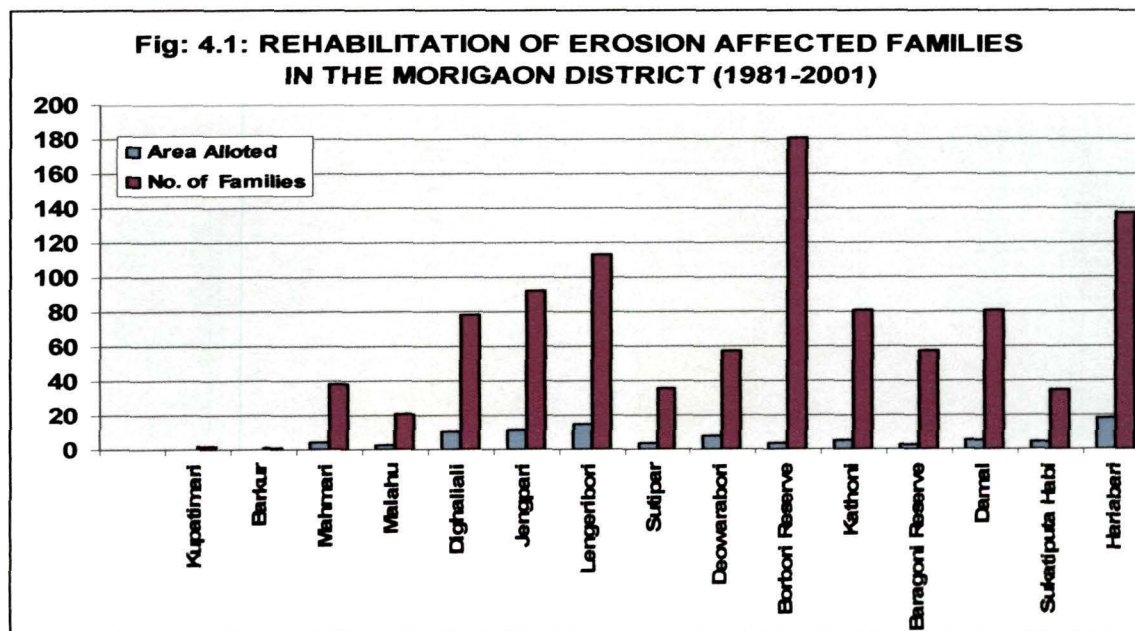
It can be observed from the table that there is a negative growth of population in the erosion affected villages indicating a large scale migration of people from these areas to other parts of the district or region.

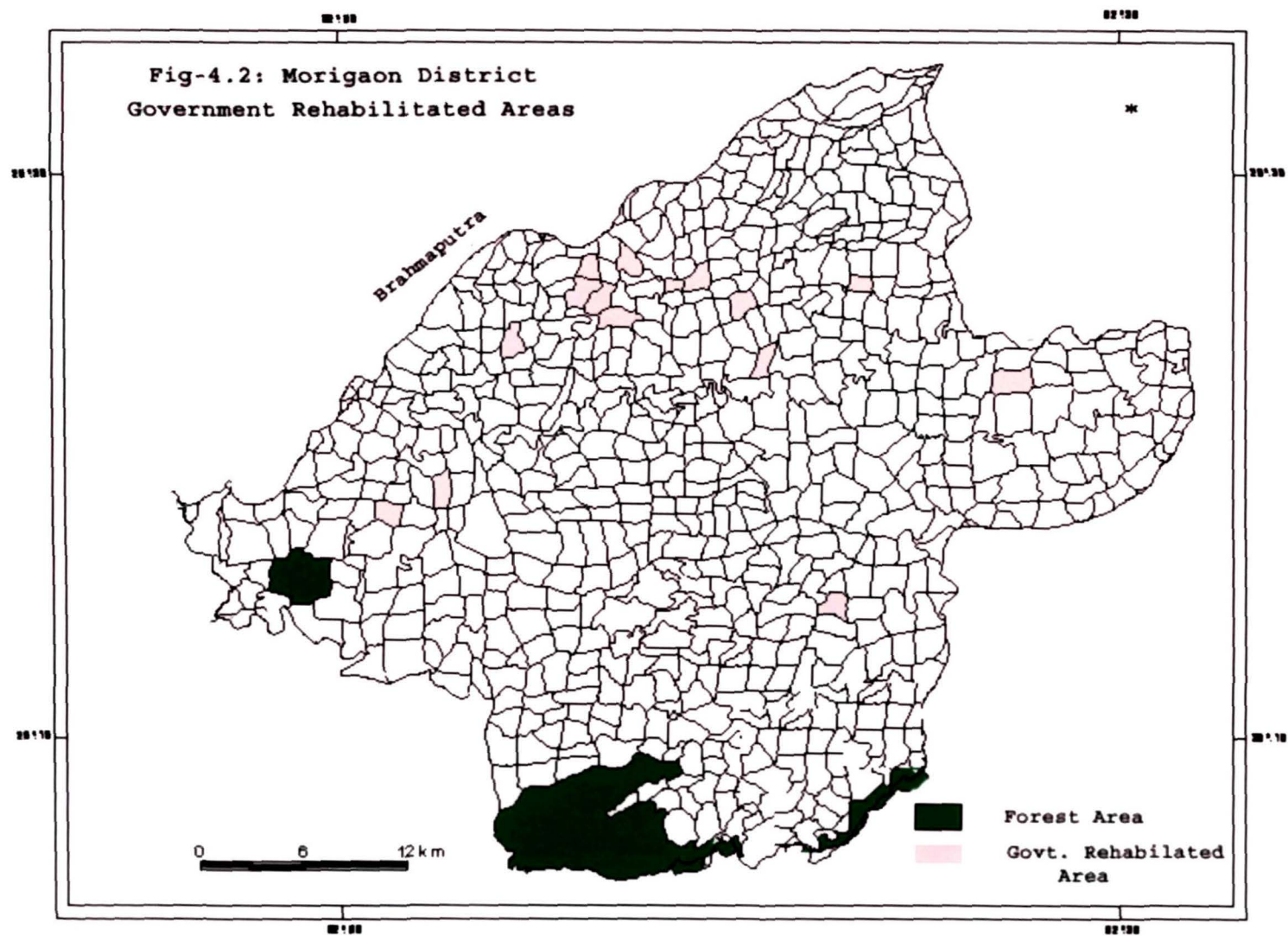
Table-4.2 shows that only 5.96 per cent of the affected families (1010 families out of 16950 families) were rehabilitated through governmental efforts in various parts of the district where barren Govt. land were available. However, only 0.94 hectares of land were provided per family to most of the rehabilitated families for their dwelling and agricultural purposes. Thus the erosion affected families either resettled by the government or by themselves in barren areas or in government lands which were earlier used by the nearby villagers for agricultural purposes making new settlement areas. It is evident from the fact that 43 new villages were added in the recent census, since 1991 (593 nos. of villages in 1991 and 636 nos. of villages in 2001 census).

From the tabulated data, it is clear that few of the erosion affected people of the region are rehabilitated in some government reserved lands through the rehabilitation programme initiated by the government. The official record shows that the affected people were allotted a land ranging from 1 to $\frac{1}{2}$ *bigha* (0.331 acre to 0.166 acre) of land per family, but in reality they got only two *kathas* (0.132 acre to 0.264 acre) of land which is too small for a family.

Circles	Mauza	Villages	Area Allotted (ha)	No. of Families
Bhuragaon	Bhuragaon	Kupatimari	0.13139	2
	Bokani	Barkur	0.0538	1
		Mahmari	4.5988	38
		Malahu	2.7593	21
		Dighaliali	10.2487	78
		Jengpari	11.5627	92
		Lengeribori	14.5848	113
		Sutipar	3.2849	36
Laharighat	Moirabari	Borbori Reserve	3.4425	181
	Laharighat	Kathoni	5.4397	81
		Baragoni Reserve	2.9432	57
Mayong	Niz-Ghagua	Sukatiputa Habi	4.5988	35
	Manaha	Hariabari	18.0010	137
Morigaon	Niz-Tetelia	Damal	5.3096	81
Mikirbheta	Silpukhri	Deowarabori	7.4895	57
Total			94.4487	1010

Source: District Revenue Department, Morigaon, Assam.





Thus the first hypothesis which states that “following the redistribution, new settlements emerges accompanied by depopulation of villages located in areas affected by bank erosion” is accepted as most of the eroded and partially eroded villages were depopulated either partially or completely depending upon the extent of erosion and were resettled in new settlements areas in governmental reallocated sites, self resettlement areas and as well as in make shift areas like P. W. D road side or in river embankments.

The resettlement of the affected families were made in the government reserved lands which were either unused land or earlier used by the near by villagers for agriculture. These areas are away from the nearby villages with poor communication. Some families with below the poverty line were also provided with dwelling houses under the *Indria Awas Yujana* (IAY) scheme. Table-4.3 shows the

Circles	Mauza	Villages	No. of Families
Bhuragaon	Bokani	Barkur	1
		Mahmari	8
		Malahu	9
		Dighaliati	18
		Jengpari	12
		Lengeribori	23
		Sutipar	6
Laharighat	Moirabari	Borbori Reserve	18
	Laharighat	Kathoni	16
		Baragoni Reserve	25
Mayong	Niz-Ghagua	Sukatiputa Habi	13
	Manaha	Hariabari	39
Morigaon	Niz-Tetalia	Damal	81
Mikirbheta	Silpukhri	Deowarabori	5
		Total	274

Source: District Rural Development Agency, Morigaon.

GOVT REHABILITATED DWELLINGS NEAR DOMAL



number of families received dwelling houses under I. A. Y. during the period 1981 to 2001. It is evident from the table that only 274 families out of 16950 displaced families i.e. 1.62 per cent of the affected families could be provided with dwelling houses.

By choice people do not want to change their original place of settlement. They try to resettle themselves within the locality after being driven out by erosion, but as it is no longer possible due to the high density of population as well as scarcity of vacant lands in nearby areas, they are compelled to move out of the locality. Thus it is observed that the families, when uprooted by erosion, first try to settle in the same village with a hope that there will be no further erosion. But in reality, some of the families had to change their locations more than seven times in the process. Although the poor agricultural families are the immediate sufferers of flood and erosion, but the erstwhile large farmers in the locality suffers most in the long run (Centre for Science & Environment, 1981). The service holders especially in organized sector or in government jobs and business persons could manage to resettle themselves in relatively safer places in such events. The places where rehabilitation programmes are executed are in the interior areas coupled with many hindrances including lack of communication system. Thus people in the earlier years tend to make a choice of the place of resettlement themselves, but now-a-days there is no alternative but to accept it due to dearth of land.

In the initial stage people always tend to have reservation, fear and reluctance in adopting a new place to live in. Moreover, there are problems of adjustment in the new locations, means of livelihood, agricultural productivity, means of communication, problem of drinking water etc. Hence, the erosion affected people

try to settle in the new location in a group hailing from the same village or locality and try to maintain their identity as in their original place, giving the same name to the village, school etc. in their new locations. The socio-economic conditions of the rehabilitated people in most of the cases are miserable. It is more acute in case of people resettled in later years, where their conditions are more precarious.

The socio-economic conditions of the resettled villages are not satisfactory. The efforts of the government sponsored machinery ended after allotment of land and in some cases after allotment of dwelling houses under I.A.Y. Thus the basic amenities like drinking water, education, medical facilities, transport and communication etc. were lacking in these localities.

The lands they occupy were of poor quality having lower or no productivity potential. In some areas, the land provided is so insufficient that it could be used for shelter only, without any scope for agricultural uses.

The conditions of the rehabilitated families are so pathetic in certain areas that all the able members of the family have to work to earn their daily bread. The rehabilitated people in Domal area are one such example where people along with their children are working as daily wage labourers in the nearby brick industries to earn their livelihood.

Govt. has rehabilitated 57 families within an area of 2.94 hectares in Barangoni Reserve locality in Laharighat Mauza of Laharighat circle. The rehabilitated people are deprived of the basic facilities like communication, medical, drinking water, educational and other means of economic benefits. On the social

sector, discharge and tension always persists between the old and the new group of settlers.

In the Kathoni reserve resettlement area the socio-economic conditions of the rehabilitated families are not so different from that of Barangoni Reserved locality. Out of the 81 rehabilitated families only 16 (19.75%) were received houses under the I.A.Y. Initially there was a sericulture farm in the locality, but due to increase in the number of rehabilitated people the farm areas have been encroached. The rehabilitated people of this area earns their livelihood only by working as daily wage labourers or bonded labourers, as they do not have any other income generating options.

Hazard prevention strategies always bear better results with long term economic benefit than rehabilitation strategies (Hays, 1981). Moreover, in the present context rehabilitation of large numbers of affected people became a herculean task for the rehabilitating agencies. As flood and erosion is becoming a regular phenomenon in Morigaon district, therefore migration and rehabilitation process will also continue as long as erosion and flood menace continues. Thus it become imperative for the concerned agencies to formulate long term mitigation strategies considering all the aspects of the malady to combat the problem is a sustainable way.

CHAPTER-V

MIGRATION

FROM RURAL TO RURAL

AND

RURAL TO URBAN

CHAPTER-V

MIGRATION FROM RURAL TO RURAL AND RURAL TO URBAN

The population of any country is altered by three factors namely fertility, mortality and migration. The third factor is the most difficult to measure as it is a fluid, continuous, non-discrete and poorly defined measure. Two major sources of information on migration in India are census of India's migration tables and National Sample Survey Organisation's (NSSO) report on internal migration in India. The Census of India defines migrants as those people whose place of enumeration is different from their place of birth. The place of birth is the main criteria used to distinguish a migrant from a non-migrant. Since 1971, the census also included a criterion on place of last residence in addition to the place of birth to identify migrants from non-migrants. The place of last residence states that migrants are those individuals whose last residence is different from the place where they are enumerated. Return migrants are those who have returned to their place of origin. The NSSO uses the concepts of native place and usual place of residence in their definition of migrants, but neither the NSSO nor the Census considers the movement of people from India to other countries as migrants (Balagopal, 1999).

It is a common feature of human settlement that people are always attracted to the riverine locations. History provides examples of civilizations like the Indus valley, the Nile valley and the Mesopotamia valley which grew up along the river valleys. But flood plains are advantageous in many respects for settlement. However, it can be mixed blessings also as flood and bank erosion is the perennial problems^{all} of

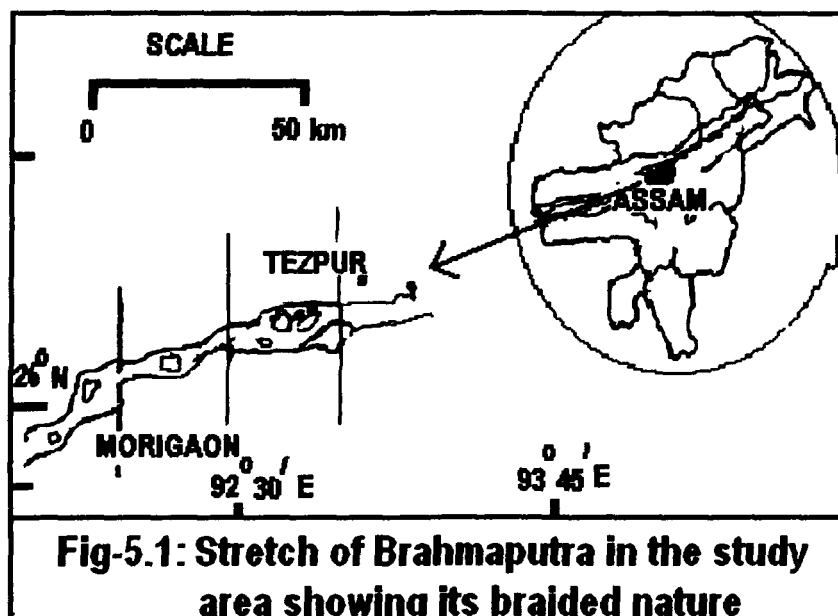
many river systems. Unless due and proper adjustment with nature is made, one may pay dearly in the form of losses of life and property. Therefore the settlement pattern of the river valley areas changes quite frequently.

The river Brahmaputra is a major river system of the world characterized by exceedingly high rates of basin erosion. In many parts of the world, mostly belonging to the developing countries of the tropics and subtropics including India, the vastly increased erosion rates have already set difficult-to-reverse chain reactions leading to degenerated environmental quality, reduced agricultural productivity, increased runoff and accelerated siltation in rivers, reservoirs and lakes. The river Brahmaputra in Assam provides one example in which high erosion rate of the drainage basins results in rapid aggradations of the channel and over bank flooding. It is estimated that India loses 6000 million tones of soil along with the major plant nutrients annually due to erosion, causing a production loss of 30 million tones of crops. Besides being a major threat to continued productivity of the land, soil erosion is now viewed as a major “non-point” source of environmental pollution. (Goswami, 1985).

The Brahmaputra valley in Assam represents a tectono-sedimentary active area which is 720 km in length and 80 to 90 km in wideth, with elevation ranging from 120 m at extreme east to 28.45 m above mean sea level at Dhubri in the extreme west (Goswami, 1985). The channel of the river itself occupies about one-tenth of the valley, with over 40% of its area under cultivation. The Brahmaputra valley in Assam is the home of more than 15 million people. In Assam, the river flows in a highly braided channel characterized by numerous mid-channel bars and islands. The

Brahmaputra is the fourth largest river in terms of average discharge at the mouth, with a flow of $19,839 \text{ m}^3 \text{ s}^{-1}$, and second in terms of sediment transport per unit drainage area in the world. Migration of the channel with time towards the south is a characteristic feature. Moreover, the location of the system in a highly seismic area needs immediate evaluation of its geomorphologic behaviour, keeping in view its socio-economic implications.

The erosion phenomenon as evidence on the braided Brahmaputra river channel in the Morigaon district of Assam was studied with the help of Survey of India toposheets and Indian Remote Sensing (IRS) satellite imagery (1987 and 2001). During the period, the study area evidences significant erosion activity.



Erosion of the banks takes away valuable land, and destroys towns built on its banks and adversely affecting the dwellers. Prevention of a river from eroding is a very difficult and costly task. It takes many years before stability can be established

arresting the erosion process. Large rivers particularly the Brahmaputra, the Ganga and their tributaries cause immense annual loss due to erosion. In many countries of the world, soils erosion has increased flood havocs. The total land area subjected to erosion throughout the world is estimated at 600 to 700 million hectares and this constitutes about half of the total cultivated areas of the world (Rao, 1999).

Bank erosion of the river Brahmapurta causes immense long-term destruction every year. The river Brahmaputra has been shifting slowly towards south as the water flow of the river is directed towards the southern bank due to presence of hilly protruding rocks in its northern bank. The Brahmaputra and its tributaries while flowing down from the Himalayas and the tertiary hills carries enormous quantities of sediments and on reaching the plains the sediments are deposited on their own beds. Thus the channels are filled up and the water in the following summers digs out different courses abandoning the earlier ones. Besides, the seismic instability of the region also contributes to such shifts.

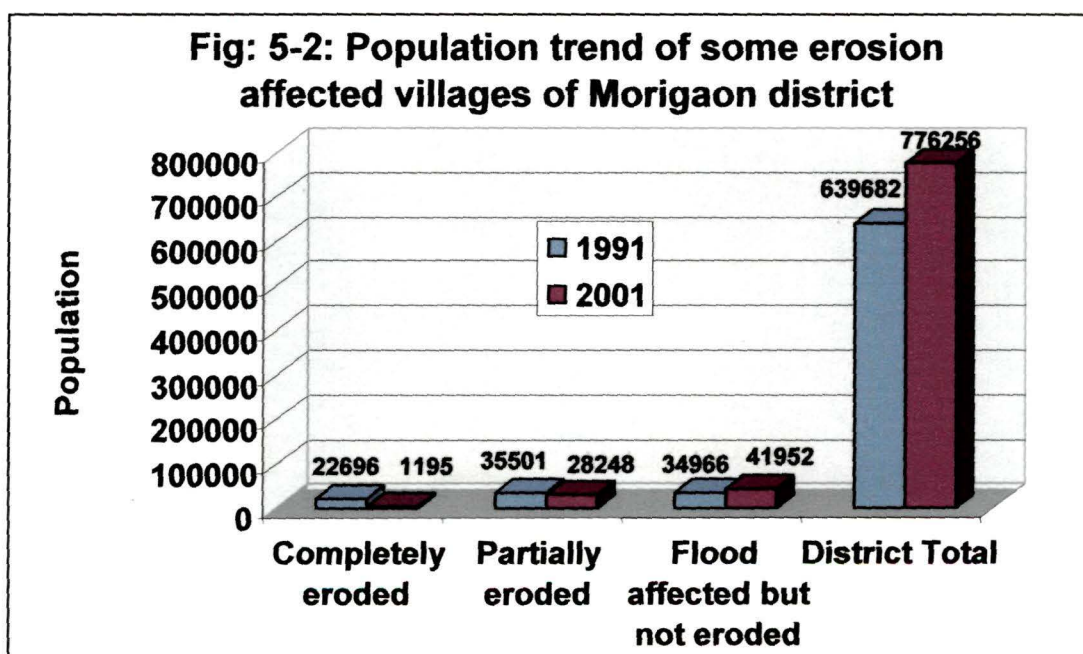
In the middle part of the Brahmaputra valley, where the Kalia-Bhumura Road Bridge is located in Silghat area, the river flow maintains a hypercritical velocity and the hilly protruding rocks never allows to deposit its heavy silt loads. Afterwards, the river enters into the alluvial plains and fan out into several channels. The velocity at this stage drops into sub-critical state and thus the river deposits its silt loads. After flowing through a few kilometer stretches, the flow gets obstructed at the protruding escarpment of the Singri hill on the north bank. This hill creates a spur action deflecting a major flow towards the south bank. As a result, the south bank is always prone to bank erosion.

The continuous retirements and unabated erosion causes heavy loss to the valuable homestead and fertile agricultural lands, besides evacuating thickly populated areas. In the process over the years from 1969 to 2001, as many as 93 nos. of revenue villages got obliterated due to unabated erosion. Table 5-1 depicts the population trend along with decadal growth rate in some eroded, partially eroded as well as non eroded but flood affected villages in the district.

Table-5.1: Population trend of some erosion affected villages of Morigaon district

Category	No. of villages covered	Population		Decadal Growth rate
		1991	2001	
Completely eroded	19	22696	1195	-94.73
Partially eroded	27	35501	28248	-20.43
Flood affected but not eroded	26	34966	41952	19.98
District Total	636	639682	776256	21.35

Source: Census of India 1991 & 2001



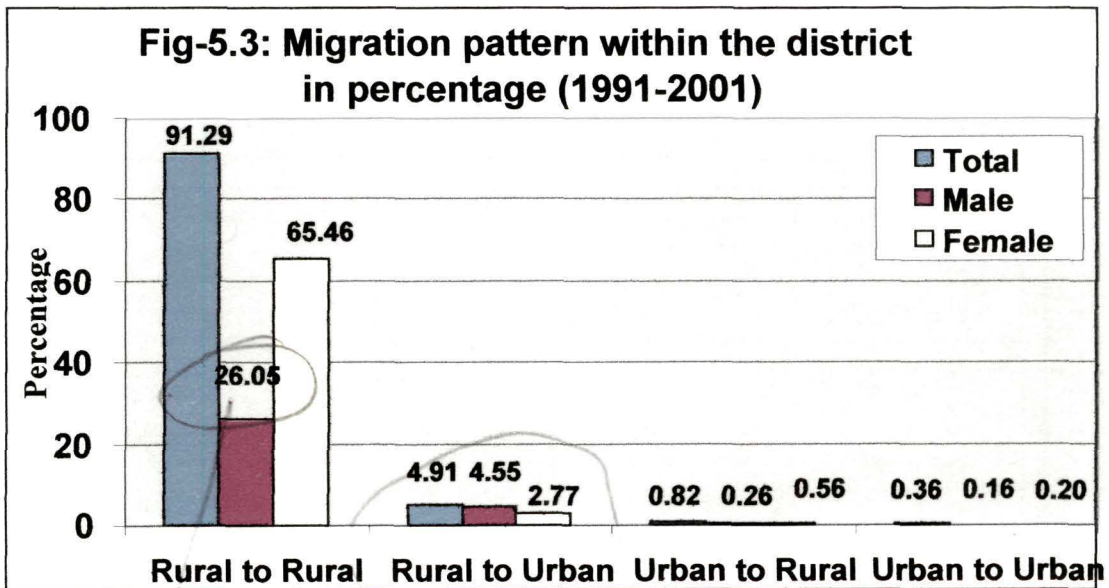
The damage caused by erosion is of permanent nature. It is evident from the table that there is a negative growth rate even up to the extent of -94.73 per cent in the eroded villages virtually indicating complete evacuation of the villages. The partially eroded villages also showing a negative growth pattern indicating large scale migration of people from these villages. The flood affected villages also shows a lower growth rate of population than the district average indicating a marginal migration from these villages. Thus the tabulated data indicates that the amounts of migration of people are directly related to the rate of erosion. Thousands of people from the eroded or partially eroded villages have migrated out from their permanent homes to take shelter in the river embankments and P.W.D. roadsides. Thus they are living a perilous life in such a situation. Rehabilitation of these people is becoming much more difficult since lands are becoming a scarce commodity.

People used to migrate out from their original abode in search of better livelihood from time immemorial. Increasing land alienation is giving rise to major change in the occupational pattern creating tenants, agricultural labourers and at times paupers. Many of the migrants who left their heart-land in search of occupation other than in agriculture are also living a difficult life in their re-settlement areas. The migrations of people from the erosion affected areas of Morigaon district are mostly confined within the district itself, probably because they find it difficult to adjust in the new place. Thus they prefer to stay within their known territory for obvious reasons. The trend of migration within the district is depicted in table-5.2.

Table- 5.2: Migration pattern within the district (1991-2001)					
	No. of Migrant	Rural to Rural	Rural to Urban	Urban to Rural	Urban to Urban
Total	91748 (100.00)	83756 (91.29) ✓	6912 (7.53)	750 (0.82)	330 (0.36)
Male	26680 (29.08) ✓	23700 (25.83) ✓	2590 (2.82)	240 (0.26)	150 (0.16)
Female	65068 (70.92) ✓	60056 (65.46) ✓	4322 (4.71) ✓	510 (0.56)	180 (0.20)

Figures in parenthesis indicates percentage of total migrants.

Source: District Collector's Office, Morigaon, 2001



From the above table and illustration it is evident that migration of people are mostly rural to rural in nature as 91.29 per cent of the migration within the district belongs to the rural to rural. However, it is also observed that many of the migrated people are engaged as daily wage labourers in urban areas, but residing in the rural areas.

The findings of table 5.1 and 5.2 clearly indicate that migration of people are directly related to the rate of erosion, however, destination of the migrants mostly confined to the rural sector. Hence, the second hypothesis stating “the extent of bank erosion will be directly proportional to a movement of affected people to the nearby towns and other urban centres” is showing a negative result.

The nature and extent of migration accelerating the process of redistribution needs to be understood in its time space context. The present day migration; its causes and manifestations are fundamentally different from those of the past. Moreover, the process of migration manifests itself differently over diverse geographical regions depending upon the specific requirements of the regions economy and its level of development. Regions with very highly developed peasant economies and larger surplus production have given rise to a spatial reorganization in the form of a hierarchy of urban centres acting as centres of attraction in concentrating people and activities. But base has experienced an operation of developmental processes at a very low key. In the region, urban development is of marginal importance. Consequent upon high growth rates are taking place and there is a net outflow of people to other regions.



Essentially subsistence in nature, the economy in this region has experienced large scale internal migration in the past. Traditional economic theory suggests that a relatively backward (underdeveloped) economy, in the beginning of the development, would send out migrants due to low wage and lack of opportunity in the region. Conversely, the relatively better developed regions (more industrialized and urbanised) would attract the labour force. The process of this migration would be age, sex and skill selective.

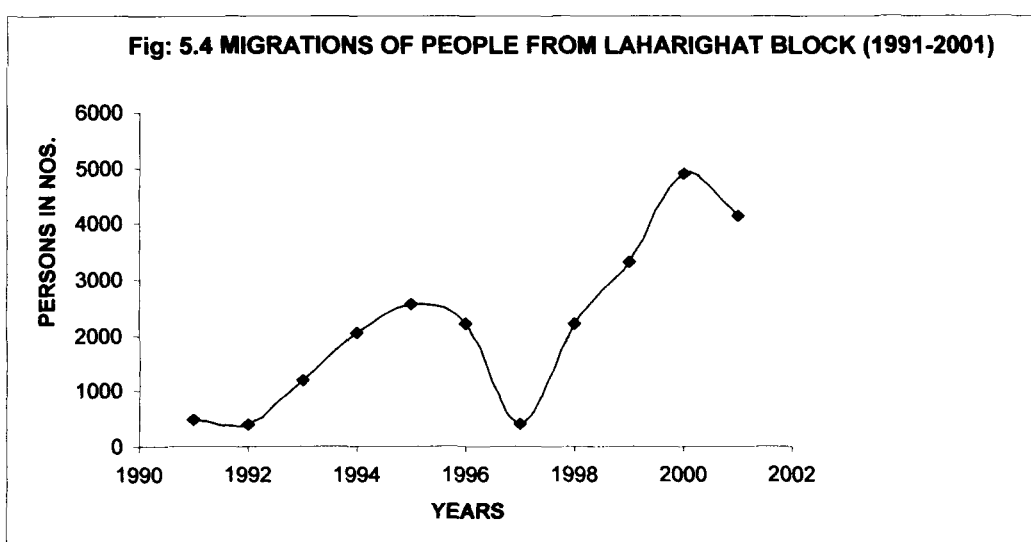
The economy of Morigaon district is characterized by near absence of any organized sector of labour. The people are mostly engaged in agriculture, its allied works and as other part-time labours. Thus there is a tendency of migration to other places in search of better income generation opportunities. A large number of people are known to migrate out from economically backward families or from other families to other parts of the region mainly in search of jobs as no gainful employment opportunities were available in their locality. Since, more employment opportunities are available in cities and towns, they form the destination of a large number of migrant populations, where they get jobs mostly as wage labourers in construction industry or are employed as casual labour for different seasonal activities. Many of them earn their livelihood by pulling rickshaws, carts etc.

Migration of people into urban areas of the district occurs in search of better economic benefits through wages earned as unskilled labour force. Moreover, the income in the urban areas even from unskilled labour is substantially higher than that of rural areas. It is natural for the erosion affected people, those who cannot find jobs in agricultural sector to migrate out to urban areas in search of other jobs.

The migration trend from severely erosion effected circles (i.e. Laharighat & Bhuragaon circle or Laharighat Block) can be visualized from the periodical variation. People used to migrate from time immemorial from their original abode in search of better dwelling environment including better employment, income and better living condition. In addition to the above factors, the river bank erosion in certain areas of the district has compelled people to migrate out to safer places. The year wise migration patterns of erosion affected Laharighat block to other places are shown in Table-5.3.

Year	Nos. of Persons Migrated	Percentage
1991	519	2.17
1992	415	1.72
1993	1200	5.02
1994	2040	8.53
1995	2550	10.66
1996	2210	9.24
1997	424	1.76
1998	2224	19.29
1999	3302	13.80
2000	4900	20.49
2001	4140	17.31
Total	23914	100

Source: S.D.C. office, Laharighat & Block office, Laharighat

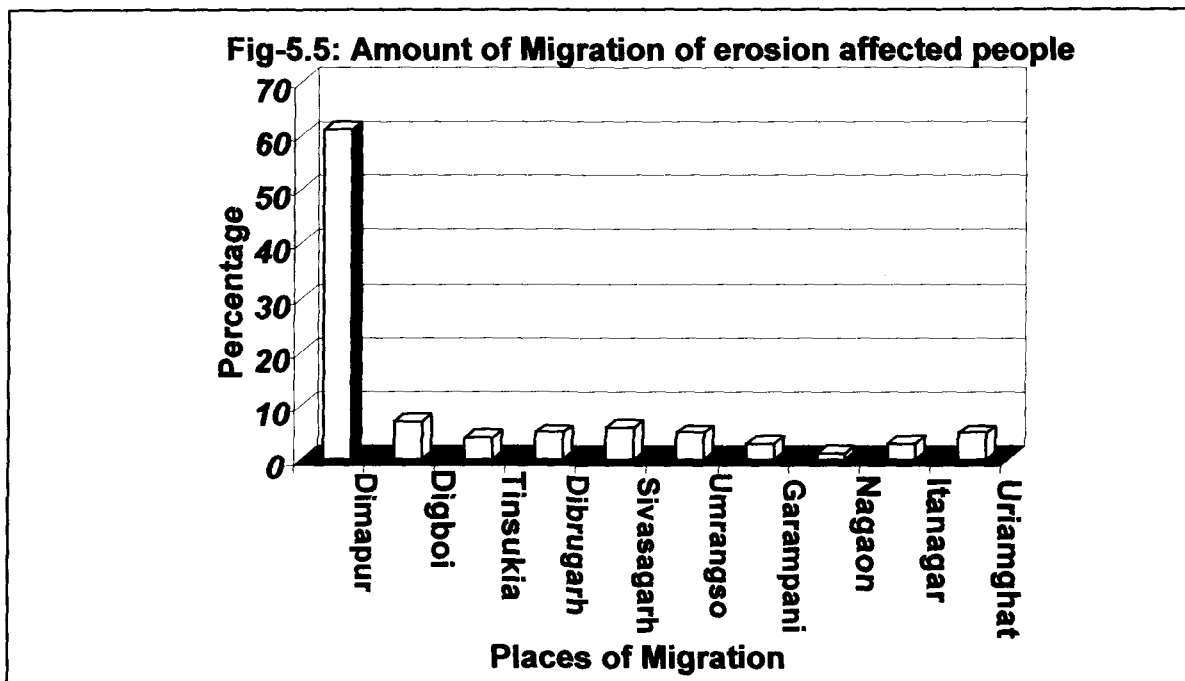


It is observed from the above table and illustration of the trend of migration that the population migration from the erosion affected areas of the district started to rise from the year 1992 (1.72%) and reached its peak in the year 1995 (10.66%). Then the migration is observed to be lowest in the year 1997 (1.72%), but started rising again to reach its peak in the year 2000 (20.49%). Increasing population pressure, lack of sustainable income within the locality as well as decreasing land holding pattern, coupled with flood and erosion forced them to go for such a migration.

The process of land alienation is one of the major causes for migration of people from one locality to another. In a predominately agrarian economy land alienation is characterized by highly distorted distribution of land and adverse land-man ratio aggravates the inequality in terms of income and wealth. The place wise migration pattern of the affected people due to land alienation resulting from the erosion of Brahmaputra river is presented in table-5.4

Table-5.4: Place wise and State wise Migration of People			
Destination of Migration	State	No. of Persons	Percentage
Dimapur	Nagaland	122	61
Digboi	Assam	14	7
Tinsukia	Assam	8	4
Dibrugarh	Assam	10	5
Sivasagarh	Assam	12	6
Umrangso	Meghalaya	10	5
Garampani	Assam	6	3
Nagaon	Assam	2	1
Itanagar	Arunachal Pradesh	6	3
Uriamghat	Meghalaya	10	5
	Total	200	100

Source: Primary field survey, 2002



The migration pattern of the people from the erosion affected areas clearly indicates that they are mostly attracted towards the areas where unskilled labour force is required on a large scale. Large numbers of people from the erosion affected areas of the district are migrated to Dimapur in the state of Nagaland (61%) in search of job. Although distance of destination is inversely proportional to amount of migration, but in the present context this relationship is not observed and maximum number of migration is observed Dimapur town in Nagaland though it is comparatively located at a distance. The possible reason for this phenomenon is that there is a dearth of local manpower to perform certain unskilled jobs in Dimapur and thus there are ready jobs of such nature where wage structure is also better as compared to other places.

Migration is one of the most important characteristics and phenomenon in all the societies. Migration is a special process which increases the technical and

economic progress. Migration generally occurs from low opportunity areas to high opportunity areas within a short distance or from rural area to small towns and from villages to towns/cities. Unemployed persons are more migratory than employed. However, migration among the erosion affected people of Morigaon district is different from the migration of other types in the sense their migration is not voluntary but under compulsions and forced.

Every movement of population is associated with some definite reasons – like economic, social, and political. Land alienation also compels people from erosion affected areas to migrate. Among other reasons, inadequate employment opportunities, attraction for urban life etc. also acts as a motivating factor for migration. However, migration for education is very limited among them. The causes of migration observed in the present study are depicted in table-5.5

Table-5.5: Causes of migration shown by the respondents		
Causes	Nos. of respondent	Percentage
Flood & bank erosion	464	77.33
Inadequate job opportunity	109	18.16
Attraction of urban life	27	4.50
Total	600	100
Source: Field survey & interview, 2002.		

The tabulated data shows that flood and erosion are the major causes of migration of people from their original abode as 77.33 per cent of the migrated people cited this as the primary cause of migration. Historically also, the specific stimuli for migrations is cited to be either natural or social. Natural causes are change in climate, natural calamities like cyclone, volcanic eruptions, floods, periodic fluctuations in rainfall etc. Social causes also prompt many migrations. In the present

context search for better job opportunity (18.16%) and attraction for urban life style (4.5%) are also cited to be causes of migration of people from the flood and erosion affected areas.

Most of the migrated people do not enjoy social protection under their new environment, since they work mostly in unorganized sectors. It is a fact that most of the workers in the unorganized sector do not have the social protection. The migration of erstwhile agricultural workers who became unemployed due to flood and erosion is adding to the already unusual unemployment problem of the state making a negative impact on economy. Moreover, flood and erosion has damaged most of the fertile and highly productive agricultural land, making a negative impact on the agro-based economy of the district also.

Among the unorganised workers, the agricultural workers earn least as compared to the non-agricultural workers. This level of inequality has created the rural-urban divide and encouraged migration. Thus, the problems of excessive dependence on agriculture, slow process of agricultural and industrial growth and ensuing inequality, unemployment and poverty are much too serious and demand careful evaluation and planning for adopting suitable mitigation strategies.

CHAPTER-VI

CHANGING OCCUPATIONAL STRUCTURE AND CONSEQUENCES

CHAPTER-VI

CHANGING OCCUPATIONAL STRUCTURE AND CONSEQUENCES

The working force and the occupational pattern are greatly influenced by the socio-economic status of a society. Further, the work participation rate, occupational pattern in different economic pursuits certainly reveals the economic status of a society. Agriculture employs most of the economically active people in our country and most of the agricultural workers are self-employed workers.

The occupational structure of a population in a region is indicative of the role played by them. The occupational compositions of workers are analyzed in terms of proportion of workers in different categories out of the total main workers as defined by the Census of India. The occupational categories are grouped into three major sectors viz. primary, secondary and tertiary.

The Indian work force participation rate is 37.7% (Census of India, 2001). The pattern of work participation in various activities varies across the country depending upon geographic location, caste, class, socio-economic and engagement in the formal or the informal sector. The majority of the main workers (66.8%) in India are employed in agricultural and allied industrial sectors.

Employment in any occupation depends upon various parameters. Any occupation involves certain range of responsibility and functions, which requires education, training and experience. Therefore, a positive co-relation between occupational pattern and education always exists. Experience or expertise substitutes

educational requirement of certain occupations. The critical objective of improvement of general literacy is still very slow in Morigaon district of Assam. The male and female literacy for the last two census periods (1991 and 2001) of Morigaon district is shown in the following table.

Table-6.1: Literacy Rate in Morigaon District & Assam (in percentage)						
	Person		Male		Female	
	1991	2001	1991	2001	1991	2001
Morigaon	47.99	59.46	51.20	57.32	39.91	42.68
Assam	52.89	64.28	64.28	71.93	43.03	56.03
Source: Statistical Handbook of Assam, 1996 and 2004						

It is observed from the field study that the majority of the literates have only a primary education or even less. As a rule, the level of education is directly proportionate to the share of main workers of the population. However, in spite of the substantial growth in general literacy pattern over the decade, work participation in various occupations are low except in the primary sectors. Table-6.2 shows the distribution of main and marginal workers in Morigaon district of Assam. It is evident from the table that the proportion of main and marginal workers in Morigaon district is lower than that of the state average in every category.

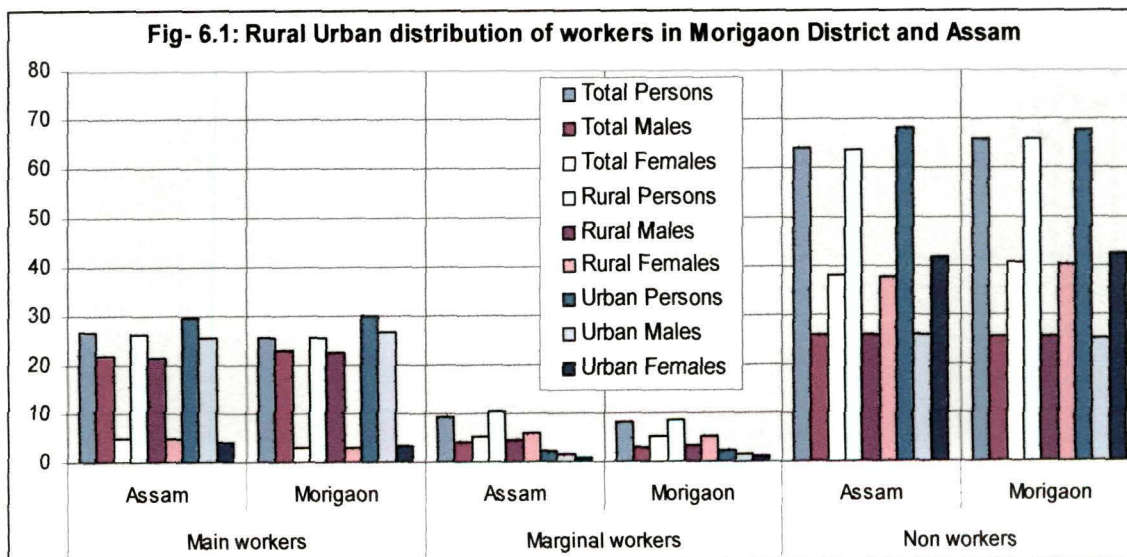
The rural urban analysis of the distribution of workers indicates that the work participation in the district with the state average do not differ significantly from that of total work participation. However, the overall work participation scenario in the district is seen to be lower to that of the state average.

Table-6.2: Rural Urban distribution of workers and non-workers in Morigaon District of Assam

		Total Population	Percentage to total population			
			Total Workers	Main Workers	Marginal Workers	Non - Workers
Total	Persons	775874 (26,638,407)	33.93 (35.88)	25.74 (26.59)	8.19 (9.29)	66.07 (64.12)
	Males	398930 (13,787,799)	26.00 (25.84)	22.92 (21.92)	3.08 (3.92)	25.42 (25.92)
	Females	376944 (12,850,608)	7.93 (10.03)	2.82 (4.67)	5.11 (5.36)	40.65 (38.21)
Rural	Persons	737813 (23,248,994)	34.01 (36.45)	25.52 (26.15)	8.49 (10.30)	65.99 (63.55)
	Males	378674 (11,983,157)	25.89 (25.65)	22.72 (21.37)	3.17 (4.28)	25.44 (25.89)
	Females	359139 (11,265,837)	8.12 (10.79)	2.80 (4.78)	5.32 (6.02)	40.55 (37.66)
Urban	Persons	38061 (3,389,413)	32.37 (31.98)	30.07 (29.62)	2.30 (2.36)	67.63 (68.02)
	Males	20256 (1,804,642)	28.12 (27.17)	26.76 (25.70)	1.36 (1.47)	25.10 (26.08)
	Females	17805 (1,584,771)	4.25 (4.81)	3.31 (3.93)	0.94 (0.88)	42.53 (41.94)

(Figures in parenthesis indicates state average)

Source: Census of India, 2001



Occupation of a person refers to the type of jobs that he holds. It is also an important indicator of the family's social status in the community. The occupational structure of a family also changes the outlook leading to a change in societal set-up. On the other hand work defines the conditions of human existence in many ways. Majority of the workers perform some kind of productive activity apart from their main occupation. However, data on such informal sectors are very imprecise, which tends to be a significant source of employment of a substantial number of people. Further, even statistics over time for the same region may alter dramatically as a result of changed definitions of work.

ILO (2002) defines main characteristics of the informal sector as ease of entry; reliance on local resources; family ownership; small-scale operations; labour-intensive work, using adaptive technologies; use of skills acquired outside school; an irregular and competitive market and possess development potential because of its flexibility and potential for creative responses to economic change. However, work in the informal sector is less remunerative and under conditions which are inferior to organised sectors' work and is highly vulnerable to workers due to the absence of workers' rights and social protection. The erosion displaced persons are found to be over-represented in the informal sector because the flexibilities of work involved in such activities.

Services constitute a very heterogeneous economic category, and include activities like retailing, banking, insurance, and administration as well as other arms-length transactions. However, reliable estimates for most of the service sector works, especially under the form of self-employment are difficult to obtain. Thus data

inadequacy in determining the occupational structure of a population in a region is certain. The rural urban distribution of workers in different categories of works in Morigaon district is shown in table-6.3.

Table- 6.3: Category wise percentage of workers in Morigaon District						
		Total workers	Cultivators	Agricultural Labourers	Household Industry workers	Other Workers
Total	Persons	263238 (9,557,064)	52.56 (39.15)	20.28 (13.50)	2.96 (3.44)	24.20 (43.91)
	Males	2,01,696 (6,884,451)	41.77 (27.85)	13.79 (8.89)	0.75 (1.23)	20.31 (34.07)
	Females	6,1542 (2,672,613)	10.80 (11.30)	6.49 (4.61)	2.20 (2.21)	3.88 (9.85)
Rural	Persons	2,50,917 (8,473,127)	54.69 (43.93)	21.18 (15.12)	2.96 (3.54)	21.17 (37.41)
	Males	1,90,992 (5,963,601)	43.39 (31.22)	14.41 (9.95)	0.71 (1.19)	17.61 (28.02)
	Females	59,925 (2,509,526)	11.30 (12.71)	6.78 (5.16)	2.25 (2.35)	3.56 (9.39)
Urban	Persons	12,321 (1,083,937)	9.26 (1.82)	1.90 (0.84)	2.91 (2.63)	85.93 (94.71)
	Males	10,704 (920,850)	8.61 (1.48)	1.15 (0.58)	1.66 (1.55)	75.46 (81.34)
	Females	1,617 (1,63,087)	0.65 (0.34)	0.75 (0.26)	1.26 (1.08)	10.47 (13.37)
(Figures in parenthesis indicates the state average)						
Source: Census of India, 2001						

It can be observed from the table that as high as 72.84 per cent of the workers in the district are engaged in the primary sector (cultivators and agricultural labourers), while a mere 27.16 per cent of workers are engaged in other sectors of occupation including the household industries in comparison to the state average of 52.65 per cent and 47.35 per cent respectively in similar occupations. This indicates the agrarian nature of economy of the district. Moreover, the district is predominantly rural in nature, and thus there exist a very limited scope for job

opportunity outside the agricultural sector apart from the government jobs and services or supply oriented occupations in the Nagaon Paper Mill, the only notable industry of the district.

Therefore, in Morigaon district, variation in occupational structure is relatively low. Lack of industrial and associated infrastructure development is one of the primary causes of over representation of workers in the primary sector in the district. However, in case of the erosion affected people, there is a move from agriculture as the primary livelihood, to agricultural labourers, wage labourers in other areas than agriculture and various other occupations like rickshaw pullers, cart pullers, small or petty traders etc. in or outside the district. The trend of occupational structure of the affected people reflects their economic status also. Table- 6.4 shows the occupational structure and monthly income of the affected people prior to erosion.

Table- 6.4: Occupational structure and monthly income of the respondents prior to erosion calamity			
Occupation	Monthly earning (in Rs.)	Nos. of respondent	Percentage (%)
1. Marginal farmer	-----	412	68.6
2. Agricultural labourer (daily wager/ Monthly labourer)	800-1050	47	7.8
3. Bonded or attached agricultural labour (yearly)	50-200	12	2.0
4. Employee (teacher/clerical/ defiance etc.)	4000-7000	59	9.8
5. Seasonal Agricultural worker	1100-1500	56	9.3
6. Others (workers in shops, hotels, vendor etc.)	600-900	14	2.3
	Total	600	100
Source: Primary field survey data, 2002			

The rehabilitated areas were most unprivileged areas in respect of the three most important indicators of development viz. health, education, and economic status. Most of the people (85%) of the area derived their livelihood mainly from the primary sector prior to erosion. However, flood and erosion had made the life of these farmers miserable by depriving them from their agricultural land and making the farm lands unusable for cultivation. The erosion displaced people transformed the farmers to agriculture labourers and also into wage labourers in other areas. It has been shown, the shift from cultivator to laborer status, can only be explained by loss of land for subsistence cultivation and inadequate growth of productive employment opportunities on family structure (Duvvury, 1989). Agricultural labour is seasonal work with long period of unemployment and under employment during the year. Thus their income had shown a downward trend in their new environment. Table- 6.5 shows the occupation and income of the respondents after their displacement.

Table- 6.5: Occupation & income of the respondents after displacement due to erosion			
Occupation	Monthly income (in Rs.)	Nos. of respondent	Percentage (%)
1. Daily wage labourer	2000-3200	298	49.6
2 Construction/ Industrial labourer	2000-2300	70	11.6
3. Agricultural workers	1500-2500	78	13.0
4. Employee (teacher/clerical/ defiance etc.)	4000-7000	74	12.3
5. Rickshaw puller	1500-1800	25	4.2
6. Vendors (vegetable, fish, oil, egg etc.)	1200-1800	55	9.2
Total		600	100
Source: Primary field survey data, 2002			

The assessment of the occupational status of the respondents in the changing scenario reveals that there is a significant transformation in occupation pattern and their income. The erstwhile marginal farmers vanished in the post erosion scenario while the proportion of agricultural worker declined from 85% to 22%. Most of the farmers were forced to become wage earning labourers after loss of their agricultural land.

The occupational structures of the erosion affected people are showing a change towards activities outside the primary sector. People who were earlier engaged in farm related activities have become wage labourers due to loss of the farmlands which become evident from the table 6.6 which shows that there are changes in occupational structure of the migrants from farming activities in rural areas to wage earning activities in urban areas. Similar observations are also depicted in the table 6.7 where it is seen that there is a drastic reduction in the number of cultivators in the post erosion occupational pattern in rural areas.

The people those who migrated to the other areas under the minimum needs programs of the government and the people staying in the roadsides, embankments and the people not wanting to move to safer places from their own land which are located in the critical areas of the river became daily wage labourers in the nearby villages. Their monthly income also declined compared to their past income. In their original abode the affected people had land for growing food grains and thus were able to lead a better life. After erosion, more than 70 per cent of them became seasonal agricultural labourers and marginal farmers, many of whom used to own

Table- 6.6: Changing Occupational Structure of Erosion Affected People															
Category.	Name of the Village	OCCUPATION OF SELF REHABILITATED PEOPLE													
		Before Migration (in %)							After Migration (in %)						
		Farmer	Agri. Labour	Bonded Labour	Employee	Seasonal Worker	Others	TOTAL	Farmer	Daily Wage Labour	worker in Carriage industry	Employee	Vendor	Rickshaw puller	TOTAL
Rural to Rural	Taptala	63.2	10.5	0.0	5.27	21.1	0.0	100	7.9	65.8	0.0	15.8	10.5	0.0	100
	Barukati	57.5	35.0	5.0	0.0	2.5	0.0	100	12.5	82.5	0.0	0.0	0.0	5.1	100
	Bardia	91.4	8.6	0.0	0.0	0.0	0.0	100	28.6	62.9	0.0	0.0	8.6	0.0	100
	Bilarmor	78.4	5.4	0.0	0.0	16.2	0.0	100	10.8	78.4	0.0	0.0	10.8	0.0	100
	Total	72.0	15.4	1.4	1.4	10.0	0.0	100	14.7	2.7	0.0	4.0	7.4	1.4	100
Rural to Urban	Chenimari	64.7	20.6	5.6	0.0	8.8	0.0	100	5.9	38.2	32.4	5.9	8.8	8.8	100
	Basana-ghat	22.9	0.0	0.0	71.4	0.0	5.7	100	0.0	0.0	11.4	80.0	8.6	0.0	100
	Milanpur	41.9	11.6	14.0	23.3	0.0	9.3	100	0.0	32.6	7.0	32.6	14.0	14.0	100
	Na-bheti	42.1	0.0	0.0	34.2	23.7	0.0	100	5.3	18.4	15.8	39.5	10.5	10.5	100
	Total	42.7	8.0	5.3	32.0	8.0	4.0	100	2.7	22.7	16.0	39.3	10.7	8.7	100

Source: Primary field survey data, 2002

at least 25-40 bighas of agricultural land prior to erosion. The erosion affected people, who were rehabilitated by the government, were provided with insufficient land to be used for agricultural purposes. A classic example of the can be observed in Domal government rehabilitated area where most of the rehabilitated people including their children have to work as labourers in the brick kiln industry to earn their livelihood.



**HOUSES PROVIDED TO AFFECTED FAMILIES UNDER
INDIRA AWAS JOJANA**



**CHILDREN OF EROSION EFFECTED FAMILIES WORKING
IN BRICK INDUSTRIES**

Table- 6.7: Changing Occupational Structure of Erosion Affected People															
Category	Name of the Village	OCCUPATION OF GOVT. REHABILITATED PEOPLE													
		Before Migration (in %)							After Migration (in %)						
		Farmer	Agri. Labour	Bonded Labour	Employee	Seasonal Worker	Others	TOTAL	Farmer	Daily Wage Labour	worker in Carriage/ industrial	Employee	Vendor	Rickshaw puller	TOTAL
Rural to Rural	Baragoni (Kustali)	77.3	9.1	0.0	0.0	13.7	0.0	100	0.0	72.7	0.0	0.0	18.2	9.1	100
	3 No. Damal	91.7	0.0	0.0	4.2	4.2	0.0	100	10.4	14.6	70.8	4.2	0.0	0.0	100
	Langari-bori	75.0	0.0	0.0	0.0	15.0	10.0	100	15.0	55.0	10.0	0.0	10.0	10.0	100
	Hariabori	73.1	11.5	3.9	0.0	11.5	0.0	100	15.4	73.1	0.0	0.0	11.5	0.0	100
	Sukati-puta habi	71.8	0.0	0.0	0.0	18.8	9.4	100	0.0	81.3	18.8	0.0	0.0	0.0	100
	Kathani	84.3	7.9	0.0	0.0	3.9	3.9	100	19.6	70.6	0.0	0.0	9.8	0.0	100
	Barbori reserve	79.2	0.0	0.0	5.7	13.2	1.9	100	45.3	28.3	7.6	5.6	13.2	0.0	100
	Deoara-bori	81.8	0.0	0.0	18.2	0.0	0.0	100	9.1	27.3	0.0	18.2	18.2	27.3	100
	Total	0.0	4.0	0.7	3.0	9.7	2.7	100	17.3	51.7	15.3	3.0	9.3	3.3	100

Source: Primary field survey data, 2002

Agriculture is used to be main occupation of 70 per cent people of the entire district and about 80 per cent of the Bhuragaon, Laharighat and Mayong circles. However, over the years, there has been a decline in the number of cultivators and increase in agricultural laborers in the district, mainly due to floods which deposits sand on agricultural land and making the farm lands unusable for cultivation. The situation is worst in the erosion affected areas, where due to loss of land, the affected families have shifted to new places and had to earn their livelihood from other types of occupations also. As most of the erosion displaced people are unskilled in activities other than agriculture, hence they were forced work as wage labourers,

rickshaw pullers, vendors, etc. as to earn their livelihood. Thus, similar to the observations made in the table 6.6 and 6.7 where it is seen that there is a drastic reduction in the number of cultivators in the post erosion occupational pattern in rural areas, the analysis of the table 6.8 also showed that the people who were earlier engaged in farm related activities have become wage labourers due to loss of their farmlands.

Table- 6.8: CHANGING OCCUPATIONAL STRUCTURE OF EROSION AFFECTED PEOPLE													
		Farmer	Agricultural Labour	Bonded labour	Employee	Seasonal Worker	Daily Wage labour	Carriage/Industrial Worker	Vendor	Rickshaw Puller	Others	Total	χ^2 value
Occupation of rural to rural migrants	Before migration	348	35	4	11	44	0	0	0	0	8	450	63.05*
	After migration	74	0	0	15	0	264	46	39	12	0	450	
Occupation of Rural to Urban Migrants	Before migration	64	12	8	48	12	0	0	0	0	6	150	17.91*
	After migration	4	0	0	59	0	34	24	16	13	0	150	
* Statistically significant at 5% level of confidence. Source: Field data, 2002													

Fig-6.2 CHANGING OCCUPATIONAL STRUCTURE OF RURAL TO RURAL MIGRANTS

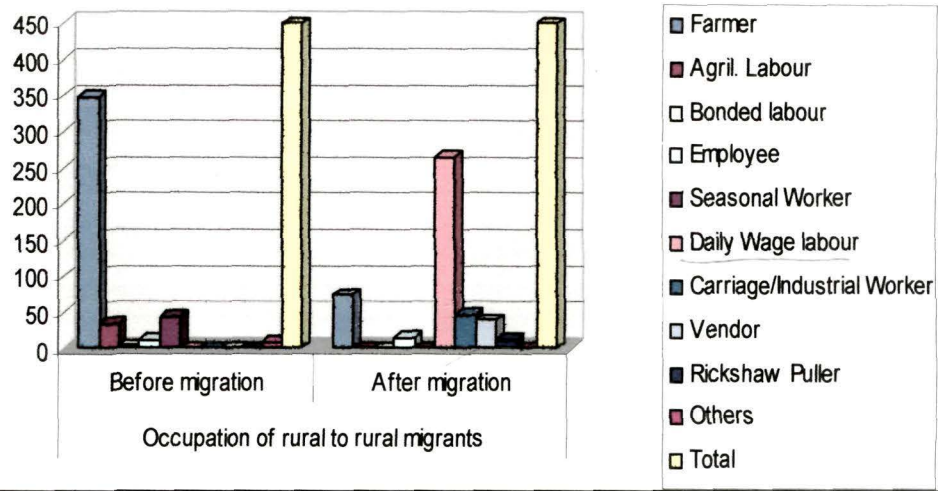
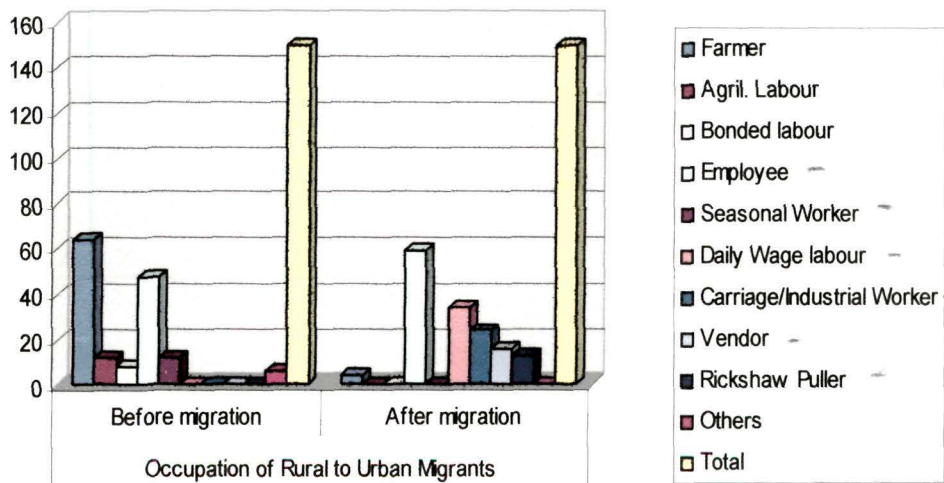


Fig-6.3 CHANGING OCCUPATIONAL STRUCTURE OF RURAL TO URBAN MIGRANTS



The statistical analysis of the data in table-6.8 also showed a significant change in the occupational structure on both rural to rural as well as rural to urban migrants. Hence the hypothesis which states that “There shall be a change in the occupational structure of the affected people characterized by a move towards non-agricultural sector in the urban areas and towards casual labour in the agricultural sector in the rural areas” is accepted and proved to be statistically positive.

The foregoing discussion about variation of the occupational structure is indicative of the fact that the erosion affected people were primarily farming community, engaged mainly in agricultural activities. It is also observed that their occupational structure has seen an abrupt change from farming community to wage earning occupations after the displacement. The share of workers in agricultural activities prior to erosion was 85 percent which has changed abruptly to occupations like wage labourers especially in the fields where there is demand for unskilled labourers. The share of unskilled workers after displacement became 87 percent in the urban sector. After displacement most of them are living a life of poverty.

CHAPTER- VII

SUMMARY AND CONCLUSION

CHAPTER- VII

SUMMARY AND CONCLUSION

The North Eastern Region of India is one of the most hazard prone regions in India, with various natural calamities like earthquakes, floods, landslides and cyclonic storms occurring at regular intervals. The river Brahmaputra and Barak drains the region. The Brahmaputra river, in terms of discharge is the third largest river in the world. The average annual rainfall in the region is very high and huge volume of water rushes through the narrow bowl shaped valley of Assam to the Bay of Bengal ravaging the area through floods and land erosion. The vulnerability to natural disasters combined with socio-economic vulnerability of the people living in these area need a comprehensive plan for disaster preparedness and mitigation.

The Brahmaputra is a major river system of the world characterized by exceedingly high rates of basin erosion. The high erosion rate of the drainage basin of the river results in rapid aggradations of the channels and over bank flooding. Soil erosion is now viewed as a major 'non-point' source of environmental pollution, besides its negative impact on soil productivity.

Bank erosion of the river Brahmaputra is causing immense long-term destruction every year. The river Brahmaputra has been shifting slowly southward. The seismic instability of the region also contributes to such shift. Moreover, considerable degradation of forests in the surrounding hills of the Brahmaputra valley due to untenable deforestation, widespread practice of shifting cultivation and other harmful human interferences are also responsible for high floods and erosion of

river banks. Human interference, like construction of protective spurs for the Kalia Bhomora road bridge is also thought to play a part in the erosion process of the river especially in its down stream where Morigaon district is located. The continuous retirements and unabated erosion causes heavy loss to the valuable homestead and fertile agricultural lands, besides evacuation of thickly populated riverine dwellers. In the process over the years from 1981-82 to 2001, as many as 93 nos. of revenue villages got obliterated due to unabated erosion.

Prevention of river erosion is a very difficult and costly task. It takes many years before stability can be established. The damage caused by erosion is of permanent nature. Erosion has made thousands of people homeless and most of them shifted to the E&D embankments and P.W.D. roadside. They live a perilous life in the edge of poverty. Rehabilitation of these people is a gargantuan task as land is a scare commodity. Besides these, socio- political factors are also added to it.

The Brahmaputra River, the fifth largest in the world, serves as a lifeline for Assam and other states in the northeast region. However, unpredictable shifts of the river, severe erosion, and frequent flooding have major adverse effects on the economy and ecology, affecting and threatening key urban centers, basic infrastructure, industrial and agricultural areas, and natural heritage sites. Erosion displaces a large number of the population who are often rendered poor and landless. To address these problems, there is a need to develop and implement a comprehensive, cost-effective, and affordable flood and erosion mitigation management strategy. It is also felt to strengthen the policy and framework for flood control. Therefore, it is felt imperative to study the population redistribution pattern

and the occupation structures of the dislocated persons due changing social and natural ecology and dislocation in the community network system. River bank erosion on areas of settlement and agricultural land has also changed the cropping pattern of the district as large areas of highly fertile and productive agricultural land have been completely submerged in the Brahmaputra river. Thus to have a proper understanding of the problems and consequences of bank erosion, and the changing social and economic characteristics due to rehabilitation it is felt imperative to carry out a research on the river bank erosion and its impact on dwellers of Brahmaputra valley, with special reference to the Morigaon district of Assam. The study is trying to bring out an effective mitigation measures which can be formulated for the benefit of the displaced people in particular and the society as a whole.

The district Morigaon is located in the central part of Assam. In the south bank of Brahmaputra between 26° 00' N and 26°40' N latitude and 91°59' E and 92°35' E longitude with a geographical area of 1431.5 sq. km., accounts an area of 1.99 % area of the state. The geographical boundary comprises with Nagaon district in the east, Darrang district in the north, Karbi-Anglong district and Meghalaya State in the south and Kamrup district in the west. The major river flowing through the district are the mighty Brahmaputra along the northern boundary and Kolong, Kopili along the middle of the district meet at Jagibhakatgaon and jointly fall into the river Brahmaputra. The tributaries of Brahmaputra like Sonai, Sonduba, Morasonai, Moraganga, Kalijam, are in the northern part and Kopili, Kolong and Kiling on the southern part of the district.

The present research work as outlined in the preceding chapters basically embodies the detailed geographical treatment of the demographic and socio-economic characteristics of erosion affected people in the Morigaon district of Assam. Main focus of the study is given on the impact of river bank erosion and changes in land use and cropping pattern in Morigaon district. The study is on the consequences of bank erosion on human settlements in Morigaon district. Moreover, analysis of the occupational change among the displaced people who have been rehabilitated and their adjustment with such social and ecological change was also studied.

Chapter-I encompasses the research problem, its goal and significance. It also includes the relevant review of research in the related fields, which forms the basic foundation and direction of the study. Appropriate methods and approaches were applied including field observation to find out the results.

A study of the physical and socio-economic background of Morigaon district is made in Chapter-II. Morigaon district is located in the mid part of Assam. The unique feature of Morigaon district is that it is constituted by combination of hills and plains. The district has a total area of 1704 sq. km with 680 villages of which 636 are inhabited. The district have a total population of 776256 with a sex ratio of 945 females per thousand male and the density of population is 456 per square km. the literacy rate of the district is 58.54%. The district is connected with the rest of the state via roads, railways and water ways. Roads are the major mode of communication of the district.

Physiographically the district Morigaon can be divided in to three regions viz. the north-eastern low lying plain, the central and the eastern built-up plain and the south western plain interspersed with hillocks

The soils of Morigaon district is classified in to three major groups as per their physical, chemical and other qualities. They are –the sandy riverine soils of the north west along the banks of the rive Brahmaputra which are chronically flood affected; the fertile alluvial soil of the central and the eastern parts; and the relatively infertile soil of the hills that spreads over the isolated hillocks and the foothills of the south-west region intervening intermittently with fertile alluvial soils affected by flash floods.

The Brahmaputra is the main river which flows along the extensive northern boundary and all the drainage of the district ultimately finds their way in to it. Its main tributaries within the district are Kollong, Kopili, Sonai, and Pakaria. In addition to the rivers, there are several other important tributaries, numerous channels and streams locally called as “*jans*” and “*juries*”. Besides these channels there are several *beels* and marshy lands scattered throughout the district. Thus the district is one of the most flood prone districts of Assam.

Morigaon district falls under the influence of the humid mesothermal Gangetic (CMG) type of climate. The climatic condition of the region is hot and humid during the summer and cold and dry during the winter. This region is influenced by south west monsoon in the summer and north east monsoon in winter.

The Economy of Morigaon district is principally agro based. Sericulture, fishing and driftwood business is carried out by people in smaller scales. However river erosion, sand deposition and other adverse effects of chronic floods on fertile agriculture land have made even affluent farmers landless. Lack of good communication system, shortage of power and lack of proper irrigation and marketing facilities add to the poverty of the district, while galloping explosion in the rate of population growth has already shown signs of negative impact.

Chapter-III deals with the changing agricultural land use and cropping pattern in the district, especially in the erosion affected and resettled localities. Agriculture is not only the main source of employment, income and food for majority of the rural population, but is also the main culture for rural families in the Morigaon district. Agricultural land use constitutes a dominant feature of the diverse uses of land for productive purposes. The major land use/ land cover categories that are identified in the Morigaon district are built-up land, agricultural land, forestland, wasteland, water bodies and grazing land. Agricultural land can be subdivided into Kharif, Rabi and double-cropped areas. The plantation agriculture of the district is mainly confined to the settlement areas. The main plants include jackfruit, banana, bamboo groves, coconut and areca nut.

However, since 1989 a total of 93 villages along with their precious agricultural land had been affected by the erosion of the river Brahmaputra disrupting the very fabric of economy of the affected villages. Of the total area of 142321.81 hectares land in the district, 10256.93 hectares (0.07%) have been lost to erosion, till 2001.

The preponderance of small and marginal type of land holding which is increasing due to fraternization and nuclearization of farm families also affects the land use pattern by the farmers. In Morigaon district large farmers constitute only 34.64 per cent while two third of the farmers are either landless or small or marginal farmers. Moreover, river erosion makes a negative impact on agriculture by way of making land unavailable for agriculture, thus making a definite changing impact on the agricultural land use pattern especially in the affected areas. The net sown area in the Morigaon, Mikirbhata and Bhuragaon circles had shown an increasing trend while that of Lahorighat and Mayong circles have decreased. The decrease in these two circles can be attributed partly to the erosion effect of the Brahmaputra and partly to the population pressure. On the other hand the increase in the net sown area in the erosion affected Bhuragaon circle may be attributed to the aggradations of the tributaries of the river Brahmaputra as well as conversion of erstwhile barren cultivable land into agricultural land. Moreover, the area sown more than once had also shown an increasing trend in all the circles except Bhuragaon and Mayong. Most of the agricultural land of Mayong and Bhuragaon circles are low lying and waterlogged and thus are considered to be unsuitable for double cropping by the farmers, majority of whom practiced the traditional method of cultivation.

The comparison of land use data of 1987-88 and 2000-01 makes it evident that erosion had an impact on the total availability of land for agriculture in the Mayong and Laharighat circles. On the other hand in the net sown area increased in 2000-01 in comparison to the year 1987-88 in the Morigaon and Mikirbheta circles where bank erosion is not evident.

Migration of people towards “*Char*” areas for winter cropping and rehabilitation makes a positive impact on reclamation of fertile agricultural land and diversification of cropping pattern. However, diversification of cropping pattern is seen to be minimal in areas where there is non availability of irrigation facilities. Although the district possesses tremendous potentiality for making provision for irrigation to most of the farms, but only 16.79 per cent of the net sown area of the district is covered by different modes of irrigation and thus most of the farmers of the district have to depend upon monsoon rains for agriculture.

The spatial variation in the cropping pattern of the district can be best measured by crop concentration and diversification. As winter rice was more or less uniformly distributed all over the district there is absence of very significant concentration of this crop in a particular circle. Out of the five circles three have recorded statistically low concentration of winter rice. All these causes indicate that the pressure of population is increases in agricultural areas which lead to changing the land use pattern of the region.

The district Morigaon like other parts of Assam produces a variety of crops such as paddy, maize, mustard, jute, pulses, sugar cane, fruits, vegetables, tobacco, etc. among which paddy occupies the largest crop hectarage of the region. The production trend of different crops in the district although not substantial, but possess a good potential for improvement.

Government policies and the changing structure of settlements and redistribution of population are discussed in chapter-IV. The human settlements areas

just adjacent to the Brahmaputra river banks are becoming worst sufferers from riverbank erosion that is taking place since last few decades. Morigaon district is located in the south bank of river Brahmaputra, which is highly erosion prone and gets flooded almost every year. The flood and erosion causes untold misery to countless persons every year. The damages caused by erosion are of permanent in nature. Since 1989, and till 2001, 16950 families comprising approximately 47000 persons have been affected by this relentless erosion and forced them to move out of the area. The people uprooted from their original places migrated out of the area and rehabilitated themselves in different parts of the state either under the rehabilitation programs of the state government or on their own initiative.

The government sponsored rehabilitation programme was started in 1981, and ran smoothly in the initial phase without any problem due to low density of population and well availability of government owned vacant land. The erosion affected people were allotted cultivable land up to 2 acres per family. But later as pressure of population growth had increased and vacant land for rehabilitation and resettlement became scarce or unavailable, the problem of rehabilitation and resettlement became acute. The uprooted people have to wait for years to be rehabilitated, occupying temporary shelters erected besides the existing embankments or on the top of the retired ones. Till now only 5.96 percent of the affected families were rehabilitated through governmental efforts. Moreover, only 0.94 hectares of land could be provided to most of the rehabilitated families at an average for their dwelling as well as for agricultural purpose. Moreover, till 2001,

1.62 per cent families belonging to below the poverty line category were also provided with dwelling houses under the *Indria Awas Yujana* (IAY).

The places where rehabilitation programmes were carried out by the government are located in the interior areas. There were problems of adjustment in the new location, means of livelihood, agricultural productivity, communication, drinking water etc. The socio-economic conditions of the rehabilitated people in most of the places were found to be worse. The conditions of the rehabilitated families are so pathetic in certain areas that all the able members of the entire family had to work to earn their daily bread.

Chapter-V deals the rural to rural and rural to urban migration of the erosion affected people. Bank erosion and channel migration of the river Brahmapurta has been causing immense long-term destruction every year. The river Brahmaputra has been shifting slowly southward where Morigaon district is situated. The Brahmaputra and its tributaries carry enormous quantities of sediments and on reaching the plain the sediments are deposited on their own beds. The channels are thus filled up and the water in the following summer digs out different courses abandoning the earlier course. The continuous sedimentations and unabated erosions are causing heavy loss of valuable homestead and fertile agricultural lands, besides evacuation of thickly populated riverine dwellers. In the process over the years from 1989 to 2001, as many as 93 nos. of revenue villages of Morigaon district alone got obliterated due to such erosion.

The nature and extent of migration is also accelerating the process of redistribution. Essentially subsistence in nature, the economy of Morigaon district has experienced large scale internal migration in the past. The economy of Morigaon district is characterized by absence of organized labour sector. The people are mostly engaged in agriculture, its allied works and other part-time labours.

Migration of people into urban areas of the district occurs for search of better economic benefit from wages earned through works in unskilled labour force. It is natural for the erosion affected people, who were unemployment in agricultural sector had migrated to urban areas in search of better income. However, the observed migration pattern indicates that more than 80 percent of the migration was from rural to rural areas, whereas less than 10 percent migration was from rural to urban areas.

The river bank erosion in certain areas of the district is still forcing people to move out to safer places. It is observed that the population migration from the erosion affected areas of the district started in the year 1992 (1.72%) and reached its peak in 1995 (10.66%). The migration was lowest in 1997 (1.72%), but it increased again in 2000 (20.49%). Increasing population pressure, lack of profitable income earning avenues within the locality as well as decreasing land holding, flood and erosion are the major causes of such migration.

The land alienation process is another cause of migration of the people from one locality to another. In a predominately agrarian economy land alienation is characterized by highly distorted distribution of land and adverse land-man ratio aggravates the inequality in terms of income and wealth. The migratory pattern of the

people from the erosion affected areas clearly indicates that they are mostly attracted towards the areas where unskilled labour force is required on a large scale. Although distance of destination is inversely proportional to amount of migration, but in the present context this relationship is not observed.

Every movement of population is associated with some definite reasons like economic, social and political etc. Land alienation forced the people of erosion affected areas to migrate. Among other reasons, inadequate employment opportunities, attraction of urban life etc also acts as a motivating factor for migration. However, migration in search of higher education is very limited among them. Flood and erosion are the major causes of migration of the people from their original abode in the district, as 77.33 percent of the migrated people cited this as the primary cause of migration. In the present context search for better job opportunity (18.16%) and attraction of urban life style (4.5%) are also cited to be minor causes of migration of the people from the flood and erosion affected areas to other places.

Changing occupational structure and its consequences in relation to erosion affected people are discussed in Chapter-IV. Agriculture employs most of the economically active people in the district. Here agricultural workers are self-employed. Employment in any occupation depends upon various parameters. Any occupation which involves certain range of responsibility and functions requires education, training and experience. Therefore, a positive co-relation between occupational pattern and education is always evident. However, the critical objective of improvement of general literacy is still very slow in Morigaon district of Assam. Majority of the literates have only a primary level of education or even less.

The proportion of main and marginal workers in Morigaon district is lower than that of the state average in every category. The rural urban analysis of the distribution of workers indicates that the difference of work participation of the district with the state average do not differ significantly from that of total work participation. Thus the overall work participation scenario of the district is seen to be lower to that of the state average. Moreover, the displaced persons are found to be over-represented in the informal sector because of the flexibilities of work involved in such activities. As high as 72.84 percent of the workers in the district are engaged in the primary sector (cultivators and agricultural labourers), while a mere 27.16 percent of workers are engaged in other sectors of occupation including the household industries in comparison to the state average of 52.65 percent and 47.35 percent respectively in similar occupations. This indicates the agrarian nature of economy of the district with very little variations in the overall makeup of the occupational pattern.

However, in case of the erosion affected people, there is a move from agriculture as the primary livelihood, to agricultural labourers, wage labourers in other areas than agriculture and various other occupations like rickshaw pullers, cart pullers, small or petty traders etc. in or outside the district. Most of the people (85%) of the area derived their livelihood mainly from the primary sector prior to erosion. However, after erosion most of these farmers transformed into agricultural labourers or into wage labourers in other areas. Agricultural labour is seasonal work with long period of unemployment and under employment during the year. Thus their income shows a downward trend in their new environment.

The assessment of the occupational status of the respondents in the changing scenario reveals that there was a significant transformation in occupation as well as income in two different conditions. The erstwhile marginal farmers became extinct in the post erosion scenario while the proportion of agricultural workers declined from 85% to 22%. Most of the farmers became wage earning labourers and were working in areas where there is demand for unskilled workers in urban areas. Moreover, the people who had re-migrated to the rural areas under the minimum needs programme and the people residing on the roadside and embankments are engaged mainly in occupations like daily wage labourer or bonded labourer in the near by villages.

Thus the occupational structure of the erosion affected people are experienced an abrupt change from agricultural workers to primarily wage earning occupations. The share of workers in agricultural activities prior to erosion was 85 percent and wage labourers increased to (87%).

MAJOR FINDINGS OF THE STUDY:

1. The unique feature of Morigaon district is that it is constituted by combination of hills and plains regions. Roads are the major mode of communication of the district. The Brahmaputra is the main river which flows along the extensive northern boundary and all the drainage of the district ultimately finds their way into it. The district is one of the most flood prone districts of Assam. This region is influenced by south west monsoon in the summer and north-east monsoon in winter. The economy

of the district is principally agro based sericulture; fishing and driftwood in smaller scales.

2. Agriculture is not only the main source of employment, income and livelihood system for majority of the rural population, but is the culture in Morigaon district.
3. The major land cover category in Morigaon district is built-up land, agricultural land, forestland, wasteland, water bodies and grazing land. The plantation agriculture of the district is mainly confined to the settlement areas. The main plants include jackfruit, banana, bamboo groves, coconut and areca nut.
4. Since 1969 a total of 93 villages along with their precious agricultural land have been affected by the erosion of the river Brahmaputra. Thus it has disrupted the economy of the villages. Of the total area of 142321.81 hectares of land about 10256.93 hectares (0.07%) have lost due to erosion, till 2001. More than 80 percent of the lost land was rich agricultural land producing some of the finest variety of jute in Assam.
5. The net sown areas in Morigaon, Mikirbhata and Bhuragaon circles have shown an increasing trend while that of Lahorighat and Mayong circles have decreasing trend. Net sown areas have increased in 2000-01 compared to the year 1987-88 in Morigaon and Mikirbheta circles where bank erosion is not evident.
6. River erosion has made an impact on the agricultural land use pattern in the Bhuragaon and Laharighat circles. Mayong saw a less erosion whereas Laharighat and Bhuragaon suffered from major erosion.

7. Migration of people towards “char” areas for winter cropping and rehabilitation during that period made a positive impact on reclamation of fertile agricultural land and diversification of cropping pattern.
8. Although the district possesses tremendous potentiality of making provision for irrigation to most of the farms, but only 16.79 percent of the net sown area of the district is covered by different modes of irrigation and thus most of the farmers of the district have to depend upon monsoon rains for agriculture.
9. The south bank of river Brahmaputra, where Morigaon district is located is highly prone to erosion, and gets flooded almost every year. Since 1969 and till 2001, 16950 families comprising about 47000 persons have been affected by this relentless erosion.
10. The people those who got uprooted from their original places migrated out and rehabilitated themselves in different parts of the state either under the rehabilitation programmes of the state government or on their own. They were allotted cultivable land up to 2 acres per family. But due to continuous recession of the bank line and erosion of the riverine tract, more and more people were rendered homeless. Moreover, pressure of population growth has also increased and vacant land for rehabilitation and resettlement became scarce or unavailable. Thus the problem of rehabilitation and resettlement became more acute. The affected people have to wait for years to be rehabilitated, occupying temporary shelters erected besides the existing embankments or on the abandoned embankments.

11. Till date only 5.96 percent of the affected families were rehabilitated through governmental efforts. Moreover, only 0.94 hectares of land were provided to most of the rehabilitated families for their dwelling as well as agricultural purposes. Till 2001, 1.62 percent of the families belonging to below the poverty line category were also provided with dwelling houses under the *Indria Awas Yujana* (IAY).
12. The rehabilitation places under government scheme were located in the interior areas coupled with many hindrances including lack of communication. The socio-economic conditions of the rehabilitated people in most of the cases are found to be worst.
13. Bank erosion and channel migration of the river Brahmapurta is causing immense long-term destruction. The Brahmaputra and its tributaries carry enormous quantities of sediments and on reaching the plains the sediments are deposited on their own beds. The filled up channels dig out different courses abandoning the earlier ones during monsoon.
14. Morigaon district is experiencing a large scale internal migration in the past. Migration of people into urban areas of the district is in search of better economic benefits as unskilled labour force. However, in Morigaon district, more than 80 percent of the migration was from rural to rural areas, whereas less than 10 percent migration was from rural to urban.
15. The population migration from the erosion affected areas of the district began in the year 1992 (1.72%) and reached its peak in 1995 (10.66%). The migration is lowest in the year 1997 (1.72%), but started rising again to in the year 2000 (20.49%). Increasing population pressure, lack of profitable

income earning avenues within the locality as well as decreasing land holding pattern coupled with flood and erosions are the main cause of such migration.

16. The migration pattern of the people from the erosion affected areas clearly indicates that they are mostly attracted towards the areas where unskilled labour forces are required on a large scale. Although distance of destination is inversely proportional to amount of migration, but in the present context this relationship is not observed.
17. Land alienation also forced the people of erosion affected areas for migration. Among other reasons, inadequate employment opportunities, attraction for urban life etc also acts as a motivating factor for migration. However, migration for higher education is very limited among them. As high as 72.8 percent of the migrated people cited land alienation as the primary cause of migration while in search of better job opportunity (21.8%) and attraction of urban life style (5.4%) are also cited to be minor causes of migration from the flood and erosion affected areas.
18. Agriculture employs most of the economically active people in the district and agricultural workers constitute most of the self-employed workers. The positive co-relation between occupational pattern and education is reflected in the occupational pattern of the economically active people within the district. The critical objective of improvement of general literacy is still very slow in Morigaon district as majority of the literates have only a primary level of education or even less.

19. The proportion of main and marginal workers in Morigaon district is lower than that of the state average. As high as 72.84 percent of the workers in the district are engaged in the primary sector (cultivators and agricultural labourers), while a mere 27.16 percent of workers are engaged in other sectors of occupation including the household industries in comparison to the state average of 52.65 percent and 47.35 percent respectively in similar occupations.
20. The occupational structure of the erosion affected people have seen a move from agriculture as the primary livelihood, to agricultural labourers, wage labourers in other areas than agriculture and various other occupations like rickshaw pullers, cart pullers, small or petty traders etc. in or outside the district.
21. The erosion displaced persons are found to be over-represented in the informal sector and there occurred a significant transformation in occupational structure as well as in the earning in two different conditions among the erosion affected people.
22. The marginal farmers became extinct in the post erosion scenario while the proportions of agricultural workers have declined from 85% to 22%.
23. Most farmers became wage earning labourers and were working in areas where there are demands for unskilled workers mostly in urban areas.
24. The people who have resettled in the rural areas under the minimum needs programmes of the government and the people who still residing on the roadsides and embankments and the people who are still to move out to safer places from their own remaining erosion prone lands are mostly

engaged in occupations like daily wage labourer or bonded labourer in the near by villages.

SUGGESTIONS:

1. The Brahmaputra River, the fifth largest in the world, serves as a lifeline for Assam and other states in the northeast region. The Brahmaputra basin corresponds to a fluvial erosional system, where the river is in its juvenile to early-mature stage. For this reason, intense riverbank erosion is taking place along its banks. The areas considered with a high flood hazard correspond mostly to the riverine areas corresponding to the alluvial plain of the district and because of its high permeability; this geomorphic unit is also prone to erosion. The findings of this research have to be considered only as a first approach. There is a need of information in order to obtain a better scenario of the situation.
2. Although, risk assessment plays a very important role in the planning and designing of disaster mitigation measures, the success of a risk assessment depends mainly on a correct valuation of the elements at risk. Moreover, there is need for identification of priority investments and development of nonstructural measures for flood control and development of an integrated flood control and erosion mitigation strategy for Assam.
3. Damages due to riverbank erosion tend to be much higher than damages caused by flooding. It implies that more attention should be given to this situation, in order to reduce such frequent erosion and flooding.

4. There is need to develop and apply rigorous policies related to landuse pattern, which intend to control the increase of run off, erosion and water contamination and the decrease of soil fertility and capacity of discharge of the river.
5. There is need to formulate economic and poverty reduction efforts through integrated flood control and erosion mitigation in the Brahmaputra river basin.
6. To provide protection from river erosion and floods particularly the most vulnerable areas including vital areas of economic and national interests and the population therein. An adaptive process approach is will protect critical reaches first, and then replicate suitable measures to other areas later.
7. Preparation of an integrated flood control and erosion mitigation strategy for Assam.
8. Preparation of cost-effective and affordable measures for flood control and river erosion mitigation.
9. Institutional assessments to define appropriate action agenda for integrated flood control and erosion mitigation.
10. Improving flood control structure, constructing river erosion mitigation structures.
11. Demonstrating pilot schemes of small dams on rivers and selected drainage improvement schemes.
12. Erosion displaces a large number of population who are often rendered poor and landless. To address these problems, there is need to develop and



SAND SPUR CONSTRUCTED BY LOCAL PEOPLE IN
BHURAGAON



MEMBERS OF EROSION PROTECTION SANGRAM
SAMITTEE WITH SAND FILLIG BAGS

SAND SPUR CONSTRUCTED BY LOCAL PEOPLE IN LAHARIGHAT



implement a comprehensive, cost-effective, and affordable flood and erosion mitigation management strategy.

13. For reducing vulnerability of the communities integrated development approach need to be developed. These approaches should include prohibition of permanent settlements in floodplains, strengthening of dykes of the Brahmaputra river especially in the weak points and erection of protective spurs in erosion prone areas. The protection and management of the embankment could be ensured through people's participation and emphasis should be given for removal of drainage congestion. Large-scale sedimentation flow and resultant reduction of velocity of water flow can be countered through upper reach treatments, different soil conservation measures, and plantation and forest protection. Forestation in the foothills and riverbanks needs to be taken up aggressively for stopping erosion and siltation.
14. Farmers should be introduced to a cropping system that starts in winter season to reduce the crop loss leading to livelihood insecurity in flood plains. Besides agriculture, other income generating activities like sericulture, handloom and textiles, riverine pisciculture etc. need to be promoted and strengthened.

*Examined
G. Prasad
20 March 2008*

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HOUSEHOLD SCHEDULE
 Department of Geography
 North Eastern Hill University, Shillong

Village Name

Present	past

Settlement	Migrated	Original

1. Name of the respondent:
2. Religion: Hindu/Muslim/Christian/ others:
3. Caste:
4. Tribe:
5. Educational Status of the respondent:
6. Size of the Family:

Male	Female	Total

7. Year of migration to the present site:
8. Cause of the migration :
9. Occupation in the original place:
10. Monthly income (approx.) in Rs. Before migration:
11. Present occupation and adjustment:
12. Present monthly income:
13. Present job opportunities:
 Type of job:
 Wage:

14. Income pattern of the Family Members:

Sl. No.	Age	Sex	Sources of income of the family members						Total income	Budget	
			Agri.	Services		Pretty business	Labour	Industry		Surplus	Deficit
Govt.	Private										

If deficit how to adjust:

15. Present land holding:

- a) Built-up area
- b) Agricultural area
- c) Others

16. Migrated to new place by govt./ own:

17. Govt Grants/ Assistances/ lone etc. for resettlement:

Yes	No

If yes under what programme:

Facilities obtained:

Housing	Land	Money (Rs.)

18. Govt. Grant/ Assistances/ lone etc. for rehabilitation:

Yes	No

If yes, mention the amount against the item:

For Agriculture	For Industry like weaving	For pretty business	Others

19. Land use (in Bighas/Katha):

Basti	Rice		Wheat	Jute	Sugar	Vegetables		Potato	Rape & Mustard	No. of Fragmented plots	others
	HYV	IND.				Consumption	Market				

20. Agricultural Production:

Crops	Production/ Bigha	Total Production	Only use for food	Just sufficient	Surplus	Deficit	Sale in the market

21. Practices of cultivation:

Share crop	Leaseholder	Own land

22. Area under the Crop:

Rice HYV	Rice Local	Maize	Wheat	Gram	Jute	Rape & Mustard	Sugar cane	Others

23. Use of fertilizers (Kg):

Type of fertilizer	Rice HYV	Rice Local	Maize	Wheat	Gram	Jute	Rape & Mustard	Sugar cane	Others

24. Irrigation Facilities:

Tubewell	Tank	Any others

25. Varieties of HYV grown:

Rice	Maize	Wheat	Gram	Jute	Rape & Mustard	Sugar cane	Others

26. Educational qualification of the family members

Sl. No	Age	Sex	Primary	Secondary	Higher Secondary	Degree	Master Degree	Others

27. Problem faced in new location:

- a) Economic
- b) Social
- c) Cultural

28. How have you adjust with the present situation?

29. Types of facilities you required most in this new location:

Medical	Educational	Transportation	Electricity	Drinking water	Others

30. Communal harmony/ tension if any

31. People's interaction in the present place:

32. Festivals:

Past	Present

33. Still affected by natural hazards?

Yes	No

If yes what measures are taken by the family/ local authority/ state authority?

34. Future plan (any place to migrate again)

PERSONAL BIODATA

1. Name : **Pranab Jyoti Sarma.**
2. Father's name : Sri Guru Prasad Sarma.
3. Occupation : Lecturer, Deptt. of Geography
Morigaon College, Morigaon, Assam.
4. Address
- Office : Department of Geography, Morigaon College,
Morigaon, Assam (782105)
- Residence : Ward No. 8 Morigaon Town, Morigaon, Assam
- Phone No. : 03678- 240071 (R)
9435266277 (M)

5. Academic Qualification:

Degree	University	Year of passing	Division/ Grade
M.A.	PUNE UNIVERSITY	1996	I
B.Ed.	GAUHATI UNIVERSITY	1998	II
M.Ed.	MADURAI KAMARAJ UNIVERSITY	2000	II

6. National / International Seminars attended: 10 (Ten)

- a. Participated in UGC Sponsored Seminar on “**Geo-Environmental problems in the Brahmaputra Valley with special reference to Nagaon District**” at Ananda Ram Dhekial Phookan College, Nagaon, Assam on 28th January’2001.
- b. Presented paper titled “ *Female work participation in primary activity: A case study of Tiwa tribe in Morigaon District of Assam*” in the **22nd Biennial Conference of North East India Geographical Society** held at Jagiroad Collge, Morigaon on 27-28 April’2002.
- c. Participated in the **National Seminar** of The Indian Science Congress Association held at Guwahati on 17th March’2003 on **Science awareness and popularization.**

- d. Presented paper on “*A Study of Landslides in Northeast India*” in the **International Conference on “Mountain Environment and Natural Hazards management”** held on 27th – 29th March, 2003 at Deptt. of Geography, NE Hill University, Shillong.
- e. Presented a paper entitled “*Impact of Bank Erosion on Landuse Pattern in the Morigaon District of Assam*” in the Annual Academic Session of the **North East India Geographical Society** held at Cotton College on 24th may’2003.
- f. Presented a paper titled “*Nature and Extent of Female Work Work Participation in Agriculture: A Case Study in Dhemaji District of Assam*” at the **XXVII Indian Social Science Congress** held on 3rd – 7th Dec’2003 at IIT, Kharagpur (West Bengal)
- g. Presented a paper titled “*Tribal Women in Agriculture: A case Study of the Mishing Tribe in the Dhemaji District of Assam*” at the seminar on **Changing Agricultural Scenario in North-East India** organized by North-East India Council for Social Science Research, Shillong on 12-13th Dec’2003.
- h. Presented a paper titled “*Landslides in Guwahati city and its Management*” at the state level seminar on **Healthy Environment is essential for survival of living being**” organized by Dimoria College, Khetri, Kamrup, Assam on 11th February/2004.
- i. Presented a paper titled “*Socio-Economic conditions of female agricultural labourers in Dhemaji district of Assam*” at the National seminar on **Population and Development in North-East India** organized by International Institute for Population Sciences at NEHU, Shillong on 25-27 February/ 2004.
- j. Presented a paper titled *Socio-economic conditions of Sonowal Kachari women in Dhemaji District of Assam* at the seminar on organized by **North-East India Council for Social Science Research, Shillong** on 12-13th Dec’2004.

7. Paper Published:

2 (Two)

- a. “Landslides in Guwahati city and its Management” in booklet published in connection with the state level seminar on “**Healthy Environment is essential for survival of living beings**” Published by Deptt. of Education, Dimoria College, Khetri, Kamrup, Assam (2004) Ed by A. Bhattacharya and B. Majumder Bharali.

- b. "Temporal Changes in the river course and Mass Migration: A Spatio-temporal Analysis in the Morigaon District of Assam" in the XXVII Indian Social Science Congress, held on 3rd – 7th Dec. 2003 at IIT, Kharagpur (West Bengal)

8. Articles Published: 3 (Three)

- a. Published an article entitled "**Bank erosion of river Brahmaputra and its impact on human life of the Morigaon District**" in Prabandha Bichitra, 1st Edition 2004.
- b. Published an article titled "**Geographical Environment and the Culture of Assam**" in Unmekhan- Silver Jubilee Journal of Assam Association, NEHU Shillong, 2004.
- c. Published an article titled "**Floods- A spatio- temporal analysis in the Morigaon District**" in Mariyan a Magazine of Morigaon College, 2004.

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