CHAPTER II

ECOLOGICAL SETTING

The State of Nagaland is located in the extreme north-eastern part of India, which was inaugurated on the 1st. December 1963. It lies between 23°12' N. and 27°2' N. latitude and between the longitudinal lines 93°20' E. and 95°15' E. having an area of 16,579 km². The State is bounded by Assam in the north and west by Burma and Arunachal Pradesh in the east, Manipur in the south and runs more or less parallel to the left bank of the Brahmaputra river.

The population of the State according to the census of 1981, is 7,74,930 living in 1,112 villages and 7 towns. The density of population is 47 persons per km². The peoples are mostly tribal and 72.36 per cent of the working force engaged in agriculture. The topography is very severe, full of hill ranges except some areas of fertile level ground of the valley provides ample opportunity for agriculture.
NAGALAND
PHYSIOGRAPHIC FEATURES

SCALE:

10 5 0 10 20 30 Km

INDEX:

INTERNATIONAL BOUNDARY

STATE BOUNDARY

HIGH HILL

LOWER HILL

PLAIN OR FOOT-HILL

HEIGHT IN METRES

△2500 m
2.1 Physiography

2.1.1 Geological Formations:

Nagaland has an interesting geological history. The rocks are comparatively young being of Tertiary origin. According to geo-scientists, this region was under ocean which existed between India and Burma. The land which now joins India and Burma did not exist at that time but came up much later.¹

Marine deposition took place on that ocean floor layer after layer which is now represented by Disang group formation giving rise to shale, sandstone, phyllite, slate and limestone. These rocks contain fossil remains of various marine organisms which thrived in the sea. Besides marine deposits there were volcanic activities in the basin. It has been proved by the existence of igneous rocks in the eastern part of the State. The area remained submerged till the Eocene period, that is 65 million years back. When a powerful crustal movement initiated the first phase of mountain building activity. The sedimentary and volcanic rock layers were finally uplifted due to compressive forces.

from the ocean floor. Thus forming the first folded mountains. During this process the water receded to the south into the present Bay of Bengal.

The first orogenic movement was partial because between the newly formed mountains the water continued to remain. Again in these basins sedimentation took place which is today known as the Barail group formation. Numerous fossils of ancient flora and fauna are present in these rocks. Such rocks are found mainly in the eastern region of the State, especially in places like Pfutsero, Melure, Kiphire, etc.

After the formation of Barail, Surma and Tipam groups of rocks, a second orogenic movement took place in this region which gave rise to the more north-east to south-east trending hill ridges and valleys. The hills of this orogenic movement are higher than the previous one. This movement took place during the period of Oligocene, Miocene and Pliocene.

The third orogenic movement occurred during the Pleistocene and Recent periods, only eight million years ago, and it shaped the present topographic features.

It may be noted that all these three major orogenic movements are contemporaneous to the great
Himalayan mountain building activity.

In the eastern region of the State, there are rocks which are of comparatively ancient formation like Mini and Zepuhu formation which are formed during the Palaeozoic and Mesozoic periods. These two belts bear some minerals of economic importance. The largest limestone deposit of the State occurs in the Mini formation.

Earthquake are common in this Nagaland, the State being within the tectonically unstable belt of the Eastern Himalaya.

2.1.2 Relief:

Nagaland which was once submerged in the deep Tethyan sea, present a complicated structural and physical features and the formation of land mass may be correlatable with the young fold mountains of Alpine-Himalayan orogeny as a result its topography is similar to that of any other young mountain terrain featured with high hills, sharp crest ridges, deep gorges and narrow valleys. The hills are a continuation of the Burmese arc being joined with the sub-Himalayan ranges in the north. The ranges stretch in general from north-east to south-

* The above information is based on the findings of the Directorate of Geology and Mining, Govt. of Nagaland, Misc. Publication, No. 1, 1978.
The altitude of various places in the State ranges almost from approximately 110 metres in the comparatively plain areas bordering Assam to about 3826 metres in the eastern high ranges.

Broadly the State can be divided into three physiographic divisions: (1) The plain or the foothills in the extreme west and north-western side of the State. (ii) Lower hill ranges in the intermediate zone. (iii) The high hills in the east.

The hills of Nagaland rise from the plains of Assam. These hills are low and there are plains in the outer foothill areas in the west as well as in the north-west. In Kohima district Dimapur plain is the most important area which starts from Chumukedima and merges into the plains of Sibsagar district of Assam. Its area is about one hundred and fifty square kilometres. It is situated in the south-west of the State. Another plain is found around Naginimara in the mid-west of the State. The plain starts from Morjan colliery and extends up to Dikhu river lying to the west. The area of this plain is about fifty square kilometres. It is an important business centre for the Konyak Nagas. The third plain is situated in Mon district around Tijit in the north-eastern side of the State is about seventy-five square kilometres in area.
From foothills the altitude increases eastward up to Saramati range which forms the international boundary with Burma. Between the plains adjoining Assam and the high mountain ranges in the extreme east there lie the hill ranges which gain altitude as one goes deeper from 600 metres to 900 metres. In the outlying hilly tract there are a few valleys, especially along the western side of the State, which have an average altitude of about 300 metres. Of these valleys the important ones are the Ghaspani Valley in the Kohima District, the Baghty Valley, the Bhandari Valley and the Merapani Valley in Wokha District, the Lakhumi and Tsurang Valleys in Mokokchung District, and finally the Tiru Valley or Tirupathar in Mon District. Rest of the region is hilly with only occasional small valleys here and there.

There are a number of high mountain ranges in the east which are parts of the Patkai and in the south which form the Barail. The altitude of Saramati lying near the Burmese border is 3626 metres. The Barail range enters the State at the south-west corner and runs in a north-easternly direction beyond Kohima to merge with the Patkai. Its highest peak near Kohima is Japvo (2995 metres).

2.1.3 Drainage Systems:

The topography of the State being hilly breaking into a wide chaos of gorges, spurs and ridges, there are many
small rivers. Many of them dry up during the winter season but roar torrentially in rainy season.

2.1.3.1 Brahmaputra Drainage System: (i) Doyang is the largest and the longest river of this State, originating from the Barail Range near Mao and flowing northward through hair pin bends to open into Dhansiri in Assam. The principal tributaries near the mouth are Dzulu and Sidju in Kohima District. The Angami people called it as Dzulu. As the river turns west it is joined by its largest tributary Rengmapanl in the wokha District. During the later stage it suddenly turns westward and then debouches into the plains and finally falls in the Dhansiri river in the Assam plain.

(ii) Dhansiri river rises in the south-west of the State. It first flows westwardly and then takes a northwardly course forming a natural boundary with North Cachar Hills. Having crossed North Cachar, it bends eastwardly and flows past the Rangapahar and Dimapur plains in Kohima District and then flows on northwardly until it falls into the Brahmaputra at Dhansirimukh. Important tributaries of this river inside the Nagaland are Intanki, Barimongla, Taham and Jarnapani.

(iii) Milak is one of the important rivers which originate in the heart of Mokokchung town itself at an
altitude of about 1,300 m. It flows northward and finally turns westward in the plains of Assam. An important tributary of Milak is Tsurong. It rises east of Lakhumi village and joins Milak which is known as Jhanzi in Assam.

(iv) Dikhu rises from the northern flanks of the Murato mountain in the Sema area. It is known as Longa or Nanga to the Semas and as Tsula to the Ao. Flowing westward from the Sema area it enters the Ao area west of Longsa village, then it flows northward forming a natural boundary between the Ao on the one hand and the Sangtam, the Phom and the Konyak on the other. It flows through the hills of Konyak area and finally leaves for the plains near Naginimara. Namung and Yanyo are its important tributaries. Further north, there are rivers like Tihu and Tarhok which pass through the districts of Tuensang and Mon.

2.1.3.2 Barak Drainage System: The Barak river itself which originates from the springs of Yumai or Liyai village in the Mao-Naga area in Manipur does not fall within Nagaland. But it has many tributaries which fall within Nagaland. Of these Tasanghi and Sulen are important. Apart from these there are many small tributaries to it which wash the southern slope of the Barail Range falling within Nagaland.

2.1.3.3 Chindwin Drainage System: The south-eastern part
of Nagaland between the Patkai and the Barail Ranges are
drained by the tributaries of the Chindwin River of
Burma. Of these the most important one is Timu which
first flows towards the south and then through successive
right-angled turns reaches Burma. Timu has been fed by
Zungki from the north, which in its turn is fed by
Tsohyemung and Lamiye on the east. The Timu river forms
an important drainage system in the eastern part of the
State and assumes a special significance as it exposes
the ophiolite complex of Nagaland in its deep gorge sec-
tions providing vital geological data.

2.1.3.4 Lakes and waterfalls: Lakes are few in the State.
The very important and natural lakes are: Lecham, a
natural lake in eastern Chakhesang, east of Meluri. Totsu
Wozhu is also an important lake in Wokha district but it
covers only about an acre of land. Many varieties of
hill fish abound this lake and during leisure, people
enjoy angling here. There are small natural lakes also in
the Sanis and Mekokla areas.

In Mokokchung district, there are only two
important natural lakes. One of them is Omoklushi (also
known as Omom Mulu). This is situated at the outskirt of
Chuchiyiispang village. This lake is a beauty spot near
the town of Mokokchung. The other lake is found near
Mapungshuket village and is known as Yimyu Awatsung. Both the lakes are situated at an altitude of about 1,300 metres above sea level and have sparse aquatic vegetation.

At Dimapur, there are historical relics and tanks belonging to the old Kachari Kings. The most important tanks are: (a) Bongola Pukhuri (b) Padum Pukhuri (c) Jor Pukhuri and (d) Bason Pukhuri. In the western part of the State adjacent to the Assam plains there are swamps and marshy tracts some of which are used for terrace cultivation.

Many small waterfalls appear during rainy season in the State. Most of these are rapids and cataracts occurring on the rock beds of unequal resistance. Similarly there are a number of small springs especially around the foothills which are the source of drinking water in many rural areas in Nagaland.

2.2 Climate

The climatological data are conspicuous by their absence in Nagaland. Long term data are not available, while, whatever recent data are found, are not much dependable.

The climate of Nagaland has been very much controlled by the seasonal winds as in other parts of the country.
The seasonal winds are the South-West Monsoon and the North-East Winds. The climate of the State is tropical monsoon modified by local factors like altitude, location of the area, direction of the prevailing local winds and seasonal rhythms. The average annual rainfall varies from 150 cm to 280 cm and the temperature varies from 0°C in winter to about 35°C in summer. Occasionally extreme weather may also prevail but this is only of short duration.

2.2.1 Temperature:

Maximum temperature even in the hills may rise up to 25°C in July while the minimum may go down to 4°C in December (Tables 2.1 and 2.2). There is however, regional variation in temperature. In the foothills and the plain areas adjoining the Brahmaputra Valley, the places around Dimapur, Tuli, Tijit and others temperature is more and it is not a limiting element to cropping. It may be noted in this context that the favourable temperatures for growing rice and many other crops are 16°C to 24°C during the growing period and more than 25°C for ripening. As it is evident from the temperature figures assembled in Tables 2.1 and 2.2 the temperature is little below requirement, especially for ripening of paddy. The length of growing season in the foothills are shorter than
CLIMOGRAPH
KOHIMA AND PFUTSERO
1973

KOHIMA (ALT. 1444 m)  
PFUTSERO (ALT. 2134 m)

RELATIVE HUMIDITY

FIG: 1
<table>
<thead>
<tr>
<th>Month</th>
<th>Maximum °C</th>
<th>Minimum °C</th>
<th>Mean °C</th>
<th>Range °C</th>
<th>Relative humidity in percentage</th>
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Table 2.2

Pfutsero


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<th>Maximum °C</th>
<th>Minimum °C</th>
<th>Mean °C</th>
<th>Range °C</th>
<th>Relative Humidity in percentage.</th>
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<tr>
<td>March</td>
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<td>11.6</td>
<td>16.9</td>
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<td>13.4</td>
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<td>55</td>
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<td>15.0</td>
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<td>90</td>
</tr>
<tr>
<td>August</td>
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<td>78</td>
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<tr>
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<td>2.0</td>
<td>7.9</td>
<td>11.8</td>
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Total 234.3 59.0 146.8 175.3 838

Monthly mean 19.5 4.9 12.2 14.6 69.8

in the hilly regions which clearly indicates that the temperatures are higher in the foothills and the plain areas. 'The two best indicators of regional differences in temperature currently available are length of growing season and accumulated temperatures above the minimum for plant growth.'

Table 2.1 and 2.2 show five variables, maximum, minimum, mean and range of temperature in °C and relative humidity at two different centres in various months of the year 1973.

Kohima, the capital of the State which is situated at an altitude of 1,444.12 metres experience a maximum of 25°C in July and a minimum of 4°C in December. Thus the annual range is about 21°C. Pfutsero station is situated at an altitude of 2133.60 metres. Incidentally this is the highest town in Nagaland located at the distance of 70 km from the capital, Kohima. It experiences a maximum temperature of 23.4°C in July and a minimum temperature of 2°C in December.

2.2.2 Pressure:

The average pressure in Nagaland during the cold season is around 1016 mb. which is higher than that of the other seasons. The pressure tends to decrease with

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the onset of the monsoon. In August the pressure decreases to 1002 mb. From the month of September the pressure tends to rise. Such fluctuation of pressure has a great influence on the velocity and the direction of the wind. However, the region is located in a high pressure area as can be seen from the isobars which are above normal throughout the year.

2.2.3 **Relative Humidity:**

Relatively dry winter and wet summer are the major features of this region. The northerly winds and the south-west winds are mainly responsible for this seasonal variation. During winter season from December to February clear sky, fine weather, light northerly winds, lower humidity and temperature are normal features in the region. During summer from June to September the temperature and relative humidity begin to rise accompanied by heavy showers and violent storms. In July, August and September which are the rainiest months, both the relative humidity and temperature are at their maximum. Climographs of Kohima and Pfutsere centres illustrate the climatic conditions of the area. (Fig. 1).

2.2.4 **Rainfall:**

The annual rainfall of Nagaland is on the average 200 cm and the number of rainy days is 160. Bulk of the
Rainfall is concentrated to the months of July and August. There is an aerial variation in rainfall. The northern part of the State receives a higher amount of rainfall than the southern part.

The South-West monsoon sets in the middle of June and continues up to the middle of September. It brings rain mostly in showers. During this period the region receives more than sixty per cent of its annual rainfall. In August the highest rainfall is recorded at Wokha station which is 1108.5 mm but in the same year it was only 4.5 mm in the same station in November. Other stations such as Zunheboto and Mon also receive considerable amount of high rainfall (Appendix 1). The other centres (Tables 2.3 and 2.4) show relatively low average rainfall distributed again over relatively less rainy days. Frost falls in Zunheboto, Phek, Pfutsero, Tuensang and several other high places. During winter season, December to February, weather is normally clear and rainfall is absent except occasionally. Thus in this region practically two seasons, winter and summer dominate the year. Spring and autumn are nominal and shortlived.

Rainfall like temperature is an important determinant of agricultural or pastoral utilization of the land. The rainfall data of Nagaland (Tables 2.3 and 2.4) are
### Table 2.3

Nagaland

Rainfall and Its Intensity

<table>
<thead>
<tr>
<th>Month</th>
<th>Dimapur, 1973</th>
<th></th>
<th>Phak, 1982</th>
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<td></td>
<td>Rainfall in mm</td>
<td>No. of Days</td>
<td>Intensity in mm</td>
<td>Rainfall in mm</td>
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<td>January</td>
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<th>No. of Days</th>
<th>Intensity in mm</th>
<th>Kiphire Rainfall in mm</th>
<th>No. of Days</th>
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<td>October</td>
<td>123.0</td>
<td>10</td>
<td>12.3</td>
<td>107.8</td>
<td>15</td>
<td>7.2</td>
</tr>
<tr>
<td>November</td>
<td>14.0</td>
<td>2</td>
<td>7.0</td>
<td>44.2</td>
<td>6</td>
<td>7.4</td>
</tr>
<tr>
<td>December</td>
<td>34.0</td>
<td>2</td>
<td>17.0</td>
<td>33.7</td>
<td>4</td>
<td>8.4</td>
</tr>
</tbody>
</table>

| Total    | 1923.0                    | 143         | 148.6           | 1265.9                 | 145         | 97.1            |

| Monthly mean | 160.2 | 11.8 | 12.4 | 105.5 | 12 | 8.1 |

being used to work out the daily average intensity. The distribution of rainfall in different areas in Nagaland is shown in (Appendix 1). The maximum intensity (Table 2.3) has been recorded at Dimapur 22.5 mm in August but the annual mean intensity is only 11.4 mm. Phak has the maximum intensity of 12.7 mm is in February. The highest intensity 25.3 mm in August was recorded at Ongpangkong, where annual average intensity is 12.4 mm. In Kiphire the highest intensity 12.1 mm is in July where annual mean intensity is only 8.1 mm. At Amhebote the highest intensity of all the centres 37.7 mm is recorded in September followed by Wokha 35.7 mm which experiences it in August. On the whole, the intensity is at its maximum in the monsoon months.

Most of the monsoon rainfall is wasted in run-off and there is much soil erosion as the region is hilly with steep slopes. Thus topography and the soil is mainly responsible for agricultural backwardness.

2.2.3 The Seasons:

Seasonal changes in climate exerts a great influence on economic life of the Nagas, especially on agriculture which is the main occupation of them. The seasons are characterised more by the differences in the amount of rainfall than temperature.
On the basis of rainfall, temperature and wind velocity and direction the year may be conveniently divided into the following four seasons:

(i) Cold weather season or winter season (December to February).

(ii) Hot weather season or spring season (March to May).

(iii) South-west Monsoon or summer season (June to September).

(iv) Retreating South-west Monsoon or Autumn season (October to November).

(i) Cold Weather Season or Winter Season: The cold weather season starts early in December. During these months the weather is bracing. Here the cool continental winds set in driving away the patches of strato-cumulus clouds from the sky heralding clear and fine weather. Few drops of rain, low humidity and temperature are the normal features of this season. The mean temperature during this season varies from 8.6°C to 13.4°C. The humidity is low, being 60 to 70 per cent. Condensation of water vapour is common with dense fogs sometimes lingering to late forenoon. Rainfall is at its lowest during this season and January is the driest month when only 4 mm rainfall is recorded at Dimapur. The winter is quite severe with minimum temperature coming
down sometimes to 1\textdegree{}C in some places during night time. Sometimes due to the passage of western disturbances travelling eastwards the serenity of the weather is disturbed and some rainfall accompanied by light storms may occur.

(ii) **Hot Weather Season or Spring:** Towards late February temperature begins to rise and appreciable heat begins to prevail from March. Thereafter temperature rises quickly and the cold weather season changes to warm weather and the high pressure of the cold season gradually changes to a low pressure. The mean temperature of the period is 17.3\textdegree{}C and the mean range of temperature is about 11.6\textdegree{}C. The relative humidity varies between 40 per cent in March and 78 per cent in May. Local thunderstorms occasionally occur during this period which give some rainfall. Sometimes hailstorms occur in March and April. During the hailstorm the temperature falls down suddenly and the weather becomes cold.

The earlier part of this season is bracing and pleasant. Although the weather is fine in this period the air is polluted by the smoke that comes out from the burning of jungles and jhum fields.

(iii) **South-West Monsoon or Summer Season:** The rainy season sets in by the second week of June and continues up
to September. The rhythmic character of the monsoon rainfall is significant to the people of Nagaland as they are basically agriculturist and agriculture cannot be carried out without adequate rainfall. Sometimes the rain may be early and sometimes late. If it last longer with prolonged breaks of rains the results may be disastrous to crops.

During this period at times the relative humidity goes up to 90 per cent and as such it is rather damp during summer. In the foothills the temperature varies from 30°C to 35°C while on the even it may rise up to 25°C. The highest monthly rainfall recorded during this period is 1108.5 mm in the month of August at Wokha. Violent local storms often occur in these areas where humid winds from the Bay of Bengal meet the hot dry land winds. These storms are often accompanied by violent winds, hail and torrential rains. There is severe land erosion in the hilly regions as a result of heavy downpour.

(iv) **Retreating South-West Monsoon or Autumn Season:**
Towards the end of September the rainfall begins to decrease in frequency as also in quantity. Side by side, temperature also decreases. The cool winds begin to blow from the high Patkai range which lies to the east of the State. This wind gets mixed up with North-East
winds and it brings down the temperature substantially in the eastern region. Thus the autumn season sets in. In this period the highest temperature (21.6°C) is recorded at Kohima and the lowest (7.6°C) at Pfitsero. The mean relative humidity is about 77 per cent. Sometimes during this season temperature, relative humidity and pressure may change suddenly causing storms and light cyclones.

2.3 Soils

The large variation in altitudes ranging from 300 metres to 3,300 metres have given rise to diversity in climate and vegetation within this small territory. These, coupled with the geological formation have influenced the process of soil formation.

Soils of Nagaland are derived from tertiary rocks belonging to Barail and Disang series. The Barail consist of alternating layers of sandstones and shales with carboniferous intrusions or even coal seams. The under­lying Disang series represent unfossiliferous shales, slates and phylites.

The valleys and the foothills are made up of alluvial and colluvial soils. In the higher altitudes and in the higher ranges there are mainly residual soils. In the hill slopes, the soils of the lower ranges are subjected
to stronger weathering than those over the high altitudes. The hill slopes of the temperate region are very rich in organic matter, while those developed under pine forests do not exhibit accumulation of organic matter. Soils are generally fertile and responsive to application of fertilizer. Soils are acidic, very rich in organic carbon but poor in phosphate and potash content. The pH value ranges between 4.80 to 6.50, while the organic carbon content may be as high as 2.943 per cent. The average phosphate and potash content are 20 kg/ha and 120 kg/ha respectively.

The soils of Nagaland have been tentatively grouped into four orders, namely, entisol, oxisol, mollisol and spodosol.

2.3.1 Entisol:

The alluvial soils occurring in the valleys have been grouped under this order. It can be again sub-grouped into recent alluvium, old alluvium and mountain valley soil. The total area covered by this group of soil is about 2,241.8 km². This group of soils is the most important for agriculture.

2.3.2 Oxisol:

This group is constituted mainly by non-laterised red soils of the foothills, lower ranges and lateritic
NAGALAND
SOIL MAP

REFERENCES:
- INTERNATIONAL BOUNDARY
- STATE BOUNDARY
- DISTRICT BOUNDARY
- STATE CAPITAL
- DISTRICT HEADQUARTERS

SOIL INDEX:
- ENTISOL pH 4.4-6.6
- OXISOL pH 4.2-4.5
- MOLLISOL pH 5.3-5.8
- SPodosol pH 5.4-6.0
soils of the foothills. This group of soils covers an area of approximately 4,495.8 km². The subsurface horizon of this group of soils is characterised by low base exchange capacity, friable and massive structure and accumulation of iron and aluminium. These soils occur over the foothills and lower ranges on the west more or less up to an altitude of 750 metres from the sea level. These soils are under degraded grass and bamboo forests.

2.3.3 *Mollisol:* 

This group of soils are in fact forest soils of the high altitudes supporting temperate evergreen broad-leaved rain forests. These soils occur over cool and temperate areas and are characterised by high organic matter and high base saturation. The subsurface also has high base saturation higher than that in the entisol and oxisol. The area covered by this order is about 4,952.7 km².

2.3.4 *Spodosol:* 

These soils occur over high altitudes with humid and temperate climate but under coniferous vegetation and are characterised by a subsurface horizon with high cation exchange capacity and high base saturation. Here the mean pH value is 5.7. These contain 1.804 per cent
of organic carbon with 54.3 per cent of base saturation. The area covered by this group of soils is about 4,833.0 km$^2$.

2.3.5 Soil and Crops:

The main food crop in Nagaland is rice. It is well cultivated mainly in the entisol where the pH value is comparatively less (mean 4.5). These places are found in the western part of the State bordering Assam. In other parts of the State rice is cultivated with the help of irrigation in the form of terrace cultivation. In the higher altitudes where the soils are of mollisol and spodosol groups and the pH value is comparatively high, people practise mainly Jhum cultivation. Other food crops are millets, yam, jobs tears, maize and pulses. In the northern district of Mon where all the three types of soils viz. entisol, oxisol and mollisol are found, yam and taro also constitute important food crops. Other crops such as potato, chilli, fruits, vegetables, mustard, sugarcane and soyabeen, etc. are also grown in many parts of the State irrespective of soil qualities.

2.3.6 Soil Erosion:

Among the problems associated with soil such as soil erosion, infestation with weeds, salinity, alkalinity and water-logging which lead to deterioration or depletion
of the land resources, soil erosion is the most serious because it affects by far the largest area in the State.\(^3\)

Since the entire State is hilly, land is prone to soil erosion. There are nearly 6,00,000 hectares of Jhumland which are subjected to severe soil erosion. With the increase in the pressure of population on land and also advent of such developmental programmes as construction of roads, houses, etc., the hazards of soil erosion are on the increase. There are mainly three types of soil erosion in the State:

(a) Sheet Erosion: Occurring mostly over the Jhumlands which are denuded of the vegetative cover and abandoned after 2-3 crossings.

(b) Gulley Erosion: Occurring mostly over the areas of steep slopes and soft soils.

(c) Sinkage, landslips, etc.: Occurring over the vulnerable areas of geological faults and fissures. These may also occur due to moisture saturation of clayey subsoils over impermeable layers and displacement of the centre of gravity of the overlying mass.

In Nagaland, soil erosion is a serious problem. It is so because the slope of the land is steep, the soil is of the recent origin as a result of which the erodibility of the soil is more, the intensity of the rainfall is also high, the vegetative cover is less because of the Jhum cultivation and burning of jungles. Further, no proper soil management and maintenance are practised. It has been felt that there is an urgent need for soil conservation by preventing soil erosion. The most needed measures are contour-bunding, contour-ploughing, terracing, creation of vegetative cover on the erosion-prone land, rotation of crops and planting of legumes and other soil enriching crops.

2.4 Flora

The natural vegetation of the region as that of any other mountainous region within the monsoon belt, varies with changes in the topographic features, altitude and soil. Thus, varieties of flora varying from the aquatic species to those growing in high altitudes are found here.

It is evident from the accounts of J.W. Master, a botanist, who visited Nagaland in the year 1844 that, the area was an ideal home for many species of
### Table 2.5
**Nagaland**

**Types of Forest, 1982-83**

<table>
<thead>
<tr>
<th>Forest type</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reserved forests (original)</td>
<td>9,053</td>
<td>3.14%</td>
<td></td>
</tr>
<tr>
<td>(ii) Reserved forests (purchased)</td>
<td>19,491</td>
<td>6.76%</td>
<td></td>
</tr>
<tr>
<td>2. Protected forests</td>
<td>50,751</td>
<td>17.61%</td>
<td></td>
</tr>
<tr>
<td>3. Village forests</td>
<td>1,87,832</td>
<td>65.16%</td>
<td></td>
</tr>
<tr>
<td>4. Wild life sanctuary</td>
<td>21,125</td>
<td>7.33%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,88,252</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

**Ownership**

<table>
<thead>
<tr>
<th>Ownership</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. State</td>
<td>1,00,420</td>
<td>34.84%</td>
</tr>
<tr>
<td>2. Private</td>
<td>1,87,832</td>
<td>65.16%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,88,252</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

**Composition**

<table>
<thead>
<tr>
<th>Composition</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coniferous</td>
<td>25,900</td>
<td>8.98%</td>
</tr>
<tr>
<td>2. Non-coniferous</td>
<td>1,86,517</td>
<td>64.71%</td>
</tr>
<tr>
<td>3. Bamboo</td>
<td>75,835</td>
<td>26.31%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,88,252</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Source: Chief Conservator of Forests, Nagaland.
flora. It is also noted that the area was once covered by a thick evergreen canopy of vegetation. But continuous onslaughts by men, clearance, heavy exploitation and devastation caused by burning jungles have destroyed the natural vegetation to a great extent. 'Tribal economy is intimately connected with the forests and their economy. This relationship has been recognised, but has not been articulated in terms of clear policies and programmes. The tribal economy and the forest economy, therefore, have tended to drift apart with adverse implications to both. In some cases, the forest have suffered tremendous loss while in others, the tribal economy has been shattered. Because of the people's apathy and the absence of proper policies and their implementation for conservation of natural vegetation, the vast forests have dwindled considerably. The problems have become more acute because of the increase of population pressure on land.

2.4.1 Types of Natural Vegetation:

Nagaland has both evergreen and deciduous vegetation as determined by climatic and pedologic conditions.

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There are tall trees, shrubs and herbs. The grasses which are of deciduous character invariably dry up in winter. The vegetation types differ from foothills to hills and hills to to high hill tops. Based on all these conditions, the natural vegetation of the State can be group into five types, viz., (a) Sub-tropical moist deciduous forest including bamboo, (b) Sub-tropical evergreen rain forest, (c) Temperate evergreen highland forest, (d) Coniferous forest and (e) Degraded regrowth forest (Map 7).

(a) Sub-Tropical Moist Deciduous Forest Including Bamboo:

This type of natural vegetation is found in the plains of Dimapur, western lower hills of the districts of Wokha and Mokokchung. The average annual rainfall in this zone is about 180 cm to 200 cm, while the mean annual temperature varies from 20°c to 25°c. The average altitude of this area is about 600 metres. Some of the important species of this group are Hollock (Depteroearpus Terminalia myriocarpa), Bhalu (Tetrameles nudiflora), Hollong (Dipterocarpus macrocarpus) and varieties of orchids, medicinal herbs and edible plants are also found in this region.

The sub-tropical moist deciduous forests in Nagaland contain many bamboo forests which are found in the extreme western part of the State bordering Assam especially in the Jaluki region and in a small area in the upper catchment region of the river Barak bordering Manipur.
(b) **Sub-Tropical Evergreen Rain Forest:** This type of vegetation is found only in the north-western part of Mon district. This area (especially that around Tijit) is the most important lumbering region in the State. There are many valuable trees in this region and at the same time the area is comparatively plain. This has facilitated the development of transport system. Some of the valuable trees of this region are Badam (Mansonia dipikai), Dhuna (Canarium resiniferum), Hollong (Dipterocarpus macrocarpus), Jamuk (Eugenia jambolana), etc.

(c) **Temperate Evergreen Highland Forest:** This type of forest comprises mainly all the eastern parts of the State bordering Burma. Another area of this type of vegetation runs through the middle of Tuensang district from north to south. Again there are small patches of this vegetation found in the south of Kohima and in Temning area of Peren sub-division. Further this type of vegetation is also seen in a small area in Wokha district in the southern part and a small area in eastern Mokokchung district. These forests cover the highest hill ranges in the State like Saramati and Japvo. This type of vegetation form thick forests. Some of the valuable trees of this group are Bogipoma (Chikrassia tabularis), Oak (Quercus serrata), etc. The altitude in which this vegetation is found is higher than any other region but the rainfall and temperature are comparatively less.
(d) **Coniferous Forest:** This type of forest is found in the middle and eastern part of the Phok district as well as in the Kiphire region in Tuensang district. Here the dominant tree is *Pinus khasya* (*Insularis*). Besides this there are also other valuable trees. These trees are tall evergreen coniferous with soft white suitable for planks, packing cases, wood pulp and matches. The region is situated at higher altitudes about 1,200 metres above sea level.

(e) **Degraded Regrowth Forest:** A look into the forest map of Nagaland, shows that a large area is used for *Jhum* cultivation. In the process of *Jhumming* large forest areas are cleared and burned. After using for two to three years the areas are abandoned, which will then support only grasses, shrubs and creepers as secondary growth.

There are in Nagaland some swamps and marshy tracts which support marshy and aquatic vegetation like water hyacinth, water lily, lotus, etc.

The State has three reserved forests, viz. Singpham in the north-eastern part, Kangapahar and Intamki in the south-western part.

2.5 Fauna

Fauna of any region is of tremendous importance
far as the ecological balance is concerned. But because of the recent illegal felling of trees and burning of jungles in Nagaland, there has been a rapid depletion of wild life in the State.

Major part of the State being covered by forests and jungles, it is natural that there should be a rich animal life. But after the introduction of guns especially after the second world war, the wild life has been killed indiscriminately.

Like any other part of the monsoon region the common invertebrate found in the area belong to the following classes: (i) Phylum Arthropoda which consists of common insects like common fly, mosquito, economic and uneconomic bee, butterfly, mantis, shrimps, grasshopper, etc. (ii) Phylum Mollusca includes various sub-species of snails and (iii) Phylum Annelida includes earthworms of various varieties.

As the region is traversed by many small rivers, fish was abundant in these areas but now the number has decreased because of indiscriminate killing. Some of the rare varieties of fish found in the State are Boggra (Channa punctatus), Sareng (Wallago attu), Ngakra (Clarias batrachus) and Pengba (Rehtee octio).
Among the reptiles lizard, tortoise, boa constrictus, large size python, king cobra and some of the common poisonous snakes are also found in this region. Common amphibians found in the State are frog and toads.

The avi-faunal species of this region are those common to other parts of the country. The species are jungle fowl, kaleej pheasant, horn bill, black strock, white vulture, common green pigeon, blue rock pigeon, spotted dove, spotted owlet, great horn owl, woodpecker, etc. The rare bird, Tragopan is found in the higher altitudes south of Kohima (in Japvo range and the Dzuku valley). The government has prohibited the killing or trapping of Blythe's Tragopan. Successful breeding of Tragopan in captivity has been started in June 1975 for the first time in the world.

With the depletion of forests and the use of guns, the large carnivores like leopard and tiger have been reduced greatly in number. Bison and wild buffalos are found only in the Intzaki area, extreme south-western part of the State. Elephants are found along the border with Assam in the comparatively low areas. Among the other wild animals, the most common are wild boar, barking deer, Himalayan black bear, wild goat, jackal, jungle cat,
Indian porcupine, Royal Bengal tiger, wolf, fox, langur, Rhensus monkey, flying squirrel, sloth bear, hare, etc.