CHAPTER – II

THE DIKRONG RIVER AND THE VALLEY:

CHANGING PATTERNS

Rivers flow on every continent and on all but the smallest island. They occur with an almost bewildering variety, ranging from a mere trickle to a mighty surge. As a source of water, rivers have always been objects of wonder and practical concern for people everywhere. They have acted as cradles of civilization and agents of disaster. A river may be a barrier or a highway. It can bear trade and sediment; culture and conflict. A river may inspire or it may terrify.49

Rivers have played an important role in development of human being since time immemorial. We know of many towns and cities that are distinguished by the rivers that flow through them, some of them being – London and Thames, Rome and Tevere, Paris and Seine, Banaras and Ganga, Delhi and Yamuna50. Besides, one cannot deny the interconnecting relationship that exist between people, river and the state. The evolutionary history of men suggest that transport and communication were possible mostly through water ways. Moreover, waters helped to permanently settle people in one place. Settled cultivation was possible where continued supply of water was

assured\textsuperscript{51}. Historically, populations have mostly settled close to sources of water. We have known that the major civilizations of the world developed and flourished on the banks of river. For example, the Indus valley civilization, Egyptian, Tigris, Euphrates, Hwang - Ho etc. We may also mention the civilization called the Aryan Civilization which flourished in the valley of Ganga, and which continues to exist. Such civilizations have seen rivers being worshipped as Gods and Goddesses. They held the belief that Earth originated in water. We can find traces of such belief even in the descriptions of the mythological inscriptions like Vedas, Puranas and Upanishads etc. Gradually, apart from revering rivers as Gods and Goddesses, they have been the primary source of drinking water, food, for domestic usages, irrigational and industrial purposes and livelihood and as a means of transport and communication\textsuperscript{52}.

Rivers have also been site of development and exercise of state power. Harnessing rivers for irrigation and power has been one of the many ways through which post independent India decided to steer development. In fact, not only India, it has been a feature of many countries around the world to intervene with the natural flow of rivers; to tame, control, direct, regulate and channelize the natural course of river systems – “The domination of rivers is one of the clearest illustrations of the link between the control of nature and the control of people. Large dams are not built and operated by all society but by an elite with bureaucratic, political or economic power. The dams give these elite the ability to direct water for their own benefit depriving the previous users of some or all of their access to

\textsuperscript{51} Ibid.

\textsuperscript{52} Ibid.
riverine resources.”53 And if we go back in time, there has been colonial attempts at controlling rivers for revenue generation which in turn resulted in the creation of a class (zamindars) who engaged in embankment building for increased revenue collection. It is at the same time required that we keep in mind, as mentioned earlier, that all great civilizations of the world developed and flourished along the banks of river. And this brings us to the crucial issue of the claims of users who live along the catchment areas, survive and depend on the rivers for various purposes. There is another serious concern regarding the life of the river itself; what happens to rivers when anthropocentric activities meddle with the natural ways of the river system. Furious flood and river bank erosion are the most visible impacts on rivers because of artificial control over natural rivers. And the implications on the ecology and ecosystem is something that has been much discussed and debated and are precisely the reason why a study and understanding of human intervention with nature needs to be carried out in the first place. In this chapter, we will understand the river in all its geomorphological characteristics and the physiography and ecology of the valley. This is done to present the ecological status of the river Dikrong and valley prior to the construction of the dam in 2001 as part of the Ranganadi Hydro Electric Project.

Myths and Realities of the River Dikrong

Rivers have been part of our social, historical, religious and cultural realm. We have read and heard of many myths that revolved around rivers. It has provided great stimulation and inspiration to musicians, artists, and poets. Many songs, paintings, and writings have venerated

rivers as mother and deities. Rivers thus have come to occupy and interact with our cultural value system. Like any other myths and legends about river and river valleys, pre-historical description of Dikrong river are found in early religious book of Assam like “Kalika purana”, where the river Dikrong is described as “Dikkar Basini”. Towards east of Dikrong, flows the Subansiri river which is described as golden river in “Kalika purana. There was also description of existence of gold in Dikrong river. The valley of Dikrong has been historically a place inhabited by people of different caste, religion and tribes. According to one belief system, the Dikrong valley is said to be the birth place of Madhabdev the disciple of Sri Sri Sankardev, Padma ata, Anirudha etc who led the New Baishnavi movement in the north bank of upper Assam. Another legend has it that the great Assamese Guru Sri Sri Sankardev along with 126 disciples lived in the valley for six months and six days at Badati. Seemingly, it was during this period of his stay that he could establish a great Changini Satra and through it made attempts to create good relationships through Baishnav Dharma among various people including the schedule tribes and schedule castes.

As far as the ecological history of the Dikrong river is concerned, we have to trace the history of the region back to 1987 and 1950. “The Great Earthquake of 1950 created havoc, especially in the upper reaches of the Himalaya, in and around the Siang and the Debang river courses as well as in the upper Assam plains. There was considerable impact on the topography on both sides of the Brahmaputra valley. This natural calamity was mainly responsible

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for the abrupt changes in the river ecology. The Brahmaputra and its many tributaries in upper Assam suffered badly due to blockage caused by uprooted trees, boulders, and soil erosion.”

We are well aware of this famous earthquake of 1950 in Assam where like most other district, Lakhimpur too came to be affected badly. The ecological damage of the earthquake to the rivers in state of the Assam and to the neighbouring states to which these rivers flow were far reaching. The earthquake had blocked the flow the river Subansiri in Arunachal Pradesh due to the huge rocks that fell into it. In fact, both the earthquakes caused irreparable changes to the region and its rivers. The earthquake caused landslides, blockage of rivers courses, flash flood when the landslide created temporary dams busted, raising of riverbeds due to heavy siltation, fissuring and sand venting, subsidence or elevation of existing river and lake bottoms and margins and creation of new water bodies and waterfalls due to faulting. This affected the agricultural and navigational system; besides the floodwaters of the Dikrong and the Ranganadi river affected the districts agricultural and navigational system. Many inhabitants of the Dikrong Valley shifted to other places. Various people from Majuli and other place of Assam filled up the vacant places. This resulted in multi dimensional changes of the region.

The River System: Dikrong and its Tributaries

The Dikrong is one of the major north bank tributaries of the river Brahmaputra, which originates from the lesser Himalayan ranges in

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Arunachal Pradesh\textsuperscript{56}. A number of rivulets join the river Dikrong on its left and right banks before it outfalls into the Brahmaputra in Assam. The total length of river Dikrong is 145 kilometer. It flows through the hilly region of Arunachal Pradesh for a distance of about 113 kilometer and remaining 32 kilometers it flows through the plains of Assam\textsuperscript{57}. The river may be divided into two main reaches on the basis of topography, river gradient and the confluence of important rivers. These reaches are (i) The reach from the source to Harmutty. (ii) The reach from Harmutty to outfall of the Dikrong into the Brahmaputra\textsuperscript{58}.

(i) The reach from the source to Harmutty: This reach lies in hilly region of Arunachal Pradesh. The head stream of Dikrong is known as Par Nadi, originates at an elevation of 2579 metres. The left bank tributaries in this reach, are Keyate, Pang Nala, Shu Pabung and Peti Nala\textsuperscript{59}.

Keyate originates from an elevation of 2100 metres and joins Par Nadi at 30 k.m. distance from the source (115 k.m.away from the outfall of Dikrong to Brahmaputra) at an elevation of 980 metres. Pang Nala originates from an elevation of 2100 metres flows in the south west direction and meets Par Nadi near Sagali at an elevation of 800 metres and 105 k.m. away from the confluence with the Brahmaputra. Shu Pabung originates from an elevation of 2000 metres, flows south east direction and meets Par Nadi at a distance of 78 k.m. from the confluence with the Brahmaputra. Par Nadi is


\textsuperscript{57} Ibid.

\textsuperscript{58} Ibid.

\textsuperscript{59} Ibid.
known by the name Dikrong after it joins Shu Pabung. Peti nala originates from an elevation of 1000 metres and meets the Dikrong at a distance of 65 k.m. away from the point of confluence with the Brahmaputra. Right bank tributary Ranchi Pabung originates from an elevation of 2000 metres and joins Par Nadi near Rayayi. Another right bank tributary Pachin Nadi joins the Dikrong at 45 k.m. away from outfall.\textsuperscript{60} 

(ii) The reach from Harmutty to outfall of the Dikrong into the Brahmaputra: In this reach, left bank tributary Beguli Nadi meets the Dikrong at a distance of 21 kilometer away from the outfall. In the right bank, Kachikata Nadi meets spill channel of the Subansiri. Mora Dikrong is a dead channel of the Dikrong. It receives a very small discharge in the monsoon period, but the channel remains like a beel in the rest of the period. It receives a back-water flow from the Brahmaputra. The catchment area of the tributaries of the Dikrong, their lengths and distance from the outfall to their joining are describe as follows. Originally the outfall of river Dikrong was on a bifurcated channel of the Brahmaputra known as Kharkatiasuti. This channel has been blocked and as a result Dikrong outfalls now on a spill channel of the Subansiri which also meet the Brahmaputra. But during flood season, the Brahmaputra flows through this so called blocked portion and hence the outfall of Dikrong is considered to be on the Brahmaputra and hence treated as one of the tributaries of the Brahmaputra\textsuperscript{61}.

\textsuperscript{60} Ibid. 
\textsuperscript{61} Ibid.
Table 2.1 Name and Particulars of Tributaries of Dikrong

<table>
<thead>
<tr>
<th>Name of Tributary</th>
<th>Length in K.M</th>
<th>Catchment in Sq.Km</th>
<th>Location of its Joining with Dikrong with Respect to the OutFall Point of the Dikrong with the Brahmaputra</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A- Hills Area</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Bank tributary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Keyate Nadi</td>
<td>10</td>
<td>31</td>
<td>115&lt;sup&gt;th&lt;/sup&gt; k.m</td>
</tr>
<tr>
<td>b) Pang Nadi</td>
<td>15</td>
<td>73</td>
<td>105&lt;sup&gt;th&lt;/sup&gt; k.m</td>
</tr>
<tr>
<td>c) Shu Pabung</td>
<td>23</td>
<td>74</td>
<td>78&lt;sup&gt;th&lt;/sup&gt; k.m</td>
</tr>
<tr>
<td>d) Peti Nalla</td>
<td>12</td>
<td>29</td>
<td>65&lt;sup&gt;th&lt;/sup&gt; k.m</td>
</tr>
<tr>
<td>Right Bank tributary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Ranchi Pabung</td>
<td>20</td>
<td>66</td>
<td>125&lt;sup&gt;th&lt;/sup&gt; k.m</td>
</tr>
<tr>
<td>b) Pachin Nadi</td>
<td>59</td>
<td>295</td>
<td>45&lt;sup&gt;th&lt;/sup&gt; k.m</td>
</tr>
<tr>
<td><strong>B- Plains Areas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Bank Tributary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Beguli Nadi</td>
<td>23</td>
<td>40</td>
<td>21&lt;sup&gt;st&lt;/sup&gt;k.m</td>
</tr>
<tr>
<td><strong>ii) Right Bank Tributary</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Kachikata Nadi</td>
<td>24</td>
<td>46</td>
<td>Joins spill channel of Subansiri</td>
</tr>
</tbody>
</table>

Figure 2.1 Drainage Map 1999, Dikrong River Basin
Physiography

The Dikrong river is known as river ‘par’ in the upper part of Arunachal Pradesh. We will discuss here the present physiographic features of the Dikrong basin which has taken shape due to geological changes that have occurred only during recent times. The geologic and tectonic movements of the study area has led to various changes in the landforms. Coupled with the changing climatic conditions and geomorphic processes, the low hill ranges experienced erosion, siltation and landslides. Part of the reason also lies with hot and humid climate and heavy rainfall which are concentrated for a few months of the year. Landslides are usually common and especially high in the Himalayan foothills where heavy rainfall occurs. Due to a combination of all these factors, fluvial processes are significantly dominant on the valley downhill and plains. Here, alluvial deposition takes place due to erosion of the higher surface by rivers and flooding in the valleys.\(^\text{62}\)

Physiographically the Dikrong basin has been divided into three divisions namely, (i) The Hill Zone (ii) The Foot Hill Zone (iii) Active Floodplain Zone.

(i) **The Hill Zone:** This zone stretches from a distance of about 70 k.m. from its source to Kimin locality in south east direction. It is at an elevation of around 2000 metres and covers the area of 1123 sq.k.m. The streams and gullies of this zone have cut steep valleys of gentle gradient. The flat iron and scarps are characteristic features of this zone. An overview based on satellite imageries shows that the area is characterized with low relief, uneven topography and closely

\(^{62}\) ibid.
spaced dendritic drainage pattern. This zone consists of largely boulders, cobbles, pebbles, gravels, sand and silt\textsuperscript{63}.

(ii) **The Foothill Zone**: The physical features the Foothill region of the Dikrong basin mostly correspond to the active floodplain zone. It consist of unconsolidated materials like sand, silt, clay and pebbles etc. and has a very low gradient from north to south. This zone extends from Kimin to Harmutty area. The maximum height of this area is about 1100 metres. At Banderdewa near Harmutty tea estate the height of the basin is almost 100 metres. It covers an area of about 167 sq. k.m. Satellite imageries and topographical map of this area show low to high relief and sub parallel to dendritic drainage pattern. The drainage density is comparatively lower than that of low relief rugged hills. Here too, the streams and gullies have cut steep valleys of gentle gradient. The transitional movement is common in this zone especially on the right bank of river Dikrong along the N.H.52A, around 8 k.m. away from the plains of Assam. In this area alternate rocks or clay and conglomerates are susceptible to such slide\textsuperscript{64}.

(iii) **Active Floodplain Zone**: This region stretches about 30 k.m. from Banderdewa to its out fall in the Brahmaputra. It consists of alluvial material like sands, silt, and clays. This deposits composed of poorly sorted mixture of boulders, cobbles, pebbles and gravels with a mixture of coarse to fine sand, silt and clay. It has very low gradient from north to southwards. The maximum and minimum height is 100 meters at Bandardewa and 84 meter at the confluence point of Dikrong with the Brahmaputra. Old abandoned channel of Dikrong known as *Mora* Dikrong is at present 8 kilometer away from its

\textsuperscript{63} Ibid.
\textsuperscript{64} Ibid.
present course. It covers an area of about 267 sq. kilometer. Meander, abandoned channel, sandbars, swampy and wetlands are common characteristics of this unit.\(^{65}\)

**Figure 2.2** Flood Zonation Map: Dikrong River Basin

*Channel Formation and Changing Course of the River - A Brief History*

A number of changes have occurred in the last hundred years in the formation of channels and drainage system of the river. We have to take into account the entire upper and lower reaches of the river to understand its history of channel formation. Let us mention here that earthquake play an important role in changing the geomorphology of

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\(^{65}\) Ibid.
the river. A significant change occurs in flow regimes of river depending upon the severity of earthquake. It is well documented in studies conducted in disciplines of geography about the two earthquakes of 1897 and 1950 which changed the flow and other properties of the rivers located in Assam and its neighbouring areas. From records, it appears that prior to the 1897 earthquake, for the greater part of 19th century there was only one river system which is presently known as Mora Dikrong channel. We can assume from this that the original Dikrong must have been the present Mora Dikrong river which is still flowing in the western side in its lower course. This river originally flowed through the then “Bangphang Mouza” (presently known as Kherajkhat Mouza) till it reached the Brahmaputra at original Nayagooria Ghat.

The book “An Account of Assam” written by Dr John peter Wade in 1800, mentions that the Dikrong used to flow through Bangphang, Potia gaon, Auniati Gosaikhat, Balikhetra, Daybayrapar, Naugoria gaon, Orali goan and these places were the main town on its bank. The places mentioned in the book is presently located near the Mora Dikrong channel. Hence we can assume that in the early period the river used to flow through this places.

In the 19th century the river used to flow through Bangalmora grazing, Mornoi, Laholial, Gobindapur, Nahoroni than, Bahgora Deori gaon, Dahgharia Missing gaon before falling in the Subansiri river. In the early part of the twentieth century, after the earthquake of 1850, the river changed its flow regime and started flowing through Borbali, Dusutimukh, Gosaibari, Sri bhuyan, Kinapathar Deori, Bordeori,

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66 Ibid.
Chamaguri before falling in the Subansiri river towards the eastern side of Silikhaguri ghat.

In 1935 the river flowed through the Pithaguri, Dikrong ghat, Dongibeel, Sonarigaon, Keyamora, Bihpuria, Moricha pathar, Santapur, Sisapathar ghat, Nepali gaon, Gandhia, Pokadol, Bagicha, Jajrup, Madhupur and falls in the Subansiri river near Dahgharia. From 1985 onwards it flowed through Bangalmora grazing, Islampur, Baghor doloni, Sandohkhowa, Bahgora before falling in the Subansiri and after one year it again changed its direction to the present channel. The river Dikrong can be divided into two main reaches on the basis of topography, (a) river gradient and (b) confluence of important river.

**Geomorphic Characteristics of the Dikrong River Basin**

In the understanding of a river, the basin of the river constitutes as fundamental geomorphic unit which represents a working system of energy inputs and output (Schumm, 1977). However, recent studies in river have shown that drainage basin has emerged as a renewed subject of interest as a ‘geomorphic unit’. This interest has stemmed from reasons that include topographic, hydraulic and hydrological unity, which laid the key stone of Horton’s ‘morphometric system’ (1945). In understanding the river and its various flow pattern, a drainage basin is taken to be as an open system which receives and discharges energy. Climatic conditions provide the input energy which the basin is considered to have received and loss of sediments and water from the basin is considered to be the output energy which the basin discharges.
Climatic conditions that provide input energy to the drainage basin comes from two sources, namely, (i) From the atmosphere in the form of precipitation and (ii) From within the earth where in endogenetic forces provides energy to the erosional process. As the Dikrong river is surrounded by mountains, hills and alluvial plains and its climate marked by heavy rainfall, the basin is characterized by physiographic mosaics of structural mountains, hills and foothills, alluvial plains and flood plain. This results in different forms of highland and lowland interactions. Highland-lowland interaction forms a distinct and well organized system at the basin scale. A river basin which is characterized by such neat physiographic units of hills and plains will naturally have effects on the most dynamic and sensitive highland lowland linkage in terms of physical, socio-cultural, economic and political issues. The hills and plains have different characteristics and hence different utilization of resources by people inhabiting the highland or the lowland. The highlands and the lowlands are mutually dependent both in terms of the people and the physical characteristics of the area. Any change in the highland environment brings proportionate change to the lowland environment. Exploitative uses of upland resource is bound to cause downstream ecological change and adverse environmental impacts which will in turn affect the physical, ecological, and human sub system.

**Drainage System**

The Dikrong sub basin lies between latitudes 26 55 N and 27 20 N and longitudes 93 15 E and 94 E. Since Dikrong river is one of the important north bank tributaries of mighty Brahmaputra river, the area it drains covers parts of Assam and Arunachal Pradesh. Hence, it drains certain parts of the lower hills of Arunachal Pradesh and
Lakhimpur districts of Assam. The drainage system obviously starts from the source of its origin which is at an elevation of 2579 meter near the border of lower Subansiri district and East Kameng district of Arunachal Pradesh. The catchments area of this river system is about 1557 sq. k.m out of which 252 sq. k.m. lies in Assam and remaining 1305 sq. kilometer lies in Lower Subansiri district of Arunachal Pradesh. The upper catchment area of the Dikrong valley measuring 1305 sq.km, lies in Arunachal Pradesh and the Lower catchment area of the Dikrong valley measuring 252 sq. k.m. lies in Lakhimpur district of Assam. Hence, we can see that the valley is divided into two states in its upper and lower catchment area. The river is rainfed only.
Figure 2.3 Drainage Map of Dikrong River Basin

The Dikrong River Basin- The Study Area and its Location

The river Dikrong is one of the major tributary of the river Brahmaputra which flows along its northern bank. We have pointed out that the Dikrong sub basin is situated between latitude 26 55’’ N and 27 20” S and longitude 93 15” E and 94 E. It flows through areas covering a part of the lower hills of Arunachal Pradesh and the Lakhimpur District of Assam67. Out of its total catchment area of about 1,528 sq. km, 252 sq. km lies in Assam and the rest 1,279 sq. km lies in the Lower Subansiri district of Arunachal Pradesh.

According to available data, the entire length of the river Dikrong from its source to its confluence is about 145 km\textsuperscript{68}. The river Dikrong joins the Subansiri river at a place called Badatighat flowing 113 km in the hilly terrain of Arunachal Pradesh and remaining 32 km flowing through the plains of Assam. In the upper reaches of Arunachal Pradesh, the river is known as the Parnadi and the remaining part is called Dikrong\textsuperscript{69}.

Our study area is the lower part of the Dikrong sub-basin. It can also be called the lower catchment of the Dikrong sub-basin. In its lower reaches, the river flows from the state of Arunachal Pradesh to the State of Assam. The lower part of the Dikrong sub-basin lays mostly in the plains of Assam i.e in the Lakhimpur district of Assam. Hence, the lower catchment of the sub-basin is under Lakhimpur Forest Division and North Lakhimpur civil sub division. Our study concentrates on the villages that are situated in lower catchment areas of the Dikrong sub basin from Banderdewa in Arunachal Pradesh to Badatighat in Assam. The population in the lower part of the sub-basin according to 1991 census is 83,172.

\textsuperscript{68} Ibid
\textsuperscript{69} Ibid
Some Relevant Bench Mark Information of Dikrong Sub Basin

a) Total area of the Basin 1528 sq.km (252 sq.km in Assam and 1276 sq.km at Arunachal Pradesh

b) Area of the flood plains in the sub basin 8600 ha.

c) Area of the flood plains prone to flood 4,800 ha

d) Total no. of villages in the sub-basin 272 in Assam and 429 in Arunachal Pradesh

e) Villages in the flood plains
   (Name of villages submitted vide no. 97 nos BB/SID/M-5/200 dt. 29-7-95

f) No. and name of villages affected by flood and drainage congestion same as above

g) Extent and duration of inundation in the affected villages
   Duration of inundation 10 days and extent of inundation is upto 1.5m (av)

h) Total agricultural area in the sub basin 49745 ha

i) Agricultural area in the flood plains 8600 ha

j) Agricultural area affected during normal flood 4800 ha and in high flood 8600 ha and high floods

Note: Item b, c, h, i, j are as per District agricultural Office, North Lakhimpur, Item ‘d’ Statitical Deptt of Assam and Arunachal Pradesh, Item ‘e’ and ‘f’ area s per circle officer of Narayanpur and Bihpuria circle.
k) Low lying areas /wet lands areas in the flood plains  NA

l) Drainage congested areas  Sisapathar and Mora Dikrong Area

m) Total no.of bends in the river system  15 nos.
n) No.of river bends which have been treated with anti-erosion measures  3 nos

o) No.of river bends which are likely to be subjected to erosion in the next 5 years and 10 years 4 nos and 9 nos respectively

**Climate**

The climate of the Dikrong basin has to be understood keeping in mind its location between two states.ie. Assam and Arunachal Pradesh. Besides, the Dikrong basin is positioned on the sub-tropical belt. Due to its geographical location, in its Arunachal portion, the Dikrong basin has severe winter and short summer, while on the part of Assam, the basin experiences mild winter and moist and warm summer. The location of the basin on a sub tropical belt lends it an effective monsoon climate. Both the south- west monsoon and the north-east monsoon bring rainfall to the basin. The south-west monsoon during summer brings heavy rainfall and the north – east monsoon during post monsoon season causes little rainfall in the basin. On the basis of the amount of rainfall and variations in the degree of temperature, we can divide the monsoonal climate of this basin into four seasons. The seasons are
(i) Winter : December to February
(ii) Pre- monsoon : March to May
(iii) Monsoon : June to September
(iv) Post monsoon : October to November.

Main Aspects of Agriculture

More than 80% of the land in the lower part of the Dikrong valley is agricultural and forest land. The lower catchment area of the Dikrong river basin, which is the study area of this research, lies in Assam and is highly fertile. Frequent flood is the prominent feature of this part of the sub-basin. The most important cultivation here is rice. Apart from rice, other crops that are cultivated include jute, mustard, pulses and wheat.

Since rice is the principal crop here, we can find the cultivation of a variety of rice like Sali, Boro, Awush etc. The area is suitable for the cultivation of both kharif and rabi crops. However, cultivation of rabi crops have not been pursued satisfactorily.

The people living in the lower catchment area, unlike the population of upper catchment area who are mostly tribals, practice settled agriculture. The area is thickly populated and settled grain cultivation is their traditional occupation. The natural environment is pleasant. However, due to its location in a riverine area, agriculture practices are effected by frequent floods. Ground water resources have not been exploited to its full potential in these areas. The monsoonal rains plays a negative role in efforts made to tap ground water resources.
Changing Landscapes and Riverscapes

The 1962 Chinese attack on India turned Arunachal Pradesh into a strategic place. It was through this region, then known as NEFA, that Chinese army attacked India. In 1974, NEFA was declared a state to be called Arunachal Pradesh. This declaration sounded the march of development in the state. As a result, many concrete development schemes were taken up in the state.

Before we look into the changing landscapes and riverscapes of the Dikrong sub basin, let us through the following table understand the land use pattern of the Dikrong Sub Basin.

Table 2.2 Land Use Pattern of the Dikrong Sub-Basin

<table>
<thead>
<tr>
<th>SI. NO.</th>
<th>Item</th>
<th>District wise Area under the State of Assam (Sq.Km)</th>
<th>District wise Area Under the State of Arunachal Pradesh (Sq.Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lakhimpur Undivided</td>
<td>Lower Subansiri</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>1.</td>
<td>Geographical area</td>
<td>5129.75</td>
<td>13,010.00</td>
</tr>
<tr>
<td>2.</td>
<td>Built up Land</td>
<td>500.00</td>
<td>NA</td>
</tr>
<tr>
<td>3.</td>
<td>Agricultural Land</td>
<td>3691.22</td>
<td>288.00</td>
</tr>
<tr>
<td>4.</td>
<td>Forests Land</td>
<td>358.38</td>
<td>2451.00</td>
</tr>
<tr>
<td>5.</td>
<td>Waste Land</td>
<td>212.65</td>
<td>94.00</td>
</tr>
<tr>
<td>6.</td>
<td>Water Bodies</td>
<td>386.54</td>
<td>N.A</td>
</tr>
<tr>
<td>7.</td>
<td>Others</td>
<td>475.96</td>
<td>N.A</td>
</tr>
</tbody>
</table>

Source: 1) District Report on Land use and Land Cover, Lakhimpur District
2) Statistical Handbook of Lower Subansiri District, 1993
The table above shows the district wise area of the Dikrong Sub basin lying under Arunachal Pradesh and the undivided Lakhimpur district of Assam. The total geographical land under Arunachal Pradesh is 13010 sq.km and in the undivided Lakhimpur district is 5129.75 sq.km. The total built up land in undivided Lakhimpur district of Assam is 500 sq.km. The data for the built up land for of Arunachal Pradesh is not available. We can see from the table that agricultural land for undivided Lakhimpur district of Assam amounts to 3691.22 sq.km whereas, it is 288 sq.km in Arunachal Pradesh. Forest Land in Assam and Arunachal Pradesh is 358 sq.km and 2451 sq.km respectively. Water Bodies cover an area of 386 sq.km in the undivided Lakhimpur district of Assam whereas data for the same in Arunachal Pradesh is not available. Area of land occupied by others include 475.96 sq.km in the undivided lakhimpur district of Assam and again data for the same in Arunachal Pradesh is not available.

We can see that the geographical land under the Dikrong Sub basin of Arunachal Pradesh is higher compared to the land in the undivided Lakhimpur district of Assam. One important development was to make Itanagar the capital of Arunachal Pradesh and thus on the banks of Dikrong river emerged the new town called Itanagar. Deforestation followed the total urbanization of the area. The hills and forests were destroyed in the process of building new towns. When forests were cleared and access to forest became easy, the plunder of the forest also increased. Extracting fuel wood from the forests, constructing roads and infrastructures and the increasing activities in the areas started putting additional pressure on the forests and wildlife. It was reported that important forest belt rich in wildlife was disturbed. The increasing infrastructural activities hampered elephant movement by
blocking the elephant corridor. Besides, the existence of many animal species like tiger, leopard, marbled cat, golden cat, dhole (wild dog), gaur, serow, capped langur, slow loris and gharial were threatened. The wetlands and beels and fisheries downstream were also affected and the flow regime of waters was interrupted in a negative way. A total change of landscape transformed human environment relationship. Urbanization brought about deliberate and inadvertent changes to rivers. With the felling of trees and hills, the very nature of the river changed resulting in changes in the natural environment some of which were flood, landslide, erosion etc. that occurred more frequently and fiercely changing the social and environmental setup for many years to come.

Industrialization brought multi purpose projects and dams were proposed to be built across the rivers that flowed from Arunachal to Assam to provide power, irrigation and water to its people and others outside the state. The construction of dam has its own set of effects on catchment areas, plants animals and aquatic ecosystems. It has been found through scientific investigations that dam can contribute towards the degradation of the catchment area. Summarizing the effects of hydroelectric projects on the river species, Baruah and Biswas writes –

A large number of hydroelectric projects have been planned upstream of the Brahmaputra, Siang, Subansiri, and other Himalayan rivers…..the possible ecological consequences [are] …the impoundment and heavy accumulation of water [which] will definitely cause the loss of many hill stream species such as garza, glyptothorax, hara, conta, etc. as they will be deprived
of their usual fast-flowing habitat. Migratory fish species, both anadromous and catadromous, will find it difficult to reach their spawning grounds. Giant catfish such as Bagarius yarelli, Pangasius pangasius, Silonia silondia, Aorichthyps ssp. and Wallago attu migrate upstream when the river starts to swell after the pre-monsoon rains (April-May). In the subsequent floods (June-July), the carps move upstream and enter the tributaries, distributaries and floodplain lakes (beels) to breed. It has been recorded that species composition in the floodplains largely depends on the intensity of the floods. It is expected that the absence of high intensity floods due to construction of upstream dams will definitely affect the ‘auto-stocking’ of the lakes. Thus the lakes might not be adequately stocked by the riverine species. The profuse pre-monsoon growth of aquatic weeds will also not be ‘flushed out’ due to the inadequate flooding of the beels. Impoundment will also bring about drastic changes in the nutrient composition of the bottom of the soil influencing the biodiversity of benthos as well as aquatic biota.71 (emphasis ours)

Due to the dramatic changes in transforming the landscapes of the capital town Itanagar, the Dikrong river underwent tremendous changes of which the rise in the river bed and channel migration has been depicted as the most serious problem of the valley. Moreover, it not only changed the beds, banks and course of the river, but also

drastically changed the landscapes, waterscapes, the soil and its quality and above all the lives of the people inhabiting the flood plains. For urbanization and industrialization, the state set in motion series of development related activities like deforestation, digging of hilly area and extraction of gravels, stones, rocks and sands from river catchments area significantly affecting the geometry and ecology of the river. The soil, sand and stones that are mined and quarried from the rivers have contributed to adverse environmental effects like dust pollution, disturbing wildlife and destroying vegetation. The loss of this hard bottom substance of the river has affected the habitats of semi-aquatic and semi-terrestrial insects which used the rocky bottom of the river for feeding, hiding and breeding purposes. Not only this, the most damaging effect of this is on the physical and biological quality of the river as well as on its morphological behaviour. The loss of rocks and stones of the river leads to accelerating the speed of water flow of the river, which earlier was controlled by the friction offered by the weight and roughness of stones, boulders, sands etc. Due to the removal of river materials like stones, gravels, boulders etc, the flow of the water in such empty segments results in unexpected high speed causing damages to both downstream and upstream.

Taking into account the enhanced activities together with tectonic forces due to frequent earthquakes, it has been observed that sediment load of the river has increased which in turn has increased the turbidity of the river. The increased amount of sediment in the

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72 Boni Amin Lashkar and Jawan Singh Rawat, “Rivers in Threat”, Current Science, Vol.96, No.11, 10 June 2009 pg. 1431
73 Ibid.
river resulted in decreasing the carrying capacity of the river. This in turn resulted in the deposition of the sediment on the river bed raising its height. This raised river bed caused high flood and bank erosion during the rainy season. In addition to this, excessive deforestation led to loss of trees from mountains which could earlier hold waters, erosion of the top soil making it lose its absorptive capacity, and flattening of vast stretches of cultivated lands and natural vegetation which could act as protection against flooding. All this affected the flood run off. With the erasure of this thick combination of woods, soil and grain fields, the flood waters rushed easily and destroyed the cultivated crops and also the cultivable land. Naturally it also destroyed the dwelling houses and their belongings. Flood and erosion led to the forcible displacement of people living around the riverine areas. Most of the moving populations were peasant who turned landless and were forced to give up their agricultural practices and look for jobs in the informal economy. As such, people had to move to other place in search of livelihood. The forcible displacement due to ecological reasons created a working class mostly of women and children. The search for alternative means of livelihood and ownership and fight over of scarce resources gave rise to ecological conflicts leading to a new set of claims and conflict in the valley which were absent prior to the ecological catastrophe. In a way, rivers became a source of conflict. Negotiations and solutions entailed that culture and civilization make change and cope with the new environment. Diverse coping mechanisms arose among the environmental victims in their attempt to survive against odds. Many villages were destroyed. Many people lost their lives and property. Trade and commerce, navigation etc. forced tremendous changes.
In our field study we have found that the Dikrong Valley in upper Assam has been exposed to severe flood and erosion. Due to this, the population pattern and statistics of the place has drastically changed. Ten villages in the area have been completely wiped out by the floodwaters and erosion. Under the Bihpuria and Narayanpur revenue circle, from Banderdewa in Arunachal Pradesh to Badatigahat in Assam, near about two hundred villages have been partly devastated and more than hundred villages are affected directly and indirectly by flood and erosion. This has brought about changes in the life patterns of people, their settlement habits, their kinship network, work and livelihood opportunities, health and nutrition, informal social networks, trade and economic relations and loss of community support systems.

There seems to be on record certain measures taken by the state authorities at the regional and central level to tackle the problems of flood and erosion in these areas. However, even though the government of Assam and the government of India has taken some necessary steps for protection of the life of people and villages, the actual conditions in which the valley stands today can be said to be economically, ecologically, environmentally devastating. In the following chapter the researcher crucially examines the impact of urbanization and industrialization which had a bearing on the relationship between people, river and the state.

1. For convenient explanation, let us divide the whole Dikrong Valley in to five parts. In the first part includes the hilly region of Arunachal Pradesh for a distance of about 113 km from origin to Bandardewa. The remaining 32 km of the river flows through the plain region of Assam are divided in to four parts
where each part consists a stretch of 8 km. The relationship between these five parts of Dikrong Valley is not a similar one due to three major causes namely-

a) Creation of Itanagar, the capital of Arunachal Pradesh on the river bank of Dikrong.

b) Man-made Hydro-electrical power dam in Ranganadi.

c) Unscientific protection boulders on the Dikrong river in Assam.

Numerous other causes also affected this valley in terms of economy, religion, culture and heritage. For example the government of Assam applied plantation scheme on the river bank of Dikrong many a times. But the common people completely destroyed the trees on the river side for their individual profit. There are also allegations that protection spurs are taken away by the common people for individual profit and so on. Therefore, it can be seen that the common people are also to some extent responsible for creation of the problem. So, in this study the researcher wants to study the relationships between the people, river and state by taking the Dikrong River Valley as a sample.