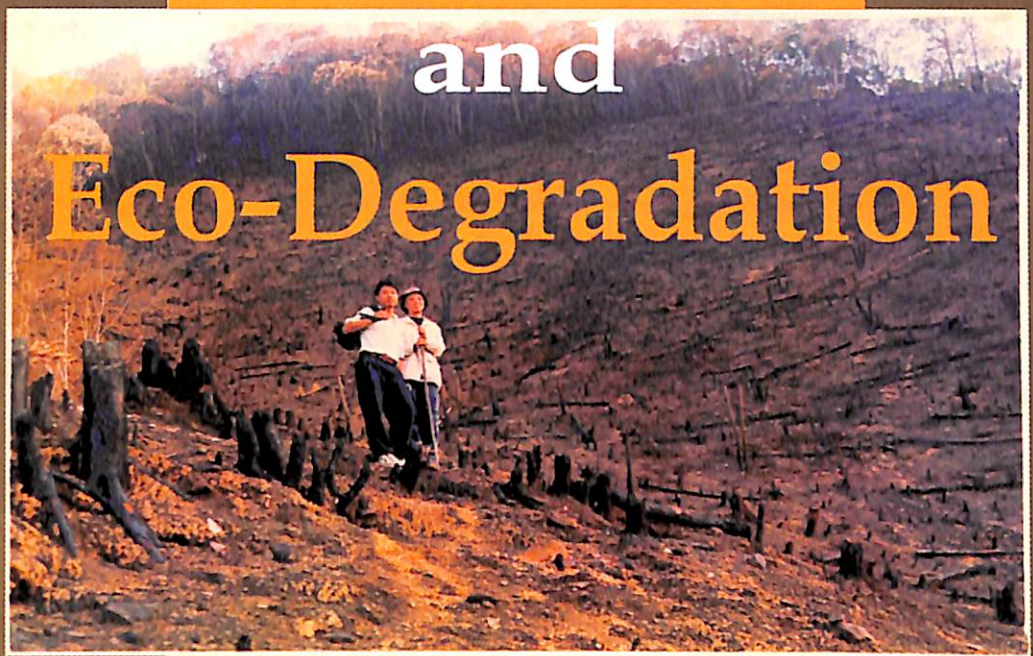
MANIPUR

Jhum and Eco-Degradation



Md.Bahar-Ud-Din Shah

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JHUM AND ECO-DEGRADATION

Md. Bahar-Ud-Din Shah

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Dedicated

To

MY LOVING PARENTS

who stimulated me to visualize
the changing social milieu

Contents

List of Figures

Foreword

The tropical countries of Africa, Latin America and South-east Asia accounts for over 98 per cent of the total area under shifting cultivation. More than 525 million people live and farm on tropical hillsides, which covers 12.9 million sq. km. and forms 9 per cent of the earth's landmass, out of which Africa has 40 per cent. In Asia about 53 per cent of the total landmass is in the upper watershed, which is home to 65 per cent of the 1.6 million rural populations. In India about 4.9 million hectares in the 11 states (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, Orissa, Madhya Pradesh and Andhra Pradesh) is affected by the problem of *jhum* and about 4.44 million families are engaged in this. In India more than 90 per cent of the area under *jhum* is in Northeastern region of the country (Assam, Arunachal Pradesh, Manipur, Mizoram, Nagaland and Tripura). About 0.45 million families annually cultivate 10,000 sq. km. of forest. With the phenomenal increase in population, the *jhum* cycle has decreased from 20 to 30 years to about 5 years and even up to 3 years.

Shifting cultivation otherwise called *jhum* in Northeast India may be defined as an agricultural system which is characterized by rotation of fields rather than by crops, short period of cropping alternating with long fallow period and clearing by means of slash and burn. It involves slashing down of trees and bushes, burning them and then showing crops. This method of cultivation is solely responsible for degradation of the ecosystem, depletion of land resources, leaching, soil erosion, loss of soil fertility, loss of pernicious biomass, siltation of lakes, water bodies, reservoir and flood.

This is a pioneer work done by a geographer Dr. Bahar-Ud-Din Shah. The study is based on remotely sensed data, village surveys and household surveys with the help of questionnaire interviews. Data for assessing the socio-economic conditions *of jhumias* were drawn from a comprehensive survey of 5 villages and nearly 100 per cent sampling of *jhumia* households. Conducting field survey and gathering information from the tribal dominated villages with no accessibility, bad roads, and steep terrain was difficult task. For accessing the loss of soil fertility soil samples were collected from the *jhum* fields.

The author has very aptly concluded that the physico-socio-cultural environment of Manipur has compelled the tribal to adopt *jhuming*. The mountainous topography, undulating slopes and wet weather conditions almost all the year round provides ideal conditions for people to practice jhuming. It is a way of life for the tribal. Their needs, food habits, folklores, festivals and overall cultural ethos has a say to *jhum*. The life of the *jhumias* is that of a desperate struggle for survival in such harsh conditions. With the increase of population the *jhum* cycle has decreased and this has resulted in the degradation of ecosystem.

Abha Lakshmi Singh

Preface

'*Jhum*', though the term is old, it is not exaggerated to say that any solution of *jhum* is yet to find. This outdated method of cultivation system exists from the very beginning of agricultural history. Much has been written, much has been told and many hue and cries has been made over the degradation of ecosystem due to *jhum*. Yet *jhum* continues but how long...?

The tropical countries of Africa, Latin America and South East Asia accounts for over 98 per cent of the total area under shifting cultivation (*jhum*) in the world. More than 525 million people live and farm on the tropical hillsides which covers 12.9 million sq. km. and forms 9 per cent of the earth's land-mass, out of which Africa has 40 per cent. In Asia, about 53 per cent of the total landmass is in upper watersheds, which is home to 65 per cent of the 1.6 million rural population. In India, 4.9 million hectares in 11 states (i.e., seven north-east states plus Sikkim, Orissa, Madhya Pradesh and Andhra Pradesh) is affected by the problem of *jhum* and about 4.44 million families are engaged in this.

In India, more than 90 per cent of the total area under *jhum* is in the north-eastern region of the country. Out of total geographical area of north-eastern region (i.e., 25.5 million hectares), 2.7 million hectares is under *jhum*, of which 17 per cent is in use at any given time.

Logically, *jhum* is an agricultural problem which creates forest and soil erosion. This cultivation system involves slashing down of trees and bushes over the forest area, drying and burning, sowing of seeds of host of crops by using stick,

dibbler or by hand before the onset of monsoon. Leaching, erosion and loss of fertility takes place rapidly in practicing *jhum* and the field per unit of land becomes progressively lower. Land-water system which is basic life supporting factor and a prime mover of socio-economic development has already fallen into the clutches of law of diminishing returns with the reduction of productivity.

The pernicious effect of *jhum* has been increasing and have now assumed a devastating proportion. Several hill sides of Manipur have become barren—slopes with rills and gullies without vegetation. The eroded soil from the upper reaches/fills up the streams and reservoirs where siltation takes place. Due to decrease in the water depth in the lakes/ reservoirs, life of hydro-electric projects like Loktak Hydro-Electric Project is going to be shortened. Drying up of many perennial sources of water also takes place. On the other hand, floods occur more often now than before and quality of environment is being seriously affected. Ecological balance of the whole region is being endangered with denudation of invaluable flora and fauna and finally eco-degradation.

On the other hand, high hills offer low returns and restrict alternatives. Difficult terrain encourages isolation of small communities. To such isolated communities, *jhum* satisfies their minimum food and other basic requirements. In fact, *jhum* in Manipur occupies a distinct place in the tribal economy and contributes a vital part of the socio-economic network of tribal life. They clearly do it for their food requirements. The hill man of the state has to bear with steep slope, poor soils, mosquito infested and less invigorating climate, poor means of transport and communication and a life of isolation and relative isolation. Under such an adverse physico-socio-cultural environment his life is a desperate struggle for survival. Consequently he seems to be compelled to adopt *jhum*.

The present study was conducted with keeping in mind the significant background of two schools of thought. The practice of *jhum* has been severely attacked by the first school of thought as it disturbs the ecosystem causing ecological imbalance while the second school of thought has been supported the continuance of *jhum* with necessary and effective reforms. The study suggests various alternatives and

modifications to *jhum* as measures to minimize the negative impact of *jhum* on ecosystem and to bring better socio-politico-economic conditions of the *jhumias*.

I wish to express my sincere and heartfelt thanks and deep sense of gratitude to my revered and learned teacher and guide Prof. (Mrs.) Abha Lakshmi Singh, Department of Geography, for her omniscient guidance rightly from its inception to its culmination in the present work. Without her unceasing encouragement and cooperation this work would not have been completed. Words are not enough to express my debt of gratitude.

I am also indebted to Prof. Mohd. Shafi, Professor Emeritus, Department of Geography, Prof. R.J. Singh, Department of Physics, for their invaluable suggestions and encouragement. I would be remiss in my gratitude if I do not express my heart-felt thanks to my parents and other family members for their intrinsic love, support and encouragement.

Md. Bahar-Ud-Din Shah

Glossary

Local words	English equivalent
Purvanchal	A local name of the eastern arm of Himalaya
Jhuming/jhum/jum Ladang, Caingin, Milpa, Ray, Conuco, Roca, Masole, Podu, Dadi, Koman, Bringa, Kumari, Watra, Penda, Bewar, Dahia, Deppa	Shifting cultivation
Kumari	Local or regional name of shifting cultivation
Yoke	A traditional agricultural implement
Dao	A traditional agricultural implement (machetes)
Kharif	Summer (a term used in agricultural practices)
Rabi	Winter (a term used in agricultural practices)
Jungle	Forest
Pakhangba	The first mythological king of Manipur
Sidaba Mapu	Supreme God
Jhumia/jhumias	Shifting cultivators/farmers
Kuccha	Which is not cemented
Pucca	Which is cemented
Tin	A container (mustard oil tin) which is used to measure the quantity of paddy/rice
Sangam	A local land unit system which is roughly equal to 0.62 acre.

Introduction

As the pressure of population increased, the hunters-cum-cultivators of the Neolithic period started clearing more patches in forests to bring them under cultivation. At the depletion of fertility, the cultivators used to migrate to new tracts to burn and clear forests for sowing of crops. This type of cultivation is termed as 'slash and burn agriculture' or 'shifting cultivation' or 'bush fallow agriculture' or 'swidden agriculture'.

Shifting cultivation is called by different names in different parts of the world. It is variously termed as *Ladang* in Indonesia, *Caingin* in Philippines, *Milpa* in Central America and Mexico, *Ray* in Vietnam, *Conuco* in Venezuela, *Roca* in Brazil and *Masole* in Congo and Central Africa. It is also practised in highland areas of Manchuria, Korea and South West China. In North East India it is known as *Jhum* or *Jum*, in Orissa as *Podu, Dabi, Koman* or *Bringa*, in Western Ghats as *Kumari*, in Rajasthan as *Watra,* in Madhya Pradesh as *Penda, Bewar* or *Dahia* and in Chattisgarh as *Deppa* and *Kumari.*

Jhum cultivation otherwise called *'Pamlou'* in Manipur may be defined as an agricultural system which is characterised by rotation of fields rather than crops, by short period of cropping alternating with long fallow periods and clearing by means of slash and burn. The operation of *jhum* cultivation is associated with systematic processes like selecting the forested hilly land, clearing the forested tract by cutting down the *jungles*, burning the dried forest into ashes, worship and sacrifice, dibbling and sowing of seeds, weeding, watching and protecting the crops, harvesting, threshing and storing,

merry making and fallowing. This practise of raising agricultural crops does not involve cultivation of land using agricultural implements or drought animals or any mechanical power. The inputs are human labour and seeds. Crops raised for a few seasons and areas are abandoned once in 2 or 3 years which are affected by serious erosion. The farmers called *jhumias*, then shift over to other lands and resort to similar practise (but the villages do not shift). Leaching, erosion and loss of fertility takes place rapidly. Land-water system which is basic life supporting factor and a prime mover of socio-economic development has already fallen into the clutches of the law of diminishing returns with reduction of productivity vis-a-vis inputs and gross physical degradation of the system. All this further aggravates the situation and makes the *jhumias* increasingly poor inspite of his putting much greater labour.

Jhum cultivation, generally in Manipur and particularly in Ukhrul district occupies a distinct place in the tribal economy and contributes a vital part of the socio-economic network of tribal life. They clearly do it for their food requirements. The land around the village within certain fixed bounds is usually the property of the village, though the system of ownership of land differs from village to village particularly in Ukhrul district. In the midst of sharp relief, gentle slopes are used for terracing, in the absence of which, the land is put under *jhum*. According to the prevailing customs in the hills, all land adjoining the village belongs to the community as a whole or to the village headman and exclusive right of an individual is not entertained. The site of *jhum* is selected by the headmen or priest with the help of other aged experienced *jhumias* in advance and individual families are allotted their share if there is no any already marked particular field of particular family. In some Tangkhul Naga villages of Ukhrul district, the roughly marked permanent *jhum* fields are available for particular families. In such situations, there is no new allotment of land in the particular *jhum* year, if the land is enough to feed the family otherwise one could demand for more *jhum* land. *Jhumias* start, after selection of *jhum* site, the labour intensive processes of *jhum* with cutting down the trees in the month of December with

Dao and Axe. After felling the forest, the wood and twigs are allowed to dry, so that it may be fired in the month of March when the weather is sunny and overcast skies are rare. The uncontrolled fire, in many cases spreads beyond the *jhum* area and does great damage to the valuable virgin forests of the region. The soil for a depth of one or two inches gets completely burnt. The soil is, thereafter, scratched up with little hoe and in this process the soil and the ash gets mixed up together.

Logically, *jhum* cultivation is an agricultural problem which creates forest and soil erosion problems. Soil erosion takes place due to dynamic processes of nature and other natural factors. This has been further aggravated by human interference by way of *jhum* cultivation, indiscriminate cutting and felling of trees for fuel and timber, free grazing of cattles, unscientific cultivation of crops on the steep slopes, etc. leading to destruction of flora and fauna and finally eco-degradation.

The pernicious effect of *jhuming* has been increasing and have now assumed a devastating proportion. Several hill sides of Manipur have become barren-slopes with rills and gullies without vegetation. The eroded soil from the upper reaches fills up the streams and reservoirs where siltation takes place. Due to decrease in the water depth in the lakes/ reservoirs, life of hydro-electric projects like Loktak Hydro Electric Project is going to be shortened. Drying up of many of the perennial sources of water also takes place. On the other hand, floods occur more often now than before and the quality of environment is being seriously affected. Ecological balance of the whole region is being endangered.

The mountainous topography, undulating slope surrounding the Manipur valley and wet weather for over seven months (April to October) provides ideal conditions in which people practise *jhum* cultivation. The people who are scattered over the mountains depend for their sustenance on *jhum*ing and food gathering from the forest. All the hill districts are most sparsely populated having a density of about 49 persons per sq. km. as against the density of 628 persons per sq. km. in the central valley. The hill man has to bear with steep slope, poor soils, mosquito infested and less invigorating

climate, poor means of transport and communication and a life of isolation and relative isolation. Under such an adverse physico-socio-cultural environment his life is that of a desperate struggle for survival. Consequently, he is compelled to adopt a primitive mode of cultivation on the undulating slopes of the surrounding hills of Manipur.

On the other hand, the practise of *jhum* cultivation has been severely attacked by the ecologists, environmentalists and planners as it disturbs the ecosystem causing ecological imbalances. There are, however, some people who support the continuance of *jhum*ing with necessary and effective reforms.

Keeping this significant background of *jhum* cultivation in mind, it was decided to study the impact of *jhum* cultivation on the ecosystem of Manipur. Ukhrul district of Manipur is selected for this study because of its mountainous topography, undulating slopes and wet weather conditions that provides ideal conditions for *jhum* cultivation; the predominant tribal population mainly Nagas and Kukis who are the main *jhum* cultivators in Manipur and they have been practising *jhum* cultivation for centuries; absence of industries and minimum urbanization (whole district came under the rural category both in 1991 and 2001 Census), abject of poverty, unemployment, economic exploitation, social deprivation, poor health, illiteracy and lack of infrastructure.

1

Physical Setting of Manipur

Manipur is an isolated hill girt state in the North Eastern corner of India along the Indo-Myanmar border with Imphal, a flower on the lofty heights (Evans *et al.*, 1960), as the state capital. It extends from 93°03' to 94°47' east longitudes and 23°50' North to 25°41' north latitudes. It is centrally located on the eastern arm of the Himalayas—the *Purvanchal* (Chatterjee, 1965), which separates India from Myanmar. The state is almost rectangular in shape with a fertile alluvial plain in the centre surrounded by hill ranges on all sides. It is bordered on the north by Nagaland, on the east by Myanmar, on the south partly by Mizoram, and the Chin hills of Myanmar and on the west by Cachar district of Assam (Fig. 1.1).

Manipur spreads over an area of 22,327 sq.kms. and has a population of 2,388,634 (Census of India, 2001). It has about 0.68 per cent of the country's land and 0.23 per cent of the country's population.

The boundary line is approximately 854 kms. Out of which, 532 kms. is the International boundary line with Myanmar in the east. Politico-administratively, Manipur comprises of nine districts namely, Imphal East, Imphal West, Bishnupur and Thoubal districts which lies in the central valley and Senapati, Ukhrul, Chandel, Churachandpur and Tamenglong districts which lies in the hill areas. These districts have been further sub-divided into 37 subdivisions and 38 community tribal development blocks. Table 1.1 shows the politico-administrative structure of Manipur.

Manipur consists of an oval, beautiful fertile valley in the

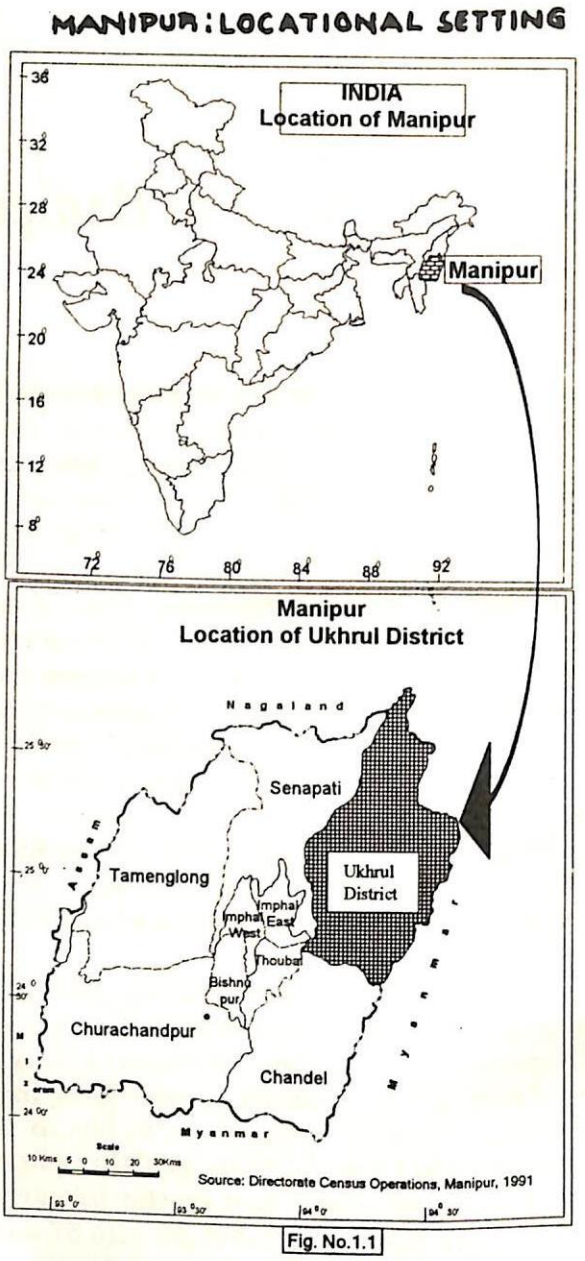


Fig. No.1.1

Figure 1.1

Table 1.1: Politico-administrative Structure of Manipur

Districts	Area (sq.km)	Population	Number of				
			Sub-Divisions	CD/TD Blocks	Zila parishads Auto District Council	Inhabited Villages	Towns
1. Imphal East	670	3,93,780	4	4	1	206	3
2. Imphal West	558	4,39,532	4	4	1	117	10
3. Thoubal	514	3,66,341	3	3	1	87	9
4. Bishnupur	496	2,05,907	3	3	1	45	7
5. Senapati	3,271	3,79,214	5	5	2	516	–
6. Tamenglong	4,391	1,11,493	4	4	1	193	–
7. Churachandpur	4,570	2,28,707	5	6	1	504	1
8. Chandel	3,313	1,22,714	4	4	1	292	1
9. Ukhrul	4,544	1,40,946	5	5	1	222	–
Total valley	2,238	14,05,560	14	14	4	455	29
Total Hill	20,089	9,83,074	23	24	6	1,727	2
Total Manipur	22,327	23,88,634	37	38	10	2,182	31

Notes: (i) Area and Population figures are based on 2001 Census.
(ii) Other figures are based on 1991 Census.

Source: Census of India, 1991 and Census of India, 2001 (Provisional), Directorate of Census Operations, Manipur.

centre which is surrounded on all sides by the Manipur Hills. Structurally, the region forms the central segment of the tertiary foldings on the eastern rampants of the country. The hill ranges of Manipur and the enclosed intermont basin—the Imphal Valley, belongs to the Alpine system and the Barak basin on the western margin, to the sedimentary cover. The state, thus, falls into three landform divisions—the Manipur hills, the Manipur valley and the Barak basin, which differ to much extent in their physical characteristics. In this chapter an attempt is made to assess the physical setting of Manipur. This state lies in isolation and is politically disturbed state of India. People know little about this state. So it was thought worthwhile to add a chapter on it. This chapter forms the foundation of the research study. This chapter is based on secondary source of data.

1.1 GEOLOGY

The state has a sketchy geological knowledge. Detailed geological survey reports are still awaited. In the early pleistocene age or quarternery period during Cenozoic era, some 55 million years ago, the whole region was uplifted from the sea of Tethys to its present position. This is confirmed from the recent findings of the Geological Survey of India (*Amrita Bazar Patrika*, 14.1.1989). According to the Geologist of the Burma Oil Company, 'the term axial was described for the rocks which are older than Disang, probably cretaceous and the tertiary rocks in Manipur'. Thus, rock formations found in the state reveal the geological history to some extent. Five rock groups can be identified in the state (Fig. 1.2).

1. Ukhrul limestones, found in a small narrow belt in the north eastern part, were formed during the cretaceous period, about 80 to 90 million years ago, where limestone occurs as lenses in a sequence of gritty sandstone and buff to grey coloured shale.
2. The Disang group, spreads over the eastern half of the state, was deposited in the middle and lower Eocene period. It consists of a monotonous sequence of dark grey shales with thin mudstone, siltstone and

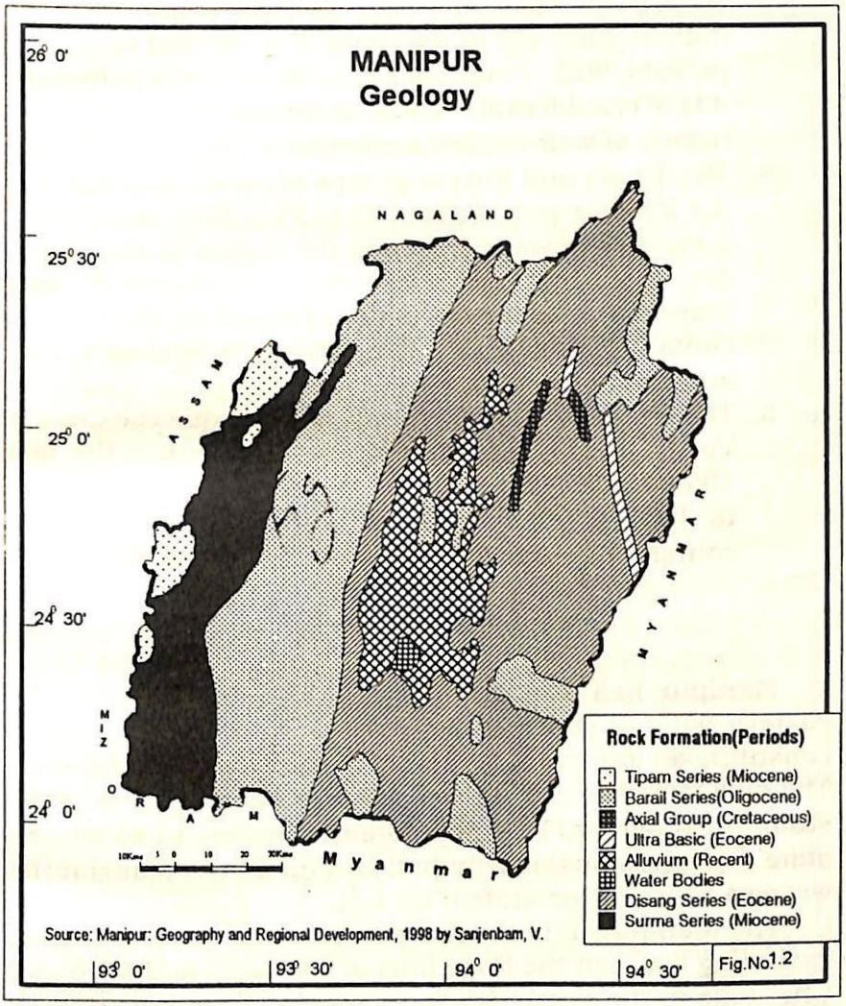

MANIPUR
Geology
26° 0'
25° 30'
25° 0'
24° 30'
24° 0'
NAGALAND
ASSAM
MYANMAR
MIZORAM
Myanmar
Rock Formation(Periods)
Tipam Series (Miocene)
Barail Series(Oligocene)
Axial Group (Cretaceous)
Ultra Basic (Eocene)
Alluvium (Recent)
Water Bodies
Disang Series (Eocene)
Surma Series (Miocene)
Source: Manipur: Geography and Regional Development, 1998 by Sanjenbam, V.
93° 0'
93° 30'
94° 0'
94° 30'
Fig.No.1.2

Figure 1.2

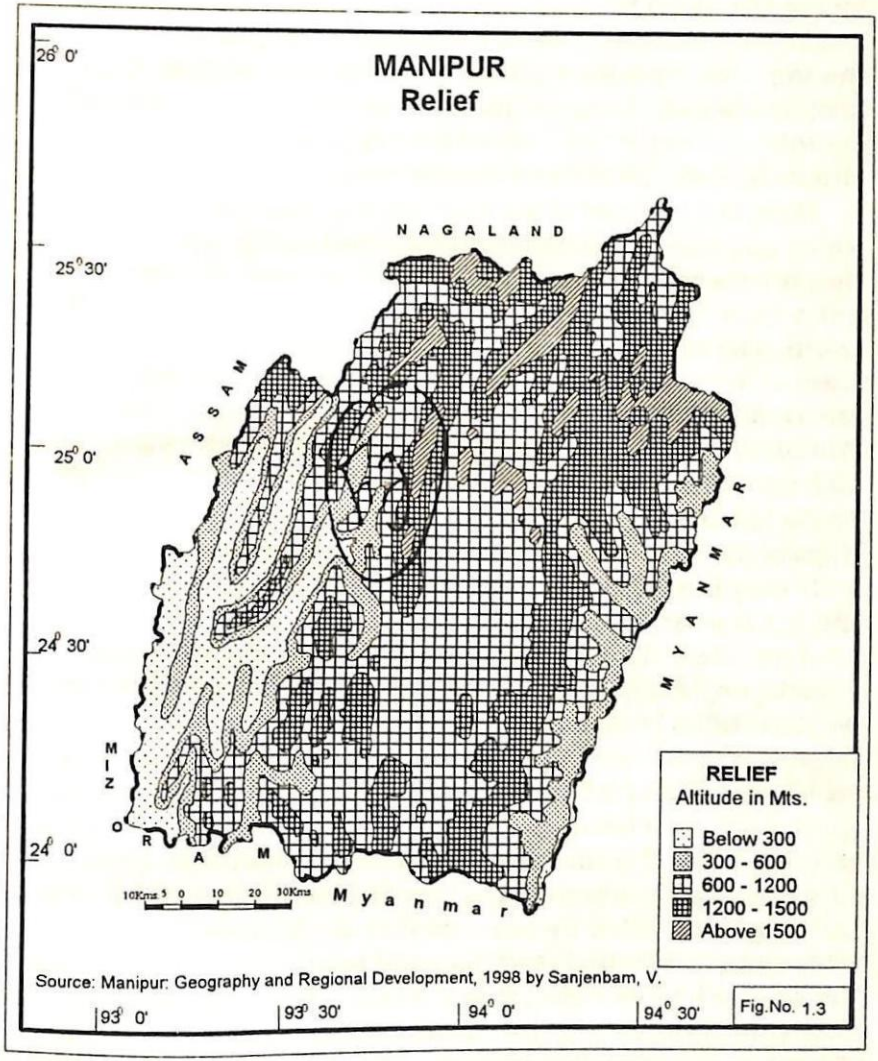

MANIPUR
Relief
NAGALAND
ASSAM
MYANMAR
MIZORAM
Myanmar
26° 0'
25°30'
25° 0'
24° 30'
24° 0'
93° 0'
93° 30'
94° 0'
94° 30'
10Kms 5 0 10 20 30Kms
RELIEF
Altitude in Mts.
Below 300
300 - 600
600 - 1200
1200 - 1500
Above 1500
Source: Manipur: Geography and Regional Development, 1998 by Sanjenbam, V.
Fig.No. 1.3

Figure 1.3

Yomadung forms a compact and continuous chain along the Indo-Myanmar frontier for about 200 km., attains an average height of about 1,500 metres. The breadth ranges from 50 km. in the north to about 30 km. in the south. *Khayangbung* (2,833 m.), *Shiroi* (2,568 m.) and *Kachubung* (2,498 m.) are the important peaks. Formed of the Disang shales, Ukhrul limestones and the serpentinites, the Manipur eastern hills contain a number of important minerals like limestone, chromite, talk, nickel and copper ores.

With the number of parallel ranges—*Uningthou, Koubru, Khoupum,* and *Haobi,* the Manipur western hills spreads over the entire western part, running north to south for about 180 km. with a breadth of 50 km. in the north and 70 km. in the south. The hills are generally higher in north and west and lower towards the south. Important peaks of this hill region are *Tenipu* (2,994 m.), *Koubru* (2,652 m.), *Leikot* (2,831 m.), *Tamphaba* (2,664 m.), and *Iso* (2,460 m.). Small valleys are also found running parallel with ridges from north to south. These hills are composed of compact sandstones, shales and clays of the Barail series, but their western slopes are covered with sandstones, shales, mudstones and conglomerates of the Surma series.

Like the Vale of Kashmir and Kathmandu Valley in the Himalayas, Manipur valley, enclosed by Manipur eastern and western hills, is also one of the Himalayan midlands. It is a large intermont basin, about 70 km. long and 35 km. broad having an area of 2,067 sq. km. The valley is a high level flood plain with an elevation of about 760 metres above mean sea level. The 900 metres contour forms its outer limits. It is a lacustrine plain-site of an ancient lake, which was subsequently filled up and uplifted to its present position, the remnant of which occupies the south-east corner of the valley, the Loktak Lake (Singh, 1982). This basin of flat-land topography, formed by the alluvial deposits after the Tertiary period, is occasionally broken by hills and mounds which rise above the flat surface. This include the *Langol, Heingang, Nongmaijing Ching, Langthabal* and *Waithou* etc. The scenic beauty of Loktak Lake, which is the largest fresh water lake in north-east India, is moreover coloured with a series of

islands which rise above the water level. *Sendra, Ithing, Thanga* and *Karang* are the most important among them.

Barak basin on the western flanks, beyond the Manipur western hills, is a small plain formed by the headward erosion and subsequent deposition of river Barak and its tributary Jiri. This basin is dotted with low sandstone hillocks, the Barak basin contains rocks of both Surma and Tipam series. Thus, altitudinal variations range from 95 m. in the Barak basin to 2,994 m. in the northern hill section of Manipur.

1.3 DRAINAGE

The state is drained by various streams, which belong to three river systems (Fig. 1.4). Manipur river and its tributaries—Imphal, Iril, Thoubal, Nambul, Nambol, Khuga and Sekmai with Loktak Lake and other associated lakes form the water resources of the central valley. It has a catchment of 6,322 sq. kms. and embraces 28.4 per cent area of the region. The Iril river is the largest on the Central plain and meets in the Imphal river at Lilong. The Thoubal river also meets with Imphal river at Irong. It merged with Loktak Lake and further flows down in the name of Manipur river. After crossing the Manipur border, it joins with Chindwin river of Myanmar and finally meets with Irrawady river to merge in the Bay of Bengal. These rivers carry a good amount of silt, which has raised their beds considerably. Discharging maximum quantity of water during the monsoon months, they frequently innundate the land along the river banks.

The Barak river is the main river in the western part of the state with a number of its tributaries, like the Jiri, the Makru, the Irang, the Tuivai and their associated streams, which drain in the northern and western hill areas, have a catchment of 9,042 sq. kms, covers about 40.5 per cent area of the entire region. Its source lies close to the Nagaland-Manipur border. At one point it forms the trijunction between Mizoram, Manipur and Assam. The Barak enters the plains of the adjoining Cachar district of Assam as it bends north-westward and after crossing the low hills of the Bhubon range it flows into Assam.

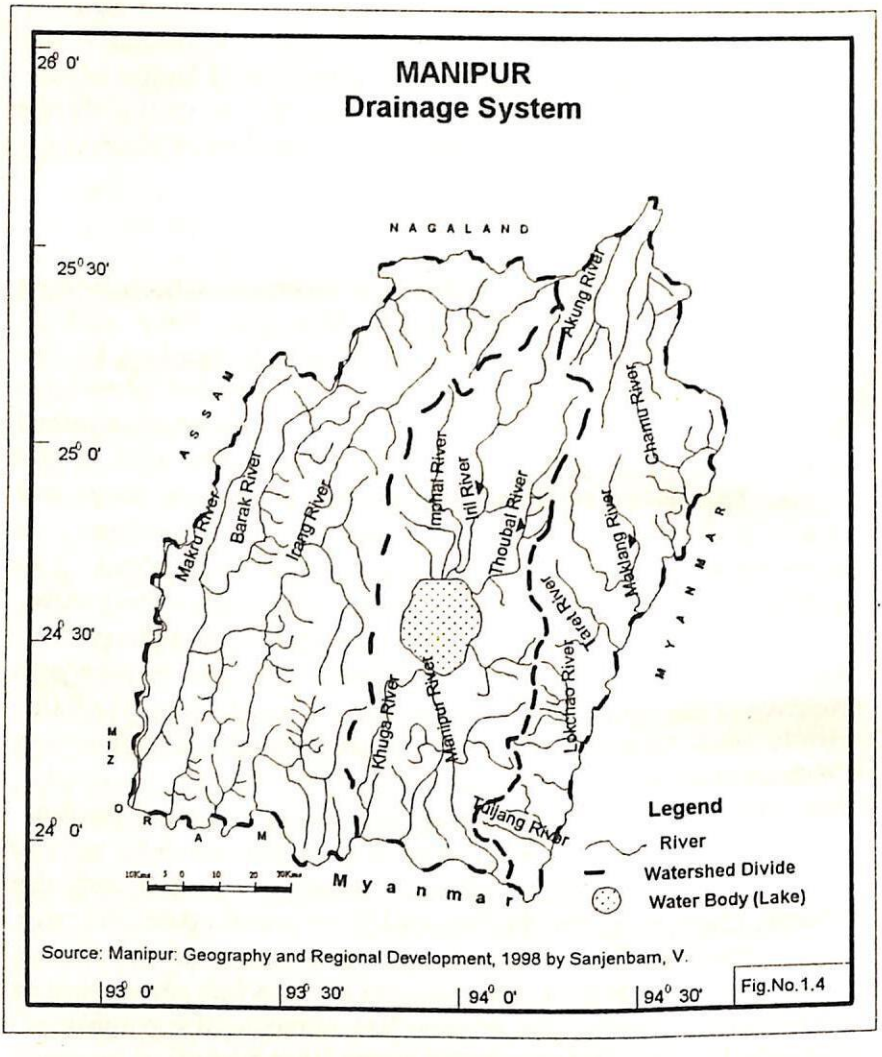

MANIPUR
Drainage System
NAGALAND
ASSAM
MIZORAM
MYANMAR
Myanmar
Makru River
Barak River
Irang River
Imphal River
Iril River
Thoubal River
Akung River
Chamu River
Maklang River
Tarel River
Khuga River
Manipur River
Loktchao River
Kyjang River
Legend
River
Watershed Divide
Water Body (Lake)
Source: Manipur: Geography and Regional Development, 1998 by Sanjenbam, V.
Fig.No.1.4
26° 0'
25° 30'
25° 0'
24° 30'
24° 0'
93° 0'
93° 30'
94° 0'
94° 30'

Figure 1.4

The eastern slopes of the Manipur eastern hills are washed by a number of small streams of Chindwin system, which have a catchment of 6,953 sq.kms., about 31.1 per cent area of the state. River Akonglok and its tributaries—Chamu and Chingai, and river Yu and its tributaries—Maklang, Tuyungbi, Taret Lok, Lokchao, Lailimlok and Tuiyang flowing in sub-parallel pattern through their steeply cut valleys, finally join the Chindwin river in Kabaw valley in Myanmar.

These swift flowing rivers and streams of the state, associated with waterfalls and springs in the hills, and lakes and marshes in the valley, have economic importance for agricultural and industrial growth of Manipur.

There are a number of lakes in Manipur valley besides swamps and marshes along the lakesides and in the inter-riverine tracts. *Loktak, Pumlenpat, Kharungpat, Ikoppat* and *Waithoupat* etc. are important lakes.

1.4 CLIMATE

Manipur enjoys a typical monsoonal climate with variants ranging from tropical to temperate conditions. The rapid changes in topography results in climatic changes within short distances. The foothills, plains, sheltered valleys and the ranges are marked with climatic contrast. The Barak basin and the lower foothills of Manipur western hills have a warmer climate than the central valley and the surrounding hills. Eastern foothills near Moreh bordering with Myanmar is also relatively warmer. The western part of the state has more rain than the eastern part due to its location on the windward slope of the hills.

Cold weather can be experienced even in the month of February but in the month of January, which is the coldest, the temperature in Imphal is between 4° and 20° Celsius. Sometimes the temperature goes down to below freezing point and there is fog and mist in the morning hours during winter. The summer season starts with sudden increase of temperature, vanishing fog and occasional thundershowers. The early part of this season is the pleasant 'spring' season, the period of major festivals and dances in the state. The

Table 1.2: Average Monthly Distribution of temperature (°C) and rainfall (cm) in Manipur (1999)

Stations	Temp./ Rainfall	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	Range of temp.
Imphal (Jiri)	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	–	–	–	–	–	–	–	–	–	–	–	–	–	
Lamphel-pat	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	–	–	–	–	–	–	–	–	–	–	–	–	–	
IFCD-Lamphel	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	Nil	Nil	1.70	Nil	Nil	14.18	21.16	19.92	12.31	Nil	Nil	Nil	69.27	
Raj-Bhavan	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	0.03	0.00	Nil	Nil	Nil	8.15	17.90	18.85	12.08	Nil	Nil	Nil	57.01	
Thoubal-Wangbal	Temp.	15.5	15.5	19.0	24.75	25.5	26.0	26.25	26.0	25.0	23.75	19.0	13.5	18.25	12.75
	Rainfall	0.46	Nil	4.82	1.04	15.11	10.97	22.59	23.38	15.52	8.58	0.84	2.06	105.37	
C.C. Pur-Tuibong	Temp.	8.5	14.0	17.5	22.0	21.0	23.0	22.0	23.0	22.0	19.5	13.5	9.0	14.2	14.5
	Rainfall	1.50	Nil	5.60	5.30	41.0	29.50	35.24	41.82	43.80	26.17	2.60	2.60	235.13	
Tinsong	Temp.	16.0	20.0	20.25	22.50	22.25	22.0	22.5	23.0	22.5	22.75	20.25	17.0	19.75	7.0
	Rainfall	2.0	Nil	5.50	6.22	55.16	34.48	70.29	36.25	50.27	3.01	5.18	8.20	276.56	
Thanlon	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	0.56	0.00	7.08	8.06	48.48	26.53	56.88	64.64	51.46	31.64	6.30	1.54	303.17	
Geljang	Temp.	14.0	18.5	20.0	23.0	26.5	25.5	27.0	27.5	28.0	22.5	14.0	13.5	19.5	14.5
	Rainfall	1.40	0.80	2.00	2.80	11.40	7.10	9.40	7.80	10.80	6.50	Nil	Nil	60.00	
Chandel	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	–	–	–	–	–	–	–	–	–	–	–	–	–	
Temp. Kangpokpi	Rainfall	Nil	Nil	5.51	3.00	46.51	27.70	33.72	65.01	33.91	26.62	Nil	Nil	241.98	
Saikul	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	Nil	Nil	2.51	1.90	45.40	31.30	26.60	49.41	17.50	24.80	Nil	Nil	199.42	
Tameng-Long	Temp.	16.0	–	–	22.5	23.5	25.5	23.0	23.50	–	–	18.5	18.0	–	–
	Rainfall	0.12	–	–	3.60	25.60	41.05	45.10	28.80	–	–	0.10	0.30	–	
Ukhrul	Temp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Rainfall	Nil	Nil	3.65	20.34	14.12	18.00	49.18	20.31	12.30	–	–	–	–	

– Not Available.

Source: Statistical Abstract of Manipur, 2001, Directorate of Economics and Statistics, Govt. of Manipur.

rainy season is associated with heavy rainfall, widespread cloudiness, high humidity and invariably surface winds. The rains heralds the beginning of the agricultural activities. The retreating monsoon season is marked by the gradual decline in rains, clear sky, short duration morning fogs and fair and pleasant weather besides bright sunny days and cool pleasant nights.

Temperature and rainfall data are not available since the last three or four years in Manipur. Data of 1999 assessment is the latest one, in which number of recording centres were not working properly due to recording machines which were found unserviceable. Highest temperature i.e., 39°C was recorded in the month of May in Geljang in Churachandpur district while lowest temperature i.e., 0°C was also recorded at Geljang in December and January. In the valley, 34.5°C was recorded at Thoubal as highest temperature in April and 2°C as lowest temperature in December and January. Thus, April and May are the hottest months in Manipur while December and January are the coldest months.

Same problem is also with the rainfall figures. Numbers of centres have not been working properly and so the annual figures are not known. Highest annual rainfall of 303.17 cm. was recorded at Thanlon centre (Churachandpur district) while lowest rainfall of 57.01 cm. was at Raj Bhavan (Imphal) in 1999. Jiribam recording centre was also not working otherwise it would have given the highest rainfall figure for Manipur.

A year in Manipur can be broadly divided into four seasons. The summer season begins with early March and extends up to May, then the rainy season starts by mid-May up to September. October and November are the retreating monsoon months and the period from December to the end of February is the winter season. The winter and summer seasons are dry while rainy and retreating monsoon seasons are wet.

1.5 SOILS

Manipur is endowed with rugged topography, narrow range of geology, climate and vegetation which governs the

ecosystem and influences the development and behaviour of different kind of soils. It is revealed that the soils have been derived primarily from shales and sandstone. Climate and relief have played a dominant role in the development of these soils. Weathering is intense due to high precipitation under favourable condition of temperature and vegetation. The state comes under the warm per-humid agro-eco region. However, at micro level it can be divided into two distinct sub-eco regions with thermic and hyperthermic temperature regimes. Thus, soils of Manipur are categorized broadly under two heads.

1. Soils of Warm Per-Humid Agro-Eco Zone with Thermic Eco-System

This kind of soils are derived from shale and sandstone and they occur mostly on the hills of varying slopes. Soils occurring on the gently sloping foot-hills are generally deep but vulnerable to sheet and rill erosion hazard. These are well drained soils having greyish brown to yellowish brown colour. They are well developed in some places and qualify for Inceptisols, Alfisols and Ultisols. These comprise of Umbric Dystrochrepts, Typic Haplohumults and Ultic Hapludalfs.

Soils of the steep to very steep hill slopes are very much susceptible to erosion. The texture varies from clayey skeletal to fine and are classified as Typic Kanhapludults, Umbric Dystrochrepts, Typic Udorthents, Typic Haplohumults and Typic Hapludults. These soils are acidic ranging from moderately acidic to slightly acidic with high organic matter content. These soils are highly leached and devoid of bases. The base saturation varies between 14 to 30 per cent.

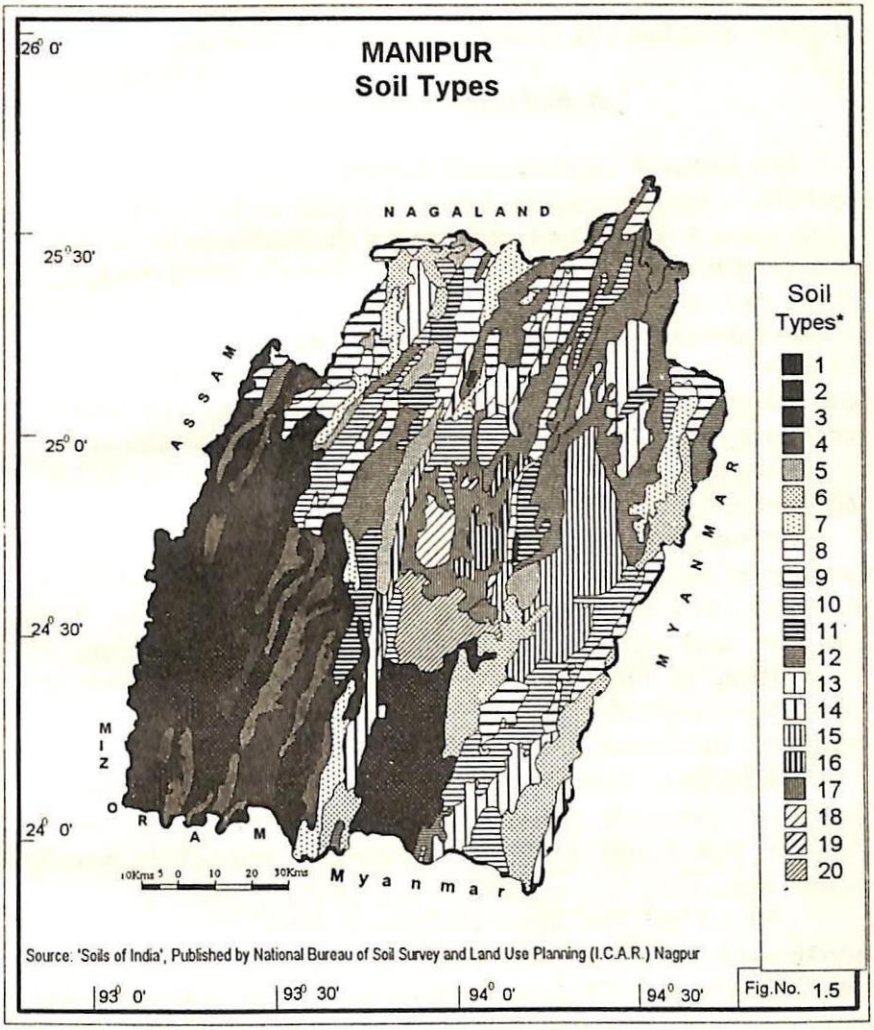
2. Soils of Warm Per-Humid Agro-Eco Zone with Hyperthermic Eco-System

Soils of this region are heterogenous in nature and developed on gently sloping narrow valleys and strongly sloping to moderately steep side slopes of hills with moderate to severe erosion hazards. These are well to excessively drained. The texture varies from fine to loamy skeletal and

Table 1.3: Soils of Manipur

Taxonomic name of soil	Area ('000 hectare)	Percentage to the total area
1. Fine-loamy, Umbric Dystrochrepts Fine, Typic Haplaquepts	29.2	1.30
2. Fine, Typic Dystrochrepts Fine, Typic Haplohumults	331.4	14.81
3. Cleyey-skeletal, Typic Haplohumults Loamy-skeletal, Umbric Dystrochrepts	150.3	6.72
4. Fine-silty,Umbric Dystrochrepts Fine, Typic Haplohumults	97.8	4.37
5. Fine, Umbric Dystrochrepts Fine, Typic Haplohumults	93.2	4.16
6. Fine, Typic Kanhapludults Fine, Ultic Haplududalfs	118.1	5.28
7. Fine, Typic Haplohumults Fine-loamy, Umbric Dystrochrepts	106.0	4.75
8. Fine, Typic Hapludults Fine, Typic Haplumbrepts	86.0	3.84
9. Fine-loamy, Typic Dystrochrepts Cleyey-skeletal,Typic Baplohumults	178.0	7.95
10. Fine, Typic Paleudults Cleyey-skeletal, Typic Udorthents	197.0	8.80
11. Fine, Typic Palehumults Cleyey-skeletal, Typic Udorthents	101.6	4.54
12. Cleyey-skeletal, Typic Udorthents Fine-loamy, Typic Hapludults	307.0	13.72
13. Fine-silty,Typic Udorthents Cleyey-skeletal, Fluventic Umbric Dystrochrepts	184.1	8.23
14. Fine-silty,Typic Haplaquepts Fine, Aquic Dystrochrepts	55.8	2.49
15. Fine, Typic Haplaquepts Fine, Reptic Ultic Dystrochrepts	23.1	1.03
16. Fine,Typic Humaquepts Cleyey-skeletal, Umbric Dystrochrepts	10.9	0.48
17. Very fine, Mollic Haploquepts Fine, Typic Haplaquepts	100.6	4.49
18. Very fine, Mollic Haplaquepts Fine, Fluvaquentic humaquepts	15.7	0.70
19. Fine, Typic Hapludalfs Fine-silty, Typic Haplumbrepts	3.9	0.17
20. Marshy land	43.0	1.92

Source: 'Soils of Manipur' (1987) National Bureau of Soil Survey and Landuse Planning (ICAR), Regional Centre, Jorhat.



*Note: Soil types are denoted by different numbers according to their category given in table no. 1.3

Figure 1.5

classified as Umbric Dystrochrepts, Typic Dystrochrepts and Typic Haplohumults. These soils are moderately to strongly acidic, humus rich and have low base saturation status. Soils developed in narrow valley are deep, poorly drained, fine in texture with slightly erosion hazard.

1.6 NATURAL VEGETATION

The natural vegetation of Manipur mainly consists of forests, which occupies about 70 per cent of the total geographical area. The forest area of the state can be divided into four zones viz., Myanmar border forests along the Indo-Myanmar border occupying an area of about 900 sq.kms., Ukhrul pine forest covering an area of about 1,300 sq.kms. of which good pine forest occupy about 30 sq.kms., forest overlooking the valley and Jiri-Barak drainage forest occupying a total area of about 5,852 sq.kms., of which about 1,300 sq.kms. are covered by tree forest while about 2,500 sq.kms. are covered by bamboo.

Medium to thick tropical deciduous and evergreen forests occupies the hills of Manipur in general. The ground is covered with thick undergrowth of bushes, shrubs, tall grasses and other types of vegetation. The variation of vegetation is marked by growth of specific species at particular altitude. Bamboo forests are common which exhibit a luxuriant growth in lower and gentle hill slopes.

The forest of this state can be grouped into four types viz., (i) tropical wet evergreen, (ii) tropical moist deciduous, (iii) sub-tropical pine forest, and (iv) montane wet temperate forest (Fig. 1.6).

Tropical wet evergreen forests are usually found in the north and south-western parts of Manipur. The annual rainfall here is 2,500 mm. Here luxuriant evergreen forests are found. The main species of trees are bamboo and cane. These forests also contain timber species like *Haldi, Siris, Chaplash, Aini, Agar, Toon, Jarul, Bonsum* and Mango.

Tropical moist deciduous forests are found in the hilly areas of Senapati, Tamenglong, Churachandpur, Ukhrul and along the Indo-Myanmar border. The warm climate and moderate rainfall prevailing in this region is helpful for the

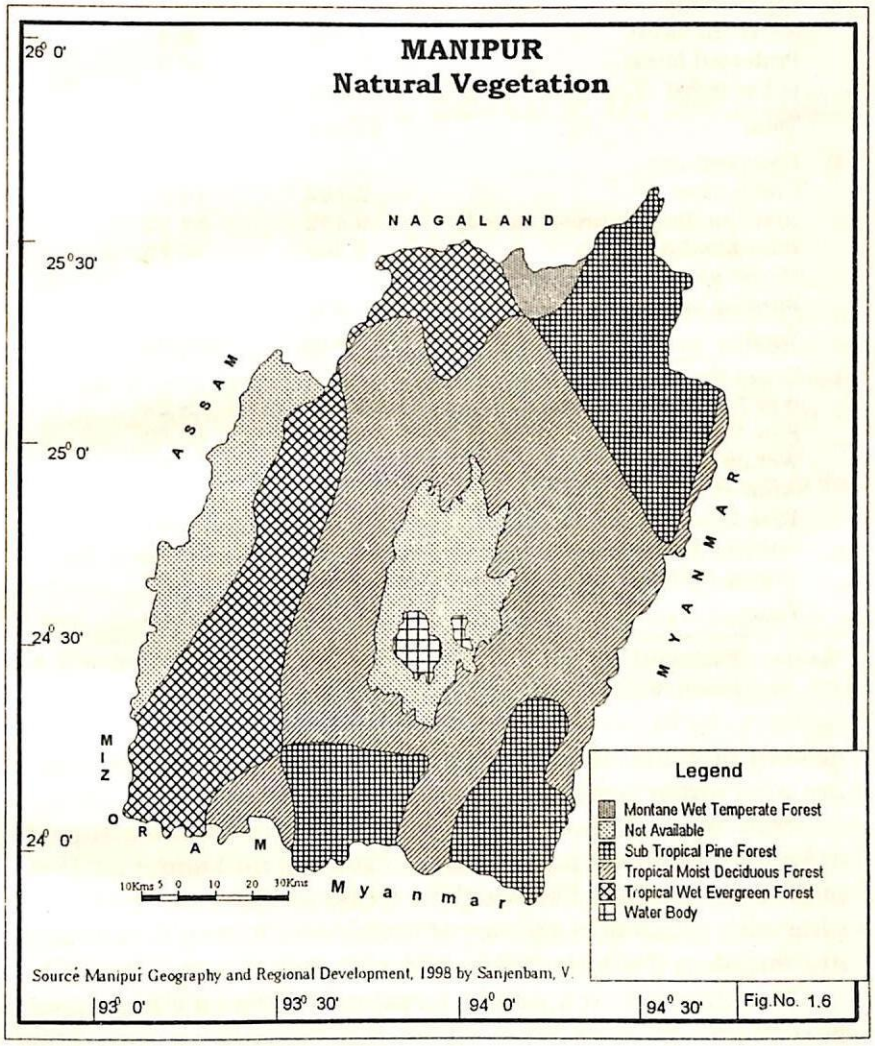

MANIPUR
Natural Vegetation
26° 0'
25°30'
25° 0'
24° 30'
24° 0'
NAGALAND
ASSAM
MYANMAR
MIZORAM
Myanmar
10Kms 5 0 10 20 30Kms
Legend
Montane Wet Temperate Forest
Not Available
Sub Tropical Pine Forest
Tropical Moist Deciduous Forest
Tropical Wet Evergreen Forest
Water Body
Source Manipur Geography and Regional Development, 1998 by Sanjenbam, V.
93° 0'
93° 30'
94° 0'
94° 30'
Fig.No. 1.6

Figure 1.6

Table 1.4: Classification of forest, Manipur (1997-98)

Classification by	Area (sq.kms.)	Percentage to the total forest area
A. Legal status:		
Reserved forest	1,467	8.4
Protected forest	4,171	24.0
Other forest	11,780	67.6
Total	17,418	100.0
B. Composition:		
Coniferous	2,442	14.02
Non-Coniferous (broad leaved)	9,442	54.22
Pure bamboo brake	3,268	18.76
Under storey and clump forming bamboo	2,264	13.00
Total	17,418	100.00
C. Types (Broadly)(FSI-1995)		
Wet Temperate forests	1,451	8.23
Pine forests	2,443	13.86
Wet hill forests	9,057	51.40
Semi-evergreen forests	645	3.66
Teak Gurjan forests	611	3.47
Bamboo brakes	3,268	18.55
Grassy blanks	146	0.83
Total	17,621	100.00

Source: *Statistical Bulletin*, 1997-98, Forest Department, Government of Manipur.

growth of valuable teak trees. Oak, *Kangin, Khen* and *Toon* are also important timber species of this forest.

Sub-tropical pine forests are found in north-eastern part of Ukhrul, south-eastern part of Chandel and some portion of Churachandpur districts. Pine trees, particularly the Khasi pine with important species of orchids including Shirui Lily are found in the area along with oak and chestnut trees.

Montane wet temperate forest cover the northernmost part of Senapati district, where oak trees are grown very widely.

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