CHAPTER I

PHYSICAL CHARACTERISTICS

Introduction

Among many components on the earth's surface, physical characteristics of a region is the most important. Its study not only gives an idea about the area in general but also helps to assess the human and agricultural utilisation in particular. The study area Bishnupur district is the continuation of the Valley of Manipur. It has variations in topography, drainage, climate, soil and vegetation due to several reasons. The Chapter deals with the Geology and Relief and their Impact on drainage systems. Moreover, a detailed study has been undertaken on climate, soil and vegetation and their relationship has been discussed.

1.1 GEOLOGY

Geologically, Manipur belongs to the Alpine system of young folded mountain, which came into existence as a result of the tertiary folding of the sedimentary strata formed in the shallow 'Tethys sea' some 40 to 90 million years ago. The present day landscape is the result of the orogenic movement which took place at the time of the first and second Himalayan upheavals. (Singh, R.P., 1982).

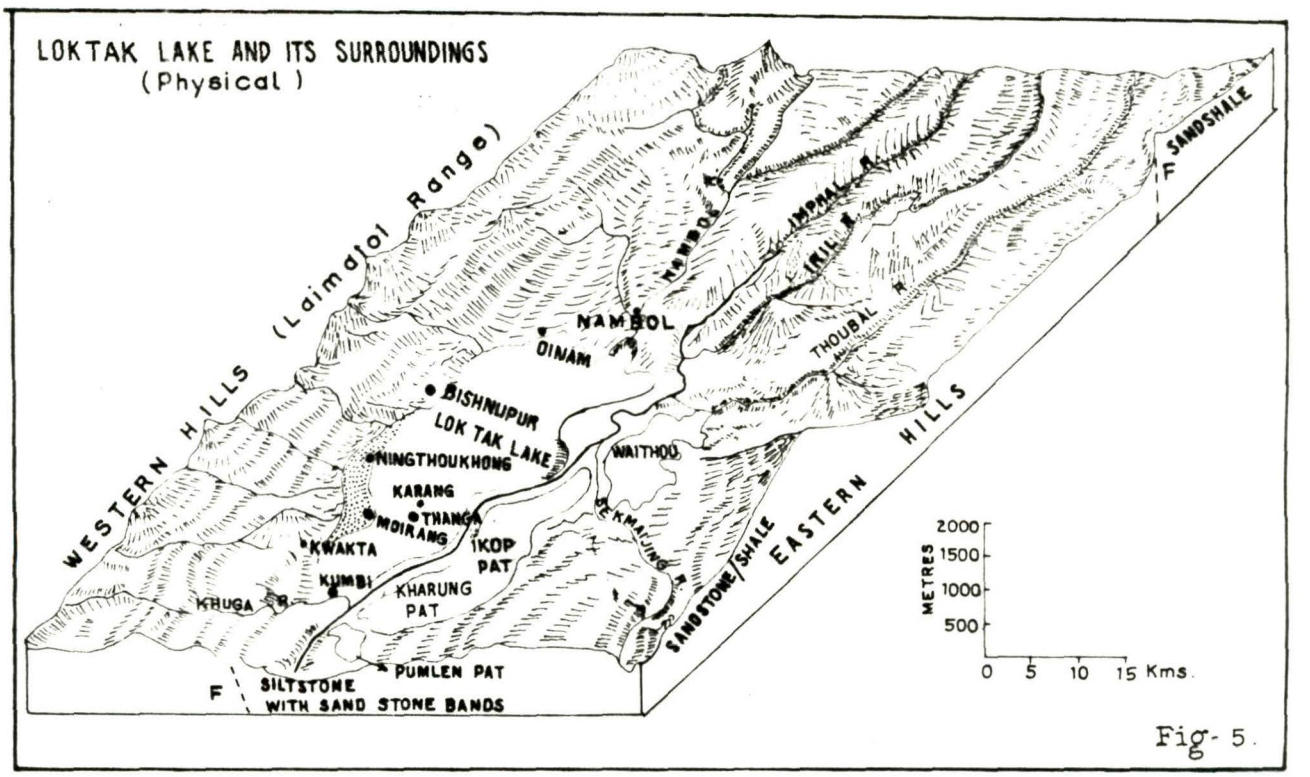

LOKTAK LAKE AND ITS SURROUNDINGS
(Physical)
WESTERN HILLS (Laimatol Range)
NAMBOL
OINAM
BISHNUPUR
LOK TAK LAKE
NINGTHOUKHONG
KARANG
THANGA
MOIRANG
KWAKTA
KUMBI
KHUGA R.
KHARUNG PAT
IKOP PAT
PUMLEN PAT
SILTSTONE WITH SAND STONE BANDS
F
WAITHOU
SANDSTONE/SHALE
EASTERN HILLS
IMPHAL
IRIL R.
THOUBAL
SANDSHALE
METRES
2000
1500
1000
500
0 5 10 15 Kms.

Fig- 5.

The valley of Manipur which is also known as Imphal valley is enclosed by the Disang series of rocks (Upper Eocene period of the tertiary era). These rocks are dark grey to grey splinter shales with fine grained sandstones, occasionally presented with Carbonaceous shales. (Oldham, R.D. 1883). These rocks form the lower hill ranges on the western side of the valley and is named Laimatol ranges and other intervening ranges at the middle of the valley flat as indicated in Fig.5. Further west of this range, another group of rocks known as Barial forms the towering hills. Flanked by the Barial on the Disang series of rocks from all sides, is the Imphal valley of Manipur (1873 km^2) with most recent origin. It is composed of alluvium overlain to a thickness of 200 to 300 m over the underlying Disang shales and contain clay, sandy clay, silt and shingle.

The Bishnupur district of the Imphal valley covers 530 km^2 out of the total area of 1,873 $km.^2$ A detailed study of the Geology of the area during the time of construction of Loktak hydro-electric project Tunnel alignment has revealed the following facts (Nambier, N.P.K., 1986).

(i) The lake deposits which are composed of mainly fine grained mud, clayey loam and abundance of organic matters form the lower reaches of the Loktak lake surrounded by 768.6 m contour line. It is further divided into another section which is termed as new alluvium deposited area and this reaches to an altitude of 780 m.

(ii) This is followed by the terrace deposits of older alluvium and the channel intake for tunnel. The geological alignment of the strata reveals that the lake deposits rest upon the terrace deposits, and they are interbedded.

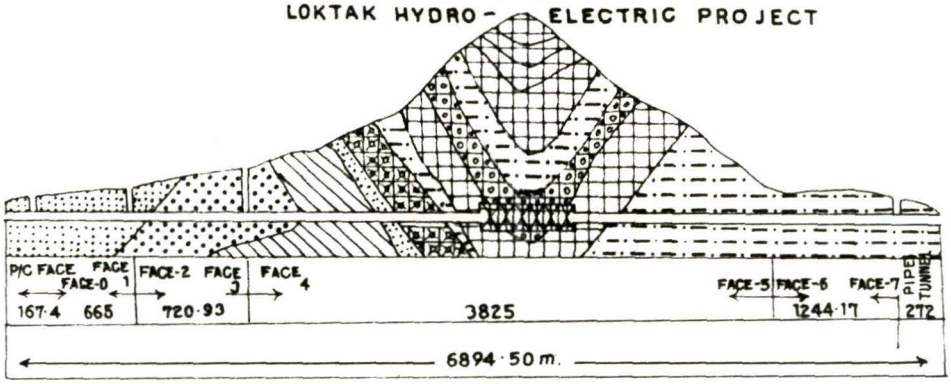
(iii) The terrace deposits is followed by the outcrop of Sandstone, Gritstone, interbedded with shale and siltstone; which forms the top slope of the Kom Keirap formation of Disang series of rocks. The Komkeirap formation contains gravels, pebbles and boulders of shales and siltstones exposed in the area. The depth of this formation ranges from 42 m to 95 m. The Nin̓thoukhong river, the Potsangbam river and the Thongjoarok river which rise from the West Disang rocks, cut open these rocks which are exposed to quarrying for construction work in the area.

(iv) The exposition of different beds at the eastern and the western flanks of the Laimatol ranges of the Disang rocks reveals that the area is exposed to heavy denudation and there are constant changes in the synclinal and anticyclinal structure of area. The zone of unconformity lies at the foot hills where the terrace deposit ends and the slope of the area increases abruptly. The valley of the eastern flank at Loktak side is concave in nature

GEOLOGICAL SECTION

(Tunnel Alingment)

LOKTAK HYDRO - ELECTRIC PROJECT



INDEX

- LAKE DEPOSITS
- TERRACE DEPOSITS
- SANDSTONE
- SHALES
- HIGHLY JOINTED AND WATER CARRING NATURE DUE TO PROXIMITY SYNCLINAL TROUGH.
- SILTSTONE INTER BEDED WITH SHALES
- SHALES AND SANDSTONE IN ALTERNATE BAND
- SHALES WITH SUB-ORDINATE SILTSTONE AND SANDSTONE

Fig.-6.

with more regular slope than the valley at the west flank which has steep slope convex in nature. These features indicate that the erosion is greater in the eastern flank than in the western flank. The domal structure of the mountain crest also indicates the excessive erosion in the area (Fig. 6). The gentle nature of the eastern slope indicates that the area is extensively drained in the eastern flank. There are innumerable streams and 'nalas' draining towards the Loktak lake. Whereas in the western flank it is marked by only small gullies flowing to the Laimatak rivers.

1.2 RELIEF

The district is a rolling plain whose highest spot lies within the Laimatol hill ranges making the natural border in the western flank. The western limit of the district is demarcated by 900 m contour line at the immediate foothills of the Laimatol. From Sadu Koireng in the Nambol Tahsil to Bishnupur, the ranges draw nearer, while from Bishnupur the ranges deviate further west, making a broad rolling agricultural land to Torbung. From Potsangbam, these ranges shift in a south westernly alignment making the highest spot at Thanging ching (ching means mountain) 2,109 m which lies between Torbung Panchayet of Bishnupur district at the south western border and Kangvai of Henglep sub-division of Churachandpur district.

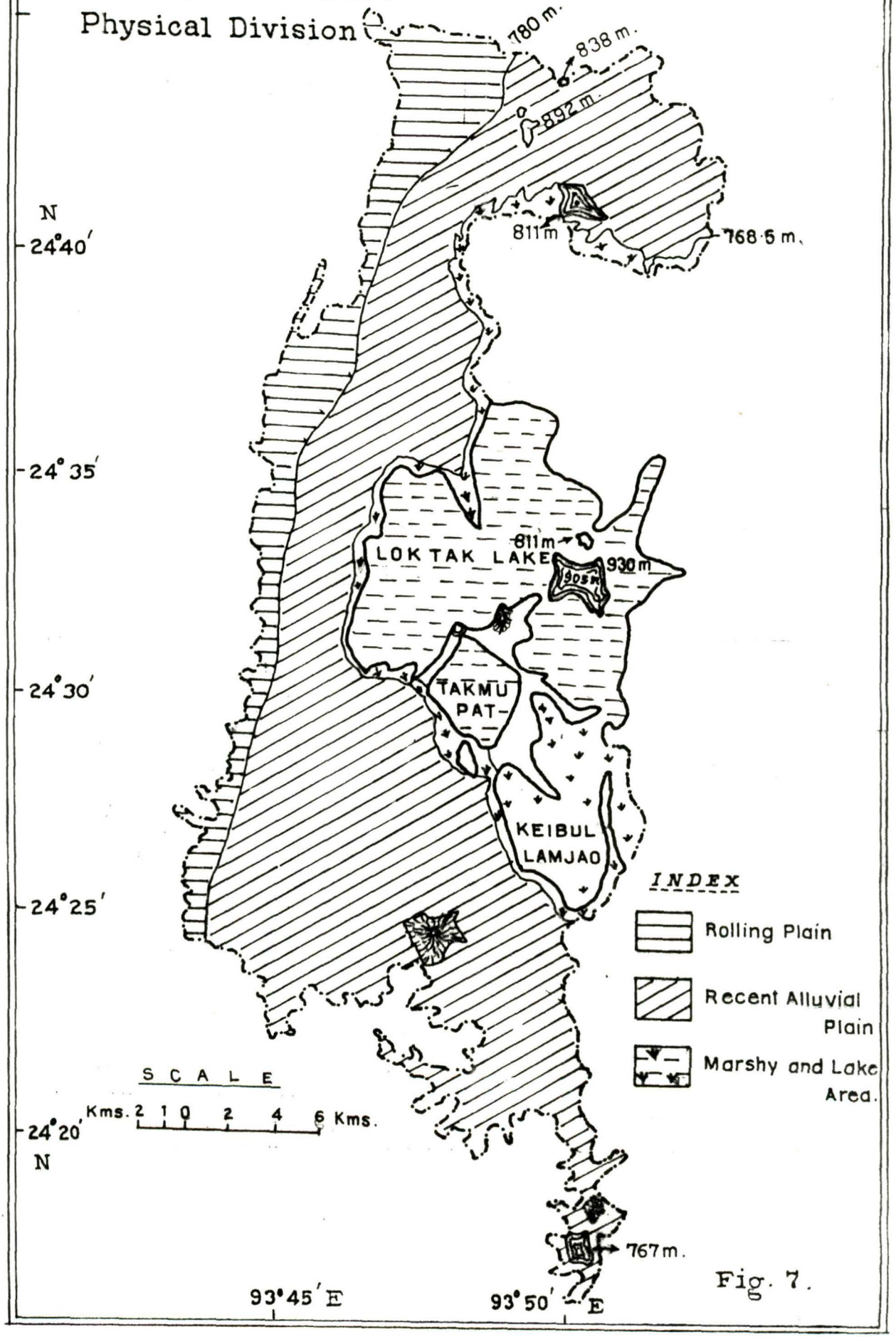

Bishnupur District
Physical Division
780 m.
838 m.
892 m.
811m
768.5 m.
N
24°40′
24°35′
811m
LOK TAK LAKE
930m
905m
24°30′
TAKMU PAT
KEIBUL LAMJAO
INDEX
Rolling Plain
Recent Alluvial Plain
Marshy and Lake Area.
SCALE
Kms. 2 1 0 2 4 6 Kms.
24°20′
N
767m.
93°45′E
93°50′E

Fig. 7.

Further down towards the south from a point known as 'Bunglow', the last point of Torbung Panchayet, the Khuga river enters the district from the southern hills of Manipur cutting a broad gorge-like feature with the intervening south easterly running ranges, this acts as the gate to the southern hills of Manipur. These south easterly ranges flank the Saiton and Sagang villages and the ranges turn in the southern direction engulfing Boŋyangbi, Chairen, Tangjèng and Kasom Tampak upto Napat village, the termination point of the district. The lowest spot height is spotted at TangJeng (767 M) above the mean sea level.

On the basis of the above observation, the district can be divided into three broad physical divisions. Fig.No.7.

(i) Rolling Plain : From 900 m the plain of Bishnupur district rolls as old alluvium plain till it touches 780 m. This old alluvium plain is broader in Laimaram, Hainoupok, Irengbam and the traces of this plain is available upto Bishnupur. While south of Bishnupur, the range shifts further west making vast stretch of agricultural land. The old alluvium plain here extends from 791 m to 780 m instead of 900 m in the northern flank because of the sharp increase of the hill slope. (Topo sheet 83 $\frac{H}{14}$). The area is traversed by Moirang high canal and Moirang low level canal which terminate near Moirang and Khuga beyond Kwakta. From Saiton to Napat

along the foot hills, the old alluvium extends some few metres downhills and the recent alluvium continues till it reaches the eastern boundary of the district flanked by the Imphal river. The new alluvial soils in this area are frequently flooded by breaching the banks of the Manipur river just below Ithai barrage.

(ii) Recent Alluvial Plain : Beyond 780 m above mean sea level, the land is gentle forming the rich agricultural land. The streams and rivulets often deposit the silts making it rich agricultural land. This extends upto the height of 768.6 m above mean sea level, bordering the Loktak lake area. The soils are generally clayey loam texture and grey to pale brown colour. They contain a good proportion of potash and phosphate and a moderate quantity of nitrogen and organic matters.

(iii) Marshy Area and the Lake : Below 768.6 m lies the lowest depression of Loktak lake which stands as a bowl like feature and stretches for 278 km^2. The outer fringe of the lake is marshy which extends to beyond 278 km^2 in the rainy season, making the total area covered by the lake to about 490 km^2. This is the homogenous part of the district. This homogeneity is broken by the emergence of few islands from amidst the water of the lakes, like Sendra (859m), Ithing (882m), Karang (811m) and Thanga (903 m).

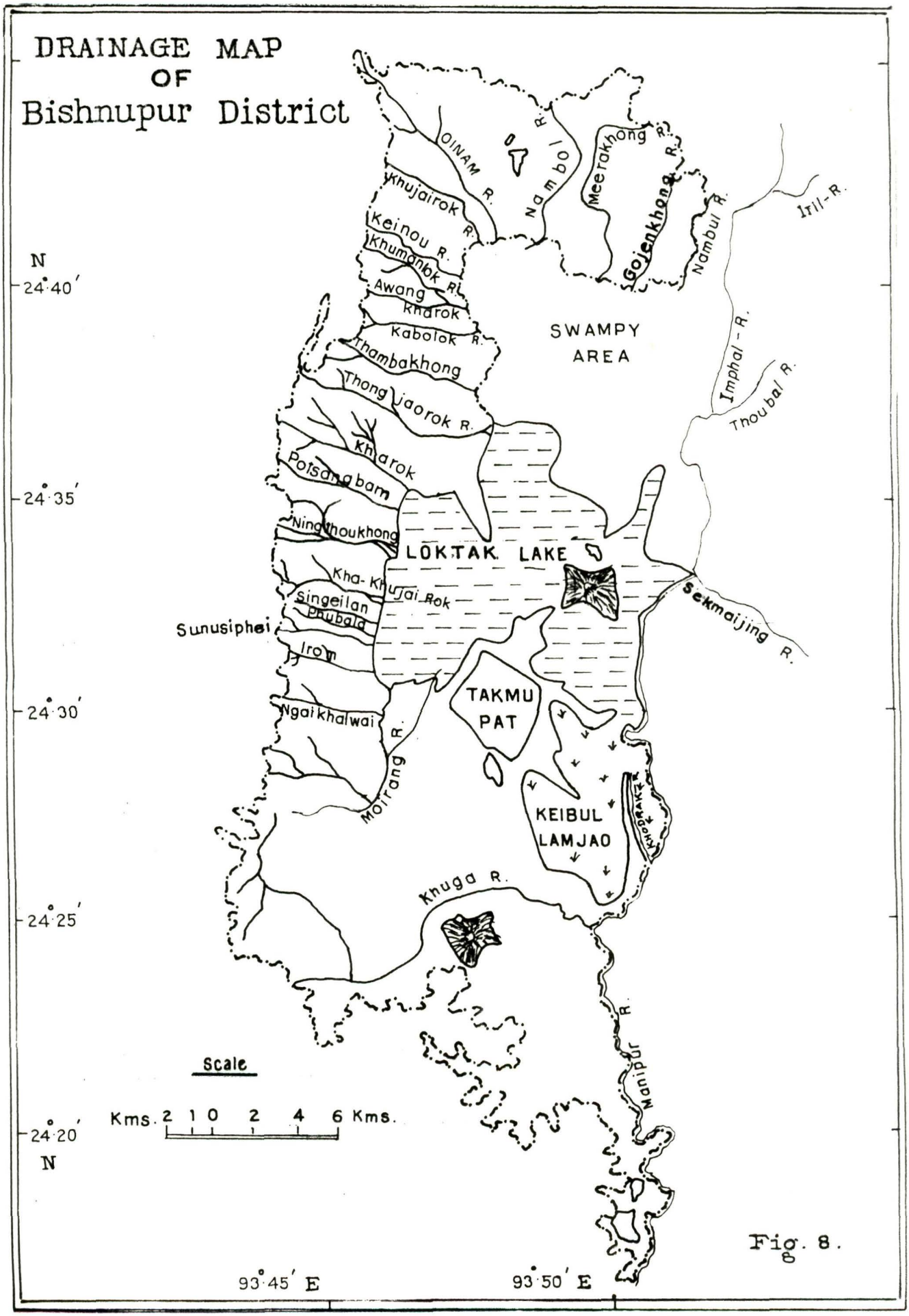

DRAINAGE MAP
OF
Bishnupur District
OINAM R.
Nambol R.
Meerakhong R.
Gojenkhong R.
Nambul R.
Iril R.
Khujairok R.
Keinou R.
Khumanbk R.
Awang Kharok
Kabolok R.
Thambakhong
Thongjaorok R.
Kharok
Potsangbam
Ningthoukhong
LOKTAK LAKE
Kha-Khujai Rok
Singeilan
Phubala
Sunusiphai
Irom
Ngaikhalwai
Moirang R.
TAKMU PAT
KEIBUL LAMJAO
Khuga R.
Manipur R.
SWAMPY AREA
Imphal R.
Thoubal R.
Sekmaijing R.
N
24°40′
24°35′
24°30′
24°25′
24°20′
N
Scale
Kms. 2 1 0 2 4 6 Kms.
93°45′ E
93°50′ E

Fig. 8.

There are few other mounds breaking the monotony of the plain of the district. These hills are Maibam (892m) Lainingthou Ching (838 m) and Ishok Ching (811 m). In the extreme southern part of the district, the hills of Noudakhong, Kamsomtampak and Tangjeng are seen. The district ends on the western bank of the Imphal river in the south eastern part while in the north eastern part it is bounded by the Samusang swampy area of the Imphal district bounded by the Nambul river. The general slope of the valley is towards the south but the presence of Laimatol hills in the western margin of the district gives local variations. (Plate-2)

1.3 DRAINAGE

The district is drained by a good number of mountain streams gauging out from the mountain after a short spell of rainfall in the Laimatol ranges. Immediately after the rainfall ceases, the perennial character of the stream is lost. The district is having a parallel pattern of drainage characteristic, when it comes at the foothills and plains. But in the ranges they follow treelis and radial pattern and in most cases they are irregular as has been evidenced in other valley like the drainage in the vale of Kashmir (Raza, M. 1978). The drainage of the area can be divided into two sections : (i) drainage along the western flank and (ii) drainage along the eastern flank (Fig. No.8).

Khujairok River, Sorrow of Oinam and Keinou.

A Mountain Stream at Nachou which Cause Flood at slight Rainfall.

1.3.1 Drainage along the Western Flank : The streams in the western flank of the district rise from the Laimatol hill ranges which act as the water divides. They are mostly dry during dry season and perennial during rainy season (Irrigation and Flood Control department, 1989) Plates 3, 4, 5. The main streams are : (i) Nambol; (ii) Oinam; (iii) Khujairok; (iv) Keinou; (v) Khumanlok; (vi) awang Kharok; (vii) Kabolok; (viii) Thambakhong; (ix) Thongjaorok; (x) Kharok; (xi) Potsangbam; (xii) Ningthoukhong; (xiii) Kha Khujairok; (xiv) Singeilan; (xv) Phubala; (xvi) Irom and (xvii) Ngaikhalwai traverse short distances covering 10 km and leave the hilly course at an average of 3 to 5 kms. From 5 km. the stream course falls under the rolling plain in nature. This short distance of the stream is found to be very profound. The following observations are noted

(i) The streams become spent force with the slightest amount of rainfall

(ii) The streams carry huge amount of debrises ranging from boulders, pebbles and gravels, to fine sand and mud particles.

(iii) Decrease in the gradient along the foothills lead to huge deposition of heavier particles and

(iv) The velocity of the streams become sluggish when the river leave the foothills and carry lighter particles of pebbles, sand, mud which are deposited along the plain.

Among the above rivers, the Nambol, Khujairok, ThongJaorok, Potsangbam and Ningthoukhong are major rivers.

While in the North eastern Sector Nambul, GoJenkhong and Meerakhong and south western sector river Moirang and Khuga forms the drainage set up of the rivers which flows direct to the lake.

1.3.2 Drainage along the Eastern Flank : Apart from the mountain streams there are four important rivers which flow directly or indirectly in the Loktak lake and form the part of drainage system for the valley of Manipur and more particularly for Bishnupur district. The important rivers which form this part of the drainage of Bishnupur district are : (i) The main river of Manipur, known as Imphal river in the upper reaches while in the lower reaches it is known as Manipur river; (ii) Iril river, a tributary to the Manipur river, joins at Lilong; (iii) Thoubal river is the biggest tributary of Manipur river which joins the main river at Irong; (iv) Sekmai-Jing river also a tributary to Manipur river joins at Sekmaijing. In this sector, most of the tributary streams of Manipur river are perennial in character as they carry some amount of water in all the seasons. The main river i.e., Imphal is no more called by its name but it is called Manipur river. This river skirts the Loktak lake at the west bank and other lakes at the east banks. The result is that the river throws the flood

water on both the sides of the Loktak lake aggravating the already saturated lake feed by the western streams. Otherwise in the dry season, Manipur river is connected to Loktak lake by natural cut which acts as both way channels. Of these, the Khodrak is the biggest and longest cut connecting the lake and the river Manipur. There are similar cuts but smaller in sizes all through Nongmaikhong to Khodrak connecting the lake and the river.

In the north and north-eastern sector of the district four small streams flow into Loktak lake. These streams have their origin within 10 kms above Imphal and skirt the Imphal and Nambol town on the western side. They flow through Nambol to Loktak lake as the most polluted rivers from city affluents (Singh, M.S., 1987).

Thus, altogether eighteen rivers on the western sector, three in the eastern sector, four in the north-eastern sector and two in the south western sector form the drainage network of the Bishnupur district. The swamps in the periphery of the lake mostly in the northern sector is also drained by rivers like Yangoimacha and Yangoi Achouba river which form after the joining of all the western sector streams of the district (Devi, G., 1989).

The strategic location of the district forming the lowest depression in the whole of Manipur valley surrounded on

all sides by mountain walls leads to water lodging below the contour line of 768.6m. The absence of escape route or outlet on the western and eastern hills and the general slope of the land from north to south leads to the gathering of all the run off at this depression. The only escape route in the south is too narrow and protected by the presence of a natural hump, restricts the escape of water from the entire Manipur valley. During rainy season, when there is excessive rainfall in the catchment areas of Loktak basin and Imphal basin, water gets accumulated above normal in this depression and takes days together to recede to the normal, creating heavy flood in the lower reaches of the district (below 768.6m). Every year crops worth of crores of rupees are being lost at the periphery of the lake. During the time of high flood even settlements at the periphery of the lake are threatened and people are to be evacuated to higher elevation.

1.4 CLIMATE :

According to W.Koppen's classifications, the climate of Manipur falls under the CWA type of Humid mesotherm regime where winter is dry and summer is hot. As a whole, it enjoys a sub-tropical monsoon type of climate (Trewartha, G. 1968). The valley district of Bishnupur with Laimatol hills in the west and Loktak lake in the east reaching the foothills of the eastern ranges is not too hot or too cold due to its high

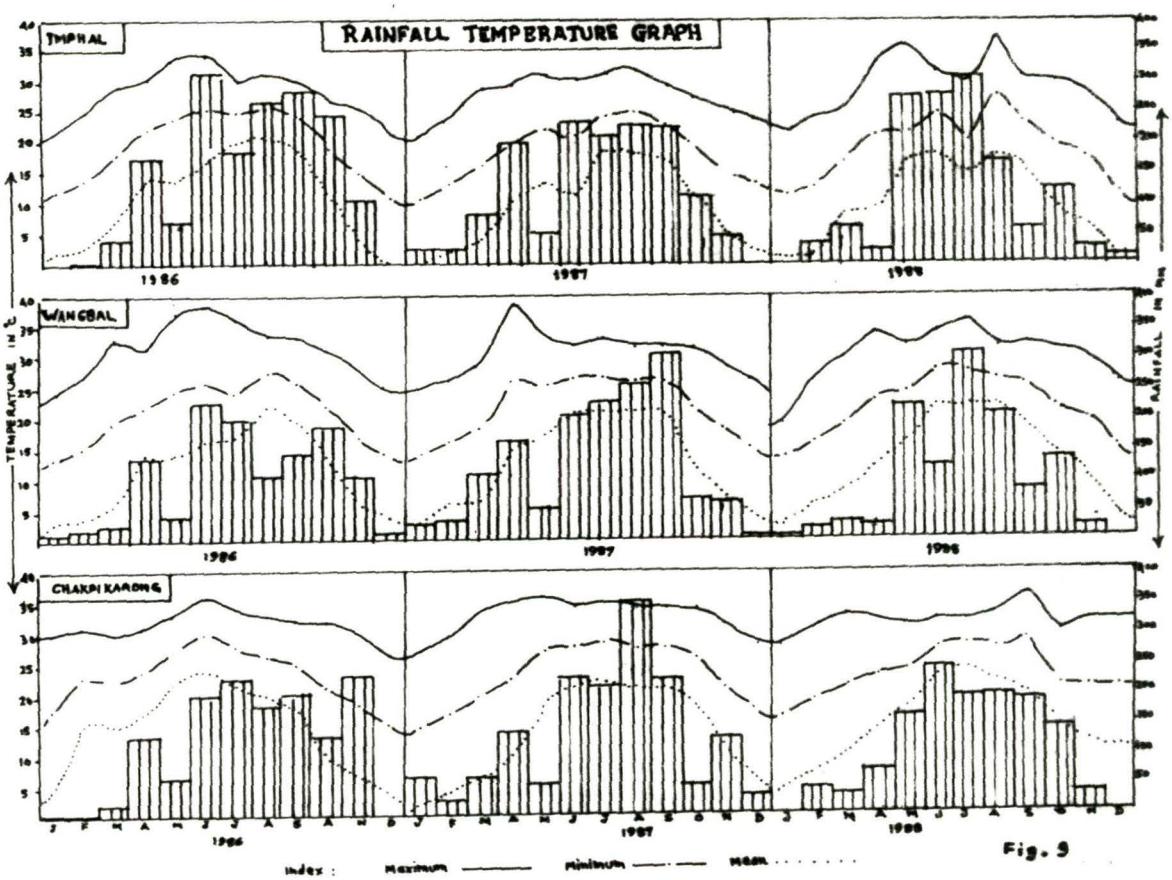

RAINFALL TEMPERATURE GRAPH
TIPHAL
WANGBAL
CHAKPI KARONG
1986
1987
1988
TEMPERATURE IN °C
RAINFALL IN mm
Index : Maximum ——— Minimum —·—·— Mean .....

Fig. 9

elevation and the prevailing drainage of cold and hot air from its surrounding hills and the lake. Usually nights are tolerable with the moderating air current coming down to the valley, resulting in the formation of fog and mist in the early morning hours specially during the winter season (Singh, T.H. Rajen, 1988). This phenomena is prevalent in hills or valley whose elevation is below 909m above the mean level (Dun, E.W., 1886).

Temperature : The district has no meteorological station of its own but the records of the three nearest meteorological stations namely, Imphal, Wangbal and Chakpikarong (Meteorological Reports, 1986, 1987, and 1988) are presented in Fig.9, appendix III and it reveals that the highest temperature in and around the district does not go beyond 38.5°C on exceptional case and generally occurs at Chakpikarong, the southern station near the district. Whereas the lowest temperature occurs at Imphal station located north of the district (at the Centre of the Manipur valley) and goes below freezing point in the month of January. It is clear from the figure that maximum temperature occurs during June-October with slight variation in the month of August and September. The trend of curve indicates that there is sharp increase of temperature during March and arrival of Pre-monsoon rain during April-May. Then there is, again rise of temperature from 36° to 38.5°c, which

is marked by the arrival of monsoon during June and July. This is followed by fall in temperature and again during August-September there is an increase in temperature followed by retreating Monsoon and a decrease in temperature till January.

Rainfall : It is clear from the figure 9 that rainfall is generally high in all the stations when there is maximum temperature which occurs during months of June-October. It is also noticed that the region of Bishnupur district experiences heavy and concentrated rain in the rainy season and is dry in winter. These affect not only the surface run off but also crop cultivation and natural hazards like flood, droughts etc. Thus, it is clear from the climatic phenomena of the area, that the study area is located in the monsoon climatic region, where summer is hot and wet and winter is cold and dry.

Seasons : The location of this valley is at a high altitude and is enclosed by mountain ranges which give a distinctive character in its climatic variations. According to the grouping of seasons adopted by the Meteorological Department of the Government of India, the area experiences four main seasons which are as follows.

(i) Winter Season : Winter season commences from the month of December and lasts upto the end of February. Fog is very common

in the valley and Loktak lake. The western disturbance occasionally passes over the area and brings gloom to the weather and finally bursts in torrential rain and is very helpful for 'Rabi' crops like Mustard oil seeds, potatoes, beams, cabbages and wheat.

(ii) Spring Season : It is also known as Pre-monsoon season which commences from March and ends by May. This is the driest part of the year in the district. This season is associated with hailstorm, squill and rainfall. As the season advances, the frequency of rainfall increases and rainy season commences.

(iii) Rainy Season : (Monsoon) : The rainy season commences in the district from June which lasts upto September. This is the time of south-west Monsoon and brings long spell rainfall. There is widespread cloudiness and weak variable surface wind which makes the weather dull, sultry and oppressive. June is the hottest month in the year while July is the rainiest month. During this season, there is heavy downpour and considerable run off causing landslide and furious flood. As it is the time for cultivation of paddy, standing crop is considerably distroyed during this period.

(iv) Autumn Season : This is also known as season of retreating monsoon. This is marked by decrease of rainfall and temperature and the sky becomes clear. Due to contrast in two air currents, there is fog in the early morning but of shorter duration. The

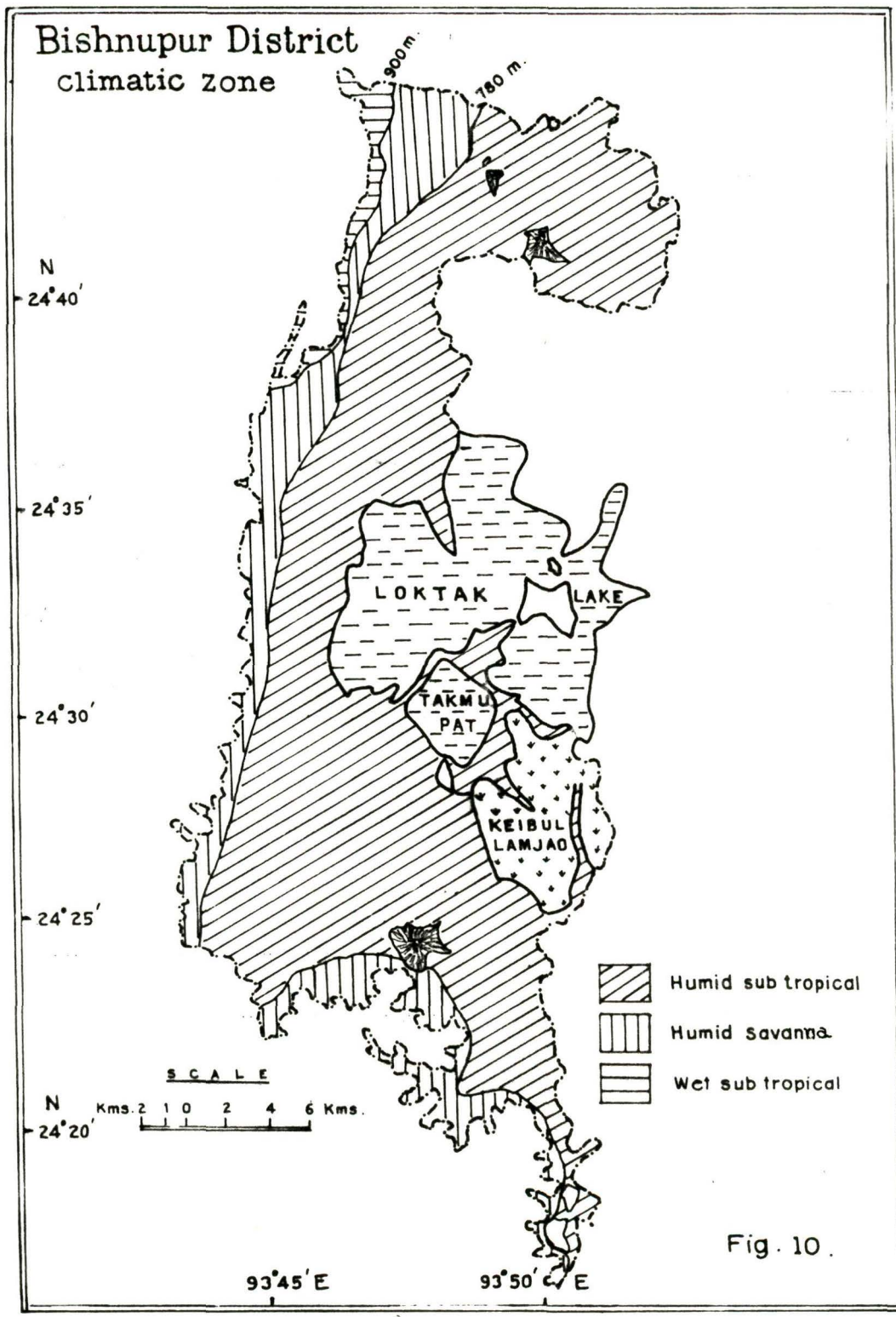

Bishnupur District
climatic zone
900 m.
780 m.
N
24°40'
24°35'
24°30'
24°25'
24°20'
LOKTAK LAKE
TAKMU PAT
KEIBUL LAMJAO
SCALE
Kms. 2 1 0 2 4 6 Kms.
93°45' E
93°50' E
Humid sub tropical
Humid Savanna
Wet sub tropical

Fig. 10.

weather in the district is fair as a whole.

As a whole the Loktak lake has a great influence upon the climate of the area in the district. The feeling of smooth oceanic climate prevails in the immediate surrounding villages of Bishnupur district.

1.4.1 Climatic Division of Bishnupur District : No attempts till yet have been done to classify and divide the district into climatic zones. It requires a detailed understanding of topography of the area and the micro regional wind direction. It is evident from the study of relief features that the district is a homogenous unit below 780 m height except a few intervening hillocks like Thanga, Sendra, Ithing, Karang, Phabockching at Keibul Lamjao, while the other part is rough terrain and water shed with occasional rise and fall along the foothills of Laimatol. Thus, Bishnupur district according to figure No.10 can be broadly divided into three climatic zones :

(i) Humid Sub-Tropical Climate Zone (below 780 m) : This zone is characterised by dry winter and hot summer with rainfall distributed during the monsoon months. This part of the district is mostly occupied by marshes, lakes and mouth of small rivers and 'nalas'. The natural vegetation ranges from mixed evergreen decidious trees of reverine type and grasses to reed of the marshy area. It also covers a stretch of open agricultural

field with fertile loamy soil which is regarded as the gift of nature to the district. Here most of the villages are situated facing the lake.

(ii) Humid Savanna : This zone extends above 780m high from sea level right upto the precipice of the mountain steep slope (800 m). It falls under the rain shadow caused by the Laimatol hill ranges which protect the rain bearing wind of the south-west monsoon. The area receives rainfall from the southwest monsoon which penetrates the district from the Khuga valley in the south. The area comes under the direct heat of the wind so vegetation is poor with scattered trees. It remains almost barren with short grasses for most of the season of the year, as have been described by (Dun E.W. 1886). Immediately on crossing the last ridge (Laimatol range) the tree jungles disappear and the eastern slope facing the lake is bare and covered with grass, and very little trees. The mist which, throughout the night has been broading over the marshy portion of the valley, is just rising. There is no villages in this tract, with Savanna type grasses.

(iii) Wet Sub-tropical hill forest type : This zone covers a very small portion at the north-western top of the district which lies above the precipice of mountain slope i.e. 900 m. High rainfall and hot sunshine gives way to luxuriant growth of forest vegetation with mixed spices.

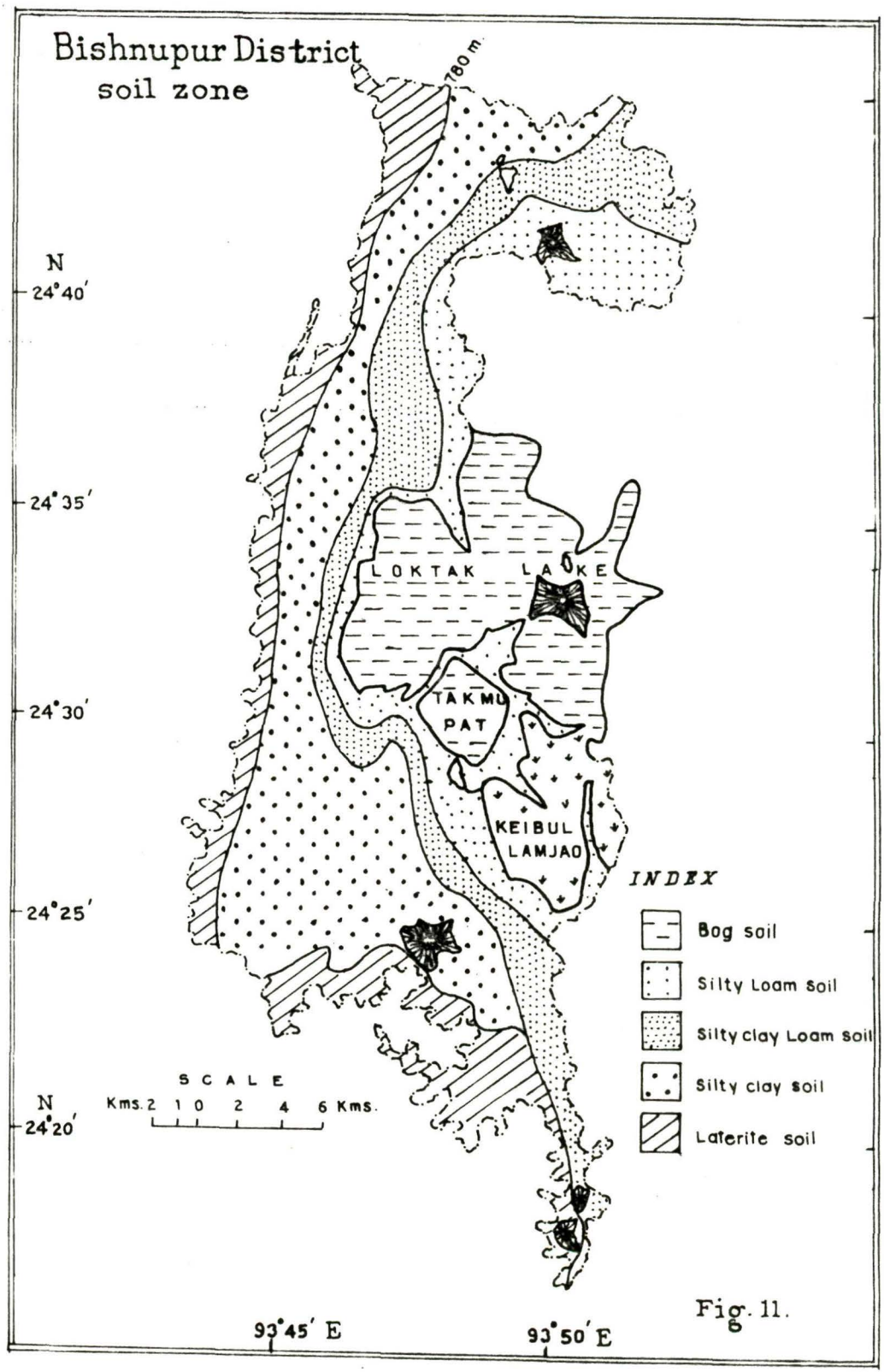

Bishnupur District
soil zone
780 m
N
24°40′
24°35′
24°30′
24°25′
N
24°20′
LOKTAK LAKE
TAKMU PAT
KEIBUL LAMJAO
SCALE
Kms. 2 1 0 2 4 6 Kms.
93°45′ E
93°50′ E
INDEX
Bog soil
Silty Loam Soil
Silty clay Loam soil
Silty clay soil
Laterite soil

Fig. 11.

1.5 SOILS :

Little work of a scientific nature has been published on the soil of Imphal valley of Manipur. The data on soil however lies in their fields of departmental reports of unpublished dissertations. The soils of the Manipur valley vary in origin from alluvial to Lacustrine. Their present day variations have been caused mainly by climatic processes and have little relation to the parent or bed rocks. They have evolved through the long geomorphic history of fluvial phases. The soil cover in the valley region of Manipur is about 50 m in the southern valley region of Loktak lake. It is richest in the low lying areas along the periphery of the Loktak lake, which is periodically enriched by floods which are a permanent feature in the valley flat. The thickness of the top soil is about 1 to 9 m in this area which decreases with altitude.

The soil has been deposited in the present sites by the innumerable rivers, streams and gullies which flow down hill from the nearby Laimatol hills. Due to the action of rivers and human agency there was a tremendous transformation of the soil in this area. On the basis of all these, soils of the district can be divided into the following zones (Fig.11)

(i) Swampy Bog Soil : The soils at the periphery of Loktak lake in the outskirts of settlements towards the blue water of the

Loktak lake, is the soil of hydrometeric origin. The soil is rich in Nitrogen and organic matter and other plant nutrients which increase the fertility of the soil. These soils are dark grey in colour and texturally they vary from clayey loams to loams. The Nitrogen content varies from 0.4 to 0.08%. Towards the lake, the soil is less developed and is covered by a fresh layer of decayed organic matters which are popularly known as Phums. These Phums which have covered almost the entire lake at one time are now removed from the deep water of the lake by the Loktak Development Authority to be utilised for other purposes, like preparation of bio-gas and manure and sometime fish feed. It was noticed that lake was drying with this hazard which will convert the lake into land mass. Most part of this soil remain under water and even higher parts get inundated during high flood.

(ii) Silty Loam Soil : This group of soil is delimited immediately beyond the permanent water level of the Loktak lake. It covers the entire length of villages at the periphery of the lake and the cultivable lands around the villages towards the lake. The soil is more developed than the bog or marshy soils. Here, the soil contains humus, while the sub-soil is clayey in nature. The peculiarity of the region is that the water is less percolated. The area is regularly inundated by floods and makes the area highly fit for the cultivation

of vegetables and rice. These soils are grey to pale brown in colour. They contain a good proportion of Potash, Phosphate and moderate quantity of Nitrogen and Organic matter. These soils are less acidic.

(iii) Silty Clay Loam Soil : This soil contains silt and clay with a certain amount of humus. The area can be irrigated with small amount of water. This area is most developed in agriculture. So vast track of lands are left for this purpose in the district of Bishnupur.

(iv) Silty Clay : Silt and clay are the component of this soil group and this type of soil is better developed than that of the silt clayey-loam soil. This soil is dark to grey in colour. The water retention of this soil is great but lesser than the previously mentioned two varieties. The humus in the soil absorbs much water which some proportion is lost by percolation. The colour of the soil differs a little in the settlement area but as we go nearer to the foot hill, the soil becomes dark to light grey in colour. The soil too suffers from leaching when excessive rainfall occurs. This soil is more adapted for cultivation of rice from time immemorial and depletion has occurred. At one time using manure was not known to the farmers. But constant use of land with only one varieties of cultivation for the whole year to which six months remain barren has led to the loose of fertility in the soil. The use of high yielding

varieties of seeds and coming of the irrigation canal in the middle of the area has helped for the use of extensive methods of cultivation.

(v) Lateritic soil : It lies at the areas of higher elevation. The area of lateritic soil may be 10% of the total area of the district. This soil is red in colour and coarser in structure. The soil is formed under condition of high rainfall and drought. It contains a rich proportion of Nitrogen and Phosphate and medium acidity. It is less fertile due to leaching and is responsive to manuring. This soil is rich in pine-apple and sugarcane cultivation. This soil needs irrigational water in the higher slope.

1.6 VEGETATION :

Darwin introduced in 1859 the theory of evolution by means of natural selection, that is species vary constantly from one generation to the next and the environment acts to select those member of a generation most able to survive. The distribution pattern of plants and animals is thus related directly to the distribution of environment to which they are adapted (Strahler, 1918). In view of the general exceptance of the Darwinian theory of natural selection, natural vegetation of the state bears the evidence of the topographic and climatic

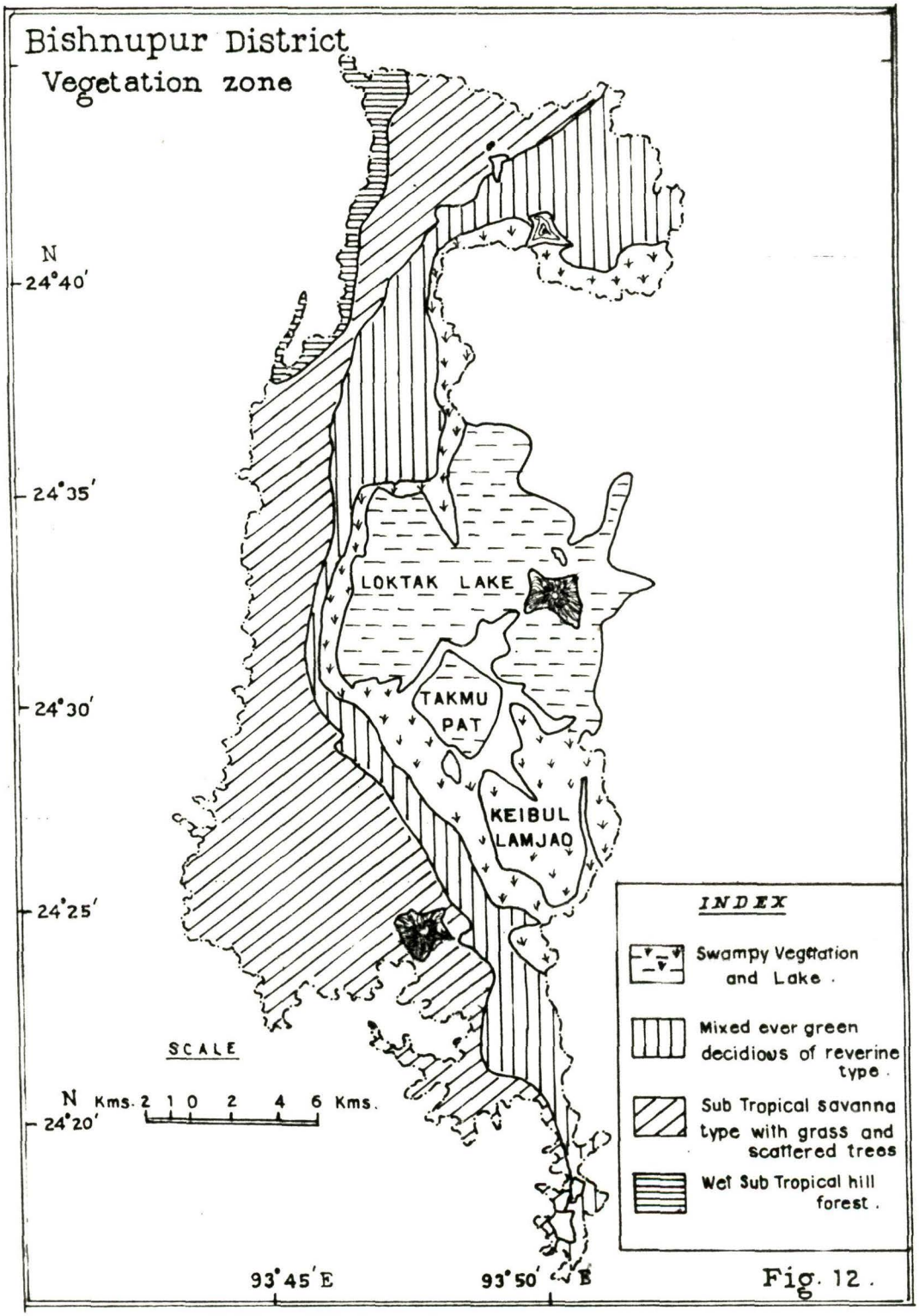

Bishnupur District
Vegetation zone
N
24°40'
24°35'
24°30'
24°25'
24°20'
LOKTAK LAKE
TAKMU PAT
KEIBUL LAMJAO
SCALE
N Kms. 2 1 0 2 4 6 Kms.
93°45'E
93°50'E
INDEX
Swampy Vegetation and Lake.
Mixed ever green decidious of reverine type.
Sub Tropical savanna type with grass and scattered trees
Wet Sub Tropical hill forest.

Fig. 12.

influence which spread both latitudinally and longitudinally. It is evident from the study of Toposheets that the district lies between very short interval both longitudinally and latitudinally and it is learnt that the longitudinal variation of vegetation is more profound than the latitudinal variation followed by more sharp variation of altitudinal factors. On the basis of latitude, longitude, altitude, climatic variation and soils the vegetation of the district can be divided into the following types Fig. 12.

i. Swampy Vegetation and grasses : This type of vegetation is found in the Loktak lake area which covers 278 km^2 out of 530 km^2 area of the district. Aquatic, swampy vegetation and grasses are found along the periphery zone. Water hyacinth water-lily and many species of plants belonging to the family of Nymphacaceal Euryale and Nihemblum Nucifra are found in this group. Certain species like Trapabir Pinese (Heikek), Cyperus ratundus (Kaothum), Sagixttaris Sagittifolie (Kaokha), Zinania Latifolia (Eshing Kambong) and underground rhizoms of lotus are used as food. It has also been found that some insectivorous plants like Bladaer wart (Utriculsia) is found in the marshy area of the lake (Singh, R.K.Ranjan, 1989).

ii. Mixed ever green decidious tree of reverine type : This type of vegetation is found on the river banks, flood plains and areas along the villages of the district. It covers nearly 42 km^2 of the total area of the district. The main species of this

A Silted River at Phubala Flowing above the Reperian Land.

A Stretch of Sub-Tropical Savanna in the Foothill at Bishnupur.

type of vegetation are : Bambusa, Picus Bengalues, Mangifera indi ca etc. (Singh, R.K., Ranjan 1989).

iii. Sub-tropical Savanna with grasses Herbs and Scattered trees : This vegetative zone is extensive in the district which lies mostly above 780m from the mean sea level. They come under the old alluvium of the laimatol foothills. The gradient of the land and clayey loam texture of soil prevent the water from percolation resulting in water deficiency which retard the growth of luxirient trees. These areas come under extensive cultivation of rice as mono crop, the main vegetation in these areas are reeds, tall grasses and various medicinal and edible herbs including polygonum brabatum (Yellang/Plumbagozuilanice (Kengnogoi) Centella asiatica (Peruk) etc. (Singh R.K. Ranjan 1989). Apart from these Savanna vegetation, climax vegetation is available in the upper reaches i.e. 800 m and above up to 900 m. But this area has been rendered to merciless plundering of trees and natural vegetation. Now only scattered trees can be found and in places it is replaced by short grasses of lesser quality. Now 150 km^2 of area has been termed as unclassed protected forest belt in the immediate foothills of Laimatol hill ranges, under Social Forestry Programme(Plate-6).

iv. Wet Sub-tropical hill forest : This zone extends to the upper Precipice of the mountain slope ending at the summit of the eastern slope. This forest too is randomly exposed to Jhum cultivation, in this zone 60 km^2 of area is under reserved forest.

A Part of Sub-Tropical Hill Forest at Bishnupur.

A Dam Under Construction, A Measure to Control Flood.

The vegetation here is denser than the other places. The defective land ownership right, prevalent in the hills will also bring destruction to these forest. The predominate spices in this zone are : Machilus, Schima, Wallichi quercis etc. (Singh, R.K., RanJan, 1989). Plate-7.

CONCLUSION :

From the study of physical characteristics of Bishnupur it is revealed that Bishnupur district is a rolling plain starting from the foothills of Laimatol range and terminates with vast stretch of flat water surface of the Loktak lake (278 km^2). The rolling plain is composed of alluvium overlain to a thickness of 200 to 300 m. Underlying the Disang Shales containing shales, sand, silt and shringles. The topography represents an uneven surface from 780 to 900 m elevation while from 768.6 to 780 m elevation forms a homogenous alluvial plain of gentle slope. As the study area slopes North-South and forms the lowest part of the state culminating in the formation of the Loktak lake where all the streams debouch and due to the enclosed nature of the Manipur Valley, there is a serious problem of drainage from the entire Valley which usually leads to flood and siltation.

The study area has the highest temperature ranging between $36^{o}c$ to $38.5^{o}c$, during the months of June and July

while the lowest temperature goes to freezing point during December and January. Though rainfall in all the stations near Bishnupur is high but it fluctuates from year to year which leads to failure of crops by devastating flood and drought very often. The district experiences mild climate because of the drainage of cool soothing air from the lake and the surrounding mountains.

The favourable climatic condition of the area is associated with high fertility of the soil which varies from alluvial to lacustrine according to the location. The alluvial soil is well drained while lacustrine soil faces the problem of water logging. It is observed that the vegetation of the district have good co-relation with the climate and soil. The lake area is covered by floating weeds, water hyacinth, ferns and reeds which are menace to the lake while higher grounds in the district have climax vegetation of mixed forest type and grasses which have been exposed to hungry hand, axes and hoofed animals.

It is observed from study of the geology relief, drainage, climate, soil and vegetation of the district that, they exert great influence upon the demographic pattern of the area, which is one of the main resources, of the district. So to study the different aspects of demography it is necessary for assessing their relationship with physical background of the study area and these have been discussed in subsequent chapters.