NILGIRI BIOSPHERE RESERVE

AN OVERVIEW

ENVIS TECHNICAL REPORT No. 11

CENTRE FOR ECOLOGICAL SCIENCES
INDIAN INSTITUTE OF SCIENCE
BANGALORE 560 012

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The NBR Information System project was carried out under the supervision of Prof. Madhav Gadgil, Dr. Sathis Chandran Nair and Dr. R. Sukumar by a team consisting of the following personnel:

Aviva H. Patel

Janardhanan Pillai N.N.

Jayakumar C.

Jayakumar Radhakrishnan

Murali K.S.

Nirmala S.

Prabhakar R.

Ramesh S.K.

Sashidhara G.B.

Shanthi S.

LIST OF AGENCIES FROM WHOM DATA WERE COLLECTED FOR THE NILGIRI BIOSPHERE RESERVE AREA

KARNATAKA

Bangalore:

1. Bureau of Economics and Statistics
2. Bureau of Geology and Mines
3. Department of Agriculture
4. Department of Tribal Development and Social Welfare
5. Indian Meteorology Department
6. Karnataka Gazetteer
7. Karnataka State Irrigation Department
8. Mythic Society
9. National Bureau of Soil Survey and Land Use Planning
10. Office of the Chief Conservator of Forests
11. State Secretariat Library
12. University Library, University of Agricultural Sciences

Mysore:

1. Anthropological Survey of India
2. Divisional Forest Office, Working Plans
3. Library, Oriental Research Institute
4. Office of the Conservator of Forests
5. Palace Library, Mysore Palace
6. Project Tiger, Bandipur Office
7. University Library, Mysore University

Other places:

1. Assistant Conservator of Forests, Thithimathi

2. Divisional Forest Office, Hunsur

3. Range Office, Ainurmarigudi

4. Range Office, Antharasanthe

5. Range Office, Balecove

6. Range Office, Hunsur

7. Range Office, Kallahalla

8. Range Office (Wildlife), Kharapur

9. Range Office, Periapatna

10. Range Office, Sargur

11. Range Office, Thithimathi

KERALA

Calicut:

1. Central Water Resources Development and Management Centre

2. Kerala Institute for Research Training and Development Studies of Scheduled Castes and Scheduled Tribes

Cannanore:

1. Cannanore Public Library

2. Local Library Authority Library

Trivandrum:

1. Bureau of Economics and Statistics

2. Census Office

3. Centre for Developmental Studies

4. Centre for Earth Science Studies

5. Department of History, University of Kerala

6. Forest Working Plan Office

7. Kerala Forest Department, CCF's Library

8. Kerala Sastra Sahitya Parishad

9. Kerala Studies, University Library

10. Land Use Board

11. Legislative Assembly Library

12. State Central Library

13. Tribal Directorate

14. University Library

Other places:

1. Agricultural College, Tauanur

2. Assistant Wildlife Warden's Office, Silent Valley National Park, Mukkali

3. Divisional Forest Office, Wynaad Forest Division, Manantody

4. Kerala Forest Research Institute, Peechi

5. Wildlife Warden's Office, Wynaad Wildlife Division, Sultan's Battery

TAMIL NADU

Coimbatore:

1. Bharathiyar University

2. Botanical Survey of India

3. Conservator of Forests, Coimbatore Division

4. District Forest Office, Combatore Division

5. Forest Resources Survey Division, Coimbatore

6. Forest, Soil and Vegetation Survey

7. International Institute of Ayurveda

8. State Forest Research Centre

9. State Forestry Training College

10. University Library, Tamil Nadu Agricultural University

Coonoor:

1. Planters' Association of Tamil Nadu

Madras:

1. Adyar Library
2. Centre for Water Resources, Anna University
3. Chief Conservator of Forests
4. Connemara Library
5. Geography Department, Madras University
6. Geological Survey of India
7. Institute of Remote Sensing, Anna University
8. Madras Institute of Developmental Studies
9. Indian Meteorological Department
10. State Geology Branch of Industries Department
11. Tamil Nadu Electricity Board
12. Tamil Nadu State Archives
13. Institute of Hydraulics and Hydrology, Poondi

Ootacamund:

1. Botanical Gardens Library
2. Central Soil and Water Conservation Research and Training Institute
3. Collectorate Library
4. Conservator of Forests
5. District Forest Office, Nilgiri North Division
6. District Forest Office, Nilgiri South Division
7. Government Arts College
8. Mr. Radcliffe, Talakunda

9. Mr. Ramesh Babu, Nirmala Cottage

10. Mr. Townsend, Havelock Road

11. Nilgiri Library

12. Nilgiri Wildlife and Environmental Association

13. Survey of Medicinal Plants and Collection Unit

14. Tribal Research Institute of Tamil University

15. United Planters' Association of South India

16. Wildlife Warden, Mudumalai and Nilgiri Tahr Sanctuary

Other Places:

1. French Institute, Pondicherry

INTRODUCTION

This report attempts to summarize and provide a guide to our current knowledge of the fascinating ecosystem of the hill range of the Nilgiris and its environs. A tract of over five thousand square kilometers in this region has been constituted as India's very first Biosphere Reserve; one of a worldwide network of over 250 such reserves. The Biosphere Reserve Programme initiated in early 1970's is an outgrowth of the Man and Biosphere Programme of UNESCO. It aims to encompass within its constituents as much as possible of the biological diversity of the planet Earth. The Nilgiris, with a tremendous range of variations in their physical environment coupled to a rich heritage of plant and animal species were thus a natural choice for the premier Biosphere Reserve of the country. This report provides ample evidence of this natural diversity, at the same time stressing that much of it remains to be properly documented.

But the Biosphere Reserve Programme focusses not only on natural diversity. It also emphasizes that this diversity can be conserved on a long term basis only within the framework of the actions and aspirations of the animal now dominating the Earth- the human species. The Biosphere Reserve Programme therefore stresses the need to take a close look at the needs and developmental initiatives of the human communities of the region and to align these with the conservation objectives. The Biosphere Reserve Programme must therefore consciously generate alternative models of sustainable development wherever the current models are destructive of ecological processes and of natural diversity. This report therefore goes in some depth into the human activities in and around the Nilgiri Biosphere Reserve. Again this provides a glimpse into the rich variety of human cultures and human pressures in this ecosystem and highlights the inadequacy of our understanding.

The Biosphere Reserve Programme has a strong scientific orientation in that it stresses the need to base our efforts at conservation and sustainable development on a sound understanding of the whole system. The Biosphere Reserves are therefore expected to serve as sites for long term scientific research as well as education all over the world. Given this, it is essential that the scientific effort in the Nilgiri Biosphere Reserve be planned carefully, coupling it securely to practical needs of organizing a conservation and sustainable development effort in the region. It is our hope that this preliminary report will provide the necessary background. It is of course necessary to point out that there are several major deficiencies in this attempt; however, we bring it out in the hope that it will serve as a worthwhile beginning.

TOPOGRAPHY

The Nilgiri Biosphere Reserve lies between latitudes 10^{o} $50'$ and 12^{o} $16'$N, and longitudes 76^{o} and 77^{o} $15'$E. It forms an almost complete ring around the Nilgiri plateau, covering an area of 5520 sq km. The northwestern, northeastern and south central points of the ring around the Nilgiris extend far outward, while its midwestern and mideastern points are extremely attenuated. This mountain mass, ranging in height from 1800 m to 2200 m, is one of the most conspicuous topographic features of southern India. On the western side is the narrow strip of the Malabar seaboard bounded by the Arabian Sea, with a maximum elevation of 150 m. In the north is the Mysore plateau with an elevation of 800 m to 1000 m, and on the southeastern side stretch the Coimbatore plains, 300 m to 400 m in height. Consequently, the Nilgiris have a massive appearance whether approached from the Malabar plains, the Coimbatore plains, or the Mysore plateau. The prominence of the Nilgiri hills over the surrounding country has a bearing on the climate and water resources of the peninsula.

THE NILGIRI PLATEAU

The Nilgiri plateau, shaped like an irregular triangle, is a gigantic highland marking the points of union of the Eastern and Western Ghats. The southern extremity of the Eastern Ghats forms a discontinuous and irregular chain of mountains merging with the undulating uplands of southwest Mysore. The Western Ghats start from the river Tapti in the north and extend southward upto Cape Comorin in a NNW-SSE direction almost parallel to and close to the coastline of the Arabian Sea. The Nilgiri plateau and the main Western Ghats have a common watershed line in the Kundah hills, where the mountains are high and extremely steep and descend precipitously to the Nilambur valley. But immediately south of the Nilgiris, the Western Ghats break up into a complex knot of ridges and peaks which abruptly taper off in the northern lip of the Palghat Gap. The Palghat Gap is a major tectonic discontinuity of about 25 km width where the valley floor is less than 200 m above msl with mountains on both the northern and southern margins rising abruptly to average elevations of about 1200 m. This discontinuity in the mountains is a biogeographic barrier between the southern Nelliyampathis and Anamalais and the northern Palghat hills. On the other hand, the Palghat Gap forms a corridor for communication between the Malabar and the Coimbatore plains.

The Nilgiri plateau itself is a tableland of about 50 km in length east to west and of about 20 km to 30 km in breadth north to south, with an average elevation of 2000 m. The plateau is formed by a series of undulating hills and valleys which rarely rise much above or fall much below the average elevation of the tableland. It is divided east and west into fairly equal parts by a range of hills running north-south and culminating in Doddabbetta (2636 m). The western edge of the Nilgiri plateau is formed by the series of high hills of the Kundah range which is contiguous with the Western Ghats. Most of the peaks of the range are over 2500 m high and constitute an almost unbroken wall except at the Sispara pass (2120 m). On the western side, this range falls off almost perpendicularly onto the Malabar plains.

A second, inner line of hills runs parallel to the outermost rim of high peaks on the western half of the plateau.

THE MALABAR PLAINS

The narrow strip of land 25 km to 70 km in width, bounded by the Arabian Sea and the Western Ghats, forms the Malabar plains. At some distance from the coast they become a little more varied, with solid rock platforms and isolated hills seldom reaching 150 m. From these plains, the Western Ghats present a wall-like appearance which is a characteristic feature of the Malabar scenery. This is particularly so of the Nilambur basin (60 m). From there, the Western Ghats rise to the towering Kundah range (2400 m), first gradually then with increasing gradient and finally perpendicularly, sometimes even with overhanging walls, as in the horseshoe-shaped recess south of Mukurthi peak. Southward, from Silent Valley (900 m), the ascent to the Ghats is not quite as dramatic because of the higher elevation of the valley which is raised from the Malabar plains, tectonically conditioned by the Nilgiri plateau. Further north, the Malabar plains rise into the Wynaad plateau (700 m), which is contiguous with the Mysore plateau.

THE COIMBATORE PLAINS

The Coimbatore plains have an average elevation of 300 m to 400 m, with a small eastward gradient. They lie on the south east side of the Nilgiri plateau. They are open to the west along the narrow strip of the Palghat Pass. On the eastern side, they are not bounded by any morphological feature and extend all the way to the Tamil Nadu plains. They are bounded on the north by the Biligiri Rangan hills (2000 m) of the Eastern Ghats. Apart from the occurrence of rock outcrops and isolated hills, the landscape shows little variation.

THE MYSORE PLATEAU

Gentle undulations of the land and wide valleys of eastward flowing streams characterize the Mysore plateau. It forms a part of the great Deccan plateau that extends from the Vindhyas in the north to the Nilgiris in the south. The average elevation of the Mysore plateau is 800-1000 m, and its general inclination is to the east.

Compiled with excerpts from:

1. Francis, W. (1908). Madras District Gazetteers. Vol. I: The Nilgiris. Government Press.

2. Grigg, H.B. (1880). A manual of the Nilagiri district in the Madras presidency.

3. Lengerke, H.J. von (1977). The Nilgiris - weather and climate of a mountain area in southern India. Springer-verlag, Berlin.

4. Logan, W. (1887). Malabar. Vol. I. Reprinted by Charithram Publications, Trivandrum, 1981.

5. Survey of India maps and topographical sheets.

GEOLOGY

Structurally, the entire Nilgiri Biosphere Reserve area belongs to the continental block of peninsular India, made up of metamorphic Archaean, i.e. pre-Cambrian rocks, mainly gneisses, charnockites and schists. Until late Jurassic times it was part of ancient Gondwanaland, connected to southern Africa, Madagascar, Australia and Antarctica. In the wake of its disintegration due to continental drift, and coincident with the Himalayan orogenesis, major changes occurred in the area around the Nilgiri plateau. There is clear evidence that suggests that considerable tectonic strains acting on this part of peninsular India resulted in the breaking up of the pre-Cretaceous landmass. This resulted in the formation of horizontal and particularly vertical dislocations of its component parts, with repercussions throughout the Tertiary and Quaternary periods. Basically, these strains account for the remarkable morphological differentiation in the Biosphere Reserve. Its main Divisions are easily recognizable by their clear-cut tectonic boundaries accentuated by selective sub-aerial denudation.

The Nilgiri plateau appears to have been uplifted from the ancient Deccan landmass as a result of tectonic movement, with clear dynamic fault lines all around the plateau. On the north, the Moyar river cuts a deep (300 m) canyon into the Mysore plateau and joins the Bhavani east of the Nilgiris. Although the general inclination of the Deccan plateau is towards the east, the area around the Nilgiri plateau shows an inclination towards the north. The Nilgiri plateau follows an east-west tectonic line representative of the structural orientation that also prevails in the northern escarpment of the Nilgiris, i.e. the Sigur Ghat. On the western side of the plateau the raised elevation of Silent Valley (900 m) is also presumed to be tectonically preconditioned, running in a NNW-SSE direction upon the uplifting of the Nilgiris. The south eastern escarpment of the Nilgiris falls to the Bhavani valley in Attappadi, clearly separating it from the Vellingiri hills and the Coimbatore plains.

LANDFORMS OF THE NILGIRI PLATEAU

The Nilgiri plateau is geomorphically distinct from the rest of the Western Ghats; as such, it warrants a separate description of its landforms.

There are two different types of landforms found on the plateau. Many of the high peaks have steep, rocky scarp phases with radial drainage patterns which are called 'Doddabetta landforms'. The escarpments are attributed to faulting by some geologists. Others consider them to be an erosional feature. The other prominant type of landform has gentle mounds with thick soil development,meandering streams and smooth round hills. This has been termed as the 'Ootacamund landform'. Together they constitute the Nilgiri planar surface.

GEOLOGICAL HISTORY

Based on a variety of evidence, different hypotheses have been put forward to explain the origin of the Nilgiri plateau. The prevalent view is that the plateau was formed by uplift due to block faulting. There is another view held, that it is a relict feature carved out by erosional processes. Palynological studies from the Nilgiris during the post-glacial period indicate that a cold period was preceded and followed by arid phases. When the climate changes from wet to dry, plant communities also change, and the withdrawal of vegetation enhances erosion and the deepening of stream courses. The climatic fluctuations since the Pleistocene play an important role in determining the nature and distribution of superficial deposits in the Nilgiris, which in turn are indicative of the climatic shifts.

GEOLOGY AND ROCK TYPES OF THE NILGIRI BIOSPHERE RESERVE

The Nilgiris expose the oldest rocks of India and form part of a stable land mass, the rocks of which include charnockites, biotite gneiss, hornblende biotite gneiss, magnetite quartzite, basic and ultrabasic rocks, horblende granulite, pegmatites, granite, quartz veins, dolerite and laterite.

The geological succession of the area is as follows: nearest the surface are recent to sub-recent deposits of alluvium and soil with laterite and lithomargic clay underneath. Thereafter, below a nonconformity, are the lower Proterozoic to Archaean pink granites, pegmatite, dolerite, and charnockite. The deepest stratum is Archaean basement gneiss.

Areawise, the Nilgiri hills consist mostly of charnockites having a NE-SW to ENE-WSW foliation direction. Gneisses are extensively exposed in the lowlying areas around the hills. Alluvial deposits, peaty subsoils and detached lateritic patches constitute the superficial deposits of the Nilgiris.

The rocks found in the Nilgiris are of deep seated metamorphic origin and have undergone considerable deformation in pre-Cambrian times. There are three principal systems of faulting: two, at right angles to each other, are probably synchronous and coincide with the lines of the Eastern and Western Ghats; the third fault is related to the final upheaval of the Nilgiri plateau. E-NE lineaments are present, one along the southern extremity of the Nilgiri plateau north of the Bhavani river, another, which extends in a southwest direction into the Silent Valley RF in Kerala and beyond traceable from near Kundah upto Moyar, and a smaller third one along Kaducuppe RF and Nanjanad RF.

A northeast lineament connecting Pykara and Mukurthi extends into New Amarambalam RF and the plains of Kerala. Three parallel north-northwest fractures are noteworthy: one cuts Kammajsagar northwest of Ootacamund, the second forms the Bhavani stream for 18 km, and the third represents the Kundipuzha in Kerala. The east lineament of the Moyar river, traceable for about 40 km, is conspicuous. Some of the abovementioned lineaments indicate shearing. Many of the lineaments represent faults.

The Coimbatore plains:

The Coimbatore plains appear to be a very old, undisturbed landmass. The whole surface of the plains is composed of a vast spread of schistose or foliated rocks such as gneiss, hornblende-schist, mica-schist, etc., a class of rocks termed metamorphic. Generally speaking, the entire plains area is calcareous; many parts highly so, owing to the fortunate fact of the hornblendic character of the gneiss. The formation, whenever apparent, conforms to a general strike in the direction east-northeast and west-southwest in the neighbourhood of Coimbatore, and a northwest strike towards Bhavani.

The Malabar plains:

The Malabar plains are mainly alluvial accumulations of countless perennial streams and rivers meandering toward the Arabian Sea. These rivers carry heavy loads of silt, scouring the upper reaches of the catchment areas. Closer to the Western Ghats, the Malabar plains become a little more varied with solid rock platforms of gneiss and isolated hills, generally capped with laterites and metamorphic gneiss. The finely foliated gneiss is composed of quartz, felspar and biotite, with an occasional admixture of garnet. In many places the gneiss has undergone metamorphosis. In some of these areas, the gneiss contains veins of quartz and quartzite. In certain other places, the gneiss has metamorphosed into schist, the important constituent of which is hornblende. In still other places, the gneiss has metamorphosed into laterite. These softer clays of metamorphised gneiss are transported by the swiftly flowing rivers and deposited on the valleys and plains of the Malabar.

The Mysore plateau:

The geological formation is principally of granite, gneiss, quartz and hornblende. In many places, these strata are overlaid with laterite. In certain parts adjacent to the Nilgiri plateau, charnockites are present.

Compiled with excerpts from:

1. Francis, W. (1908). Madras District Gazetteers. Vol. I:

The Nilgiris. Government Press.

2. Grigg, H.B. (1880). A manual of the Nilagiri district in the Madras presidency.

3. Lengerke, H.J. von (1977). The Nilgiris - weather and climate of a mountain area in southern India. Springer-verlag, Berlin.

4. Logan, W. (1887). Malabar. Vol. I. Reprinted by Charithram Publications, Trivandrum, 1981.

5. Rice, L.B. (1897). Mysore. Vols. I and II. Westminster, London.

6. Seshagiri, D.N. et al. (1982). The Nilgiri landslides. Geological Survey of India. Misc. publications No. 57.

CLIMATE

Climate denotes the nature of a country with regard to temperature, moisture, rainfall, etc., but it cannot be understood without also considering the weather processes and geographical factors that determine its nature. The Indian monsoon dominates the entire subcontinent. Monsoon denotes the phenomenon of a large-scale, annually recurrent, seasonal change of winds blowing with a certain constancy from almost opposite directions.

The Indian monsoon is characterized by an alternation of northeasterly surface winds during winter and southwesterly winds during summer, called the northeast and southwest monsoons, respectively.

WEATHER AND CLIMATE

A region as diverse in topography as the Nilgiri Biosphere Reserve must needs have a great range in climate. But a certain unity results from the monsoonal changes, which are common to the whole.

RAINFALL

The amount of rainfall received has always been considered one of the most important parameters regarding the climate of a place, particularly in a country dependent on rainfall for agriculture, as India is. The average annual rainfall distribution over the Biosphere area is shown in the climatic map prepared by the French Institute. It reveals the remarkable spatial diversity of rainfall. The most conspicuous feature is a general decrease in annual rainfall from west to east. On the western escarpment of the Western Ghats and along the western slopes of the Nilgiris, rainfall well exceeds 4000 mm, and on the Malabar plains it does not fall short of 2500 mm except in the vicinity of the Palghat Gap. On the eastern side, the Mysore plateau including the Moyar canyon and the plateau east of Masinagudi and a major part of the Coimbatore plains receive a rainfall of less than 750 mm.

North and south of the Nilgiris, the west to east decrease in rainfall occurs with almost parallel isohyets following the general orientation of the Western Ghats. On the Wynaad-Mysore plateau, and in the Palghat Gap, the transition is gradual with wide spacing of isohyets, whereas in the Attappadi valley, the southeastern face of the Nilgiris, horizontal gradients appear to be pronounced.

During the first inter-monsoon period (April/May), rainfall is comparatively evenly distributed throughout the area with an average of 150-300 mm. The western parts generally record higher amounts of rainfall than the plains and plateaux further east. It contributes 20-30% of the annual rainfall of the Coimbatore plains and Sigur plateau. During the southwest monsoon period, i.e., June to September, the western slopes of the Western Ghats generally receive over 2500 mm of rainfall, or 75% or more of the annual rainfall. On the Coimbatore plains and the eastern Mysore plateau, rainfall is about 100 mm, accounting for about 20% of the annual amount. On Mukurthi on the Kundah range, rainfall exceeds 5000 mm, due to the peculiar shape and abnormal steepness of the western slopes along this section; the whole configuration acting like a 'trap' in which the moist southwest monsoon is caught and forced up in order to escape through the gaps of the Kundah range.

During the second inter-monsoon period (October/November), substantial changes from the southwest monsoon period occur, spatial differentiation of rainfall being relatively small. The whole area receives 250-400 mm of rainfall. This constitutes 40% of the annual total for the Coimbatore plains and the eastern Mysore plateau, and only 20% of the annual for the western plateau and plains.

The northeast monsoon period (December to March) is characterized by extremely low rainfall throughout, except for the Coonoor ghat and adjacent tracts of the Nilgiri plateau and the Coimbatore plains exposed to the easterlies, including cyclonic disturbances associated with them. Here, 250-500 mm contributes 20% to the annual rainfall average. Elsewhere, the northeast monsoon's share is confined to below 10%.

TEMPERATURE

The incoming solar radiation becomes an important climatic and ecological factor. Its qualitative and (indirect) quantitative determination is usually made in terms of temperature.

The most conspicuous feature regarding temperature is its well-known inverse relationship with elevation. Thus, annual average temperatures on the Malabar and Coimbatore plains as well as along the southeastern base of the Nilgiris, at elevations below 500 m, usually exceed 26 ^{o}C. Annual average temperatures between 500- 1000 m remain around 23 ^{o}C, whether on the Wynaad-Mysore plateau, the Coonoor ghat, or in Silent Valley. On further ascending the ghat, on the central plateau, the air becomes increasingly cooler with average temperatures much below 20 ^{o}C.

The monthly temperature values over the whole area vary only by 3 to 6 ^{o}C between the minima that occur during the early northeast monsoon period (December/January) and the maxima during the first inter-monsoon period (April/May).

In the plains, below 500 m, average annual maxima are 30 ^{o}C or even higher, with monthly values exceeding 35 ^{o}C from March to May. Minima may fall below 20 ^{o}C, particularly in December and January. With increasing altitude, average monthly maxima and minima of daily temperatures are moderated to below 20 ^{o}C above 2000 m for the greater part of the year, while January minima drop to very low average values.

Ground temperatures below 0 ^{o}C form frost. Frost has been recorded ever since the third official reconnaissance tour of the Nilgiri hills in 1819. It was a cause of surprise to find such conditions in the tropics. Today, however, it is a well known phenomenon. The very nature of frost formation on the Nilgiris, caused by nocturnal radiation energy loss from soil and vegetation surfaces, does not allow any reliable cartographic representation of areas susceptible to it. But evidence reveals that frost may occur above 1400 m provided the local conditions allow the accumulation of cold air during calm and clear nights of the 'frost season'. The northeast monsoon period, from December to March, appears to be particularly liable to nocturnal frost formation, although frost may also occur at any other time of year if local conditions are suitable.

SURFACE WINDS

Both wind velocity and wind direction are important climatic factors, particularly with respect to plant growth. Their influences are manifold and complicated. Mechanical action and transport of air with specific thermal and moisture properties are responsible for physiological processes, either directly or indirectly.

Surface winds of the Nilgiri Biosphere area are basically determined by two factors: 1) the position of the Reserve with respect to the macro-scale circulation pattern of the Indian monsoon; and 2) its relief features, which result in meso- and micro-climate modifications.

Thus, during the northeast monsoon period (December-March), the wind direction is generally in an easterly/northeasterly direction. But on the western side, there is strong evidence to suggest a diurnal variation in direction, dependent upon thermal responses - as in sea and land breezes. During the southwest monsoon period, strong westerly winds prevail. Other changes at different places will depend on the topography of the area in question.

ATMOSPHERIC MOISTURE

Atmospheric moisture is measured as relative humidity, which indicates the moisture exchange capacity between the earth's surface and the atmosphere in terms of precipitation as mist, dew and rainfall, or its uptake from the ground as evaporation and evapotranspiration.

On the Coimbatore plains, the air is dry and the annual average relative humidity does not exceed 68%; whereas on the western side and on the plateau, the annual average is 75% or more. Over the whole area, January, February and March are the low humidity months. July is the month of high humidity on the western side and the plateau, whereas October is the month of high humidity in Coimbatore.

CLOUDINESS, FOG AND VISIBILITY

Maximum cloud cover occurs during the southwest monsoon, while the highest frequency of clear skies prevails during the northeast monsoon, particularly from January to March.

SOLAR RADIATION

As far as plant ecology and agriculture are concerned, illumination and radiation are the most important climatic factors, besides precipitation.

Incident solar radiation depends on two factors, latitude and cloudiness. The entire Biosphere area lies between two degrees of latitude, hence there is not much latitudinal variation. The Coimbatore plains and the eastern Mysore plateau receive more daily fluctuation in solar radiation than the annual average, which itself is higher than in other places. The average daily duration of sunshine is longest during the northeast monsoon and shortest during the southwest monsoon over the whole area.

Compiled with excerpts from:

1. Lengerke, H.J. von (1977). The Nilgiris - weather and climate of a mountain area in southern India. Springer-verlag, Berlin.

WATER RESOURCES AND DRAINAGE

The Nilgiri Biosphere Reserve area is one of the critical catchments in peninsular India, exerting considerable economic and ecological influence over a vast area. The distinct orographic effect exerted by the high mountains obstructing monsoon winds and the extensive forests on the ghat slopes aiding water retention enhance the effectiveness of the catchment area. Many of the major tributaries of the Cauvery river system have their sources and catchment areas within the Reserve boundary. All human activity over vast areas of the rain-starved Deccan plateau, Coimbatore, and the Tamil Nadu coastal plains is critically dependent on the Cauvery waters. Thus these agriculturally developed regions are within the zone of influence of the Nilgiri Biosphere Reserve. In addition, there are many short and swift-flowing streams that flow toward the west, watering the Malabar plains and flowing into the Arabian Sea. Many of the rivers and streams that arise on the elevated plateau scour the sides of the plateau, forming narrow gorges and waterfalls of upto 120 m in height. Erosion is particularly severe in the eastern and southwestern areas that bear the fury of the monsoons. Numerous reservoirs for power generation have been built on the plateau.

The drainage of the Biosphere area can be studied under two categories: 1) the short and swift westward flowing rivers whose maximum length from source to mouth may not exceed 50 km, flowing into the Arabian Sea; and 2) the long, meandering eastward flowing rivers of the Cauvery river system, flowing into the Bay of Bengal.

1. WESTWARD FLOWING STREAMS

1.1 Chaliyar basin:

The Chaliyar river drains the steep western slopes of the Nilgiri hills. The whole basin receives 3000 mm-5000 mm of rainfall annually, mostly during the southwest monsoon period. All its tributaries take a very steep course with a series of rapids and falls as they debouch into the foothills and the plains below. The elevation of the basin varies from 100 m-2200 m in the short distance of 10 km. The slopes and the plains bear lush forests which aid water retention and enhance the effectiveness of the catchment area.

The Chaliyar puzha runs more or less northeast to southwest. It has four main head streams, the Chaliyar puzha, the Punna puzha, the Karim puzha, and the Pallisseri puzha. The Chaliyar puzha arises in the southwest of the Wynaad plateau, while the sources of the Karim puzha and Punna puzha are in the Kundah hills. These streams drain the forests of the Nilambur Kovilakkam, Manjeri Kovilakkam, Gwalior Rayons Forests, Edakode RF, and New Amarambalam RF.

1.2 Kadalundi basin:

The western outer slopes of Silent Valley and the nearby areas in the Kalikavu Range of the Nilambur Special Division are drained by the Olipuzha and the Velliyar, which drain into the Kadalundi river.

1.3 Bharatha puzha basin:

A few tributaries of the Bharata puzha river originate in the Nilgiri Biosphere Reserve:

1.3.1 The Kundi puzha rises in the southwest corner of the Nilgiri plateau and flows through Silent Valley. The plateau receives about 5000 mm of rainfall during the southwest as well as the northeast monsoon.

The Kundi puzha runs north-south and empties its waters into the Thuthapuzha, a tributary of the Bharatha puzha or Ponnani river, which also receives the waters from the Kunjirapuzha draining the forests of the Thenkara Range of Palghat Special Division.

1.3.2 The southern extremity of the Nilgiri Biosphere Reserve along the Palghat Gap falling within Palghat Division, Palghat Special Division and part of the Bolampatti Block II of Coimbatore Division are drained by tributaries of the Kalpathipuzha, namely the Malampuzha and Walayar. Kalpathi puzha in turn empties into the Bharathapuzha. Both the Malampuzha and the Walayar have been dammed to create irrigation reservoirs.

2. EASTWARD FLOWING STREAMS

2.1 Noyil basin:

The Noyil river rises in the southern extreme of the Nilgiri Biosphere Reserve area and flows eastward, joining the Cauvery a little north of Karur. The river arises on the eastern side of the Vellangiri hills (1801 m). The hill slopes form an arc facing east and are steeply sloped. The main rainfall for the catchment is from the northeast monsoon, although the southern catchment of the Noyil bordering the Palghat Gap receives rainfall from the southwest monsoon as well. The average annual rainfall of the area varies between 1500-2000 mm.

The forests of the catchment form the Bolampatti Block I RF and Bolampatti Block II RF.

2.2 Bhavani basin:

A significant section of the Bhavani basin lies within the Biosphere. Many of the perennial streams of the Bhavani arise in the Nilgiri hills, giving the Bhavani its importance in the Cauvery river system.

2.2.1 The Bhavani river originates from the southwest corner of the Nilgiri plateau, flows southward down to the Attappadi plateau, and swings around the Nilgiri hills to flow in a northeasterly direction girdling the southern edge of the Nilgiris. Its important tributaries are Siruvani, Kundah, Coonoor and Moyar. The catchment area of the Bhavani river, being on the southwest edge of the Nilgiri plateau, receives copious rainfall from the southwest monsoon amounting to 2000-4000 mm. The catchment area is forested with shola grasslands in the Upper Bhavani and Korakundah RFs. Eucalyptus and wattle plantations have been raised in many of the areas. The river also drains degraded areas of the Attappadi RFs.

2.2.1.1 The Siruvani river originates on the crest of the forest-clad mountains on the northern edge of the Palghat Gap. A considerable volume of runoff is collected on the amphitheatre-like Muthikulam plateau before the Siruvani river descends toward the north into the Attappadi plateau and flows northeast to merge with Bhavani near the Kerala-Tamil Nadu border. The river catchment constitutes the Attappadi Block VI RF.

2.2.1.2 The Kundah river rises on the Nilgiri plateau. It drains the southwestern slopes of Doddabetta and the southeastern slopes of the Kundah range. In its descent to the low country along the Melur slopes it forms a deep gorge. The annual rainfall at the catchment is about 2500-3000 mm. A major portion of the area fed by rain consists of tea and vegetable plantations, causing heavy erosion of the hillsides. The Kundah river joins the Bhavani at the foot of the Nilgiri hills. The slopes from where the river descends to the plains constitute the Kundah RF, Melur slopes RF and the Hiriya Shige RF.

2.2.1.3 The Coonoor river rises from Emerald valley, draining Coonoor and Wellington. The catchment gets an annual rainfall of 1500-2000 mm. A major portion of the area is under cultivation. The Coonoor river descends the slopes in the Hulical Durg RF and joins the Bhavani a few kilometres before Mettupalayam.

2.2.1.4 The Pykara river, which rises as the Mukurthi stream on the grassy slopes of Mukurthi peak, receives from the east the Krurmund and Parson's valley streams. Draining the extreme northwest of the plateau, it plunges through a steep valley by a series of spectacular falls into the low country near Gudalur. The river, thereafter known as the Moyar, winds placidly to Teppakadu, turns sharply eastwards, drops over a considerable fall, passes along through a narrow gorge known as the Mysore Ditch, and finally falls into the Bhavani at the eastern foot of the plateau in the Lower Bhavani reservoir. On its course, the Moyar receives numerous streams and rivers streaming down the Nilgiri hills (Sigur river, Kedar halla) as well as streams from the Mysore plateau (Kakanhalla). The Pykara is the biggest river on the plateau and is held sacred by the Todas.

The catchment area on the plateau receives an annual rainfall of 2500-3000 mm. A major portion of the catchment area on the plateau is under cultivation. After it descends the plateau, the river passes through the Mudumalai Wildlife Sanctuary and the Sigur RF before it joins the Bhavani.

2.3 Kabini basin:

The Kabini river is one of the major tributaries of the Cauvery. The Nilgiri Biosphere area forming the southwest part of the Mysore plateau is drained by the Lakshmanatirtha, Kabini, Nugu, Gundal and Suvarnavathi, all flowing either north or northeast and emptying into the Cauvery.

2.3.1 The Kabini river originates as many streams in the Wynaad plateau in Kerala, which join to form the Manantody puzha and Panamaram puzha which flows in a northeasterly direction. The catchment areas of some of these tributaries receive an annual rainfall as high as 4000 mm, but the Kabini basin shows a sharp gradient of rainfall from west to east, the rainfall decreasing sharply to less than 750 mm in the Mysore plateau. Although the Kabini has many tributaries, most of its water is contributed by the southern and western tributaries originating on the Wynaad plateau.

The entire Kerala Wynaad is drained by the Kabini. The Reserve Forests through which the river flows are: Begur, Rampur, Kurichiyat, Kuppadi and Mavinhalla in Kerala and Kakankote and Begur in Karnataka. The river is dammed in Kakankote RF, forming the large Kabini reservoir. The Kabini flows into the Cauvery at Tirumakudal Narasipur.

2.3.2 The Nugu hole is a tributary of the Kabini. It rises in northern Wynaad, and flows northward to join the Kabini. The catchment area of the river includes the following Reserved Forests of the Nilgiri Biosphere Reserve: the Rampur RF (Kerala), Beerambadi RF and Ainurmarigudi RF (Karnataka). The river is dammed to form the Nugu reservoir, situated adjacent to the Biosphere Reserve. It joins the Kabini at Haradanahalli.

2.3.3 The Gundal river which flows due north and meets the Kabini at Nanjangud drains parts of Bandipur Tiger Reserve and the Chamarajnagar forest division of Karnataka.

2.4 The Suvarnavathi is a tributary of the Cauvery, and joins it near Kollegal. It drains the southeastern corner of the Mysore plateau falling mostly within the Talamalai plateau, the Dimbam ghat areas in Tamil Nadu, and the Chamarajanagar RF adjoining the Biligiri Rangans in Karnataka.

2.5 The Lakshmana Tirtha flows northeast, emptying into the Cauvery at the Krishnarajasagar reservoir. It drains the extreme northwestern part of the Nilgiri Biosphere Reserve. Its basin forms part of the Nagarhole National Park.

RIVER VALLEY PROJECTS IN THE NILGIRI BIOSPHERE RESERVE AREA

The copious rainfall, perenniality of streamflow, and many geologically and geomorphologically suitable locations for impounding large volumes of water have created conditions suitable for a large number of hydel and irrigation reservoirs in the Biosphere Reserve area.

HYDRO-ELECTRIC PROJECTS

The block uplifted Nilgiri massif, creating large heads ideal for power generation, has been the cause of a number of hydro-electric schemes in the Kundah, Bhavani and Moyar basins. Hydro-electric power generation in these basins goes as far back as the 19th century. Katteri hydel power station was started in 1905 for the Defence establishment. After a lapse of two decades, Pykara powerhouse was commissioned in 1932-33, followed by Moyar in 1951-52 and the Kundah complex in 1959-60. The Bhavani basin alone accounts for 50% of the total hydel power generated for Tamil Nadu.

The Kundah hydro-electric scheme:

The Kundah river, a major tributary of the Bhavani, has been dammed repeatedly and waters from the adjoining Bhavani, its tributary Varahapallam and the headwaters of the westward flowing tributaries of the Karimpuzha are diverted to the Kundah basin to generate power in five different power houses. Streams flowing along the Avalanche valley and the Emerald valley have been dammed to create two adjacent, interconnected reservoirs. From the western edge of the Nilgiri plateau, two streams flowing into the Karimpuzha have been dammed (Western catchments 2 and 3) and their waters taken by tunnel to a third dam across the Porthimund. The three reservoirs are connected to Emerald reservoir. Upper Bhavani dam across the Bhavani river in the southwest corner of the Nilgiris creates a large reservoir, into which the waters from the source of the Arikkayam puzha, a tributary of the Karimpuzha are diverted (Western catchment 1). Downstream of Upper Bhavani dam, from a diversion weir, water is pumped up back into Upper Bhavani reservoir. Water from the reservoir is taken via a tunnel to Avalanche reservoir after generating power (in power house No. 5). Two small tributaries of the Bhavani, the West and East Varahapallam which drain south into the Attappadi valley of Kerala are dammed separately. Their combined waters are then taken from East Varahapallam reservoir to Avalanche reservoir. At the northern end of the Parson's valley stream is a dam, and its waters are also diverted into Avalanche reservoir. The waters from Avalanche and Emerald reservoirs are brought through a tunnel and conduit system to power house No. 1 for power generation at Kundah pallam. After power generation, the tail race waters are taken from behind the Kundah pallam fore bay to power house No. 2 near the Pegumbahalla. Again, the tail race waters are taken through the fore bay and tunnel to power house No. 3, downstream by the Bhavani. All the tail race waters are stored behind Pillur dam across the Bhavani and taken to power house No. 4, immediately below the dam. A tributary of the Coonoor river called the Katteri is diverted by a weir and tunnels into a separate small tributary of the Bhavani called the Niralapallam. Again, through a diversion weir and tunnel, the combined waters are brought to Kundah power house No. 3 for power generation.

Pykara-Moyar hydro-electric scheme:

The northern end of the Nilgiri plateau, drained by the Pykara and Sigur which ultimately form the Moyar river, has extremely steep slopes down which these rivers cascade. The Pykara river has been dammed upstream by the Mukurthi dam and immediately below that by the larger Pykara dam. The Sandinala river, which flows further east, has also been dammed; the waters from the dam have been transported to the Pykara reservoir, from where they are taken to Glenmorgan fore bay and diverted for power generation to Singara power house. The Glenmorgan reservoir taps additional inflow into the fore bay. The tail race waters from Singara power house are diverted to Maravakandi dam across the Avarahalla stream through canals, from where they are again taken through canals to Moyar power house further down in the Moyar vallley for power generation. Tail race waters from the Moyar power house are let out into the Moyar river.

IRRIGATION PROJECTS

The Nilgiri plateau, feeding copious amounts of water to the Cauvery drainage basin upon which large agricultural tracts of Karnataka and Tamil Nadu depend has attracted irrigation development.

Bhavanisagar:

The Lower Bhavani dam is constructed at the confluence of the Moyar and Bhavani forming the Bhavanisagar reservoire immediately below the eastern edge of the Nilgiris. This large irrigation dam, with a storage capacity of 986 million cubic meters of water provides irrigation to 82,800 ha.

Kabini Reservoir:

The Kabini river is dammed near Beechanahalli-Bidarahalli in the HD kote taluk of Mysore district. This multipurpose river valley project is meant to irrigate 42.51 ha. in Mysore district and to generate 32 MW of hydel power. The formation of the reservoir has submerged 22 villages with 14 hamlets and an area of 15180 acres of land including valuable parts of the Kakankote and Begur RF's where, in earlier years, 'Khedda' operations used to be conducted.

Nugu Dam:

The Nugu river in the HD kote taluk of Mysore district is dammed to develop a potentially irrigable area of 26,000 acres.

Siruvani Dam:

The Siruvani river, originating in the Attappadi Block VI RF in Kerala, has been dammed in the Muthikulam hills to provide drinking water to Coimbatore city.

Chittur Dam:

Downstream of Siruvani dam, the construction of an irrigation dam across the Siruvani at Chittur in Attappadi is under implementation. This project is meant to irrigate Agali, Pudur and Sholayar panchayats in the Mannarghat taluk of Palghat district.

Walayar Reservoir:

The Walayar river, also called the Koraiyar, originates in the Bolampatti Block II RF of Tamil Nadu and the Walayar RF of Kerala. It has been dammed for irrigation at Walayar, on the Kerala-Tamil Nadu border, and the waters used to irrigate part of Coimbatore district and some areas in Palghat district.

Malampuzha Reservoir:

The Malampuzha river drains Emoor Bhagavathi Kovilakkam, vested forests of Palghat Special Division, and Chenat Nair RF of Palghat Division. It is dammed to create a large irrigation reservoir, the waters from which being used to irrigate extensive areas in Palghat district. Both Walayar and Malampuzha rivers are part of the Kalpathi tributary of the Bharathapuzha.

Kunjirapuzha Dam:

The Kunjirapuzha drains the western outer slopes of the Muthikulam hills, and is dammed for irrigation at Kunjirapuzha. Its waters are diverted to the Mannarghat plains of Palghat district. The Kunjirapuzha is a tributary of the Thuthapuzha, which in turn forms a part of the Bharathapuzha drainage. The Kunjirapuzha irrigation project has been under construction for the past 38 years.

Chick hole Reservoir:

In the Chamarajanagar taluk in Mysore district, the Suvarnavathi river is dammed near the village of Ankanesettypura. This reservoir is meant to irrigate about 4076 acres.

Compiled with excerpts from:

1. Chinnamani, S. and Sakthivadivel, R. (1981). An integrated study of hydrology of the Bhavani basin. Part I. Anna University of Technology, Madras.

2. Francis, W. (1908). Madras District Gazetteers. Vol. I: The Nilgiris. Government Press.

3. Grigg, H.B. (1880). A manual of the Nilagiri district in the Madras presidency.

4. Lengerke, H.J. von (1977). The Nilgiris - weather and climate of a mountain area in southern India. Springer-verlag, Berlin.

5. Nicholson, F.A. (1887). Coimbatore Manual. Government Press, Madras.

6. Rice, L.B. (1897). Mysore. Vols. I and II. Westminster, London.

7. Survey of India topographical sheets.

HISTORY

The history of man in south India and in the different regions of peninsular India has been inadequately studied, so we do not have an overall picture of man and society over time in the Nilgiri Biosphere Reserve area, either. Ancient antiquities still existing on the Nilgiris and the surrounding plains have been observed and conjectures made as to their origins. Along the plains the history of the varying fortunes of the many kingdoms are reasonably well documented. But a holistic understanding of the society in the past is yet to emerge.

ANTIQUITIES

The various antiquities found on the Nilgiris and surrounding plains are caves, cairns, barrows, kistvaens, cromlechs or dolmens, stone circles, sculptured stones, and some ruins of forts and villages.

To the first and earliest period belong the caves that are inscribed and painted. Two are found in the Nilgiris, and another, Edakkal Cave, is in Wynaad. Attempts made at deciphering the script have not been successful because the marks are very rudely executed. The general period of occupation of the caves may be around the 3rd century B.C.

To the second period belong the following: 1) the cairns, which range from carefully constructed circular walls of uncemented stone rising above the ground, through rougher similar walls backed with earth, down to mere circles of stones embedded in the ground; 2) the barrows, which consist of circular heaps of earth surrounded by a ditch which is sometimes enclosed in one or more circles of loose single stones; 3) funeral circles built of rough stones; 4) kistvaens, or box-shaped constructions made of six slabs of stone sunk down to the level of the ground and sometimes surrounded by a circle of loose stones or earthen tumulus; and 5) cromlechs or dolmens, which have one side open and stand above ground level. These monuments contain ancient relics, such as pottery, weapons, implements, beads, etc.

There has been a lot of speculation about the builders of these monuments. The nature of the relics in them does not point to a really remote antiquity. None of the hill tribes claims any rights to the monuments, and there is nothing about them to connect them to any of the existing tribes. Their contents seem to indicate that they were the work of people who differed altogether from the present inhabitants, and who have disappeared long since.

To the third period belong the sculptured cromlechs, the Tamil inscriptions at Melur, the ruins of villages, and ruined forts. The sculptured cromlechs stand in a class apart, and appear to have no connection with any of the other monuments. They lie at lower altitudes and near the passes leading up from the low country. On the tops of these stones are inscribed the sun and moon, denoting that the testimony of the stones will last forever. Below these are often sculpted a bull kneeling before a lingam, while the corner stones are decorated with battle or hunting scenes. These cromlechs resemble the numerous hero stones and great sati stones that are scattered all across the Tamil country to commemorate local chieftains who held sway in medieval times.

THE PURANIC PERIOD

A land covered with one mighty and all-embracing forest, the great Dandakaranya; nestling here and there on the bank of a sacred stream, the ashrama of some rishi, his mind intent on penance; hidden in forest clearings or perched on isolated rocky eminences, the retreats and strongholds of chieftains: such is the picture of south India depicted in those earliest records of civilization, the Puranas.

The course of events and migrations seems to have been as follows: a few, solitary Vedic rishis made their way as hermits to the south in search of suitable retreats in the depths of the forests, where they sought to acquire knowledge by uninterrupted austerities and rites. Here, too, however, they did not find unpeopled solitude; and in many places, they faced the hostility of the previous settlers. These cultural and ideological intruders were followed by warriors of the Kshatriya class, who often came into collision with the rulers of the indigenous tribes.

There are numerous Puranic stories like the travels of Agasthya, a rishi who in earliest times penetrated the south and was the bearer of Aryan ideas and culture to that area. The numerous stories of asuras, rakshasas and devas are allegories of the cultural interactions between the local inhabitants and the Aryan invaders.

Many of the descriptions of places in the Puranas have been identified with places in south India. Kishkinda, or the kingdom of the vanara or monkey race, is identified with Hampi, on the banks of the Tunghabhadra. The legend of Parasurama is associated with Kerala state. Rama and his travels in south India to enlist support for his attack on Lanka are well familiar. Even the Todas claim a place in this story, believing they are descended from the palanquin bearers of Ravana, who after the latter's defeat settled in the Nilgiris. In the Mahabharata, the twelve year exile of the Pandavas includes an account of Arjuna, who journeyed south to Manipura, where the king's daughter Chitrangada fell in love with him and married him. This place has been identified as a location 5 km southeast of Chamarajanagar, called Haralukote in Kannada.

THE HISTORICAL PERIOD

The strategic geographic location of the Nilgiri Biosphere Reserve, bridging the Mysore plateau with the Tamil Nadu plains through the Gajalhatti pass and the Tamil Nadu plains with Kerala through the Palghat pass, is extremely significant. The area has, at one time or other, been divided between the three great historic kingdoms of the south - those belonging to the Tamil country, Kerala and Mysore. Around its base, from earliest times, contending tribes and nations have struggled for supremacy, while in its wild recesses, remnants of earlier inhabitants have found places of shelter and refuge.

The earliest mention of Mysore, or Mahishur, is in the time of Asoka in 245 B.C., when on the conclusion of the third Buddhist convocation, a 'hero' was dispatched to Mahisa-mandala to establish the religion of the Buddha. An old Jain work of the

10th century says that Bhadrabahu journeyed south in the 3rd century on his way to Punnata country. Further, it is recorded that one of the seats of Jainism was Maleyur, near Gundlupet; and three Ratta kings of Maharastra who occupied Kongu in the first and second centuries had Jain gurus. Thus, Buddhism and Jainism have both had their influence in this area.

In the Tamil historical work 'Kongu-desa rajakkal', mention is made of a Nilgiri durga which was taken by Harivarideva, a king of the Chola kingdom, around the 7th or 8th century A.D. Around 930 A.D., the Wynaad was probably part of the territories of the well known Ganga dynasty of Mysore, and is referred to as Bayalnad (the land of swamps). Between the close of the 10th century and the beginning of the twelfth century, the Ganga kings were ousted from the Wynaad by a branch of the Kadambas, a dynasty which at one time had its capital at Banavasi in North Kanara. The Wynaad was at this time divided into two portions, the Bira Bayalnad and the Chagi Bayalnad. One of the Mysore inscriptions alludes to the treacherous beauty of the country, which both attracted the stranger and laid him low with illness.

The Hoysala dynasty, whose capital was at modern Halebid, captured the Wynaad and the Nilgiri plateau in about 1115 A.D. A record of 1117 A.D. says that the Hoysala general Punisa "frightened the Todas, drove the Kongus underground, slaughtered the Poluvas, put to death the Malayalas, terrified king Kala and, entering the Nila mountain, offered up its peak to the Lakshmi of Victory". This is the first known mention of the names "Toda" and "Nilgiri". It is worthy of note that the conquest of the Nilgiri plateau was considered to merit special mention, and that the country possessed, at the time, inhabitants who were capable of considerable resistance. The title 'Subduer of the Nilgiris', (Nilgiri sadaran) appears to have been hereditary, used for long afterwards by the Hoysalas and their successors.

In 1310 A.D., this Hoysala line was overthrown by the Mussalmans of Delhi, and authority seems to have descended to Madhava Dannayaka (son of a minister of the Hoysalas), who ruled from Terakavambi in Gundlupet taluk. Early in the 16th century, the Wynaad and the Nilgiri plateau fell under the rule of the famous Hindu kings of Vijayanagar, whose capital was at Hampi. An inscription of 1527 records that the village Masanahalli (present Masinagudi) and its hamlet Devarayapatna were granted to a certain person and his heirs in perpetuity. Around both these places are numerous ruined buildings and sculptured cromlechs, which indicate that both places were clearly of great importance. The country around Masinagudi appears at that time to have been included in the Wynaad, and one inscription seems to suggest that the former was actually the capital of that tract.

By 1730, authority over the area was gradually passing out of the hands of the kings of Mysore, and south Indian kingdoms aligned with the French and British traders were in conflict. But it was in these conflicts that an obscure Mussulman soldier Hyder Ali, by military genius, courage, and energy rose to eminence and established his kingdom in 1759. He fought valiantly against the British and died in 1782, when his son Tippu Sultan ascended the throne.

Stormy years followed in the Wynaad. One of the most important ruling families in Malabar at the time were the Kottayam rajas, whose territory included the whole of the Wynaad and much of Ernad, i.e., the Kerala Western Ghats region adjoining the Nilgiris. The most celebrated member of the family who ruled Wynaad was Kerala Varma Raja, known as the 'Pazhassi rebel', who belonged to its 'Padinjare Kovilakkam' or 'western branch', located in 'Pazhassi amsam' of the Kottayam taluk.

Kerala Varma Raja had already been engaged in disputes with Tippu. The British entered into an agreement with the Pazhassi raja in their war with Tippu. The war ended in 1792, and Tippu had to cede parts of Wynaad. The British restored Wynaad to the Kerala Varma, but he persistently refused to come to any agreement about the revenue settlement of his country. The British then tried to capture him, but he fled and aligned himself with Tippu. Fighting followed, and the Pazhassi rebel led a guerrilla war against the Company army.

In 1799, during the Third Mysore War, Tippu was killed during the final assault. In the treaty which followed, the Nilgiri plateau, including Danaiginkottah district, was ceded to the Company. But the Wynaad, by some blunder, was ceded under one name to the Company and under another, to the young king of Mysore whom the British had resolved to re-establish on the throne.

Even after Tippu's death, Kerala Varma would not surrender and declared that Wynaad always belonged to his family. Meanwhile, the British consolidated power in the Nilgiris and Wynaad, and by 1801 had established their troops at every post above and below the Ghats. Every attempt was made to capture

Kerala Varma and he was finally killed in November 1805, resisting to the end. By now, the British had consolidated their power. And in Mysore, the kingdom was restored to the Udaiyars. A young prince was placed on the throne, and the Company appointed a Resident in the court to advise him on matters concerning revenue, military, and administration. In its consolidation of power, the Company considered all land to be an exploitable source of revenue. In 1857, after the First War of Independence (Sepoy Mutiny), the country was transferred to the British crown. Their power and control over resources was further consolidated. From the 1860's, the forests were seen as a great source of revenue, and were taken over by the government. The potential of the Nilgiri plateau as a haven for the European administrators was realized and by the 1850's, the area was well colonized.

During this period, from the early discovery of the Nilgiris in 1820 to 1850 tribal lands were alianated by paltry compensation and many public and private buildings came to be established. A sanatorium and a convalascent depot was established for the sick officers. Regular roads and paths were cut up to the hills from the Coimbatore plains, the Mysore plateau and the Malabar plains. All this development brought with it a host of immigrant labour. Consequently, the forests outside the towns were cut down to provide for the fuel requirements of the labour. In 1837, the Government interfered directly to check the destruction of woodlands but this had little effect. From 1848, under the Wasteland rules, huge areas of government lands was leased on very soft terms to the Europeans to encourage coffee and tea plantations. Thus, plantations were begun in the Wynaad and the western slopes of the Nidumalai. Attempts at growing the much needed Chinchona plantations were started in 1852 by the government. This was to ensure a steady supply of the much needed drug Quinine, useful for the treatment of malaria. The availability of this for the government would help its colonial pursuits in the malaria infected tropics. All attempts were made to smuggle Chinchona plants out of Peru and establish them elsewhere. The first Chinchona plantation in the Nilgiris was established in 1862.

A conservancy establishment was set up in 1852 to protect the forests of the area. But still the progress of conservation was slow. In 1856, the Conservancy department undertook plantations of several exotic species to supply the fuel wood requirements of the towns. This very much eased fuel wood pressure on the forests. Meanwhile, several attempts were made to grow fruits, vegetable and flower gardens by the early colinizers. Many of these were attempts at creating replicas of their British homes, and many of the English vegetables thrived in this environment. From 1857 onwards the North-west of Nilgiris on the Mysore frontier was discovered to have large tracts of teak. This was leased in by the government. It is these forests that provided the much needed timber for the construction activity on the hills.

In 1868, by an act of the government, the Nilgiris was separated from Coimbatore and was established as a separate district of the Madras Presidency. The first Imperial census of the population was conducted in this district also, in 1871.

By 1870, the Madras Railways was established and the Coimbatore-Olavakot section made functional. In its wake, the forests around were put to huge demand for railways sleepers and fuel. As early as in 1873, along the Palghat gap, the Walayar fuel reserve was constitued with a view to ensure a permanent fuel supply to the Madras Railways. A working plan, the oldest one in the country, was drawn up for this reserve. With the increasing importance of the Nilgiris in the Madras Presidency, plans were made to extend the Madras Railways to Coonoor and Ootacamund. In 1880, the construction of the line was taken up and was completed in 1905. The proposal to extend the Mysore Railways up the Wynaad hills was mooted in the 1880s. The Wynaad had acquired importance because of the prospective gold mining and the increasing coffee plantations in the area. Gold mining was not considered vaible a few years later and consequently the extension of the Railways was not persued.

In 1882, after the passing of the Madras Forest Act, many of the forests of the Biosphere Reserve were declared Reserved forests with the local population having limited rights over these resources. Shifting cultivation at the cost of the forests were stopped and forest land was leased to forest dwellers. Huge areas of forest lands was also leased to Europeans to develop plantations in the area.

By the early 1900s, the Nilgiris was well known as a sport, recreation and recruperation resort and this attracted many visitors to these hills. The area all round the hills was known to abound with wildlife and many took to game hunting in the area. The Nilgiri Wildlife Association which was established in 1877, set up laws to restrict hunting of wildlife to resonable limits. During this period, we have many travelouges and game hunting anecdotes from the area. The indigenous population also attracted many of the Europeans to undertake detailed studies on their culture and life style.

In 1920, large areas of the Malabar forests and the Malabar forest establishment suffered damage due to the Mappilla Rebellion. During the war years, a heavy demand was made on the forests to supply teak for their ship building ventures and their gunnery factories. During the Second World War period, the Mudumalai forests were occupied by the military for jungle warfare training. In 1947, India attained independence. Later years are discussed as the post-independence period.

POST-INDEPENDENCE HISTORY - SOCIAL, ECONOMIC, AND ECOLOGICAL CHANGES

At the time of independence, practically the entire western part of the Nilgiri Biosphere Reserve falling within the state of Kerala was part of British Malabar, a separate district in Madras Presidency. Nilgiri district and part of the Talamalai plateau-Sathyamangalam area of the Biosphere Reserve presently forming part of the state of Tamil Nadu lay within the Presidency of Madras. The Bandipur Tiger Reserve and the adjoining forests within the revenue district of Mysore in Karnataka were part of the Princely state of Mysore. Naganhole National Park and the adjacent areas, the present Coorg district of Karnataka today, were part of the independent State of Coorg. During the linguistic reorganization of the states in 1956, British Malabar was merged with Travancore-Cochin and became the new State of Kerala. The State of Coorg was merged with the new State of Mysore, the latter becoming the State of Karnataka. The remaining portions of the Biosphere Reserve were all in the State of Madras, which later became the state of Tamil Nadu. The Gudalur part of the Ernad taluk of British Malabar was detached and added on to Ooty district of Tamil Nadu.

Practically the entire area falling within the Biosphere from within the state of Karnataka was Reserved Forest or State Forest area, administered by the Forest Department. Some pocket of encroachers cultivating the 'hadlus' or the 'vayals' of Hunsur Forest Division were later relocated. In Tamil Nadu also, most of the areas falling within the Biosphere Reserve area, excepting the area of the Gudalur Forest Division were Reserved Forests administered by the Forest Department. But in Gudalur taluk, most of the forests were Janmam lands of the Nilambur Thirumulpad, and were subject to widespread land alienation and deforestation. As early as in 1949 the Madras Administration passed a special enactment called the Madras Preservation of Private Forests Act (Act XXVII of 1949) to prevent wanton destruction of the extensive Zamindari Forests (Private Forests) in British Malabar. The Act was meant to check the clearfelling and conversion to other uses of these economically and ecologically valuable forests by the designation of the Collector as the authority for granting permission for timber felling.

Although this was meant to insert some checks into the system, the Act was never effectively implemented.

A large number of demobilized soldiers from World War II, Indian repatriates from Sri Lanka, Burma and Malaysia were all rehabilitated on forest lands in many parts of the tract falling within the Biosphere. The ex-servicemen colonies in many parts of Kerala (for example in Wynaad), plantation activities such as that of TANTEA wherein Sri Lankan repatriates were absorbed by public sector tea plantations in the Gudalur part of the Nilgiris etc., indicate developmental trends in this region which continued until recently. This tract was viewed as a huge reserve of land to be opened up.

The massive and successful conversion of forests and arable land to cash crop plantations in the hills of Travancore-Cochin, as economically profitable activity, prompted a very large number of land hungry people from Travancore to migrate to the Wynaad, Nilambur and Palghat hills. The more traditional subsistence agriculture oriented hilly areas of Malabar offered vast scope for the expansion of cash crop agricultural practices. Land became a capital asset even in the mountains. Although migration into the Biosphere area began in Kerala in the 1930's, it increased to a veritable mass migration after 1945. Rubber as a cash crop had expanded rapidly, mostly due to war-time demand. Insecticides like DDT which controlled malaria which had kept many of these hill forests safe from human habitation made possible rapid colonization of the forests in the the post-War years. The appearance of jeeps during World War II which could negotiate the rough hill roads considerably opened up the hinterlands.

The massive national drive for planned economic development through Five Year Plans set in motion, after 1950, the process of development of river valley projects, industrialization, accelerated forest exploitation, etc. in hitherto inaccessible areas which were similar to and also included the Biosphere Reserve areas. The process of opening up the resource-rich hill areas in a manner similar to colonial exploitative policy had far reaching implications on the ecology of the area.

To cite an example, the gradual shift in forest management policy after 1960, toward exploitation of forests primarily for raw materials for wood based industries led to the massive conversion of natural mixed forests to monoculture plantations of teak, or the so called quick growing eucalyptus. States like Karnataka or Kerala which had an abundance of bamboo resources set up rayon or pulp industries. This led to the creation of a permanent demand for pulp- or rayon-grade wood produce from the forest. Almost as a natural corollary, bamboo forests were degraded or disappeared entirely due to a variety of causes which went unchecked. This led to the expansion of eucalyptus plantations with all their social, economic and ecological ramifications.

The gradual implementation of land reforms and the land ceiling enactment, particularly after the 1960's led to large scale shifts in land use on both agricultural and forest lands. For example, in 1971 the Kerala government passed the Kerala Private Forest (Vesting and Assignment) Act, 1971, which empowered it to take over thousands of square kilometres of privately owned forests without paying compensation. Anticipating this move, the private owners alienated vast areas of forests during the late 'sixties. Most of the area of the Biosphere Reserve in Kerala state excepting a few Reserved Forests was extensively and seriously affected by encroachment and illicit tree felling.

The 1960's also witnessed a galloping food deficit and the governmental move to counter the chronic food deficit and usher in the Green Revolution. This necessitated the construction of big irrigation dams such as the Kabini Dam, Bhavanisagar Reservoir, etc., which in turn increased the intensity of land use over large areas of the Coimbatore plains, southern Mysore plateau and Palghat plains. Intensive modern agricultural practices made greater demands on basic resources, in particular water and soil. Larger profit margins led to economic and social inequality. The emphasis on reducing 'vegetative' growth in harvested produce decreased the availability of agricultural wastes for fodder, fuel and even fertilizer. Traditional mosaic farming lands, with a variety of crops,along with non-cropped areas, fallows, hedgerows, etc. gave way to extensive monocultural croplands. This eliminated not only the ecological stability of the area but also extinguished the availability of the wide variety of natural produce that used to be available to the poorest people in the land. Such pressures were invariably transmitted to the nearest forest land. The same thrust to enhance food productivity led to the massive expansion of potato cultivation and similar measures in the Nilgiris and many parts of the Kerala ghats.

As the thrust of forest management shifted to raising plantations for new industries in the vicinity such as the Gwalior Rayons rayon pulp factory at Mavoor (near Calicut) in Kerala and the Tan India Industries in Coimbatore, the attention paid to protection of natural forests declined.

Developmental measures which focussed on industrialization for the alleviation of poverty focussed on backward areas such as the Nilgiris on a priority basis. The special climatic conditions of Ooty, i.e. the cool, dust-free atmosphere, attracted industries like the Hindustan Photo Film Company, Defence production industries, etc. These also helped to quickly transform the Nilgiris into an urban landscape.

The rapid growth of an affluent rural and urban middle class which had the leisure and means to travel for enjoyment resulted in a tourism boom which changed the very landscape of towns such as Ootacamund, in the Nilgiris. Examples of the changing socio-economic scenario of the Biosphere area are the increased construction activity, destabilizing hill slopes and triggering landslips, and the competition for basic resources such as fuel and water between tourists and local residents.

The greater thrust for welfare measures for those on and below the poverty line, such as scheduled castes and scheduled tribes, affected the population and habitat of the Biosphere Reserve area. Tribal development measures modified time tested lifestyles and resource utilization strategies which were bound to the potentialities and limitations of the specific habitat.

These lifestyles and strategies were undermined or altered, and led to shifts in the balance between the people and the habitat. The supply of large numbers of goats to the tribes of Attappadi, a region where ecodegradation is rampant and where regeneration of natural vegetation should have been a priority measure, is one such example. The prevailing and intensifying drought conditions in many parts of Karnataka and Tamil Nadu have affected the Biosphere area in many ways. One visible symptom of these is the increasing grazing pressure on the forests of the Biosphere, particularly in dry tracts, from cattle driven in from the parched plains.

The realization of the value of hill ecosystems and the extent of their current degradation has been recognized at policy planning levels, hence the formulation of the Centrally funded Hill Area Development Programme. Ecorestoration has been accepted as a crucial element in rural development strategy and is now being implemented through soil conservation, watershed management and social forestry programmes.

Compiled with excerpts from:

1. Francis, W. (1908). Madras District Gazetteers. Vol. I: The Nilgiris. Government Press.

2. Grigg, H.B. (1880). A manual of the Nilagiri district in the Madras presidency.

3. Logan, W. (1887). Malabar. Vol. I. Reprinted by Charithram Publications, Trivandrum, 1981.

4. Nicholson, F.A. (1887). Coimbatore Manual. Government Press, Madras.

5. Ranganathan, C.R. (1941). Working plan for the Nilgiris division. Government Press.

INDIGENOUS INHABITANTS

The indigenous inhabitants of the Indian subcontinent living in the thickly forested jungles of tropical India and leading lives of hunting and gathering or pastoralism and practising shifting cultivation can be divided into three groups: the Tibeto-Burman, Kolarian and Dravidian. The Aryans who colonized the land settled by these inhabitants came into conflict with them and established their own culture in the plains and valleys of northern India. However, as Aryan culture developed with time, it incorporated many elements of the indigenous culture also. Similarly, the local inhabitants absorbed elements of Aryan culture. Many indigenous clans, however, sought to maintain their individuality and culture, and retreated to the interiors of jungles or on the mountain heights. As the civilizations in the plains expanded and spread, these original inhabitants were driven into more and more remote areas. And even today many of these clans exist maintaining their own culture and identity whereas some would have perished.

Although these inhabitants are classified into three distinct groups based on physical features and phrenology, there is an underlying unity among them in their culture, religion and world view. And although each group has widely differing livelihoods, social structure, dwellings, dress, and mannerisms, there are underlying similarities in the way they have adapted to their environment. The stability of their cultural practices over centuries also reveals that these practices are highly adapted to their surroundings.

The Nilgiri Biosphere Reserve, being thickly forested, harbours many of the Dravidian groups of tribes in its remoter regions. Many of these tribes have been studied and reported upon, but some of them may still be undiscovered or scantily understood. The extremely difficult terrain, dense forests and harsh and extreme climate of the Western Ghats and in particular the area which now comprises the Nilgiri Biosphere Reserve have provided a safe refuge for a variety of peninsular Indian tribals who were forced to move to, or voluntarily withdrew to their mountain fastnesses. A very wide range of human communities ranging from the pre-agricultural Cholanaikas to the primarily pastoral Todas and forest-dependent Kurumbas, Paniyas, etc. have survived in this area retaining their distinctive cultural identities until recently. Many of them are not aboriginal inhabitants of the area but are remnants of vanquished civilizations from the plains of the Deccan plateau. The Nilgiri Biosphere Reserve thus harbours, along with its extraordinarily rich diversity, a rich variety of human cultural diversity also.

TODAS

The Todas have probably inhabited the Nilgiri plateau for many centuries. However, there are not sufficient reasons to prove them the earliest inhabitants of the Nilgiris. It is not known when the Todas first appeared on the hills. Before British settlement on the hills, the Todas used to receive tribute in kind from the other hill tribes, and were thus regarded as lords of the soil. The Todas occupy land on the western side of the plateau, where the rolling grassy downs have patches of dense evergreen forests, called sholas, interspersed in their hollows.

The typical Toda is above medium height, well proportioned and stalwart with a straight nose, regular features and perfect teeth. The put-kuli is his chief garment, made of thick cotton cloth with red and blue stripes. This is simply wrapped around the body by men and women alike.

The Todas are essentially a pastoral people, and nomadic to some extent. The inhabitants of each mund or village possess one or two other munds and move among them according to convenience or necessity, to secure pasture for their herds or shelter from the monsoons. They never cultivate land. The 'gudu' which they receive from the Badagas and Kotas supplies them with grain; otherwise, they depend entirely on their large herds of buffaloes for support. It seems likely that at some point in their history, the Todas gave up arms, agriculture and other occupations and turned pastoral. This is evident from the fact that they still use bows and arrows in many of their rituals connected with births, weddings, and funerals. In fact, some believe that the grasslands of the hills are a consequence of Toda intervention, by fire or other means, to create more pasture for their cattle.

The Toda village is called a mund. The name itself means a herd or cattle pen. It is usually a collection of three or four huts, each with a very low doorway. Besides these, the mund has another, slightly larger hut called the Tirieri or dairy temple. In the vicinity of the mund is a cattle pen called a Tuel, which is a circular enclosure within a loose stone wall. The buffaloes are penned here at night.

The life of the Toda revolves around the Tirieri. It is also called a Palchi and is managed by Palals. A Toda must obtain the sanction of the Toda panchayat and undergo rigorous initiation before he becomes the Palal, a sort of high priest. Priests of the second order are called Varzhals. They also undergo similar initiation, but officiate for a shorter period and are employed as milkmen. The next two orders are called Kokvali and Kurpuli, respectively, and are attached to particular munds.

There are four Boa temples on the hills, which, although revered by the Todas, seem to belong to some earlier race. They are tended by the Varzhal. Each is a circular stone edifice about 10 m high, with a thatched roof. They are also used as dairy temples.

The Todas call their god Kadavul. They also venerate the rising sun and the moon. They point to an area above Mukurthi which they call Amnad, the heavens. They consider the Pykara river to be sacred, and prefer not to cross it nor to draw water from it.

The Todas are divided into five clans, the Kenna, Kuttan, Peiki, Pekkan and Todi. Intermarriage between some of them is strictly forbidden. The Palals and Kaltamaks come from the Peiki clan, who seem to be superior to the others. They are called Tertal (superior) and the rest Tartal (inferior). The women practice polyandry, and one woman often marries all the brothers of a household.

The Nilgiri hills were discovered by the British in 1812.

Early reports hailed the salubrious climate and surroundings of the hills. The hills were considered to be a recuperative and recreational centre for both British army personnel and civilians. Quite a few Britishers, like Baikie, Bake, Rivers, Harkens, Henry, etc. were attracted to the customs and manners of the Todas, and chronicled them. Thus, many reports describing the Todas in the 1900's are available today. Early settlers bought land from the local inhabitants and established themselves on the hills. Plantations were encouraged from the 18d0's onwards under the 'Wasteland rules'. All these drastically changed the Todas' way of life, and it is questionable how many of their original customs and values remain.

BADAGAS

The Badagas occupy the southwestern part of the Nilgiri plateau and are the principal agriculturists of the hills. They are the descendants of the Kanarese from Coimbatore and south Mysore, which at one time formed an important part of the Kongu kingdom. It is commonly reported that the principal migrations of these people occurred about 300 years ago following the dissolution of the Vijayanagar Empire, but there is no doubt that Kanarese colonists occupied portions of the plateau long before that. They probably migrated to the hills when driven from their homes by famine, political turmoil or local oppression.

Compared to other indigenous inhabitants, the Badagas are an Aryanized people, though probably of the same Dravidian stock. Their rites and rituals reveal an Aryan influence. It also clear that they came as a wave to colonize the hills, for they have all necessary crafts and professions within their community. They must have come as agriculturalists in the expectation that they would find in these high regions land lying waste in plenty which they could easily cultivate and thus lead a life of plenty. In these high expectations they must have been thoroughly disappointed but still they contended with the situation of the weather and the existance of Todas and continued staying on the hills. To the Todas they offer an annual share of produce called 'gudi'.

As mentioned earlier, the Badagas carried on all necessary professions themselves. Thus there are several sects among the Badagas. They are the Udaya, Haruva, Adhikari, Kanaka, the high caste Badaga and the low caste Toraya. These castes resemble the Hindu castes of the 'twice born' and the 'other'. The Udaya, Haruva and Adhikari sects are vegetarians, while the others eat meat. The Toraya render services to the community that are considered essential but lowly.

Every Badaga man has a few acres to cultivate, which are managed by his wife while he himself engages in some other profession. They live in a comfortable, neat house that bears a remarkably close resemblance to every other house in the community. Badaga villages, consisting of neatly thatched houses, stand in the midst of fields of korali and semai, surrounded by well stocked farmyards. They possess a characteristic air of thriving industry, for the Badagas are a hardworking people. Other crops they cultivate include ragi, barley, wheat, navane, mustard, poppy, onion, garlic, peas and potatoes. They use a plough to till the soil. Their rights and rituals are very

Aryanized. During all their ceremonies and festive occasions the Kota play a major role by being musicians.

The social organization of the Badagas is conspicuous. Each village has a headman called the Monegar. He is generally the wealthiest man in the village, and is regarded as final authority on all subjects. He is practically an autocrat, but holds power only through the goodwill of the community. The Badaga seeks out the Monegar on all religious and social questions, and the latter's word is law. Questions of land partition, cultivation, outcasting, disputes and other minor matters are settled by the village council with the Monegar at its head. It is, however, in connection with marriage that the Monegar and his council play their most important part. The marriage has to have the approval of the Monegar. Later, Monegars were also in charge of revenue administration as officials of the British government.

The advent of the British and development during later years have deeply affected the Badagas' way of life. Their agricultural system has undergone much change, with many farmers switching from subsistence food cropping to cash cropping. During the early years of British occupation, much Badaga land was unjustly acquired, as in the well known Keity valley case. Further, the Badagas were considered a major threat to the forests and their method of shifting cultivation was stopped in the 1860's. Today, many Badaga communities have migrated to cities and towns all over India, although they maintain some roots in the Nilgiris. Much needs to be studied of their present social organization and religion, and of the forces acting on this community, now very much a part of the mainstream of society.

KOTAS

Our knowledge of the origin of these people is meagre. It seems possible that the Todas and the Kotas lived near each other before the settlement of the former on the Nilgiris, since their dialects bear a great resemblance to each other. According to their tradition, the Kotas formerly lived on the Kollimalai.

The Kotas are the neighbours of the Todas. There are seven Kota villages on the plateau, Kotagiri or Peranganad, Kilkotagiri, Mekanad (Ketti), Kundanad, Todanad and Sholur, and a village near Gudalur near the northern slopes of the Nilgiris. A village consists of 30 to 60 detached huts arranged on streets called keris, ie., Kilkeri, Melkeri, and Nadukeri. The keri is an exogenous unit. The hut is of mud brick, stone, and thatch or tiles, divided into living and sleeping compartments with verandahs and pials, and resemble the Tamil houses of the plains. Some huts or forges have carved stone pillars.

The Kotas are hard and sturdy men and are given to turbulent intoxication and the eating of carrion.

The Kotas are artisans. They are also agriculturists and herdsmen of buffalo and cattle. They are skilled at blacksmithy, carpentry, rope and umbrella making, and gold and silver jewellery making, and are indispensable to other tribes. Each tribal settlement has its Muttu Kotas who supply it with sundry articles in return for carcasses, ghee, grain and plantains. Kota blacksmiths make hatchets, bill hooks, knives, etc. for the hillmen. Earlier, they used to smelt iron ore brought from the plains, but now they use scrap iron. As agriculturists, they are on a par with the Badagas. Shifting cultivation, called 'podu' or 'bhurty' was stopped by the government in 1862. Kotas used to make medicines from the poppy heads cultivated by the Badagas. They also dispense medicines to the hill people. The Kota band that is employed for all functions on the hills consists of clarionet, drum, tambourine, bass horn and buguri or Toda flute.

Kota priests are the Devadis (or Terkarams) and the Pujaris (or Muntakannam). The Devadi is a hereditary office and the Pujari is appointed by the Devadi when he is inspired or possessed. At Kalamale are three temples. The Kotas believe that Kamataraya (Shiva) created the Kota, Toda and Kurumba, but not the Irula. The three were born from three drops of the god's perspiration. The Todas were told to live on milk, the Kurumbas were allowed the flesh of buffalo calves, and the Kotas were allowed everything.

Kota marriage is by consent of the woman, who can reject the man on the first night without fear of ostracism. Widow marriage is allowed. Kota women work in the fields, collect firewood, etc. They also make baskets and crude earthen pots on the potter's wheel.

The panchayat is active and settles cases of divorce, theft, assault as well as minor offences. In cases not capable of solution by the panchayat of one village, a council of delegates from all the villages convenes, and a Pittakar, or headman, gives a decision.

The Kotas burn their dead and kill a male buffalo at the funeral. They place a gold coin, called a 'viryapanam' in the mouth of a dying person. They carry what is called a 'teru' in front of the bier when they march to the cremation ground.

The Kotas revere the Todas and supply them necessary articles free of cost. The Kota, in return, is entitled to the carcases, horns and hides of animals belonging to the Todas.

NOTE ON KURUMBAS

"The Kurumbas are the modern representatives of the ancient Kurumbas or Pallavas who were once so powerful throughout southern India, but very little trace of their greatness now remains. In the seventh century the power of the Pallava kings seems to have been at its zenith; but shortly after this, the Kongu, Chola, and Chalukya chiefs succeeded in winning several victories over them. The final overthrow of the Kurumba sovereignty was effected by the Chola king Adondai about the seventh or eighth century A.D., and the Kurumbas were scattered far and wide. Many fled to the hills, and in the Nilgiris and the Wynaad, in Coorg and Mysore, representatives of this ancient race are now found as wild and uncivilised tribes. Elsewhere the Kurumbas are more advanced, and are usually shepherds and weavers of coarse woollen blankets." – Madras Census Report, 1891.

"However separated from each other and scattered among the Dravidian clans with whom they have dwelt, and however distant from one another they still live, there is hardly a province in the whole of Bharatavarsha which cannot produce, if not some living descendant of this race, at least some remains of past times which prove their presence. Indeed, the Kurumbas must be regarded as very old inhabitants of the land, who can contest with their Dravidian kinsmen the priority of occupation of the Indian soil". — Oppert.

"It seems probable that all the tribes still extant are remnants of a once powerful people composed probably of numerous small tribes possessing considerable territory in Canara, western Mysore and in the great Carnatic plain and have sprung from a race of nomadic shepherds, one of the great Dravidian group of tribes who inhabited the peninsula of south India before the historic period". — Griggs.

"Though Mullu Kurumbars are classified under the generic name of Kurumbars in the President's List, they have nothing in common with other Kurumbars found in the Nilgiris district. In the President's List of Scheduled Tribes, the name of Kurumbars and Kurumans are mentioned, but they are actually only synonyms or aliases. This broad category Kurumbars or Kurumans includes the following tribes: the Betta Kurumbars, the Jen Kurumbars, the Urali Kurumbars, the Pal Kurumbars, and the Mullu Kurumbars". — Census of India, 1961.

"By no stretch of imagination can the dark skinned, broad nosed Kurumba be regarded as an example of a high type of civilization. Nor would the light skinned Kuruba, with sharp cut features and aquiline nose appreciate being linked in the bonds of common ancestry with the Kurumba". — Thurston.

These and many other reports on the origin and relatedness of the Kurumbas are very contradictory and so mixed up with fable that it is impossible to extricate any intelligible account of this people'. Thus, the different Kurumbas will be dealt with separately, and a holistic account of these people and their origin must be postponed until further studies are carried out.

MULLU KURUMBAS

The Mullu Kurumbas consider themselves the descendants of the Veduval tribe, a hunting tribe that once ruled parts of Wynaad, with their capital at Buthandi. A folk song of theirs recounts that they were celestial ghosts, the followers of Shiva.

There are several theories about the origin of their name: 1) that they are the Mula, or original, Kurumbas; 2) that Mullu derives from the Mula (bamboo), on which their occupations are based; 3) that they are named after the Mullu, or arrow, that they use; 4) that the Raja of Kottayam, upon defeating them after a struggle, declared that though they were mere Mullus (thorns), they were full of Kurumbu (mischief), from whence they came to be called Mullu Kurumbas.

They are distributed in an area of about 30 to 40 sq km. This area includes the eastern part of Wynaad and the western part of Gudalur taluk in the Nilgiris. As a result, they speak a mixture of Malayalam and Tamil. The area lies at an elevation of 1000 to 1200 m, with gentle hills, broad valleys, and swamps. What was thick jungle 20 to 30 years ago has now been cleared for cultivation, and what were swamps are now mostly paddy fields.

The settlements of the Mullu Kurumbas are clean and tidy. The houses are built on sloping land that has been levelled and terraced, and have good drainage. The houses are arranged on a plan facing an open quadrangle. Where the settlement is large, there are many quadrangles, each surrounded by houses, with lanes connecting the quadrangles. The houses are unique in appearance and style of construction. They are rectangular and contain only one room. The houses are sturdily built with mud, timber and straw.

The male Mullu Kurumbas are generally of medium to tall height, with long, narrow faces. Their colour is brown though some are darker. They have prominent noses. Their dress consists of two pieces of white cloth, one around the waist and the other on their shoulders. Their women also wear white.

Though the Mullu Kurumbas gather food by hunting, fishing and digging for wild roots and tubers, they are essentially agriculturists. They cultivate dry and wet land. In drier fields, they raise plantation crops and millet. Their main crop, however, is paddy, cultivated in the swampy wet lands between hillocks. The lands owned by the Mullu Kurumbas of each settlement are held in common, but each member has a definite, inalienable share in them. Some land originally belonged to janmis, other land was forest land for which the annual rent was waived in 1915-16. They also work for the Forest Department for wages. Some are medicine men and use indigenous remedies; they believe in astrological and magic cures for illnesses, calling upon astrologers or praying to Mariamman or Kaliamman.

The Mullu Kurumbas have a well-knit caste hierarchy. Each settlement has a headman, the eldest male, called the Poornavam. He is more a master of ceremonies than an enforcer of social discipline. More power lies in the hands of the Moopan, who adjudicates, with the help of village elders, over three or four settlements. The overall tribal head is called the Valia Moopan or Talachi Moopan. The posts of Moopan and Valia Moopan are hereditary.

They enjoy the sport of hunting and are said to be capable of catching tigers.

Burial is the common mode of disposal of the dead. A few, who have lived a full span of life, are cremated.

JENU KURUMBAS

Jenu Kurumbas are mostly found in the northern portions of the Nilgiri Biosphere Reserve, in Begur, Kakankote, and Ainurumarigudi reserves. These forests are rich in bamboo teak, and with many trees and shrubs bearing fruits and tubers.

These Kurumbas speak a patois of Tamil with an admixture of Kannada. They are generally shorter and darker than the other inhabitants around, and have rounded features. They have keen eyesight and hearing. A timid, peaceful people, they live in small detached huts in the interiors of jungles, and hold no myths about their origins.

Besides their huts, they have two larger dwellings, a 'chavadi' for unmarried girls and a 'pundugar chavadi' for unmarried men, pundugar meaning vagabond. Their headmen are called Mudalis.

They subsist on honey, bamboo seeds, edible roots, etc. In the past, they were food gatherers and practised shifting cultivation, moving frequently from place to place. Now, however, they have settled down in fairly stable settlements, and cultivate paddy, ragi, avarai (cow gram), radle (Bengal gram), hurali (horse gram), and uddu (black gram). Many of them work for the Forest Department or for private contractors to augment their income. They do not possess any hunting weapon or trapping device, but are adept at collecting honey from wild bee hives on rock cliffs, clambering down at night on rattan ladders.

Couples are engaged before puberty. The son-in-law-elect works for the girl's parents until she comes of age, after which they move to their own house with no further ceremony.

The Jenu Kurumbas worship Shiva and also a deity called Kuriballaraya, the "lord of many sheep".

KADU KURUMBAS

The Kadu Kurumbas inhabit the forests of the northern part of the Nilgiri Biosphere Reserve, in the forests of Karnataka. They live in small hamlets scattered all over the forests, in groups of 8-10 or upto 15-20 families. These forests are moist and contain teak, rosewood and sandal. The area has extensive grassland. Patches of cultivation dot the area wherever the land is lowlying.

There are extremely few sources of information on these people. Francis Buchanan, on his travels to the area in 1800, thus describes the Kadu Kurubas: "A rude tribe of Karnataka who are exceedingly poor and wretched. In the fields near villages they build exceedingly low huts, have a few rags only for covering and the hair of both sexes stands out matted like a mop and swarms with vermin. Their persons and features are weak and unseemly and their complexion is dark. Some of them hire themselves as labouring servants to the farmers, and, like those of other castes, receive monthly wages. Others in the crop season watch the fields at night, to keep off elephants and wild dogs. In the interval between crops, they work as day labourers, or go out into the woods to collect the roots of wild yams; part of which they eat, and part exchange with the farmers for grain. Their manner of driving away elephants is by running against them with a burning torch made of bamboos. ... The Curubaru have no means of killing so large an animal and on meeting with one in the daytime, are as much alarmed as any other of the inhabitants. During the Sultan's reign they caught a few in pitfalls. The wild hogs were driven out of the fields by slings; but they too, are too fierce and strong for the Curubaru to kill. These poor people frequently suffer from tigers, against which their wretched huts are a poor defence; and, when this wild beast is urged by hunger, he is regardless of their burning torches. These Curubarus have dogs, with which they catch deer, antelope, and hares; and they have the art of taking in snares peacocks and other esculent birds.

"They have no hereditary chiefs, but assemble occasionally to settle the business of their castes. They confine their marriages to their own tribe. The Gauda, or chief man of the village, presides at this ceremony, which consists of a feast. During this the bridegroom espouses his mistress, by tying a string of beads around her neck. The men are allowed to take several wives; and both girls after the age of puberty, and widows, are permitted to marry ...

"They can eat everything except beef; and have no objection to the animal having died a natural death. They will eat victuals dressed by any of the farmers, but would not touch any of my provisions. They do not drink any spirituous liquors. None of them takes the vow of Daseri, nor attempts to read. Some of them burn, and others bury the dead. They believe that good men after death will become benevolent Devas, and bad men destructive Devas. ... The whole are of such known honesty that on all occasions they were entrusted with provisions by the farmers, who are persuaded that the Curubaru would rather starve than take one grain of what was given to them in charge. They have no guru, nor does the Panchanga or any other kind of priest attend any of their ceremonies. The spirits of the dead are believed to appear in dreams of their old people, and to direct them to make offerings of fruit to a female deity named Bettada Chicama; that is, the little mother of the hill. Unless these offerings are made, this goddess occasions sickness; but she is never supposed to do her votaries any good. She is not, however, appeased by bloody sacrifices. There is a temple dedicated to her near Nunjinagodu; but there is no occasion for the offering being made at that place."

Although his observations of their physical appearances and housing may be uncharitable, Buchanan's accounts of their way of life and of their honesty bears testimony to their culture.

Today, these tribals live a hand to mouth existence. They live on tubers, roots, jungle fruit, etc. which are becoming scarce due to the demand on forests to feed factories. They work as labourers both on the agricultural lands of others and in forests, where they assist the Forest Department.

BETTA KURUMBAS

The Betta Kurumbas are a small active people capable of hard work. They are said to be expert woodsmen. They are found in Karnataka, in the forests of Murkal, Kallahalla and Nagarhole in the Nilgiri Biosphere Reserve. They live in areas where bamboo grows in plenty, eating the shoots during the rainy season and living on roots and tubers in other seasons. They are also good at making baskets and sieves out of bamboo, which they sell in neighbouring areas. The Betta Kurumbas practice shifting cultivation and grow ragi. They do not plough the ground, but use sharp sticks to dig up the earth on the outskirts of forests. They speak a dialect consisting of Tamil and old Kannada words.

Betta Kurumbas live in highly organized groups. each has a hereditary chief called the Ijyamana, who lives at Priya-Pattana. With the assistance of a council of three or four persons, he settles disputes, and punishes all transgressions against the rules of caste. He can levy small fines, and expel from the caste any women that cohabit with a man outside the group. The god of the caste is Ejuruppa, who seems to be the same as Hanumanta, the servant of Rama; but they never pray to Rama, although they sometimes worship Shiva. They customarily offer fruit and a little money to their god, but never make any sacrifices to the Shakthis.

URALI KURUMBAS

The Urali Kurumbas are found all over Wynaad and, while they speak Malayalam and Kannada both in a corrupt form, they speak among themselves a peculiar dialect unintelligible to strangers. They are artisans and are handy at all kinds of work. They make the ploughs and knives used by the agriculturists of the area. They also make earthen pots by scooping out the insides of well shaped lumps of clay and firing them in crude kilns. They are also skilled in carpentry and basket weaving. They work as agricultural labourers in the rice fields of the Chettis, and occasionally gather honey from tall trees in the forest.

Their houses are called padis, which are so low that one has to crawl into them. They normally grow some ragi around their settlements, and augment their diet with rice and edible wild roots and tubers.

EDANADAN CHETTIS:

This class of Chettis, whose ancestors migrated from Coorg - from a place known as Edanad - have settled on the Wynaad plateau as agriculturists of the fertile soil of the area. They speak a mixture of Malayalam and Kanarese. They are an Aryanized community and are divided into Shaivites and Vaishnavites.

WYNAADAN CHETTIS

This is a peculiar group of Chettis who are found in the Kidinganad, Nenmini, Nulupuzha and Muppainad areas of Wynaad. Their ancestors hailed from Dharapuram in Coimbatore and were the Vellala Chettis, who for some reason not clearly ascertainable, left their country, passed through Sathyamangalam in Coimbatore, through Melpatta in Mysore, Ponkuli in Noolpuzha, and settled in the Wynaad. They are agriculturists by profession and follow many of the customs of the Kerala Nayars. They are bold hunters, their favourite pastime being the tiger hunt.

MANDATAN CHETTIS

They inhabit the Veliyembam and Pulpalli desams in the Wynaad. They are a small community found nowhere else in the Wynaad and appear to have migrated from around Gudalur in the Nilgiris. They have their own paddy and hill cultivation and practise complete subsistence agriculture.

KURICHIYANS

The name Kurichiyans was given by the Kottayam raja to this class of people, as they were adept at archery. The expression 'Kuri-vechavan' means "he who took aim". The traditional account of the Kurichiyans' advent into this country is that the Kottayam raja brought them to fight the Vedar rulers Arippen and Vedan. Their castemen would not take them back and they settled, in Wynaad. The number of families who so settled is said to be 148. While recognizing the gods of the Nayars of the area, their own special deity is 'Malakari', an aspect of Shiva as a hunter. They are cultivators, raising paddy on wet lands and ragi on the hills. They are also hunters, and in the name of Malakari, devote three days - 10th, 11th and 12th Thulam - to hunting. Brought into the land as soldiers, settled as agriculturists, this race which a century ago had the temerity to defy the British now earns its living by hired labour.

KARIMPALANS

The Karimpalans are a Malayalam speaking tribe of north

Malabar found in all the foothills of the Camel's Hump. They practise 'puram' or shifting cultivation, work in the forests as axemen, and also collect wild pepper. They have no ideology regarding their origin. The current status of the community is not known.

KADERS

This community is found in the Wynaad. They were Nayars or warriors who accompanied the Kurichiyas under the Kottayam raja, and assumed the name of Kader (forest men) when they settled in the forests. They worship Malakari, a manifestation of Shiva as hunter. They were lords of the forests in ancient times, and had to accomodate the other communities that came later. Nowadays, a few of them cultivate wet lands, while the majority lives on hill cultivation or work as coolies. They are good archers, like the Kurichiyas.

PATHIYANS

The Pathiyans are a small community of agriculturists inhabiting eastern Wynaad. According to tradition, they came to Wynaad from Mysore. Their ancestors migrated there during a famine and, being prevented by the ruling Kottayam raja from returning to their own country and ordered to adopt the customs of the local inhabitants, settled down as agriculturists. As a result, their descendants now possess an interesting mix of Malayali and Mysore customs. They are a small community of about 100 families. They were probably Gowdas (Jains) originally, this hypothesis being strengthened by the fact that a Vasti Patter, a

Jain brahmin, still officiates at their ceremonies.

KANALADIS

The Kanaladis are an exceedingly small community of oracles and fire-walkers. They are few in number and have to approach the Mullu Kurumbas, Pathiyas and Chettis for wives. Any woman is welcomed by the Kanaladis. Their language is Malayalam. They are probably descendants of the Malayans from the plains, who settled in Wynaad a long time ago. The community is a dying one, and its extinction seems to be only a matter of time.

ADIYANS

The Adiyans are a tribe found in Wynaad. They are also found in the Mysore area and are called Yeravas in Kannada. They are mainly field labourers but practise some hill cultivation also. Their language is a mixture of Kanarese and Malayalam.

KATTUNAYAKANS

The Kattunayakans are a Kanarese speaking tribe, similar in customs and manner to the Jenu Kurumbas. One difference, however, is that the Kattunayakans eat monkey flesh, while the Jenu Kurumbas do not. Their deity is Masti and has no shrine. He always lodges in an earthen pot and is represented by arrowroot tubers kept in it. There is a Masti pot in every 'padi' or village. These people always carry a stick with them for digging roots. They frequently shift their homes and own no land. They inhabit mountain slopes and subsist on wild roots. They make fire by rubbing two bamboos together. They are usually employed as labourers by immigrant castes such as the Goundans and Nayars in Wynaad.

PANIYAS

This dark skinned and curly haired Negroid tribe is found all over Wynaad. Paniyas are generally short and well built, with round faces and short, broad noses. One story of their origin relates how these wild inhabitants of Ippimala hill were caught in nets by Goundan landowners for raiding their crops, how they were taught the language and to go on errands, and how these tamed tribals induced their wild friends to join them in civilization. Today, the Paniyas do not have any legends about their origin. The words Ippi and Ippimala are unknown to them. The other tribals call the Paniyas Koottanmars, meaning tribe brought from elsewhere. Today, they are spread over many parts of Coorg and Mysore and in the Wynaad.

Their houses are scattered. They pitch their huts close to their fields, erected on a raised platform, low roofed and with stout mud plastered bamboo thattis. Each Paniya settlement has a headman who goes by the name of Kuttan or Mudali. The Paniyas living in the settlement are subject to his discipline. The office of the Kuttan is a nominated one and in olden days, the Jenmis nominated him. Cases that cannot be amicably settled among themselves in the Panchayat are taken to the Jenmi or Chetti, under whom they work, for a verdict.

The Paniyas are a necessity to Wynaad cultivation; they alone are able to control the wild cattle of this country and plough the soft, clayey soil that sinks to the touch. They are migratory, and work only under kind employers. In old times they were said to be bought and sold with the land to which they were attached as slave labour.

They are fond of music, sing while working, and spend entire nights singing and dancing to the accompaniment of a peculiarly shaped drum and a reed flute. Their language is a dialect of Malayalam, with some traces of Tamil words or word endings.

ARANADANS

They are a primitive hill tribe living north of the Palghat Gap, mainly in the Nilambur hills. They are small and dark, short, and with thick bushy hair and broad noses. They are good hunters and use bows and arrows, principally to shoot monkeys, whose flesh they like to eat. They extract an oil from the Indian python which is used to cure leprosy. They are employed in felling trees in the Nilambur forests. They also work as field labourers for the local landowners.

CHOLANAICKANS

There are few hunting and food gathering primitive tribal people who maintain this type of economy till today. Due to external pressures and a lack of sufficient good forest area in which to live many such societies once existant must have become exitinct. In order to live by hunting and gathering, the primitive community needs a generous natural environment that supplies its needs. The Cholanaickans of the Nilambur valley are one such hunting-gathering community living in the thick forests on the slopes of the Western Ghats. The valley has an elevation of 1300 m. The rainfall ranges from 2500 to 7500 mm. The area is thickly forested, with immense evergreen trees. Their trunks are often covered with creepers, epiphytes, orchids, mosses and ferns. The valley is also famous for teak plantations started by the British in 1862. The valley forms the drainage basin of the Chaliar river, on whose banks are found Cholanaickan settlements.

The Cholanaickans are said to have migrated from the neighbouring forests of Mysore. They are hunters, fishermen and food gatherers and speak a mixture of Kanarese and Tamil. They are completely isolated from other tribes. Their population in 1977 was 281, in 66 families. It is difficult to say whether the Cholanaickans chose to live in the evergreen forest or were forcibly evacuated from the more productive foothills and plains.

The settlements of the Cholanaickans are called 'kallu alais', or rock shelters. Although these are their fixed abodes, they wander from place to place in search of roots, tubers, seeds, honey, and minor forest produce. In fact, they are practically nomadic, except during the rainy season. Some of the main roots and tubers they collect are narai, kanala, venni, noorai, quayun, mayyalu, iranai, mothakka, gasvenni, pathivenni and savalu. They hunt throughout the year, except when prevented by rain. They hunt in groups with the help of dogs. Small rope nets are used, into which small deer, hares and monkeys are driven. They catch fish by poisoning the water with the extract of Ingal tree bark, or by using rods and lines.

The Cholanaickans worship the Mala Daivam or jungle god, and ancestral spirits. They also venerate Uliuruvu (the metal image of a tigress) and Kalaiuruvu (the metal image of an ox).

KURUMBAS OF ATTAPPADI

The Kurumbas of Attappadi were perhaps the earliest inhabitants of the area, who lived in complete harmony with the forest and depended to a large extent on forest produce. From their initially nomadic life they took up shifting cultivation, and organized themselves into hamlets in the wooded areas of the Attappadi Reserved Forests. They live mostly in the valleys of the main river, the Bhavani. Few settlements lie inside the forests away from the river. In older times, they were shifting cultivators, hunters and food gatherers, shifting their villages annually and settling near food and water. Then, each village had a long shed split up into compartments and within each compartment lived one family. In 1917, the Forest Department imposed restrictions on 'kumri' or shifting cultivation and specific areas of land, free of assessment, were leased to them for cultivation; the headman coordinating the allotments and supplying men for forest work in return. This brought about changes in their mode of living.

Each village now consists of a group of huts, some of which are arranged into the same compartments occupied by many families. The huts, called 'alai' or 'salai', are made of bamboo, small jungle posts, and grass. The side walls and partitions are made of bamboo thatties. They use thatching grass for roofing and mud for flooring. The huts are often single roomed and sometimes temporarily divided into two or three rooms. They have an outside and inside verandah, and a central room which is the main sleeping room with a kitchen and hearth on one side. There is a bamboo thatti ceiling above the hearth, used for drying grain. There is also an attic for storing grain and utensils.

The Kurumba males are well built, of medium height and with a sturdy physique. They are dark, with dark curly hair. The females are short and dark, with clear features and dark, long, curly hair. They often bear tattoos on their skins.

The tribe dreads epidemics like malaria, chicken pox, smallpox, etc., which have taken a heavy toll on it in the past. Venereal disease is common. They use their own herbal medicines to cure simple illnesses. They believe that diseases are due to the wrath of their deity. They seldom go to hospitals. Recently, a type of ulcer called tropical ulcer has taken on epidemic proportions. They are unable to cure this with ordinary herbal medicine.

Each tribal hamlet is headed by a Moopan, whose office is hereditary; he presides over all the social, cultural and religious ceremonies of the village. He is assisted by two officials, the Kuruthalai and the Bandari in discharging his functions and duties. The Mannukkaran is responsible for agricultural practices. He is knowledgeable about the fertility of the soil and the seeds to be sown at a particular season. He performs certain rites and offerings to Kara Daivam for a bumper crop.

They cultivate on the hill slopes of the Attappadi Reserve. It is called kothukadu, because they do not plough their fields but use a hoe to turn the soil and broadcast seeds upon it. Generally, a Kurumba chooses a tract with dense growth, near his hamlet, for cultivation since its vegetation lasts two or three burnings and its fertility lasts likewise. The Kothukadu allotted by the Forest Department is generally in the name of the Moopan, the head of the hamlet. It is he who demarcates family plots on a three year basis. After three years, the Kurumbas shift to another plot, where the fertility of the soil has not been exhausted. They normally return to the same plot after 15-18 years. The Mannukaran is the first to sow the seeds during the agricultural season. Ragi, chama (jowar millet), tuvarai, kirai, red gram, mustard, black gram and chillies are all sown together. The annuals are sown again after harvest, but tuvarai is continued for three years. After the harvest, vegetation is allowed to grow on the plot. The trees felled the previous season and left lying in the field are now cut up. The shrubs and bushes grown on the field are cut back and set on fire, fertilizing the soil for reuse.

Roots and tubers are collected especially when there is a scarcity of grain. Although they are eaten throughout the year, the main foodgathering season starts in December and continues till April. In the summer, the soil is too hard for digging and in the monsoons, it is too muddy. Several men from a hamlet go foodgathering as a group. The most important roots and tubers are Naru, Nooru, Kavalu and Perukku. They also collect honey and wax from the forests. They catch small birds, deer and rabbits in snares and traps, and fish in the Bhavani and Siruvani rivers. They also train dogs to chase wild pigs out of cover. Nowadays, many Kurumbas keep goats and cattle for breeding and milk.

Baskets of various types are made by the Kurumbas from material abundantly available from the forests. They make baskets of every possible shape for their own use and for local sale.

The Kurumbas are animists and believe in ghosts and spirits, to whom they make offerings. They also worship their ancestors. They consider the Malliswara malai sacred, and observe Shivarathri.

In Attappadi there were 200 Kurumba households in 1977, numbering about 1000 members.

MUDUGAS

The Mudugas live in the dense, forest clad hills of Attappadi Reserve Forest in two settlements, namely Pottikkal and Muthikulam, by the Bhavani and Siruvani rivers. They practise agriculture, hunting, food gathering and fishing. It is believed that they migrated from Tamil Nadu, but others say that they as a group separated from the Kurumbas and, over the years, have formed a different tribe. Their customs are very similar to the Kurumbas'; and they and the Kurumbas even intermarry. Their settlement has a headman called a Moopan, who, assisted by the Kuruthali and the Bhandari, sets the social code of the village. The Manukkaran is responsible for agriculture and agricultural practices, and collects a handful of grain from everyone's field. There are some small differences between the clans that reside on the banks of the Bhavani and the Siruvani. They currently number 94, in 37 families.

IRULAS

The Irulas are scattered all over peninsular India, with different customs and lifestyles in different areas. Those around the Nilgiris must have migrated from the east, having been ousted by the Malaiyalis from the Shevaroys, Javadi, Kolli and Pachamalais. They must have descended eastward and westward. In the west, they found lush forests and hospitable inhabitants. Thus the Irula is now seen in the Gobichettipalayam and Coimbatore taluks of Coimbatore district, in the Attappadi valley, and on the adjacent Nilgiri slopes.

Irulas have small plots of land near their villages, on which they cultivate a wide variety of crops and cereals - ragi, samai, thinai, red gram, maize, plantains, etc. - for their own consumption. Many of them work as coolies on estates or for the Forest Department. Some are excellent herdsmen and work for the plainsmen. They also collect and eat a wild yam called 'Irula root'.

Many of the Irulas are excellent craftsmen and artisans. They make ploughshares and wheels, bamboo mats and baskets, and grass mats for themselves.

SHOLAGAS

The Sholagas inhabit the jungles of northern Coimbatore and the forests of the Sathyamangalam plateau. Tradition holds that long ago, there were two brothers in the Geddesale hills, Karayya and Billayya or Madheswara. The Sholagas are descendants of Karayya and the Lingayats of Madheswara. A rakshasa (demon) named Savanan captured both and made Karayya a shepherd, settling him in the above areas.

The Sholagas are in five septs: the Chalikiri, Teneru, Belleri, Surya and Aleru. They all speak a mixture of Tamil and Kannada. They live on minor forest produce. Some till the land and cultivate various foodgrains, while others own sheep and cattle. They are also employed as farm coolies and as herdsmen by the men of the plains. Their staple food is ragi. They cultivate their crops on lands allotted to them free of assessment by the Forest Department.

Their headman is called the 'Yejamana', and has subordinates to help him maintain social morals and his word is law.

PANJARI YERAVAS

These are mostly found in the forests of Coorg district. A small number is also found in the Kakankote Reserve Forest. They speak a dialect which is a mixture of Kannada and Malayalam. They live on the outskirts of villages, and work as casual or agricultural labourers in neighbouring areas. They augment their earnings by collecting minor forest produce from the forests. They live in huts called kurais and their headmen are called Mupas.

PANI YERAVAS

They have migrated from adjoining Malabar, and speak a dialect consisting mostly of Malayalam words. They are found in the southern hilly ranges of Coorg district, and in the Kakankote Reserved Forest. Pani Yeravas are very shy, but cheerful, singing and dancing to the beat of a drum on festive occasions. They are excellent at archery, and shoot birds with marble-sized mud balls flung from their bows. They are nomadic and move around their territory seeking food.

Compiled with excerpts from:

1. Aiyappan, A. (1948). Report on the socio-economic conditions of the aboriginal tribes of the province of Madras. Government Press, Madras.

2. Anonymous (1964). Census of India, 1961, Volume IX, Madras. Part V-B-(7): Ethnographic notes on Scheduled Tribes.

3. Anonymous. (1978). Project report on the Integrated Tribal Development Project, Heggadadevanakote, Mysore district. Directorate of Social Welfare and Backward classes in Karnataka, Bangalore.

4. Anonymous. (1980). Studies on the changing pattern of man-forest interactions and its implications on ecology and management. KFRI Research Report 5, Kerala Forest Research Institute, Peechi, Kerala.

5. Avery, J. (1885). The religion of the aboriginal tribes of India. Indian Antiquary, May 1885.

6. Basha, S.C. (1986). Revised Working Plan for Palghat Forest Division, 1975-76 to 1984-85. Government of Kerala.

7. Buchanan, F. (1870). A journey from Madras through the countries of Mysore, Canara and Malabar. Vols. I & II. Higginbotham and Co., Madras.

8. Francis, W. (1908). Madras District Gazetteers. The Nilgiris. Government Press, Madras.

9. Grigg, H.B. (1880). A manual of the Nilagiri district in the Madras Presidency. Government Press, Madras.

10. Joseph, R.S.D. (1982). A descriptive study of Mullukurumbas. Annamalai University.

11. Mathur, P.R.G. (1977). Tribal situation in Kerala. Kerala Historical Society, Trivandrum.

12. Misra, P.K. (1969). The Jenu Kuruba. Bulletin of the Anthropological Survey of India. 18(3):182-246.

13. Misra, R. (1971). Mullukurumbas of Kappala. Memoir No. 30, Anthropological Survey of India.

14. Nair, R.B.G. (1911). Malabar series, Wynaad: Its people and traditions. Higginbotham, Madras.

15. Rice, L.B. (1907). Mysore, Vol. I and II. Westminster, London.

16. Verghese, I. (1969). The Kota. Bulletin of the Anthropological Survey of India. 18(2):106-182.

FOREST VEGETATION

The Nilgiri Biosphere Reserve, encircling the high rising Nilgiri mountains, extends over a wide range of altitudinal, climatic, geographic and geologic zones. Hence the differences in edaphic factors influencing the ecosystems are great and have resulted in an exceptional diversity. The conditions of the terrain and the history of human interaction with the biota have added to its inherent diversity. An exceptionally rich variety of land use patterns ranging from foraging human communities, pastoral groups, shifting cultivators, agricultural settlements and a wide range of indigenous as weil as exotic food and plantation crops are found in the Biosphere Reserve. The congenial climate and the altitude of these mountains, creating conditions similar to those in temperate and sub-temperate parts of the world, encouraged the European colonizers to introduce a very large variety of exotic plants, many of which have practically become a part of the local flora.

Located as it is, and including parts of two of the twelve biogeographic provinces of India (Malabar rainforest and Deccan thorn forest), it encompasses a spectrum of ecosystems and species assemblages which is the richest in peninsular India. The high elevation shola forests and the west coast tropical rainforests are, in effect, Pleistocene refugia for a number of humid tropical species.

THE VEGETATION CLASSIFICATION

The plant communities and associations in the Biosphere Reserve are most easily categorized on the basis of edaphic climatic and orographic conditions, which determine species distribution. Apart from the natural climax systems, the whole range of successional and retrogression stages and specific local variations are of such great variety that all of them cannot be described here. The classification adopted by G.S. Puri et al., (1983) is followed here to describe the vegetation types. However, the forest type descriptions available in the Forest Working Plans which have been used to describe the history of forests and forest management (in another section) follow the classification system of Champion and Seth (1968). Most of the forest areas in the Nilgiri Biosphere Reserve have been worked for commercially valuable timber, and unless ground surveys are carried out in each locality, the vegetation classification can be inaccurate. A vegetation map has, however, been prepared by the French Institute, Pondicherry, and it is also referred to here.

The most important vegetation types found in the Nilgiri Biosphere Reserve area are: I. Evergreen forests; II. Climax moist deciduous forests; and III. Dry deciduous forests.

I. THE EVERGREEN FOREST:

These forests are characterized by a great luxuriance of vegetation which consists of several tiers, the highest containing lofty trees often with plank buttresses at the base, reaching a height of 150 ft. or more, and the lowest containing dense evergreen shrubby growth. The trees are often infested with orchids, ferns, mosses and other epiphytes. Bamboos are uncommon, but straggling bamboos like Oxylenanthera are seen, mostly along perennial watercourses. These forests have the highest ecological status and are referred to as the climax vegetation.

There are three types of evergreen forests in the Biosphere Reserve area. They are:

1. Low elevation evergreen:

The low elevation evergreen forests are one of the most extensively destroyed forest ecosystems in the Biosphere Reserve. They occur in the western Kerala part at low elevations, adjoining the plains, in the river valleys which have all been cleared of natural forest cover.

Remnants of this vegetation occur only along the Chaliyar basin, particularly in the New Amarambalam and also in the Muthikulam-Palghat hills. Smaller pockets are available in the Coimbatore Division.

The low elevation evergreen forests in the Biosphere area can be classified under the Dipterocarpus-Mesua-Palaquium series.

This series occurs along the west coast and the Western Ghats, extending from 12^{o} to $14^{o}40'$N latitude, and from the plains up to 1500 m altitude.

The annual rainfall is more than 2000 mm with 4-5 dry months and high temperatures, the mean monthly temperature being higher than $15^{o}C$ throughout the year. The soil is loamy lateritic, enriched by humus.

The Dipterocarpus-Mesua-Palaquium series is again classified into: a) Moist evergreen; b) Semi evergreen; c) Moist deciduous; d) Open forest; e) Secondary thicket; f) Savannah woodland; g) Clump savannah; and h) Shrub savannah. Except for the first, which is the undisturbed climax system, the rest are all degraded stages of the original vegetation.

a) Moist evergreen forest:

These are dense, moist, multi-storeyed forests of evergreen species reaching a height of 35 m or more with gigantic trees towering above the, general level of the forest, the largest reaching a height of 50 m or girth of upto 4-5.5 m. The best forests are confined to the narrow valleys. The number of tree species is very large, while the contribution of individual species varies greatly. There are four main storeys: top storey, secondary storey, understorey, and undergrowth. For a detailed list of species in each storey, refer Puri et al., (1983).

b) Semi evergreen forest:

Some of the accessible areas of low elevation evergreen forests in the Nilambur Special Division, Nilambur Division and Palghat Special Division fall within this category. These are mainly moist, dense forests differing in physiognomy from the evergreen type only by the presence of a few deciduous species and by slightly lower height. They are found in the accessible areas or outer limits of the evergreen forests. These facts, as also the absence of regeneration of deciduous species in the unworked areas, indicate that their ecology is that of the evergreen series.

From a dynamic point of view, these forests are secondary forests in progression toward the evergreen climax (or, more often, evergreen forests degrading to dry deciduous or open forest or savannah woodland through a transitory stage of semi evergreen). Lagerstroemia lanceolata is the predominant deciduous species. The palm Caryota urens is very common. The presence of giant trees of heliophilous species like Bombax ceiba and Trewia nudiflora point to the secondary nature of these forests.

In the degraded areas around habitation within this type, Bambusa arundinacea and sandal are found. Xylia xylocarpa forms pure patches in lateritic areas within this type.

c) Moist deciduous forest:

Moist deciduous forests which are secondary are widespread in the Kerala part of the Nilgiri Biosphere Reserve in all Forest Divisions along the middle altitudes, and also in the upper reaches of the Bolampatti hills in Coimbatore district and Nilgiri South Division in Tamil Nadu.

Some floristic differences between this type and the climax moist deciduous type are apparent. For example, Aporosa lindleyana and Psychotria dalzelli abound in the undergrowth and Schleichera oleosa in the upper canopy of these secondary moist deciduous forests, whereas they are rare in the climax type. Xylia xylocarpa is much more common here. On the other hand, natural teak is absent here because of the lateritized soils.

d) Open forest:

The soil is lateritic, with lateritic caps exposed in some localities. The trees are not as dense as in the preceding formations, and their crowns do not touch. Their height is also less, not exceeding 15 m. The trees commonly found are Careya arborea, Hopea wightiana, Emblica officinalis, etc. In slightly better localities, Terminalia paniculata, Lagerstroemia *lanceolata*, *Xylia xylocarpa* and *Aporosa lindleyana* are found.

e) Secondary thicket:

There are patches of evergreen forests on hillocks among rice fields. These forests are over-exploited for timber and fuel. Fast growing species like *Macaranga indica*, *Mallotus philippensis*, *Trema orientalis* and *Grewia tiliaefolia* form thickets here. *Bambusa arundinacea* is also common.

f) Savannah woodland:

In this landscape, trees are scattered amidst grasses, the density of trees being greater than in a tree savannah. In fact, savannah woodland resembles an open forest with a continuous cover of tall grasses.

g) Clump savannah:

Patches of low, stunted trees ranging between 7 m and 13 m in height, separated by glades of grasses and undershrubs characterize the clump savannah. This type is the result of shifting cultivation in the past, over lateritic soils and in very heavy rainfall areas. The patches of evergreen woods are composed of *Macaranga indica*, *Mallotus philippensis*, *Cinnamomum zeylanicum*, *Vateria indica*, *Allophyllus serratus*, etc. In the savannah, the grass cover is generally overgrazed. The following species are found: *Chrysopogon fulvus*, *Wendlandia notoniana*, *Olea dioica*, *Pteridium aquilinum*, *Lobelia nicotianaefolia*, etc.

h) Shrub savannah (lateritic facies):

At this stage of degradation, annual fire becomes a dominant ecological factor which only allows the growth of fire hardy species. Shrub savannah follows the clearfellings of the evergreen forests for shifting cultivation on the plateaux. Emblica officinalis, Careya arborea, Buchanania lanzan, Acacia sundra, etc. remain. Ixora arborea, Eugenia corymbosa, Ziziphus rugosa, Ziziphus xylopyrus, Carissa carandas, Holarrhena antidysenterica, etc. are common shrubs.

Puri's classification		Corresponding Champion's Types
Moist evergreen	—	Western tropical evergreen forest (climax)
Semi evergreen	—	West coast tropical semi evergreen forest (climax and seral)
Moist deciduous and Open forest	—	Southern tropical secondary moist deciduous forest
Clump savannah	—	Subtropical hill savannah
Shrub savannah	—	Laterite thorn forest.

2. Medium elevation evergreen:

These forests are more extensive in area in the Nilgiri Biosphere Reserve, with many pockets of relatively undisturbed forest occurring in the Palghat hills, Muthikulam, Silent Valley and Attappadi Reserved Forests, New Amarambalam, Nilambur Special Division and small pockets in Coimbatore Division of Tamil Nadu.

The main species association is the Cullenia-Mesua-Palaquium series. These forests are confined to the western side of the Western Ghats in Kerala and in some moist places of Tamil Nadu. They occur under very wet conditions: rainfall of more than 3000 mm and a very short dry season of less than four months. The soils are loamy lateritic. The series is classified into the moist evergreen forest (climax) and a number of degradative stages.

a) Moist evergreen forest:

It is a dense, moist, multi-storeyed forest of evergreen species. The top canopy is 35 m or more in height. Straight boled trees are covered with lichens and mosses. Climbers and epiphytes are very common. Due to the closed cover, the ground is generally devoid of grasses, or carries only poor, shrubby vegetation.

The floristic composition is very complex. For a detailed list of species in each storey, refer Puri et al., (1983).

b) Semi evergreen forest:

This is a moist, dense forest showing almost the same physiognomy as the wet evergreen, but differing by the presence of some deciduous and heliophilous species. It is often found on the margin of the wet evergreen forest along accessible tracts. Its ecology is that of the _Cullenia_-_Mesua_-_Palaquium_ series. From a dynamic point of view, these semi evergreen forests are old secondary forests in progression toward the wet evergreen climax.

The riparian forests found on the hill slopes, sometimes called sholas of low or medium altitude, may be considered to be relic forests. Their composition varies from place to place and also according to altitude. They are of semi evergreen or evergreen type on the western side of the Ghats. On the eastern slopes, from 1500 m to 2000 m, they are semi evergreen formations. From 800 m to 1000 m they turn into a moist deciduous type.

c) Secondary thicket:

This is found in the plains, as patches of evergreen forests on the small hillocks among rice fields. These forests are over exploited for timber and fuel. In the openings, fast growing species such as _Macaranga indica_, _Mallotus philippensis_, *Sterculia urens*, *Vernonia travancorica*, *Trema orientalis*, *Grewia tiliaefolia*, etc. form a thicket dominated by the remaining trees of the previous forest. Bamboos are also common.

d) Savannah:

This is the last stage of degradation of the series, much like the savannah of the *Terminalia-Anogeissus-Tectona* series, although it has a different ecology. It is maintained in this stage by annual fires.

Puri's classification		Corresponding Champion's Types
Moist evergreen	–	Western tropical evergreen forest (climax)
Semi evergreen	–	West coast tropical semi evergreen forest (climax and seral)
Riparian/low level sholas, evergreen or semi evergreen	–	Nilgiris subtropical evergreen forest or Nilgiris subtropical hill savannah (seral).

3. High elevation evergreen:

The so-called "shola" forests, interspersed with high elevation grasslands occur extensively in the Nilgiri South Division and in the adjacent areas of Kerala: in the upper reaches of Silent Valley, Attappadi and New Amarambalam. Smaller pockets of sholas also occur in the Palghat Special Division, along the crestline in Coimbatore Division, and in Nilambur Special Division. Puri et al., (1983) classify the high elevation evergreen forests under the shola montane forest type.

Shola montane forest:

True montane vegetation is encountered in peninsular India only in the high hills of south India (Anamalai, Palni and Nilgiri hills), above an elevation of 1800 m. The vegetation type is generally designated as the high level shola-montane forest (Meher-Homji, 1975).

The climatic characteristics are: rainfall of 1000-1500 mm, with an average dry season of one month's maximum duration. The mean temperature of the coldest month may reach 10^{o} C, but on winter nights the minimum temperatures may descend as low as -9^{o} C in the open grasslands; however, at the same time, the temperature under the forest cover remains above 0^{o} C. (Legris and Blasco, 1969).

The montane forests are restricted to valleys and depressions, where the moisture content is higher. Other sites carry grassy vegetation.

Puri et al. (1983) give a detailed list of plants found in the high altitude shola, shola margins and shrub savannahs.

Grasslands:

There are also extensive grasslands in the high elevation areas along with the sholas; they are maintained by fire and climatic conditions. The grasses are generally less than 80 cm in height. Common species are *Cymbopogon polyneuros*, *Themeda cymbaria*, *Eragrostis nigra*, etc.

In the Nilgiri North Division, along its eastern edge east of Kotagiri, high elevation evergreens degraded to shrub savannah grasslands are found.

Puri's classification		Corresponding Champion's Types
Shola montane	–	Southern montane wet temperate forest (climax).

II. CLIMAX MOIST DECIDUOUS FOREST:

Climax moist deciduous forests are restricted to the

Nilambur valley in the Nilgiri Biosphere Reserve, where they have mostly been converted to teak plantations. The Wynaad plateau, which includes most of the Wynaad Wildlife Sanctuary in Kerala, the southwestern portions of Nagarhole National Park, and the western part of Mudumalai Wildlife Sanctuary also contain climax moist deciduous forests in varying stages of degradation.

Puri et al. (1983) classify these forests under the moist deciduous teak type, and under this type, the _Tectona-Dillenia-Lagerstroemia lanceolata-Terminalia paniculata_ series.

Climatically, this series is characterized by rainfall of 2000-4000 mm. The dry season is of 3-4 months' duration in Kerala.

The soil is generally red lateritic loam. On lateritic caps, _Hopea parviflora_ and _Xylia xylocarpa_ facies alone are found, while on clayey sites, poor stands of _Terminalia tomentosa_ are found. The climax vegetation is called the moist deciduous forest, and there are a number of degraded stages.

a) Moist deciduous forest:

This is a moist, dense forest with upto three storeys. Most of the species are deciduous in the top and second storeys. The undergrowth includes many evergreen shrubs and small trees. Grass cover is light or missing in closed areas. The trees reach a height of 25-30 m. In some cases, as in the Nilambur forests (Kerala), the top storey reaches 45-50 m.

Many species are common to the dry deciduous teak type also. _Dillenia pentagyna_ and _Xylia xylocarpa_ are the only characteristic species of the top canopy that are not encountered in the dry deciduous teak type. Others, like Lagerstroemia lanceolata, Terminalia paniculata, Kydia calycina, and Trema orientalis are preferred species of this series. The dominance of teak in this ecosystem is mainly due to the action of foresters.

The degraded phases are:

b) Open forest with bamboo facies:

Bambusa arundinacea forms big clumps mixed with large trees, chiefly Terminalia, Lagerstroemia, Dillenia and teak, remaining from the previous forest type.

c) Lateritic facies:

On lateritic soils, many large tree species disappear, e.g. Terminalia bellerica, Tectona grandis, Adina cordifolia, etc. Some other species are more adapted to the changed edaphic conditions, for example, Xylia xylocarpa, Hopea parviflora, Terminalia paniculata and Erodia lunuakenda and take their place.

Many parts of the forests in Nagarhole National Park, along the western part of Hatghat Reserved Forest and Arkeri RF belong to the degraded forms of the climax moist deciduous forest, as seen below:

d) Secondary thicket:

This type occurs mainly in patches in the plains. The neighbouring villagers extract timber and fuelwood from these small woods, which are in a state of coppice with some emergent trees. Introduced fruit species like Artocarpus integrifolia and Anacardium occidentale are often found. Clearings are occupied by fast growing light demanders like Macaranga, Sterculia, Trema and Grewia. Bambusa arundinacea is common in such areas.

e) Small woods:

These are small patches of forests left in place amidst areas clearfelled for cultivation.

f) Tree savannah:

This landscape consists of areas occupied by small patches of trees amidst areas clearfelled for cultivation.

g) Shifting cultivation:

Depending on the time of abandonment of cultivation and the fallowing of the area, the aspect of cultivation may vary from an open forest to a shrub savannah.

Puri's classification		Corresponding Champion's Types
Moist deciduous	-	South Indian tropical moist deciduous forest
Open forest with bamboos	-	Secondary moist bamboo brakes
Lateritic facies	-	Western laterite semi evergreen forest.

III. DRY DECIDUOUS FOREST:

Dry deciduous forests are found along the interstate boundary between Kerala and Karnataka, falling partly within the Wynaad Wildlife Sanctuary and the Bandipur Tiger Reserve, and along the southern and western edges of the Mudumalai Wildlife Sanctuary.

The dry deciduous forests in the Nilgiri Biosphere Reserve come under the main series 1. Terminalia-Anogeissus latifolia-Tectona grandis series, and the series 2. Anogeissus latifolia-Hardwickia binata series.

1. Terminalia-Anogeissus latifolia-Tectona grandis series:

This series extends from Kanyakumari district in the south to Jhansi (Uttar Pradesh) and Guna (Madhya Pradesh) districts in the north.

Annual rainfall ranges from 800 mm to 1800 mm; the dry season may last from 6 to 8 months. The mean temperature of the coldest month may go below 20 °C, but not below 15 °C.

Soil types are varied: red furruginous loam, ferruginous soils on trap, loamy sandy alluvial black soils on alluvia, slightly ferralitic (thin laterite) loam in the best situations, or skeletal soils. The abundance of teak seems to be favoured by soils that are only slightly acidic.

This is a mixed population of deciduous species. Three tiers may be recognized: i) the top canopy has a maximum height of 20-25 m and is more or less closed; ii) the second storey consists of small trees, 10-15 m high; and iii) the undergrowth is formed of shrubs and is devoid of grasses in the closed stands.

A detailed description of floristic composition is given by Puri et al. (1983).

The degraded stages of dry deciduous forest commonly found are generally referred to as 'Open forest' by Puri et al. (1983). Under the influence of destructive factors, the plant cover has decreased, although the floristic composition remains the same. Depending on the mode of degradation, fire or grazing, the forests show two types of retrogression. One is toward the savannah type, where fires are important, stimulating grass growth. The other, in areas of heavy grazing, is toward the scrub and thicket type, where palatable species disappear, leaving behind thorny elements. As grass cover is completely eliminated in this type, fire cannot pass through the thickets.

The seral stages found are:

A. With fire as the degrading agent:

a) Savannah woodland:

Extensive areas of forests along the northern part of the Nilgiri Biosphere Reserve in Karnataka and Tamil Nadu are savannah woodlands. This is an open forest containing the original species, but with a greater proportion of fire resistant species like Emblica officinalis, Diospyros melanoxylon, and Bridelia retusa. Bombax ceiba also infiltrates this type in the large clearings.

b) Tree savannah:

There is a greater spacing of trees in this type than in the savannah woodland type. Shifting cultivation often results in this formation.

c) Shrub savannah:

Tectona grandis persists even in this stage. Butea monosperma and Diospyros melanoxylon increase in proportion to biotic disturbance.

B. With grazing as the degrading factor:

d) Scrub woodland:

This type consists of groups of trees separated by thickets, either derived from a dense forest by exploitation of the upper tree stratum, or from an open forest by the invasion of bushy species. The tree stratum may reach a height of 10-12 m. The crowns of the trees do not touch.

e) Closed thicket:

Thorny shrubs and the coppice shoots of trees occur in this type, reaching a height of upto 5 m. Thorny species are *Acacia catechu*, *A. leucophloea*, *Ziziphus mauritiana*, *Caesalpinia decapetala*, etc. The stunted trees are *Tectona grandis*, *Anogeissus latifolia*, *Cassia fistula*, etc.

f) Discontinuous thorny thicket:

In addition to heavy felling, these areas are subject to excessive grazing. *Acacia milotica*, *A. leucophloea*, *Carissa congesta*, *Butea monosperma*, and *Bauhinia racemosa* are some of the species encountered in these thickets.

g) Scattered shrubs:

This is the most degraded stage, on exposed parent rock or on areas littered with boulders and pebbles. The grass cover is completely grazed. The shrubs rarely exceed 1.5 m in height, and their spacing is generally 3-6 m or more. Cactiform *Euphorbia*, with *Cassia auriculata*, *Dodonaea viscosa*, *Maytenus emarginata*, and dwarf *Phoenix* species are among the species frequently found here.

Puri's classification	Corresponding Champion's Types
Deciduous forest, open forest and scrub woodland	- Southern tropical dry or very dry teak bearing forest
Savannah woodland and tree savannah	- Dry teak bearing forest, secondary dry deciduous forest, or dry savannah forest
Closed thicket and discontinuous thicket	- Dry deciduous scrub
Low scattered shrubs	- Southern *Euphorbia* semi desert scrub and *Euphorbia* scrub

2. *Anogeissus latifolia*-*Hardwickia binata* series:

This series is absent in the Western Ghats, but is found in discontinuous patches in the northeast and southwest oriented hills of the Eastern Ghats (in Andhra Pradesh and Tamil Nadu).

The Hasanur plateau and Sathyamangalam Division in the Nilgiri Biosphere Reserve area contain this series of dry deciduous forest.

The rainfall ranges from 500 mm to 1200 mm, spread over a period of four to six months in the areas with Hardwickia. However, the distribution of the species is not correlated to climatic and soil conditions.

The degraded stages are either the savannah type or thicket type, depending on the adversely operating factor, i.e., fire in the case of the former and grazing in the case of the latter. Accordingly, various degraded stages are found.

a) Savannah woodland:

The grass layer is dense and continuous because of the open canopy. The woody species are scattered, and there is an increase in the proportion of fire resistant species like Emblica officinalis, Diospyros melanoxylon, Wrightia tinctoria, Miliusa tomentosa, Bridelia retusa and Phoenix humilis.

b) Tree savannah:

The trees are more distantly spaced in this type than in that of the savannah woodland, and are almost scattered. The undergrowth is very light, and consists of scattered individuals of Acacia sundra, Cassia auriculata, and Dodonaea viscosa. The grass cover, though light, is continuous.

c) Shrub savannah:

The violence of fires and the felling of woody species has led to a more degraded physiognomic type, the shrub savannah, wherein all the trees have disappeared, leaving undergrowth shrubs and grasses.

d) Scrub woodland (also called Albizzia amara forest):

In this physiognomic type, the grass cover is discontinuous, but the scrub or shrubby layer is thick and continuous. The crowns of the trees do not meet.

This category includes the driest part of the Biosphere Reserve, extending along the eastern and southeastern foothills of the Nilgiris. This area includes most of the Kandiyur, Nellithurai, and Jakkanari RF's of Coimbatore Division, and the Nilgiri Eastern Slopes.

e) Closed thorny forest:

When grazing is excessive, the grass cover is reduced to some dispersed tufts of Aristida and Heteropogon. Fires cannot then pass through this type. The percentage of thorny species increases, and their numbers exceed that of non-spiny species. A few crooked and deformed residual species of the Hardwickia series are also present.

f) Discontinuous thicket:

Along roadsides and in the vicinity of villages, the vegetation is even more degraded. The floristic composition is similar to that of the preceding type, but residual Anogeissus latifolia and Hardwickia binata are much more scanty.

g) Scattered shrubby facies:

Many unprotected hills are covered with this type of vegetation, which is sparse and reduced to mere low bushes.

In regions such as the Melur Slopes and Pillur Slopes RF's of Coimbatore Division and in parts of Sigur and Nilgiri Eastern Slopes RF's of Nilgiri North Division, Erode and Coimbatore Divisions, the Albizzia amara thickets are replaced by Gyrocarpus facies.

AGRICULTURE AND PLANTATIONS:

A very wide range of tree species has been planted within the forest area, and includes different species of eucalyptus, wattle, Cinchona, Bombax, Ailanthus, teak, sandal, tamarind, etc., of which the maximum area is covered by teak and eucalyptus. Extensive areas in Nagarhole National Park, Kerala Wynaad Wildlife Sanctuary, Nilambur Forest Division, Mudumalai Wildlife Sanctuary and, to a lesser extent in Bolampatti Block II are covered by teak plantations. Eucalyptus occupies extensive areas in Kerala Wynaad, parts of the Nilgiri plateau (particularly Nilgiri South Division) and, to a lesser extent, the Sathyamangalam and Gudalur Divisions. Wattle is mostly planted in the Nilgiri South Division in the Nilgiri Peak Reserved Forest, Porthimund RF, Kadcuppe RF, Mukurthi Peak RF, Kundah RF, Thaishola RF and Mikarebetu RF.

The other species occupy less area and are scattered all over the different Reserved Forests in the three states.

Adjacent to the Biosphere Reserve area and sometimes as enclosures within it, are a great variety of tropical cash crop plantations. Area wise, the most important of these are tea, coffee, cardamom, rubber, pepper, arecanut, ginger and a few other plantations. While most of the tea plantations are restricted to the Nilgiri plateau proper, there is a second lot concentrated around the Gudalur Wynaad. Most of the coffee plantations are in Kerala and Coorg Wynaad. Cardamom is mostly concentrated along the western side in Kerala, and this is true of rubber also. Most of the other cash crops occur in smaller holdings, in particular along the humid western slopes of Kerala.

A very large variety of crops - food, ornamental, medicinal, fibre, condiment, etc. - are cultivated in the Biosphere area. They include a wide variety of cereals, including rice, millets, pulses, tubers (including extensive areas of potato in the Nilgiris), banana, vegetables, in particular temperate vegetables such as cabbage, cauliflower, carrot, beetroot, etc., sugarcane, cotton, betel, tobacco, mint, etc. The extreme diversity of bioclimatic and topographic conditions have permitted this extraordinary richness of crops, possibly the richest in the country.

RESUME OF VEGETATION TYPES:

I. EVERGREEN FORESTS:

1. Low elevation evergreen forest: Dipterocarpus-Mesua-Palaquim series:

   a. Moist evergreen forest
   b. Semi evergreen forest
   c. Moist deciduous forest
   d. Open forest
   e. Secondary thicket
   f. Savannah woodland
   g. Clump savannah
   h. Shrub savannah

2. Medium elevation evergreen: Cullenia-Mesua-Palaquim series:

   a. Moist evergreen forest
   b. Semi evergreen forest
   c. Secondary thicket
   d. Savannah

3. High elevation evergreen forest: Shola montane forest

II. CLIMAX MOIST DECIDUOUS FOREST: Tectona-Dilenia-Lagerstroemia lanceolata-Terminalia paniculata series:

   a. Moist deciduous forest
   b. Open forest with bamboo facies
   c. Lateritic facies
   d. Secondary thickets
   e. Small woods
   f. Tree savannah
   g. Shifting cultivation

III. DRY DECIDUOUS FOREST:

1. Terminalia-Anogessus latifolia-Tectona gandis series:

   With fire as the degrading agent
   a. Savannah woodland
   b. Tree savannah
   c. Shrub savannah
   With grazing as the degarding agent
   d. Scrub woodland
   e. Closed thicket
   f. Discontinous thorny thicket
   g. Scattered shrubs

2. *Anogeissus latifolia-Hardwickia binnata* series:

a. Savannah woodland
b. Tree savannah
c. Shrub savannah
d. Scrub woodland (also called *Albizzia amara* forest)
e. Closed thorny forest
f. Discontinous thicket
g. Scattered shrubby facies

Compiled with excerpts from:

1. Champion, H.G. and Seth, S.K. (1968). A revised survey of the forest types of India. Manager of publications, Delhi.

2. Puri, G.S., Meher-Homji, V.M., Gupta, R.K. and Puri, S. (1983). Forest ecology. Second edition. Vol. I. Phytogeography and Forest Conservation. Oxford and IBH Publishing Co., New Delhi.

BIOGEOGRAPHY

Ecologically and biogeographically, the Indian subcontinent is one of the most fascinating regions in the world, and one of the richest in its diversity of living organisms. In fact, no other land mass of comparable size in the world surpasses this region in the richness of its biological heritage. Lying as it does at the confluence of the Ethiopian (or Afro-tropical), Palaearctic and Indo-Malayan biotic zones, the region possesses a number of interesting components from each of these realms as well as several peculiarly indigenous forms.

Each ecological zone within each biogeographic sub-region should be represented in at least two Biosphere Reserves. The Indian subcontinent has been divided into eight biogeographic sub-regions by Blanford (1901), and twelve biogeographic provinces by Udvardy (1975). The Nilgiri Biosphere Reserve falls into Blanford's biogeographic sub-region of the Western Ghats (or Sahyadris) and the West Coast, and Udvardy's biogeographic provinces of the Malabar rainforest and the Deccan thorn forest.

Thus Western Ghats - West Coast biogeographic sub-region is perhaps the richest biogeographic province of the Indian subcontinent, and the Wynaad-Mysore plateau-Nilgiris tract is an ideal location for the constitution of a Biosphere Reserve in the area. The Nilgiri Biosphere Reserve, as it is called, embraces substantial unspoilt areas of natural vegetation ranging from dry scrub, dry and moist deciduous forests, semi-evergreen and wet evergreen forests, evergreen sholas, grassy downs, and swamps, and ranks highest in extent of biological diversity. The

Attappadi plateau, Moyar valley, and parts of Wynaad provide the entire range of diversity of cultivated plants, from the millets of very dry tracts, to the paddy and plantation crops of wet and humid tracts.

FLORA

The Western Ghats - West Coast region harbours a number of plants restricted to the area; for example, 3500 out of a known total of 13,000 species of flowering plants in India occur in this region, of which at least 1500 are endemic to the Western Ghats. Examples of genera of flowering plants entirely restricted to the Western Ghats include *Adenoon*, *Baeolepis*, *Calacanthus*, *Frerea*, *Jerdonia*, *Octotropis*, *Poeciloneuron* and *Wagatea*.

"The Nilgiri hills have been described as belonging to a botanic realm of their own that shows affinities, in some cases, with the Assam flora and with the flora of the southern slopes of the Himalayas. The greater part of the region is forested, where dominant species are *Tectona grandis* and *Santalum album*, but there is considerable open rolling downland, interspersed with woods called sholas, containing *Rhododendron*, *Ilex*, ferns, bracken, tree orchids, hill gooseberries, blackberries, wild strawberries, heliotropes, *Fuchsia*, *Geranium*, etc. The introduction of eucalyptus has displaced much of the natural vegetation of the Nilgiris". -- Mani, 1974.

The Malabar region is characterized by the presence of Guttiferae, Dipterocarpaceae, Myristicaceae, and an abundance of

Malayan forms especially Sterculiaceae, Tiliaceae, Anacardiaceae, Meliaceae, Myrtaceae, Melastomataceae, Gesneriaceae, Piperaceae, Orchidaceae, etc. There is an abundance of Strobilanthus and Impatiens. The species found here and also found in the eastern Himalayas include Ternstroemia japonica, Hypericum hookerianum, Hypericum nepaulense, Eurya japonica, Rhamnus dahuricus, Photinia notoniana, Rubus ellipticus, Rubus lasiocarpus, Carallia integerrima, Rhododendron arboreum, Meliosma, Rosa, Pygeum, Viburnum, Lonicera, etc. (Mani, 1974).

The major floristic groups:

The major floristic groups are described below:

1. Exotic naturalized plants:

Senebiera didyma, introduced from America is naturalized in the Nilgiri hills. So also are Swietenia mahagoni, Cinchona officinalis, Caesalpinia coriaria, Cassia hirsuta, Cassia alata, Mimosa pudica, Acacia farnisiana, Enterolobina saman, etc. They are all species originally from America that are commonly found in the Nilgiri Biosphere Reserve area. The introductions from Australia include many species of Acacia, Flaveria australasia, Eucalyptus, etc. Some of the naturalized African species include Adansonia digitata and Bryophyllum pinnatum. The Madagascan Delonix regia has also become naturalized in the area.

2. Tropical Asiatic elements:

The tropical Asiatic elements of our flora have largely Indo-Chinese and Malayan affinities, and represent perhaps the most dominant component group of our present-day flora. Common examples of the humid tropical Asiatic elements in our flora are Piltosporum tetraspermum (Nilgiris), Cassia siamea (South India), Rhodomyrtus tomentosa (Nilgiris), Tetracera laevis (Western Ghats), Myristica (Western Ghats), Hédyotis (Western Ghats), and others.

3. Temperate elements:

A number of species of plants of temperate zone origin come from Europe, and their distribution is restricted to the Himalayas, Khasi Hills, Eastern Ghats and southern Western Ghats. The temperate elements in the flora include Corydalis and Fumaria (Nilgiris), Viola patrinii (Western Ghats), Silene (Nilgiris), Trifolium repens (Nilgiris), Rubia (Western Ghats), Valeriana (Nilgiris), and others.

A considerable proportion of the temperate elements are typically arboreal forms, often with circumpolar distribution, and occur as Pleistocene relicts in the Nilgiri hills. The boreal Caryophyllaceae - Arenaria and Stellaria - occur both on the Himalayas and the Nilgiris. Some of the Rosaceae plants like Alchemilla and Proterium have extended to the Western Ghats, and Circaceae (Onagraceae) occur on the Himalayas and the Niligiri and Palni hills.

4. Steppe elements:

The steppe species are mostly of middle Asiatic origin and have their home in the lowlands of Turkestan in the Pamirs, Afghanistan and the Northwest Himalaya. Some of them are partly from west Asia and partly from the eastern Mediterranean. Some have spread southward to the Deccan plateau and the Nilgiri hills, e.g., *Dipsacus* (Leguminosae) and *Cnicus* (Compositae).

5. Mediterranean elements:

The Mediterranean elements comprise partly southern European and partly North American species of plants. They have also penetrated to the Western Ghats and to Ceylon. The important species in the Western Ghats are *Fagonia arabica*, *Melilotus*, *Cleome*, etc.

6. Tropical African and Madagascan elements:

The tropical African, especially East African and Madagascan elements constitute an important, though small, section of the peninsular flora. Examples are *Ochrocarpus longifolius* and *Erythroxylon monogynum*, occurring in the Western Ghats and Ceylon. They are considered to be close to African species. *Mundulea*, a South African and Madagascan genus, also occurs in the Western Ghats. Other species, common throughout the Western Ghats include *Geissaspis* and *Leptodesmia congesta* occurring in the Nilgiris and Madagascar, *Tamarindus indica*, *Bryophyllum pinnatum*, *Plumbago capensis*, *Sesamum*, *Salvadora*, *Hardwickia*, *Vicoa*, etc.

7. Pleistocene relicts:

The Pleistocene relicts are temperate and boreal species of the Himalayas that spread southward during Pleistocene glaciations in the Himalayas, across the Aravalli mountains to the Western Ghats, and reached the southern end of the peninsula and sometimes even Ceylon. They became isolated from the

Himalayas in the south. The greater bulk of these species is concentrated on the higher elevations of the Nilgiri, Anamalai, Palni and Cardamom hills in the southern part of the Western Ghats. *Clematis*, *Anemone rivularis*, *Viola patrinii*, *Polygala sibirica*, *Silene saxatilis*, *Geranium nepalense*, *Rhamnus virgatus*, *Prinsepia utilis*, etc. are some of the plants found in the Nilgiris that are definitely Pleistocene relicts.

Systematic studies:

The Nilgiris have long been botanically studied, and a number of valuable publications are available. Robert Wight (1830-1850), Allardyce (1836), Bentham (1851), Schmid (1856), Beddome (1876), Fyson (1915), Gamble and Fischer (1915-1936), Champion (1936), Champion and Seth (1964), Krishnamurthy (1953), Ranganathan (1941), Jayadev (1957), Shankaranarayan (1958, 1959), Rege et al. (1959), etc. have enriched our knowledge of the flora of the Nilgiri hills. B.D. Sharma and coworkers in the Botanical Survey of India at Coimbatore have also carried out extensive botanical explorations in the Nilgiris and have published their results (1977).

Blasco (1970) observed 82 species of plants confined to the Nilgiris and pointed out that the Nilgiris appear to be an important centre of speciation in South India, next only to Travancore and Tirunelveli. The study of the vegetation of the Nilgiris is fascinating from the ecological and phytogeographical points of view.

The shola-grassland ecosystem and the Pleistocene relict vegetation in the Nilgiris are interesting areas for ecological studies. Theagarajan (1964-1974), Razi (1955, 1956), Meher-Homji (1965, 1967), and Blasco (1971) have provided valuable insights into the Nilgiri shola-grassland dynamics by their excellent floristic and ecological studies.

The Silent Valley forests in Kerala, also part of the Nilgiri Biosphere Reserve, have been and still are being botanically explored, especially by the Botanical Survey of India. Silent Valley was botanically explored during 1979-1982 for lichens, mosses and pteridophytes by the Botanical Survey of India. Eleven species of lichens were found to be new to India, four species of mosses were new to South India, and at least half a dozen taxa were new to science. Some plants were collected after a century and the fruiting parts of Handeliobryum setschwanicum were collected for the first time.

FAUNA

The Nilgiri Biosphere area is richer than any other part of the peninsula, both in genera and species of animals. Blanford has listed, for example, 48 genera of mammals, of which Platacanthomys is peculiar to the peninsula. The Himalayan Mustella, Harpiocephalus, Sciuropterus and Hemitragus occur in this tract. Viverra occurs here as well as in the Bihar-Orissa tract.

Blanford has also listed about 275 genera of birds, 28 of which do not occur elsewhere in the peninsula. The Himalayan types, like Rhopocichla, Brachypteryx, Schoenicola and Ochromela occur in the Malabar. About a dozen genera of birds found here also extend into Ceylon, for example, *Garrulax*, *Rhopocichla*, *Irena*, *Schoenicola*, *Eurystomus*, *Collocalia*, *Batrachostomus*, *Loriculus*, *Huhua*, *Ictipaetus*, *Baza* and *Gorasachius*.

Of about 60 genera of reptiles listed by Blanford, *Hoplodactylus*, *Alea*, *Pseudoplecturus*, *Melanophidium*, *Platyplecturus* and *Xylophis* do not occur in other parts of the peninsula and *Otocryptis*, *Dendrelaphis*, *Gerardia*, *Chrysopelea* and *Ancistrodon* extend into Ceylon also.

The amphibians *Nyctibatrachus*, *Nannobatrachus*, *Melanobatrachus*, *Nectophryne* and *Gegenophis* are peculiar to the Malabar tract, which has the largest concentration of endemic amphibians in India.

Bhimachar (1945) describes some of the distributional peculiarities of freshwater fishes in the Malabar tract and subdivides the Western Ghats into a northern section, the Deccan Trap area from the river Tapti to about latitude 16^{o} N; a middle section upto the Nilgiri hills; and a southern section, the Anamalai, Palni and Cardamom hills. The middle and southern portions are characterized by a larger number of species and a higher degree of species endemicity. The middle section contains *Silurus* (as also the Eastern Himalaya), *Balitora brucei mysorensis*, *Schismatorhynchus*, *Bhavania*, etc.

In the Malabar tract are a number of endemic species of the Oligochaeta: *Moniligaster*, *Dranida*, *Woodwardia*, *Plutella*, *Megascolides*, *Notoscolex*, *Megascolex*, *Pheretima*, *Perionyx*, *Howascolex*, *Curgia*, *Gordiodrilus* and *Glyphidrilus*.

The biogeographical component elements of the present day character fauna of the Indian peninsula may be grouped under: i) the derivatives of the older faunas differentiated in a southern land mass, namely the Gondwana fauna; and 2) the derivatives of the relatively younger faunas, differentiated mainly in Asia and comprising essentially the Tertiary mountain fauna.

1. Gondwana faunal derivatives:

The Gondwana faunal derivatives represent the oldest component elements - phylogenetic relicts - of the characteristic fauna of the peninsula. The oldest members of the Gondwana elements in the peninsula belong to groups of great age, which also occur in other Gondwana areas of the world, e.g. the lamellibranch mollusc, found in the river Krishna. _Streptaxis_ (Pulmonata) from the South Indian hills and Ceylon also occurs in Assam, Burma, the Andaman and Nicobar Islands, tropical Africa and South America. _Ennea_ is known from Madagascar, tropical and southern Africa, southern and southeastern Asia, Japan, the Philippines, Burma, Nilgiri-Sherroy-Anamalai and Palni hills, Mysore, South Canara, etc.

2. a) Peninsular endemics:

The principal peninsular autochthonous elements, restricted wholly to the peninsula, represent in part the dominant types of the original fauna of the peninsula. The most important examples include the Porifera _Gecarcinucus_ and _Pectispongilla_ (Potamonidae) from Malabar, the freshwater hydroid _Limnocnida indica_; the Oligochaeta _Comarodrillus_, _Octochaetus_ and _Eudicogaster_; the molluscs _Ariophanta_ occurring from Malabar to Surat and _Pseudaustenia_ occurring in the Nilgiris and Travancore, etc. As stated earlier, the Malabar area has the largest number of endemic amphibia.

2. b) Madagascan elements:

The Madagascan affinities of the peninsular autochthonous fauna are, on the whole, stronger than the African affinities. The latter are generally stronger among the ancient groups than among the more recent higher groups. In the freshwater fauna of the peninsula, the African-Madagascan affinity is, for example, more evident among the lower than the higher invertebrates or fishes. The only typically Madagascan mammals are ancient Insectivora, the endemic Centetidae, and Lemuroids like Lorissinae and Galaginae. Some of the endemic Viverrinae and Herpestinae are old forms. Chamaeleontidae are abundant in Madagascar and South India.

Anoeme, Drepanocerus, etc. are some Ethiopian genera found in Ceylon, South India, Burma and South China.

The redurid bug Edocla found in Mysore is also known from South Africa. The Chrysomilid beetle Apophylia occurs in the Nilgiris, Ceylon, Africa, the trans-Gangetic area of the Eastern Himalaya, Assam, Burma and China.

3. The younger intrusive elements:

The younger intrusive faunal derivatives belong largely to the Tertiary mountain forest faunas of Indo-China and Malaya. It is not always easy to distinguish between species of Indo-Chinese and Malayan origin.

4. Indo-Chinese faunal derivatives:

These are younger than the peninsular autochthonous and southern derivatives. They belong to higher taxonomic groups and to more specialized genera, and are abundant and widely distributed. Lepidoptera of the peninsular contain many examples of the Indo-Chinese elements. Discophora sondaica occurs in South India, Sikkim, southeast Tibet, South China, Burma, etc. Graphium doson from south Japan, south China and the Sunda Islands extends through Bengal to South India on one side, and the Kumaon Himalaya on the other. Graphium agamemnon of South China, Australia, the Solomon Islands and Burma has spread along the Himalayas to Kumaon, and is represented by Graphium agamemnon menides in the Nilgiris. The Ceylon frogmouth (Betrachastomus moniliger), the fairy bluebird (Irena puella) and the great Indian hornbill (Buceros bicornis) are examples of Western Ghats birds with Indo-Chinese affinity.

5. Malayan elements:

The Malayan elements are younger than the Gondwana faunal derivatives, but somewhat older than the Indo-Chinese elements. They belong mainly to the higher groups, especially the mammals.

Megascolex, Chaerilus, Presbitus, Phoenicia, etc. are some of the characteristic Malayan elements occurring in the peninsula. Pharnacia serratipes occurs in Borneo, Malaya and Malabar and is one of the largest Phasmids.

A number of birds in the peninsula are also from the Malayan region. Pitta brachyura, Eurytomus orientalis (broadbilled roller), Dichoceros and Anthracoceros (hornbills), Lyncornis cervinicens (large eared nightjar), etc. on the peninsula are of Malayan origin.

Mammals include Moscothera civeltina (restricted to the Malabar coast), Charrodnia gwatkinsi (from the South Indian hills), Sciuropterus macrurus (restricted to South India and Ceylon), Paradoxurus, Pteromys, Elephas, Cervulus, etc., which are all Malayan elements.

6. Palaearctic elements:

These forms, which differentiated in the Mediterranean sub-region, in southwest Asia, southeast Europe, north Africa and middle Asia entered India from the northwest and have sparsely colonized the hills of South India. A part of the Palaearctic elements in the peninsula is of the higher Himalayan origin and represents Pleistocene relicts. The rest represents the Mediterranean intrusive elements. They are restricted to the higher mountains of South India and Ceylon. The scorpion Buthus, and Butheolus, Galeodes, Harpalus advolans, etc. are examples. Other examples include Hemitragus hylocrius found from the Nilgiris to Cape Comorin, while the second species of this mammal, Hemitragus jemlahicus, is restricted to the Himalayas. Some other examples of Palaearctic elements are Hyaena, Mellivora, Gazella, Pterocles and Eupodotis.

Discontinuous distribution of fauna:

The most outstanding and familiar example of this is the Nilgiri tahr, Hemitragus hylocrius. Besides the Nilgiri species, this ibex or mountain goat has one species in the Himalayas (Hemitragus jemlahicus), ranging from the Pir Panjal range to

Bhutan, and a third species, Hemitragus jayakari, found only in the mountains of the Oman hinterland in southwest Arabia.

Another mammalian genus with the same discontinuous Nilgiri-Himalayan distribution is the marten, belonging to the carnivorous weasel family, Mustelidae. The genus Martes is represented in the Himalayas by the yellow-throated marten, Martes flavigula and in the Nilgiris hill complex by the Nilgiri marten, Martes gwatkinsi. The former is found in the Himalayas, and extends into the hill ranges of Assam, Burma, west China, and Malaysia. The latter is confined to the Nilgiri and associated hill of the southern Western Ghats.

Examples of such farflung, disjoined distribution are to be found in a great many Himalayan plants and animals which have evolved endemic species in South India. Among reptiles, a typical example is the flying lizard, genus Draco. It is represented by three species in the Eastern Himalayas and the tropical moist deciduous forests of the Nilgiri and Kerala foothills. Among amphibians, a notable example is the genus Ixalus (now Philantus), which has more or less the same disjoined distribution as the flying lizard.

Prominent among the sedentary endemic birds of the Nilgiri and associated South Indian hills which are relic populations of Himalayan forms or are clearly derived from them are: laughing thrushes (genus Garrulax), the fairy bluebird (Irena puella), the great pied hornbill (Buceros bicornis), several raptors, e.g. bazas or lizard hawks (Aviceda jerdoni and A. leuphotes), and the rufous bellied hawk eagle (Lophotriorchis kienerii).

The laughing thrushes, especially, are remarkable because they are preeminently Himalayan and are found throughout that range in something like 27 species. After a complete absence of this species over 2000 km of continental and peninsular India, the genus (Garrulax) reappears in the extreme southwestern hills, in the endemic species Garrulax cochinnans, restricted to the Nilgiris and G. jerdoni in three subspecies restricted to the Palnis and Kerala hills. There is, in addition, a third species found in Kerala, namely the Wynaad laughing thrush, which is an obvious subspecies of the Eastern Himalayan G. delesserti.

A considerable number of endemic Himalayan birds winter in ecologically equivalent temperate habitats in the south Indian hills, some apparently performing the annual migratory journey of 1500-2000 km each way in a single stop. A typical example is the woodcock Scopolax rusticola.

The uniqueness of the birds of the Western Ghats is brought out by many: Salim Ali (1969, 1977), Reza Khan (1980), Hegde and Daniels (1986), etc. Of the 13 species of birds considered endemic to the Western Ghats, two are not strictly so. The Malabar whistling thrush (Myophoneus horsfieldii) and one of the two forms of the rufous babbler (Turdoides subrufus) extend a little eastward also. Species strictly endemic to the Western Ghats are the white bellied tree pie (Dendrocilta leucogastra), the small sunbird (Nectarinia minima), the 3 forms of the laughing thrush (genus Garrulax), the Nilgiri pipit (Anthus nigheriensis), the Nilgiri verditer flycatcher (Muscicapa albicaudata), the black and orange flycatcher (M. nigrorufa), the white bellied blue flycatcher (M. pallipes), the Nilgiri wood pigeon (<u>Columba elphinstonii</u>) and the blue-winged parakeet (<u>Psittacula columboides</u>). Another species that may be considered endemic to this narrow strip is the Malabar crested lark (<u>Galerida malabarica</u>), though its northern limit lies outside the Western Ghats.

<u>Some endangered animals</u>:

The rich and highly diverse fauna of India shelters many endangered animals. The distributional ranges of most species of land vertebrates have shrunk to small fractions of what their size was about fifty or a hundred years ago. Species that were abundant then are now severely restricted to localized refugial areas or have totally disappeared during the last two or three decades. Some of the more striking examples of these vanishing species in the Nilgiri Biosphere Reserve area are described below:

1. Nilgiri tahr (<u>Hemitragus hylocrius</u>):

This species now occurs only at elevations of 1000-1200 m on the Nilgiris and Anamalais and parts of the Western Ghats in South India. The species was, however, quite common in the latter part of the 19th century, when its population was estimated at 1500 in the Nilgiris. Its present range is around 6.9% of what it was about a hundred years ago. The present population of the Nilgiri tahr in the Western Ghats may be around 1000-1500.

2. Blackbuck (<u>Antilope cervicapra</u>):

It is found on the Sigur plateau and in the Bhavanisagar area in the Nilgiri Biosphere Reserve. It has been ruthlessly hunted by man. Its present range is now 4.6% of what it used to be.

3. Tiger (*Panthera tigris tigris*):

The tiger is found on open, dry, grassy plains and in mixed forests (preferably well shaded ravines and nullas) in the Western Ghats. It is also found below the snowline and in cold coniferous forests in the Himalayas. It has been totally exterminated in most parts of its former range, and is now protected in the Project Tiger Reserve, Bandipur, within the Nilgiri Biosphere area.

4. Lion-tailed macaque (*Macaca silenus*):

Its range extends along the Western Ghats from North Kanara to Kerala. It inhabits evergreen forests. Sugiyama (1968)) estimated that its population is around 1000. The lion-tailed macaque is now restricted to the Nilgiri, Anamalai and Ashambu hills.

5. Nilgiri langur (*Presbytis johni*):

The Nilgiri langur is found in the South Indian hill ranges from Coorg to Cape Comorin: the Nilgiris, Anamalais, Palnis and adjacent ranges. It inhabits dense forests and sholas. The greatest threat to its survival is habitat destruction and poaching for its fur and flesh, believed to be of medicinal value. Its range is now only 1.8% of its former value.

The other two species of monkey found in the Biosphere Reserve are the common langur (*Presbytis entellus*), found in deciduous forests, and the bonnet macaque (Macaca radiata), found everywhere including agricultural and inhabited areas.

6. Slender loris (Loris tardigradus):

This is another primate recorded in the Nilgiri Biosphere Reserve area.

Some of the other animals of particular interest in the Biosphere area are:

1. Hyaena (Hyaena hyaena):

The hyaena is found in the Thengumarada area on the dry edge of the Mysore plateau. It is also reported from the scrub forests around Masinagudi.

2. Four horned antelope (Tetracerus quadricornis):

This is not found on the Malabar coast but in the Nagarhole National Park area adjacent to the Mysore plateau. It is very rare, and reliable reports suggest that it occurs solely in the Sundakatte-Bisalwadikere area.

3. Chinkara (Gazella gazella):

This is also found in the dry areas of the Mysore plateau.

4. Gaur (Bos gaurus):

The gaur ranges from scrub forest to semi-evergreen forest and prefers undulating, hilly terrain with moist deciduous vegetation. Hence, it is found within the Biosphere area. Good populations exist in Bandipur and Nagarhole National Parks, and a small population in Mudumalai Sanctuary. Gaur occupy the adjoining Wynaad area also. Indiscriminate poaching and habitat destruction are grave threats to the survival of gaur.

5. Indian elephant (_Elephas maximus_):

The elephant, the largest and most venerated of our wild animals, still survives along the Western Ghats, although heavy poaching and habitat fragmentation have resulted in an alarming decline in its numbers. Elephants have been forced to occupy unsuitable and inaccessible habitats, which will eventually lead to their destroying fragile habitats and finally to their own extinction. The complex of National Parks and Wildlife Sanctuaries of Bandipur and Nagarhole in Karnataka, Mudumalai in Tamil Nadu and Wynaad in Kerala, now part of the Nilgiri Biosphere Reserve, and the Brahmagiri Sanctuary in Coorg, Padiri and Kuruva RF's in Wynaad, and Kalmalai RF near Mudumalai form the largest continuous tract of elephant habitat in peninsular India. The Chamarajanagar and Kollegal Forest Divisions of Karnataka, and the adjoining Sathyamangalam Forest Division of Tamil Nadu (this last included in the Biosphere area) also have a good population of elephants which needs protection.

6. Malabar giant squirrel (_Ratufa indica_) and

7. Common giant flying squirrel (_Petaurista petaurista_) are commonly found in the Biosphere area.

8. Otters:

All three otters found in India are also found within the Biosphere area. The common otter (_Lutra lutra_) is present in cold hill and mountain streams, the smooth Indian otter (_Lutra_ *perspicillata*) is essentially a plains otter, and the clawless otter (*Aonyx cinerea*) is found in the hill streams and lakes of high altitudes. These three species are found in the Western Ghats and are all threatened by deforestation and recurring drought.

9. Civets:

All four species reported from the Western Ghats are found in the Biosphere area. They are the Malabar civet (*Viverra megaspila*), which is believed to be extinct, the common palm civet (*Paradoxurus hermaphroditus*), the small Indian civet (*Viverricula indica*) and the brown palm civet (*Paradoxurus jerdoni*). The last-mentioned is found only in the Western Ghats.

10. Mongooses:

The family Herpestidae is represented by the ruddy mongoose (*Herpestes smithi*), the common mongoose (*H. edwardsi*), the stripe necked mongoose (*H. vitticollis*), which is endemic to the southern Western Ghats, and the brown mongoose (*H. fuscus*) in the Nilgiri Biosphere Reserve area.

11. Cats:

In addition to the tiger and leopard (*Panthera pardus*) and its melanic form, the black panther, there are 4 species of lesser cats of which only the jungle cat (*Felis chaus*) is not uncommon. The leopard cat (*Felis bengalensis*), the rusty spotted cat (*F. rubigenosa*), and the fishing cat (*F. viverrina*) possibly occur in the Biosphere area; their precise status is unknown.

12. Deer:

The deer family is also well represented in the Biosphere Reserve. The largest Indian deer, the sambar (Cervus unicolor), the spotted deer or chital (Axis axis), the muntjac or barking deer (Muntiacus muntjak) and the mouse deer (Tragulus meminna) are all characteristic Indo-Malayan species found in the forests of the Biosphere Reserve.

13. Indian wild boar (Sus scrofa):

This is widely distributed in the plains and hill forests of the Western Ghats.

14. Pangolin (Manis crassicaudata):

The Indian pangolin or spiny anteater is found in the drier lower areas of the Biosphere Reserve.

15. Porcupine (Hystrix indica):

The Indian porcupine is found on rocky hillsides and in the forests of the Western Ghats.

16. Canids:

The family Canidae is represented by the jackal (Canis aureus), widely distributed, the Indian fox (Vulpes bengalensis), uncommon but reported from Wynaad and the eastern part of the Biosphere, and the Indian wild dog, found in the Biosphere Reserve particularly in Mudumalai, Nagarhole, Bandipur and in the less heavily forested areas of the Reserve.

17. Bears:

Bears are represented in India by four species, of which the sloth bear (Melursus ursinus) alone is found all over the Biosphere Reserve forests.

18. Bats:

Among bats, rare species like the Peshwar bat (Myotis peswa) and the hairy winged bat (Harpiocephalus harpia) have been reported from Silent Valley. Other bats, like Rousettus leschenaulti, Cynopterus brachyotis ceylonensis, Rhinolophus rouxi, R. lepidus, etc. are also recorded in the Biosphere Reserve.

19. Fishes:

Among fishes, the following genera have a discontinuous distribution, found in the Western Ghats including the Nilgiris and the Himalayas and Eastern Himalayas: Gagata, Silurus, Batasio, etc.

Another genus similar to the Pseudohomoloptera known from Borneo is found in the Kunthi river of Silent Valley and is named after it - Kunthia. The genus Bhavania is endemic to the Biosphere part of the Western Ghats. Glyptothorax madraspatnam is an extremely rare fish found in the Bhavani, Cauvery and Kunthi rivers. The fast-flowing hill streams necessitate species adaptation and create barriers to dispersal, resulting in the occurrence of many unique species in this tract.

20. Reptiles:

Among the reptiles, the family Uropeltidae is endemic to the region. The pit viper, cobra, Russell's viper and krait are the major poisonous snakes found in the Reserve area. The common king cobra is found, especially in Silent Valley. Pythons are also found. The monitor lizard, five species of _Scinidia_, four species of _Calotes_, and four interesting species of geckos of the genus _Cnemaspis_ are found in the Silent Valley forests alone.

21. Amphibia:

From the Silent Valley forests, two new amphibian genera, _Bufa_ and _Mirixalus_ are recorded. Out of the ten valid species, six are from India and one from Ceylon. Of the six Indian species, five are from the Western Ghats and one from Arunachal Pradesh. Other genera endemic to the Western Ghats are _Nictibatrachus_, _Nannobatrachus_, and _Melanobatrachus_.

22. Insects:

A detailed recent record of the insect fauna is only available for the Silent Valley (Zoological Survey of India, 1981).

Graphium evemon is the rarest species found in the Biosphere Reserve area, originally recorded from Assam and Burma. _Appias indira_, _Pterostichus_ and _Caraspedophorus_ are rare Himalayan genera found in the Silent Valley.

Status of the faunal studies:

The completeness of faunal systematic studies varies from group to group and region to region. The taxonomy and distribution of larger mammalian and avian species are fairly well studied for the entire tract. The greater mobility of the species and wide ranging nature of most of the mammals and bird.

have led to a more or less exhaustive listing, while the smaller mammals such as the burrowing rodents or natural bats, etc. are less well known. The reptiles and fish are better documented than the amphibians.

Due to the intense interest generated by Hora's studies on the distribution of freshwater fishes, there is some detailed data on the hill stream fishes of the rivers of the Biosphere Reserve.

Among the invertebrates, perhaps only the Lepidoptera are fairly comprehensively collected and categorized. Most of the arthropod groups remain inadequately studied. Annelids may be far less completely catalogued than the molluscs. The minor phyla and protozoans are very inadequately known.

Regionwise, there have been far more taxonomic surveys and collections on the Nilgiri plateau due to the European settlements, easier accessibility, salubrious climate, etc. The drier tracts, including parts of the Mysore plateau as well as the Coimbatore plains were also better explored than the wetter Wynaad region. The heavy-rainfall western scarps have not been explored at all.

The current degree of knowledge of even the best known group or species is highly inadequate. Beyond collections and taxonomic identification, little work has been done on the ecology or conservation of the biota and ecosystems of the Nilgiri Biosphere Reserve.

Compiled with excerpts from:

1. Hegde, M. and Daniels, R.J.R. (1986). An information system for the birds of the Western Ghats. Envis, C.E.S., I.I.Sc., Bangalore. October 1986.

2. Mani, M.S. (1974). Ecology and biogeography in India. Dr. W. Junk b.v. Publishers. The Hague.

3. Pillai, R.S. (1981). Fauna of Silent Valley. Zoological Survey of India, Madras.

4. Prater, S.H. (1971). The book of Indian animals. Bombay Natural History Society, Bombay.

5. Puri, G.S., Meher-Homji, V.M., Gupta, R.K. and Puri, S. (1983). Forest ecology. Second edition. Vol. I. Phytogeography and Forest Conservation. Oxford and IBH Publishing Co., New Delhi.

6. Sharma, B.D. et al. Studies on the flora of the Nilgiris, Tamil Nadu.

7. Vohra, J.N., et al. (1982). Observations on the cryptogamic flora of Silent Valley. Botanical Survey of India, Calcutta.

LANDUSE

A natural landscape has a variety of components and functions. It has a functional and evolutionary relationship with larger regions or global processes. The functional evolution of natural systems is a continuous process which man can influence to varying degrees of intensity. Culturally, man has evolved many ways of harvesting and manipulating natural systems and processes. The results of these manipulations are often very visible on the landscape.

All through human evolutionary history, the innovation of technologies (including agriculture) has paralleled their transfer and adaptive modification across cultures and across geographical boundaries. The critical subsistence demands on agricultural technology effectively maintained its specific locational relevance. The vulnerability of the natural ecosystems and the limitations of specific regions have been understood and accounted for in the gradually evolving knowledge base of individual cultures. On the other hand, superimposed agricultural technologies have, and can in the future, lead to disastrous destabilization of ecosystems and, consequently, of human communities.

Land use, in a narrow sense, is the interplay of climate, topography, geology including soil, vegetation, and the cultural activities of the human communities involved.

The Biosphere Reserve area can be broadly divided into nine different types of landforms.

1. The centre of the annular Reserve is the high-elevation, very

gently undulating, cool plateau, with erosion-rounded hills. Meandering stream channels, a natural vegetation cover of extensive grassy downs, and pockets of stunted, specialized evergreen forest (sholas) restricted to sheltered valleys are found here. These cool uplands receive, on average, more than 2000 mm of rainfall. In many places, this rises to 6000 mm or more, hence the soils are heavily leached, with occasional accumulations of peat. Winter temperatures at night often dip below freezing. Traditionally, this sort of habitat were used only by the Todas for grazing their buffaloes, but many larger shola-grassland areas have now been taken over by tea plantations, in particular along the eastern Nilgiris, the Korakundah range, and on the Naduvattam-Gudalur slopes. More recently, bluegum, wattle, and tropical pine plantations have been established in this habitat. The less exposed Nilgiri uplands, particularly in the western and southern parts, have been extensively cultivated, traditionally by the Badagas, but more recently by the plains people also. A wide variety of temperate vegetables, fruits, flowers, and food crops (e.g. potato) have been introduced to this upland plateau. As agriculture has expanded to higher hills and areas patently unsuited to agriculture, soil erosion has accelerated tremendously. Extensive manipulation of the slopes for terracing and bunding has modified them everywhere in the Nilgiris. The extension of settlements on the uplands has been accompanied by the destruction of the sholas, with all the attendant effects of disappearance of perennial streamflow, rampant soil erosion, microclimate changes, etc. As population density increased, construciton activities such as road building also increased, unleashing widespread landslips and slope destabilization. A modern land use trend in the Nilgiri high elevation uplands is recreational, i.e., tourism. Lately, industrial use of the land has also become apparent.

2. A significant proportion of the Biosphere Reserve is occupied by medium elevation (800-1200 m) plateaux, particularly the northwestern portion, extending from Coorg to the Moyar valley. This landform may be called the Wynaad plateau, distributed among the three different states and known as Coorg Wynaad, Kerala Wynaad, and Gudalur Wynaad. Characteristic features of this region are its undulating terrain, with many gentle and few steep, high hills, and its extensive drainage system, with impeded flow creating a large number of swamps (vayals) in the valleys of the hillocks. The Wynaad part slopes toward the north and east, draining into the Kabini. It receives an annual rainfall ranging from 1500 to 2500 mm, and has rich moist deciduous forests with extensive thickets of _Bambusa arundinacea_. Although previously malarial, its easy access from the Mysore plateau, gentle terrain and fertile soil made it a centre of extensive human habitation throughout its history. Paddy can be cultivated very productively in the vayals, with minimum land modification. Large tribal and, at times, non-tribal populations occupied this tract for long durations, subjecting it to extensive cultivation. Because the terrain is not susceptible to rapid retrogression, the natural vegetation

reestablished itself, and the Wynaad plateau remained heavily forested during the last two centuries, although its forests were extensively worked, and although it was occasionally settled by Chetti communities who were translocated there by the British. It was only during the last forty years that the Wynaad plateau became heavily settled. The entire Gudalur part of the Wynaad has now become an agricultural area with emphasis on cash crops, particularly coffee, pepper, cocoa, and to a lesser extent tea, citrus fruits, banana, groundnut, ginger, turmeric, tubers, vegetables, etc. In general, the land holdings are fairly small; and the individual farms have a very wide range of crops. Other cash crops such as citronella grass are also being cultivated, although not extensively. The Kerala and Coorg Wynaads have comparable types of land use, although the Coorg Wynaad has a much lower population density. Paddy is cultivated in all three regions in the vayals. Because of the suitability of the vayals for settled agriculture in the Wynaad, the original swamps have practically disappeared. Extensive conversion of forests to teak and eucalyptus plantations has also had an adverse effect on the swamps. The Wynaad remains one of the areas in the Biosphere Reserve where large tribal populations have retained many traditional land use practices.

3. Distinct from the Wynaad region but similar in altitude is a medium elevation plateau in the southern part of the Biosphere Reserve - the Attappadi plateau. Far more steeply undulating than the Wynaad, this region has a very different land use history. In general, the sparsely populated and more heavily

forested Attappadi plateau was a haven for hill tribals until very recently. This plateau slopes gently toward the east, from the very high rainfall region of the western edge of the Western Ghats to the dry Coimbatore plains. Within the short span of less than thirty years the entire plateau has been almost completely deforested and denuded. With a spectrum of bioclimatic regimes, terrains, and wide cultural diversity, the Attappadi plateau has, even today, possibly the widest range of crops in the entire Nilgiri Biosphere Reserve area. Although it has no swampy vayals for paddy cultivation, it harbours a variety of dry cereals, pulses, legumes, and other crops found only in less moist areas. Crops such as cardamom are grown in very moist areas, and ragi, bajra, common millet, etc. in very dry areas. Oilseeds like groundnut and sunflower, fibre crops like cotton, esential oil yielding crops like vetiver, and cash crops like tea and sugarcane are cultivated on the Attappadi plateau. Apart from these, pulses, amaranth, vegetables, etc. are also grown. This region of the Biosphere is a typical example of land misuse, with the consequent destruction of basic resources. Like the Wynaad, the Attappadi plateau is a region with a large tribal population. Both areas have been subjected to rapid demographic changes due to the immigration of non-tribals and wide-ranging changes in land use. In both, and particularly in Wynaad, the increasing agricultural settlement density has led to a rapidly increasing cattle density. Pastoralism was not practised earlier, and now the increasing population of domestic herbivores has an adverse effect on forest regeneration.

4. A distinctive type of landform is the forested Silent Valley

and Siruvani plateau. Both these areas, in the Kerala part of the Biosphere, are uninhabited, lie at over 900 m elevation, and have high ridges on three sides with watercourses running out of them. Both receive very high rainfall, amounting to more than 4000 mm annually, and both have wet evergreen forests. The Silent Valley, since the abandonment of its proposed hydro-electric power project, is now devoid of human settlement, while the Siruvani plateau has a dam site colony and a single transplanted Muduga settlement. Both of these Reserved Forests perform the vital function of protecting the catchment areas of rivers, the Silent Valley protecting that of the Kundipuzha and the Siruvani plateau that of the Siruvani river.

5. Extensive areas in the Biosphere Reserve are Ghat slopes, covered by forests which are unsuitable for any land use. The Nilgiris, being a block-uplifted massif, have practically vertical scarps which have never been occupied by humans. The development of communication channels such as roads and railways along the slopes to the plateau has badly damaged some of the scarp vegetation. The increasing incidence of annual summer fires has also led to the recent retrogression of the Ghat slope forests, particularly around the Nilgiris.

The landforms in the Biosphere area include two types of valleys: the elongated valleys carved out by the Moyar and the Bhavani on either side of the Nilgiri plateau, and the smaller, horseshoe shaped valleys abutting the steep hill slopes, formed by the headward erosion of hill streams.

6. Both the Moyar and the Bhavani, originating on the Nilgiri plateau, flow outward, the former northward and the latter southward. Both turn sharply eastward at the foot of the Nilgiris and converge at the base of the easternmost edge of the Nilgiris. While the Moyar valley is a very dry tract with less than 600 mm of rainfall, the Bhavani valley, particularly on its western edge receives much higher rainfall. The Moyar valley is practically uninhabited, except for a tribal settlement at Thengumarada, near its eastern edge. It is a deep gorge, indicating a possible fault zone separating the Mysore plateau from the Nilgiris. The Bhavani valley, on the other hand, has a number of tribal settlements along its entire length, and is densely populated near the Coimbatore plains. The Moyar valley has mostly dry thorn forests, except in a narrow riparian zone along the water margins. The Bhavani valley has evergreen, semi-evergreen and moist deciduous forests within the Attappadi Reserve Forest. No natural vegetation remains in the valley once the river exits the Reserve Forest until it flows out of Kerala. Dry deciduous forests with a narrow riparian belt are found in the valley as it approaches Mettupalayam. The Bhavani valley may also indicate the location of a fault.

7. Of the horseshoe shaped valleys, the largest is the Chaliyar valley, which abuts the southern flank of the Gudalur slopes. On the western flank of the valley are the Nilambur Kovilakkam forests ascending to Kurathimala, while on the eastern flank are the Gwalior Rayons forests and Punchakkolli Malavaram. The actual Chaliyar valley area lying within the Biospheré area has

very little of its valley floor under natural vegetation. The remaining forests range from moist deciduous to semi-evergreen, while the agricultural areas contain mainly paddy, arecanut and mixed crop farmlands, and rubber plantations. Scattered along the valley, in the riverine alluvium, are a large number of teak plantations, some of which are among the oldest in the country.

While the main axis of the Chaliyar valley is north-south, a tributary of the Chaliyar, the Karimpuzha, drains the Kundah slopes and flows east-west through the New Amarambalam forest. It then merges with the Chaliyar. The Karimpuzha valley is entirely forested. But for some teak plantations, there have not been any cultural operations in the valley.

The only other valley within the Biosphere Reserve is the Kabini valley betwsen Nagarhole and Bandipur, which has been submerged by the Kabini reservoir. Agricultural settlements have arisen along the Kabini reservoir margins right upto the border of the Biosphere.

Broken country with scattered, steep ridges and valleys occupies a significant portion of the Coimbatore Forest Division in Tamil Nadu. This rugged terrain, with settlements and forests interspersed, has a variety of land uses ranging from natural forests of many types to forest plantations, cultivation, pastorial settlements, and tribal habitats. A wide range of agricultural crops are found in the area. The southern Palghat hills, which are a continuation of the Coimbatore Forest Division along the Kerala Ghat are less rugged, but have similar hillocks, valleys and high mountain slopes. The valley mouths along the Palghat plains are being cultivated, but the hill slopes remain forested till today. The Nilambur Kovilakkam forests in the Nilambur Vested Forest Division are again areas of deep valleys and steep hill slopes, where agricultural land use is minimal.

8. The featureless, dry plains of the Mysore plateau and Coimbatore form the northern and southeastern borders of the Nilgiri Biosphere Reserve. These plains are dry, ancient, and weathered, with low rainfall (mostly below 900 mm) and a long history of human occupation. The topography of the land and the availability of water decide the settlement patterns and the crops. Dry cereals, in particular, are cultivated at least during the rainy season, from October to January. Very large areas, particularly in the Coimbatore plains, are under cotton, groundnut and sugarcane cultivation. In very dry thorn forest areas, e.g. along the Bandipur northern border and many areas of Tamil Nadu, large cattle populations are maintained. The tapping of groundwater and the extension of irrigation canals from reservoirs are initiating large scale shifts in land use in this area.

9. The humid western plains are basically different from the dry plains. These plains of Kerala, extending all along the western part of the Biosphere, are characterized by fertile valleys created by the westward flowing rivers, interspersed with low laterite hillocks. These areas, receiving more than 3000 mm of rainfall spread over almost eight months of the year, have a very high density of population and a wide variety of land uses dominated by agriculture. The principal crop is paddy. Tropical

plantation crops, coconut in particular, cover a large proportion of arable land. Tapioca cultivation has taken over extensive hill slopes, leading to serious soil erosion problems. The mixed cropping systems traditionally practised in the Kerala plains and the lower foothills have been undergoing radical changes over the past few years, partly due to economic compulsions and partly due to ecological changes over larger areas. Unsuitable land use practices are extending higher up, to the more vulnerable upper reaches of watersheds, and setting off chain reactions right upto the coastal tracts.

The manner of human interaction with the habitat is manifest in the most enduring fashion in the land use practices in an area. One of the most critical elements in the setting up and manning of a Biosphere Reserve involves evolving viable land use strategies while simultaneously preserving invaluable ecosystems and conserving basic resources.

NILGIRI BIOSPHERE RESERVE - THE LAND

The tract of natural and cultural landscape identified as the Nilgiri Biosphere Reserve (NBR) area begins from the southeast edge of the Bradhmagiris and extends along the border of Wynaad and the Mysore plateau and continues east along the Moyar valley, the Sigur plateau and the Nilgiri Northern Slopes upto the eastern edge of the Nilgiris. It further extends northeast along the Talamalai plateau towards the Biligiri Rangans i.e., toward the junction of the Eastern Ghats and the Nilgiris. It then continues around the eastern edge of the Nilgiris between the Lower Bhavani reservior and the Nilgiri southeast slopes along the Bhavani valley. This southeast protion of the NBR stretches towards the southeast across the Bhavani, and on reaching the Kerala border runs southward toward upto the Palghat Gap. The portion of the Western Ghats between the Bhavani river and Palghat Gap in the state of Tamil Nadu is highly broken with sharp isolated ridges and peaks with many low valleys in between. The major valleys in this part are the Velliangadu valley, Naickenpalayam valley, Thadagam valley, Bolampatti valley and Walayar valley. The NBR tract swings around the up of the Palghat Gap and continues north along the western face of the Western Ghats enclosing the Palghat hills (Dhoni hills) and the Muthikulam or Siruvani hills and continues along the western slopes of the Attappadi plateau. All the western slopes of Western Ghats from the Palghat Gap upto the Chaliyar valley are included in the Biosphere Reserve. The Attappadi valley forests and the Silent valley forest in Kerala and the forests along the Korakundah range on the southern edge of the Nilgiri plateau forms the south west corner of the Biosphere Reserve. The Reserve area then extends north along the steep Karimpuzha catchments stretching from the Nilambur plains all the way east including the Kundah range on the Nilgiris' western edge and the Ouchterlony valley. It then continues further, swinging west, encompassing the Nilambur side of the Gudalur plateau and merging with the southeast edge of the Wynaad. At the junction of the Kerala Wynaad, the Gudalur Wynaad and the Camel's Hump mountains projecting due suothwards, and coverad by extensive forests. They are also included with in the NBR.

Thus the Nilgiri Biosphere Reserve forms a loop around the Nilriris and extends slightly unevenly towards the northeast. The loop is broken along the central western margin, where there is no continuity in vegetation between the Chaliyar catchment forests and the Wynaad forests. The continuity is again extremely atteuated in a few other locations around the Nilgiris, in particular along the Nilambur Nadugani slopes and the Mettupalayam Coonoor slopes. The Kabini reservoir abutting the Pulpalli encroachments have also disrupted the vegetation continuity between the Coorge Wynaad and the Bandipur forests.

The northwestern extrimity of the Biosphere in Coorge covers an extensive, gently undulating, moist forest tract in the <u>Hunsur Forest Division</u>. Not connected to any other forest tract in Kerala but contiguous with the Begur and Kakankote forests of the <u>Mysore Forest Division</u> of Karnataka is a part of the Kerala <u>Wynaad Wildlife Sanctuary</u>, i.e., Tholpatty range which includes the Begur, Kudrekode, Alathur, Karthikulam and the Edakode reserve forests.

East of the Kabini, the forest belt widens, extending from the moist forests of the Kerala Wynaad plateau north into the progressively drier forests of the Mysore plateau. The eastern section of the Wynaad Wildlife Sanctuary, including the reserves of Rampur, Kurichiyat, Kuppadi, Edattara, Kallur, Alathur, Mavinhalla, Nemminad and Noolpuzha (the Chedleth and Sultan's Battery ranges) form part of the NBR. Across the border in Karnataka the Bandipur Tiger Reserve is contiguous with this habitat. East of Bandipur the Mysore plateau dry forests in the Chamarajnagar Forest Division continues along the northern bank of the Moyar and merges with the dry forests of the Talamalai plateau.

The Kerala Wynaad forests, the moist forests of Beerambadi reserve forest of the Bandipur Tiger Reserve and the Mudumalai and Kumbarakolli Reserve forests of Mudumalai Wildlife Sanctuary merge into each other at the junction of the thre states. Adjoining the Mudumalai Wildlife Sanctuary along the foot of the Nilgiri northwestern scarps, forests such as the Northern Hay, Singara, Bokkapuram, Kalhatti Slopes Reserve Forests and, further east, the Sigur Reserve Forest of the Nilgiri North Division contribute to the Biosphere area. The extreme northeastern edge of the Nilgiris, sloping down from the plateau crestline to the Moyar river forming the Nilgiri Eastern Slopes Reserve D.Forest of the Nilgiri North Division. and the Erode Division area falling within the same reserve mark the eastern end of the Biosphere Reserve. The Reserve then extends northeast across the

Moyar in the Satyamangalam Forest Division area encompassing the Talamalai and the Guttiyalathur Reserve Forests abutting the Billigiri Rangans.

The Biosphere Reserve area continues around the Nilgiri eastern edge across the Erode Forest Division area into the Coimbatore Forest Division. The northeasternmost forest in Ciombatore Division namely the Nilgiri Eastern Slopes Reserve is contiguous with the Jakkanari RF. The former is sandwiched between the Lower Bhavani Reservoir and the Nilgiri eastern crestline, while the latter is an extremely narrow and vulnerable vegitation corridor between the Bhavani river and the Nilgiri crestline. Continuing further southwest, the Pillur slopes RF and the Melur Slopes RF between the Bhavani river and the Nilgiris crest, and the Kandiyur RF and the Nellithurai RF form the mid-southern part of the vegetation belt around the Nilgiris.

Between the Kundah river flowing into the Bhavani from the north, and the Kodungarapallam flowing in the south is the junction of the Palghat-Nilgiri-Coimbatore boundaries. The highly broken terrain, gradually sloping from the Attappadi plateau of Kerala to the Ciombatore plains, has the following Reserve Forests of the Ciombatore Forest Division designated as the Biosphere Reserve area: the Gopinari RF, the Anaikatti North RF and the Thadagam RF extending from the Bhavani in the Anaikatti-Coimbatore road. The Gopinari RF and the northern end of Thadagam RF enclose the Velliangadu valley.

The Naickenpalayam valley extends into the eastern part of the Thadagam RF. The Bolampatti Block II and the Thadagam RF enclose the Thadagam valley, through which the Anaikatti-Ciombatore road passes. The Anaikatti South RF and the Anaikatti South Extension are to the east of Thadagam valley and along the Kerala border. The Ciombatore-Siruvani road passes along the horseshoe shaped Bolampatti valley which has the Bolampatti Block III RF on its northers arm, the Bolampatti Block II RF in the centre and the Bolampatti Block I RF on its southern arm. The southern extrimity of the NBR is the Walayar valley inbetween the Bolampatti Block I RF of Ciombatore Forest Division and the Walayar of Palghat Territirial Division.

All the Reserved Forests in the Ciombatore Division have very dry vegetation types along the Ciombatore plains but, as many of them extend upward upto the Nilgiri plateau edges or the crestline of the Siruvani hills, they have vetter plant communities in their upper reaches.

The Palghat Territorial Division of Kerala has contributed, apart from the Walayar RF, the Attappadi Block VI RF (Siruvani or Muthikulam), Attappadi Block I to V RF at the northwestern edge of the Attappadi plateau and the Silent valley RF adjioning the plateau. The Biosphere Reserve area extending from the Walayar RF continues upto Attappadi Block VI along the Palghat Vested Forest Division area. The extensive Attappadi plateau and its western slopes are heavily degraded. Parts of the Ciombatore Division across the state border towards the east is adjecent to the Palghat Vested Forest Division.

Immediately to the north of the attappadi plateau, higher up on the Nilgiri plateau are a number of Reserve Forests constituting the Nilgiri South Division of Tamilnadu. They are the only natural habitat of the Nilgiri plateau contiguous with the Melur Slopes qf Ciombatore Division. Extending upto the Nilgiri plateau is the Hiriyashige RF, continuing along the Korakundah Range on the southwest corner of the Nilgiri plateau, with the Palghat Vested Forest Division areas constituting the southern boundary, are the Mekainbettu RF, Thaishola RF and the Kundah RF. The last mentioned adjions Attappadi Block I to V RF's and the Silent valleyRF of Palghat Territirial Division. The Nilgini South Division forests continue along the Kundah hills which also forms the border with Kerala and contains Kadcuppe, Porthimund and Mukurthi peak RF's. From Silent Valley RF the Biosphere spills over to its western outer slopes which are partly in the Palghat Vested Forest Division and partly in the Nilambur Special Division. The Western Ghats western slopes in Kerala, immediately to the north of Silent Valley continues into the Kundah western slopes which are part of the Nilambur Territorial Division adjioning the Nilgiri South Division. This Division continues further north into the Nilambur Vested Forest Division areas enclosing the Chaliyar valley covering both the Nilambur Gudalur slopes as well as the Camel's Hump mountains. This adjions the Gudalur Forest Division of Tamilnadu. A part of the Camel's Hump mountains fall within the Calicut Vested Forest Division.

The Vested Forest Divisions of Kerala are private forests nationalised in 1971 and are not demarcated into Reserve Forests but are identified as a large number of 'Malavarams'.

The almost complete ring of vegetation around the Nilgiris, covering a variety of physiographic units including high elevation plateaux, scarps, mountain slopes, valleys and plains with a wide variety of climatic and geological conditions, encompasses not only the widest range of habitats but also the largest continuous forest tract and the largest aboriginal populations and land use practices in southern India.

ADMINISTRATIVE DIVISIONS

The Nilgiri Biosphere Reserve area encompasses parts of the states of Karnataka, Kerala and Tamilnadu. The revenue administrative units included in the NBR from each of the states are given below:

STATE	DISTRICT	TALUK
Karnataka	Coorg	Virajpet
	Mysore	HD Kote
		Gundlupet
		Chamarajanagar
Kerala	Wynaad	North Wynaad
		South Wynaad
	Malappuram	Ernad
		Perinthalmanna
	Palghat	Mannarghat
		Palghat
Tamilnadu	Udhagamandalam	Gudalur
		Udhagamandalam
		Coonoor
	Coimbatore	Coimbatore
	Thanthai Periyar	Gobichetti-palayam

FOREST DIVISIONS

The following forest divisions from Karnataka, Kerala and Tamilnadu are included in the Nilgiri Biosphere Reserve. They are:

KARNATAKA	KERALA	TAMILNADU
1. Hunsur Division	1. Wynaad Wildlife Division	1. Mudumalai Wildlife Division
2. Mysore Division	2. Calicut Special Division	2. Nilgiri North Division
3. Project Tiger, Bandipur	3. Nilambur Special Division	3. Satyamangalam Division
4. Chamarajanagar Division	4. Nilambur Division	4. Erode Division
	5. Palghat Division	5. Nilgiri South Division
	6. Palghat Special Division	6. Coimbatore Division

KARNATAKA

HUNSUR DIVISION

Forest	Range	Area (sq km)
Kachavanahalli SF	Periapatna	16.94
Veeranahosahalli SF	Hunsur	48.90
Arkeri RF	Thithimathi	73.20
Hatghat RF	Kallahalla	111.15
Nalkeri RF	Nagarhole	104.07

TOPOGRAPHY

The forests of this Division are situated between longitude 76°0' and 76°15'E and latitude 11°57' and 12°14'N. They lie at an altitude of 792 to 1224 m above mean sea level. The land is gently undulating, with scattered hills rising to about 300 m, and nallas dividing up the area. Forests of this Division are accessible throughout the year.

GEOLOGY

The underlying rock is granitic gneiss, mixed here and there with charnockite or Nilgiri gneiss. In Kachuvanahalli, the gneiss is bedded and dark coloured, containing diorites which contain garnets and hypersthene. Veeranahosahalli SF exhibits hornblende-schists along with quartz-schists. Information regarding the geology of the other Ranges is not available.

SOIL

The soils of this area are loamy, dark brown or reddish in colour, containing ferromagnesium silicates. The depth of the soil varies considerably on the slopes. Red sandy loam supports good vegetation. The availability of humus is limited since the leaf mould crumbles during the dry season and soaks into the soil during the monsoons.

WATER RESOURCES AND DRAINAGE

A typical feature of this tract is the presence of swamps (hadlus), some of which have been destroyed in the past for cultivation. The major portion of the forest area drains into the Lakshmanatirtha river. Some areas in the southern part of the division drain into the Kabini and ultimately into the Cauvery.

CLIMATE

The forests are contiguous, but the rainfall each receives varies from place to place, and is somewhat heavier in the west. Most rain falls during the southwest monsoon, between the end of May or the first week of June to the middle of June. The northeast monsoon commences in October and lasts till the end of November. The climate is comparatively warmer during the summer, but is generally equable at all times. The cold season starts in December and continues upto the second week of February. The average rainfall in the area is about 1500-1700 mm.

AGRICULTURE

There are a few fairly populous villages near the eastern borders of the forests. The people are agriculturists, and manage large herds of cattle. Paddy in lowlying areas and dry crops in higher and drier localities are the main products of cultivation.

HISTORY

Some arrangements for forest conservation seem to have been made as early as 1857, but no definite information regarding management of these forests is available prior to the formation of a Forest Department there in 1864. Even after the Department came into existence, there was no suitable system of controlling exploitation for some years. The general practice, after the advent of the Department, was to permit anybody in need of any wood except sandal and teak to fell trees anywhere on payment of a rupee per cartload. The first efforts of the Department at regular forest conservation resulted in the marking of certain trees as "reserve trees". Fifteen of these were declared to be the absolute property of the Government, and could be cut and removed only on purchase of a license, while the remaining 27 were free to the ryots within their own taluks.

In 1869, rules were first framed for the formation of State Forests, the management of which was in the hands of the Forest Department alone. Following the abolition of the Forest Department in 1879, control of all the State Forests passed again to the Revenue Department. This state of affairs continued till 1885, when the Forest Department was resuscitated. The forests suffered badly during this period through lack of proper supervision owing to inadequate forest staff. From 1885 through 1902, fellings were carried out on a sort of crude selection method over practically all accessible portions of the forests. No effective control was possible owing to the diffuse nature of these fellings. From 1902 onwards, the fellings were confined to annual coupes, and thus became more systematic. A provisional Working Scheme (1902) was drawn up for Veeranahosahalli State

Forest. The Scheme divided the forest into several working circles, and the felling cycle was fixed at 20 years. Minimum exploitable girths were also fixed for the more important timber trees.

A Working Plan was prepared for Veeranahosahalli by C. Abdul Jabbar in 1916. According to this, the forest was divided into two working circles - the Murkal working circle and the fuel working circle. The silvicultural treatment was "selection-cum-improvement fellings" for the former and "coppice with standards" for the latter. Minimum exploitable girth was prescribed for the important timber trees. The felling cycle was 30 years. The provisions of the old Working Plans were not strictly adhered to, however, and fellings were more or less controlled by the dictates of the market than by the silvicultural needs of the standing crop. Moreover, the Working Plans prescribed no adequately effective measures for checking the menacing spread of Lantana. Consequently, this weed spread rapidly, encouraged by annual fires. The Working Plan also did not adequately prescribe reliable measures for supplementing natural regeneration.

Working Plan for Hatghat and Nalkeri State Forests: The first Working Plan for these forests was prepared in 1886. The Working Plan for Arkeri RF was prepared in 1898. The prescriptions were selection cum improvement fellings by area, but in actual practice, the same old method of selection fellings was used. Only good, saleable timber was removed; no attention was paid to the improvement of the future crop. This continued till 1910. Dissatisfied with the system of exploitation in vogue and its injurious results, Tireman prepared a new Working Plan in 1912. The prescriptions were selection fellings combined with improvement fellings to favour more valuable species, and cultural operations to favour and induce the reproduction of these valuable species. Under the system the areas were divided into 20 compartments with a felling cycle of 20 years, and exploitable girth limit 7 ft for teak and 7.5 ft for rosewood and honne.

This Plan was followed till 1925, and during this period the whole area prescribed for working could not be completed. The system of selection fellings was replaced in 1925 with clearfelling followed by concentrated artificial regeneration with teak, and was continued till 1932 in anticipation of Brand's Working Plan, which actually came into force in 1933. Brand's Plan prescribed clearfelling over 200 acres per year, distributed over 4 felling series. The rotation adopted was 150 years. This Plan was replaced by Rangaswamy's 15 year Plan (1940-55), which prescribed clearfelling over 300 acres in 5 felling series, the rotation being 100 years. Though Brand's Plan was to have expired in 1943, an earlier revision of the Plan was necessary as his silvicultural prescriptions were found to be out of date. A Working Plan for Hunsur Division including Kachuvanahalli and Veeranahosahalli was prepared by Krishnaswamy which expired in 1971-72. U.T. Ålva has prepared the Working Plan for 1978-79 to 2002-03. As per this Plan, 7 working circles have been created. The exploitable girth of 1.65 m has been fixed for teak. The entire area under teak has been included under one felling series. The Working Plan suggests that the Kuruba tribals in these forests be given the teak plantations for kumri cultivation (cultivation of food crops under the trees after clearing the undergrowth). A felling cycle of 15 years is suggested in the selection cum improvement felling working circle. Trees above 1 m in girth are prescribed for felling. The collection of minor forest produce has been regulated in the Plan. It is also proposed to expand the area under Nagarhole Sanctuary.

Plantations: The mode of raising plantations of teak was partly by sowing and partly by transplanting seedlings from nurseries. In 1890, the taungya (locally known as kumri) method of raising teak plantations was attempted, with varying success. The field crop was mainly ragi, cultivated by the Kurumba labour who had settled permanently in the forests.

The regeneration operations under Tireman's Plan were confined to artificially stocking the gaps caused by selection and improvement fellings. The slashed wood in the gaps was burned and seeds of teak, rosewood and Pterocarpus marsupium were dibbled in the gaps. The period 1925-1932 was one where teak regeneration areas were continued along with taungya cultivation. There was no definite Working Plan, as Tireman's Plan was suspended. In 1937, stump planting of teak was reintroduced, instead of formation by sowings, on an experimental basis. From 1938 onwards, raising teak plantations by sowing was given up in favour of premonsoon stump plantings. From 1947 onwards upto 1952, teak regeneration areas were burnt at the end of the first year during the hot weather and cut back with the idea of inducing various coppice shoots and thereby aiming at a faster rate of growth. The benefits of this operation were doubtful, and it was discontinued in 1953.

Between 19d5 and 1951, attempts were made to raise miscellaneous species such as rosewood, Pterocarpus marsupium, Lagerstroemia lanceolata, Terminalia tomentosa, etc. along with teak in some of the regeneration areas, as mixed plantations. These attempts were a failure.

VEGETATION

The following forest types are found:

1. Dry deciduous teak types; deciduous teak forests intermediate between dry and moist categories (Tectona-Terminalia series);
2. Southern tropical dry deciduous forests;
3. Swamps.

The corresponding vegetation classes according to the Puri et al. (1983) classification are the Terminalia-Anogeissus latifolia-Tectona grandis series and its degraded stages.

Compiled with excerpts from:

1. Alva, U.T. (1978). Working Plan report of Hunsur Forest Division, 1978-79 to 2002-03. Unpublished draft copy.

2. Krishnaswamy, K. (19d3). The Working Plan report of Dodharve, Kalammankumri, Cauvery, Gulladahalla, Markal, Anechowkur, Kachuvanahalli, Viranahosahalli, Punjahalli, Aspathrekaval, Muthurayanahosahalli, Kalbetta Blocks I and II. Government Press, Bangalore.

3. Setty, K.R.V. (1972). Preliminary Working Plan Report of the Hunsur Division. Unpublished draft copy.

4. Somaiah, K.K. (1953). Working Plan for the Ghat forests of Coorg 1954-55 to 1973-74. CCF, Karnataka.

5. Somaiah, K.K. (1959). Working Plan for a portion of eastern deciduous forests of Coorg (1st April 1957 to 31st March 1972). CCF, Karnataka.

MYSORE DIVISION

Forest	Range	Area (sq km)
Kakankote SF	Kakankote	151.6
Mettikuppe SF	Heggadadevanakote (HD kote)	142.3
Katwal SF	Ainurmarigudi	
Alaganchi SF	Ainurmarigudi	168.8
Naganapura SF	Hediyala	?

TOPOGRAPHY

The erstwhile Mysore Forest Division was divided into two independent Divisions in 1965, namely Mysore and Chamarajanagar Divisions. Mysore Division lies between longitude 76°8' and 76°37'E and latitudes 11°52' and 12°8'N. The countryside is generally undulating, being more rugged in the Mettikuppe forests. At the southwestern end of Kakankote forest, the ground rises into two prominent hill ranges, Chikkamasal betta and Doddamasal betta. At Narayanadurga, Chamundi hills and Mu betta the ground rises into rugged, rocky hills. Almost the entire tract is accessible to wheeled traffic. The lowest altitude in this area is 690 m and the highest is 1120 m.

WATER RESOURCES AND DRAINAGE

Kakankote forest is drained by the Kabini river on the east and southeast, except for a small portion north of Chikkamasal betta which drains westward into Bavali stream, a tributary of the Kabini. Mettikuppe forest is drained toward the southwest by Ballehalla and eastward by the Nagarhole and Sarathi streams, all of which later join the Kabini.

GEOLOGY

The rocks of metamorphic formation in HD kote and Kakankote Ranges consist of gneiss, quartzite and hornblende schist. The underlying rocks are igneous in origin. Granite and chromite are found intruding into the metamorphic formations, and protruding as outcrops on hill ranges and in the beds of watercourses.

SOIL

Two types of soils are generally found: black clay, and deep, loamy soils of varying tenacity, red or grey in colour. The soils vary in depth according to elevation and aspect, being shallow on hilltops and ridges and deep and fine in the valleys and on lower slopes. The substratum of the loamy soils consists of a metamorphic formation of a highly ferruginous nature. The reddish loam referred to is the product of these ferruginous rocks. The best forest growth is found on deep, well drained loam covering the gentler slopes of the hills. The clay soils are confined to lowlying and flat terrain with poor drainage conditions.

CLIMATE

The year is divisible into three seasons, the cold, the dry and the wet. The cold season sets in by end November and passes into the hot season by the middle of February. The coldest winter period is from mid-December to mid-January. The hottest months are March and April.

The wet season lasts from June to September. The western extremity of Kakankote forest, near Byramkuppe, receives monsoon showers in April-May, but this rain does not reach forests beyond the eastern side of Kakankote. Most of the annual rainfall comes from the southwest monsoons. The average annual rainfall ranges from 915 mm at HD kote to 1200 mm at Kakankote.

FORESTS

Forest growth in the area can be divided into two types, namely plantations and natural forests. Some of the scattered 'thakkal' plantations have been so engulfed by the surrounding natural forest that they are now indistinguishable from natural forest.

Plantations: The plantations are either pure or mixed. The main species are teak and eucalyptus, with other miscellaneous species. The teak plantations are confined to Kakankote and HD kote. Miscellaneous species like *Dalbergia latifolia*, *Lagerstroemia lanceolata*, *Kydia calycina*, *Grewia tiliaefolia*, *Adina cordifolia*, etc. have invaded some of the plantations. *Eupatorium glandulosum* is an aggressive colonizer of the open spaces and failed patches in plantations. *Loranthus* is found in almost all old plantations. There is not much undergrowth in well stocked plantations except for climbers like *Spathodia* species, *Acacia pinnata*, etc.

The natural forests are composed of the following types:

1. Southern tropical moist mixed deciduous type;
2. Southern tropical dry deciduous type;
3. Scrub type.

The corresponding classes according to Puri et al. (1983) are:

1. Climax moist deciduous forests;

2. *Tectona*-*Dillenia*-*Lagerstroemia lanceolata*-*Terminalia paniculata* series;

3. *Terminalia*-*Anogeissus latifolia*-*Tectona grandis* series.

FAUNA

The forests in this Division, especially those of Kakankote and HD kote Ranges, are very rich in wildlife. They contain most of the important animal species found in Karnataka. The forest of Kakankote is a game preserve and the site of previous khedda operations. Many animals, birds and reptiles are found here.

HISTORY

The history of the forests can be studied under two periods: 1) the pre-Working Plan period, prior to H. Srinivas Rao's 1909 Working Plan; and 2) the Working Plan period, from 1910 to 1961.

The pre-Working Plan period:

When Tippu was defeated by the British in 1799, the rich teak forests suffered heavy exploitation by the Britishers supplying timber to the gun carriage factory and other places. From 1800 to a few years after the administration passed into British hands in 1831, not much injury was done to the forest except by way of kumri cultivation.

It was after the construction of the Mysore-Manantody road in 1840 that the forests were opened up for exploitation. Thereafter, for about 20 years, forests were managed by the

Superintendent of Ashtagram Division, during which Departmental extraction and sales at Central Depots were first introduced. Felling, however, was conducted in an unsystematic manner. It was only after the formation of the Forest Department in 1864 that the fellings were systematized by marking selected trees. Afterwards, the Department was abolished and management taken over by the Deputy Commissioner, during which period there was heavy exploitation. This continued upto 1885, when the Forest Department was reconstituted. But then came the heavy demand on timber following the introduction of railways, and exploitation paralleled needs upto 1892, when the demand decreased. A provisional Working Scheme was drawn up in 1902 by G. Krishnaswamy Naidu, resulting in more systematic fellings confined to annual coupes. Fire protection work w taken up from time to time after 1874. In 1903, rigid fire protection was extended to the forests of Kakankote and HD kote Ranges. From 1902 to 1910, the forests were worked under the provisional Working Scheme of G. Krishnamurthy, and later under the Working Plan of H. Srinivasa Rao.

The Working Plan period, from 1910 to 1961:

H. Srinivasa Rao's Working Plan came into force in 1910, and inaugurated the first period of systematic management based on silvicultural systems. The yield of timber was based on girth increment data obtained from analysis of tree stumps. The cutting was confined to annual coupes, and to compensate for the wood exploited, plantations were prescribed in such coupes with a view to sustaining yields. This Plan covered the period from

1910 to 1930.

M.M. Muthanna's revised Working Plan replaced the above Plan in 1931. The Working Plan area was divided into three working circles based on the conditions of the crop. M.A. Muthanna's Working Plan did not much alter the method of working prescribed under its forerunner, but the chief merit of the Plan consisted in its focussing attention on the formation of teak plantations. The plantation area for the first ten years was selected on the ground and marked on the key map. Detailed prescriptions based on the knowledge then available were made for carrying out the clearfelling of regeneration coupes, burning the slashed wood, aligning, staking, and planting. Three turnings were prescribed. A planting espacement of 6 x 6 ft was fixed. The following d sadvantages of his method of working were noticed 1) the annual regeneration areas were found to be too large o manage; 2) elephant damage became considerable, and regeneration was a failure. The clearfelling prescriptions were not followed almost from the beginning. During some years in Kakankote SF, the entire area prescribed was almost entirely clearfelled, with disastrous effects on the forest soil. Around 1930-31, some portions of the forests were subjected to heavy fellings to collect timber for sleepers. This considerably reduced the middle age classes of teak.

This Plan was in turn replaced by Kadambi's Plan of 1941-61, which aimed at sustained yield from the forests. The Plan provided for attainment of natural forest to ensure the highest possible income to the State. Four working circles were formed. However, even under this Plan, the prescriptions were not adhered to. Cultural operations were not carried out according to schedule. Prepaid licenses issued resulted in unsystematic working and irregular and illicit felling. *Eupatorium* dominated open areas. Selection areas were clearfelled. The increment plots and sample plots in the different forests were not maintained.

K.R.V. Setty's Plan for the period 1973-74 to 2003-04 envisages an increase in the capital growth of the forests. It also provides for the establishment of soil cover in degraded forests, restocking of the barren, hilly areas acquired from the Revenue Department, supply of raw materials to industry, meeting the demands of local people for timber, fuelwood, etc. and management of the forests on scientific lines to obtain sustained yields. Eleven working circles have been created to achieve these objectives.

Compiled with excerpts from:

1. Anonymous. (1917). Working Plan report of Kachuvanahalli, Anechowkurmarkal and Dodharve State Forests, Mysore West Division. Unpublished copy.

2. Jabbar, C.A. (1917). Working Plan report of the Naganapura State Forest, Hediyala Range, Mysore South Division, 1917-1947. Unpublished copy.

3. Kadambi, K. (1943). The Working Plan report of Dodharve, Kalammankumri, Cauvery, Gulladahalla, Marlal-Anechowkur, Kachuvanahalli, Punjahalli, Aspathrekaval, Muthurayanahosahalli, Kalbetta Blocks I and II and Arabitittu State Forests, Hunsur Range, Mysore Division.

4. Kadambi, K. (1944). Working Plan for the State Forests of Mettukuppe, Kakankote, Begur, and Ainurmarigudi Forest Ranges of Mysore Forest Division. Vol. I. Parts I and II. Government Press, Bangalore.

5. Kadambi, K. (1947). A Working Plan for the forests of Gundlupet Range, Mysore Division, 1947-1971. Government Press, Bangalore.

6. Machaya, M. (1912). Working Plan report of the forests of Gundlupet Range. Government Press, Bangalore.

7. Rao, H.S. (1909). Working Plan for the forests of the Heggadadevanakote sub-Division, Mysore District. Government Press, Bangalore.

8. Setty, K.R.V. (1972). Revised Working Plan for the forests of Mysore and Chamarajanagar Divisions 1973-74 to 2003-04. CCF, Karnatala.

9. Venkatavaradaiengar. (1921). Working Plan report of the Mettikuppe East Extension, HD kote Range, Mysore West Division, 1921-1951. Government Press, Bangalore.

PROJECT TIGER - BANDIPUR

[illegible]	Range	Area (sq km)
Moyar SF	Bandipur	60.86
[illegible]yanpur SF	Bandipur	32.64
Bandipur SF	Bandipur	85.96
Beerambadi SF	Bandipur	265.47
Ainurmarigudi SF	Moolehole	128.46
Begur SF	Begur	116.13

TOPOGRAPHY

The ground in this area is undulating, broken by chains of hills, low, flat topped hillocks and watercourses. The ridges of the hills are interrupted by low saddles. The gentler slopes are accessible to carts, but others are fairly steep and relatively inaccessible. The highest point is Gopalaswami Betta (1454 m).

Portions of Bandipur, Kaniyanpur, and Moyar are decidedly hilly. The Gopalaswamy Hills, with their spurs, form portion of Kaniyanpur Block I and Bandipur. Small detached hill ranges dot the landscape till Kaniyanpur Block III and Moyar.

The Project Tiger area lies between longitude 76^{o} 7' and 76^{o} 52'E and latitude 12^{o} 3' and 12^{o} 54'N.

WATER RESOURCES AND DRAINAGE

The general drainage is towards the east and northeast in Kaniyanpur Block I and the western portion of Kaniyanpur Block II, and toward the south in Bandipur and Moyar. The river Moyar is also called the Mysore Ditch on account of the narrow gorge it has carved out along its course. The Bandipur Reserve is drained by the Kabini, Nugu and Moyar rivers and by the Bavali, Moolehole, Kakanhalla and Waranchi streams.

GEOLOGY

The prevalent rock is light coloured biotite granite or gneiss. Quartz also forms part of the mineral composition in the southeast extremity of Bandipur, Kaniyampur Blocks II and III and Moyar. The igneous rocks, granite and charnockite, are found intruding through the metamorphic rocks and appearing as distinct outcrops on slopes and in the beds of watercourses.

CLIMATE

The area is situated in the foothills of the Nilgiris, at the convergence of the Eastern and Western Ghats. Consequently, it receives both northeast and southwest monsoons. The southwest monsoon brings sudden heavy showers and premonsoon thunderstorms. Summers are not severe. The average temperature during the summer and winter months is 28 ^{o}C and 17 ^{o}C respectively.

VEGETATION

Three main types of forest are found:

1. Southern tropical moist mixed deciduous type;
2. Southern tropical dry deciduous type;
3. Scrub type.

The corresponding classes as per the Puri et al. (1983) classification are:

1. Climax moist deciduous forest;
2. _Tectona_-_Dillenia_-_Lagerstroemia lanceolata_-_Terminalia paniculata_ series;
3. _Terminalia_-_Anogeissus latifolia_-_Tectona grandis_ series.

FAUNA

The Project Tiger Division contains a rich stock of animals. The prey animals include barking deer, bonnet macaque, chital, common langur, four horned antelope, gaur, Indian hare, Indian wild pig, mouse deer and sambar. The predators include jungle cat, Indian wild dog, tiger, panther and python.

Pug marks, faeces, hair, scratchings on the ground, etc. left behind by tigers are seen throughout the Preserve. Tigers are frequently heard roaring in certain areas of the Preserve. The scavengers are the striped hyaena and the jackal. The elephant is one of the most important associate animals of the Reserve. Another important associate is the sloth bear. Other animals found are the bandicoot, civet cat, flying squirrel, giant squirrel, land monitor, pangolin, otter and rat. Crocodiles are found in the Nugu river in Moolehole. The cobra, king cobra, krait, common green whip snake, python, rat snake and viper are also found. Tortoises live in the ponds and waterholes.

The Reserve is rich in birds. Over 180 bird species have been found here. Some of these are the paradise flycatcher, Malabar whistling thrush, shama, choloropsis, nuthatches, tits, tree pies, fantail flycatcher, Tickell's blue flycatcher, shrikes, white cheeked bulbul, red whiskered bulbul, rose finch, grackle, munias, southern grackle, orioles, racket tailed drongo, cuckoo, minivet, sunbird, woodpeckers, parakeets, hornbills, horned owl, crested serpent eagle and green pigeon. Peafowl prefer open and dry areas.

Water birds include the common teal, whistling teal, cotton teal, darter, bronze winged jacana, purple moorhen, white breasted waterhen, coot, spotbill, gadwall, and cormorant.

HISTORY

Prior to 1864, forest management on scientific principles did not exist. The Forest Department was formed during 1864, but there was an acute shortage of staff. In 1897, Chamarajanagar Range was created as a separate entity and was placed under a Range Officer. The Range was split into sub-ranges, which were further divided into beats. Protection of illicit felling in the forest became possible.

In 1902 a system of strictly localized fellings regulated by silvicultural principles was introduced. Each working circle was subdivided into 20 compartments of equal productive capacity, each compartment being worked for one year. This system was replaced by a regular Working Plan drawn up by Machaya in 1912. The Plan divided Bandipur into working circles. The felling cycle was fixed at 30 years and subdivided into five periods of six years each, starting in 1913. A partial valuation survey (11.8%) of Bandipur forests was carried out. No leases were allowed, and, all work was undertaken by the Forest Department alone.

During 1917 some avenue trees of species like honge, *Kigelia*, etc. were planted in Gopalaswamy hills. In 1924, Narayana Rao suggested introducing exotics into the area. Subsequently, till 1928-29, several exotic species were planted. The experimental planting of teak and cinchona was begun. Planting activity continued for several years. The Mysore Game and Forest Preservation Regulation was passed in the princely state of Mysore at the turn of the century. In 1931, a 90 sq km Sanctuary was set up in Chamarajanagar SF, but the area was soon felt to be too small for effective conservation. In 1941, the ambitious Venugopal Wildlife Park was constituted. Project Tiger as a Central Sector Plan Scheme was initiated in 1973-74 in Bandipur National Park. The tiger Reserve, one of 15 in the country today, was comprised of forests of the old Venugopal Park, and was 689.5 sq km in extent. The area has since grown to 865.73 sq km. Grazing in the Reserve was completely stopped. Forest villages inside the Reserve have been successfully relocated. The vacated paddy fields and garden lands are now meadows that provide good grazing for wildlife. Economic activities like thinning of plantations, firewood collection, minor forest produce collection, etc. have also been completely stopped.

Compiled with excerpts from:

1. Kadambi, K. (1944). Working Plan for the State Forests of Mettukuppe, Kakankote, Begur, and Ainurmarigudi Forest Ranges of Mysore Forest Division. Vol. I. Parts I and II. Government Press, Bangalore.

2. Krishnan, M. (1975). A guide to the tourism zone of the Bandipur Tiger Reserve. Field Director, Project Tiger, Mysore.

3. Rao, H.S. (1909). Working Plan for the forests of the Heggadadevanakote sub-Division, Mysore District. Government Press, Bangalore.

4. Neginhal, S.G. (1974). Project Tiger - Management Plan of the Bandipur Tiger Reserve. Government of Karnataka.

5. Venkatavaradaiengar. (1921). Working Plan report of the Mettikuppe East Extension, HD kote Range, Mysore West Division, 1921-1951. Government Press, Bangalore.

CHAMARAJANAGAR DIVISION

State Forest	Area (sq km)
Beerambadi Northeast Extension	20.8

The Beerambadi NE Extension covers an area of 20.8 sq km, and is situated in the southwest corner of Gundlupet taluk. This State Forest forms a compact block with Bandipur and Beerambadi State Forests, separated only by artificial boundaries. The area is undulating, and dotted with low hills. The highest peak is Shige betta (1122 m). The SF lies between longitude 76°32' and 76°34'E and latitude 11°35' and 11°53'N.

The prevalent rock is light coloured biotite granite or gneiss. Quartz also forms some part of its mineral composition.

Two principal kinds of soils prevail in this tract - alluvial black soil in the level plains, and sandy reddish or greyish loam on the slopes and well drained areas.

The general drainage of the entire tract is towards south-east into the Gundal river.

The area receives both southwest and northeast monsoons. However, the rainfall is low. The southwest monsoon brings sudden heavy showers, and the premonsoon rains are often accompanied by thunder and lightning. The northeast monsoon brings more uniform and generally lighter precipitation. Though there is no recorded reading of precipitation, 750-1000 mm is the general average. The climate is hot and dry in the summer.

There are flourishing villages to the north of these forests. The inhabitants are agriculturists and own large herds of cattle.

Beerambadi NE Extension State Forest was originally part of Venugopal Wildlife Park, established by the state government in 1941. However, in 1965 the erstwhile Mysore Forest Division was divided into Mysore Forest Division and Chamarajanagar Forest Division, of which the Beerambadi NE Extension is a part. The history of this SF is similar to that of Mysore Forest Division, hence a separate account of the history of the area is not provided.

Compiled with excerpts from:

1. Anonymous. (1912). Working Plan report of the Chamarajanagar State Forests 1912.

2. Setty, K.R.V. (1972). Revised Working Plan for the forests of Mysore and Chamarajanagar Divisions 1973-74 to 2003-04. CCF, Karnataka.

KERALA

WYNAAD WILDLIFE DIVISION

Forest	Area (sq km)
Kudrakote RF	14.3
Begur RF	61.9
Karthikulam RF	0.8
Edakode RF	0.7
Kurichiyat RF	7.4
Kuppady RF	32.0
Alathur RF	4.8
Edattara RF	2.4
Kallur RF	8.4
Mavinhalla RF	32.4
Rampur RF	72.8
Naminad RF	3.7
Nulpuzha RF	15.8

INTRODUCTION:

Kerala Wynaad is an extensive tableland of more than 3000 sq km and has an elevation of [illegible] to 1000 m. There are few high hills on the plateau, and the only noteworthy peaks of the region in the Nilgiri Biosphere Reserve area are in the southwestern corner in the Varalmala-Vellerimala ridge region. The extensive moist deciduous forest cover of the Kerala Wynaad plateau has almost completely disappeared, leaving only a few degraded islands of vegetation along its eastern margin, on the Kerala-Mysore border, even these have mostly been converted to monocultural plantations of teak or eucalyptus. Some of the reserve forests have been constituted as Wynaad Wildlife Sanctuary, which is in two discontinuous parts. The northern segment includes Begur (6192 ha.), Kudrekode (1427 ha.), Kattikulam (75 ha.) and Edakode (71 ha.) Reserve Forests along the Manantody-Kutta road. There is very little natural vegetation in this part. The area is more undulating, due to the proximity of the Brahmagiris, and there are fewer swamps. The southern part of the Sanctuary includes Kuruchiyat (7442 ha.), Kuppadi (3204 ha.), Rampur (7284 ha.) and Mavinhalla (5242 ha.) Reserve Forests and a few smaller reserves: Kallur, Alathur, Edathara, Neminad, Noolpuzha, etc. The southern half of the Sanctuary is separated from the northern half by the Pulpalli encroachments. This forest belt lies along the interstate boundary and is essentially a buffer area for the Bandipur Tiger Reserve and Mudumalai Wildlife Sanctuary. The Wynaad plateau has the largest tribal population in Kerala (91,267 according to the 1971 census).

TOPOGRAPHY

Two readily distinguishable zones exist in the area: a) the spurs, peaks and ravines which form the western slopes of the Ghats, rising steeply from the foothills to the main ridge; and b) the tableland of the Wynaad to the east of the main ridge, which gradually slopes down east and north to the Mysore plateau. It is undulating and dotted with rounded hills. The height of the plateau varies from 750 m at Kolavalli on the Kabini river, to 1092 m at [illegible]imalai hill in the Chedleth Range. The entire area drains into the Kabini river, a tributary of the Cauvery.

GEOLOGY

The principal underlying rock is gneiss. It is a biotite gneiss with felspar, biotite, quartz and garnet as its chief constituents. Small veins of quartz are common. A lateritic formation is sometimes found. Narrow streaks of quartz pebbles are frequently found, more often in the poorer forests of the east, where they may be only 50 to 60 cm below the surface; in the better forests, the strata are either much deeper down or absent. Mica appears to be a more important constituent in the east than it is in the west. Outcrops of the underlying rocks are generally confined to higher elevations. In Kurichiyat, there are exposed phyllites and grained quartz mica-schists.

SOIL

The soil on the slopes of the main ridge is a ferruginous red sandy loam generally 3.5 to 4.5 m deep. The presence of surface boulders gives it the appearance of a shallow soil. The scoured stream banks and hillsides confirm this, their loose boulders held in a matrix of soft soil like "random rubble in masonry". The root system of the dense vegetation that grows on it is the main force holding the soil; heavy rains frequently disturb the balance, causing landslides.

On the plateau, the soil is rich clayey loam, generally 60 to 120 cm deep, with either a red gravelly subsoil or a yellowish clay of considerable depth. Trees, particularly <u>Tectona grandis</u> and <u>Lagerstroemia lanceolata</u> which require good drainage grow best on the gravelly subsoil. The clayey loam referred to above tends to become more sandy towards the east, and generally supports a poorer type of forest, as in that of Sultan's Battery Range. On this Range, the soil tends to be a sandy loam - this may be due to the presence of mica in larger quantities than normal, and to the [illegible] of the normal humus content due to fierce fires and the consequent strong growth of grass. Lateritic soil is also found on the plateau, increasing with increasing rainfall. Humus content is generally high, except in areas subject to frequent fires. In the Mavinhalla Reserve Forest, the soil is made up of sands and silty clay near the watercourses. In Edathorai reserve, a silt-loam type of soil is found along the road sections, possibly underlaid by more ferruginous red loamy clay.

Forest soils are characterized by a surface layer of organic matter derived from the forest. They are mostly loamy, with varying proportions of sand and clay. They are rich in nitrogen but low in phosphates, and their pH varies depending on the degree of leaching. When forests are cleared, their soils undergo lateritization.

Plant communities that differ from the prevailing type are often indicative of growth under special edaphic conditions, as in 1) the gregarious occurrence of reeds along stream banks in evergreen and semi-evergreen areas; 2) almost pure patches of _Xylia_ on lateritic soils; 3) stunted growth of _Pterocarpus marsupium_, _Terminalia tomentosa_ and _Emblica officinalis_ on shallow soils; and 4) occurrence of _Vateria_ and _Cullenia_ near streams.

WATER RESOURCES AND DRAINAGE

The entire area drains into the [illegible] river, which is a tributary of the Cauvery. Because the slopes are gentle, the smaller streams tend to form swamps. Many of the streams are perennial. The important ones are:

1) Bavali puzha (Bavali hole), draining the Begur, Kudrekote and Alathur reserves; Nadundanna thodu and Kakkari thodu are the small streams which drain into the Bavali puzha from Begur reserve. The river Kabini is formed by the confluence of the Bavali puzha and the Panamarampuzha.

2) Murumavu river, forming the western boundary of Kurichiyat reserve, with its tributaries the Kurichiyat, Doddapallam and western fall streams.

3) Manja thodu, draining the Rampur reserve and joining the Noolpuzha.

4) Noolpuzha, draining parts of Rampur and Mavinhalla reserves, which joins the Mavinhalla river to form the Nuguhole.

5) Mavinhalla river, draining the eastern portions of Mavinhalla reserve.

6) Kattihalla, draining Rampur reserve and joining the Nuguhole.

7) Ammankuli thodu, draining the Mavinhalla and joining the Noolpuzha.

8) Kallur thode, draining Kallur and Alathur reserves and joining the Noolpuzha.

CLIMATE

The climate on the plains and that on the plateau is quite different, judging by temperature, humidity and rainfall.

Temperature:

The temperature on the plateau varies between 13 and 32 ^{o}C. There is no frost.

Humidity:

The plateau is drier than the plains. December to April are the hottest months. Mist is common from November to February on the plateau and higher elevations, and there is an appreciable precipitation of water from them in the early morning.

Monsoons:

The southwest monsoon, which contributes the larger portion of the total rainfall usually arrives around the first week of June, preceded by a few showers in April and May. The heaviest rainfall occurs in July and August. The northeast monsoon brings some rain in October and November. Breaks in the monsoon are not uncommon. The average rainfall for Chedleth, Muthanga and Tholpetti is 181.91d cm, 156.818 cm and 156.20d cm respectively.

Winds:

On the plateau, a strong dry wind blows from the east between November and April.

AGRICULTURE

The history of agriculture on the Wynaad plateau shows two distinct phases. First was the practice of ponam or shifting cultivation, begun long ago, and practised by the tribals mostly in the valleys - 'vayals' where they grew cereals and pulses. At one time the practice of ponam cultivation must have been far more extensive than it is today, and forests were extensively degraded as a result. A modified version of ponam or shifting cultivation which probably did not need to have the typical cyclical rotation of true shifting cultivation was practised by the plains people on the north Wynaad slopes, where greater emphasis was placed on cash crops. The second phase in the agricultural development of the Wynaad began during the World War

II period, when the Government threw open the Wynaad plateau forests for settled agriculture under the 'grow more food campaign'. Immediately after World War II the demobilized soldiers were given forest land in Wynaad for raising coffee plantations. Since then there has been a continuous expansion of area under cash crops such as coffee, pepper, cardamom, cocoa, etc. on the Wynaad plateau at the cost of the natural forests. T.V. Venkateshwara Iyer reports that the practice of ponam cultivation was so widespread even in 1951 that it covered about one seventh of the total extent of Tellichery and Wynaad taluks (north and south). The forest settlement claim of the tribals for rights to ponam cultivation inside the Reserved Forests was rejected, but they were allowed to carry on ponam cultivation on an area of 1457 hectares. This area was subsequently taken up for matchwood plantation from 1951 onward, and the tribals encouraged to cultivate a free field crop in the first two years of forest plantation in compensation for the area lost to them. At present, "ponam cultivation" refers solely to the raising of field crops in the regeneration area, along with forest species.

HISTORY

Very little is known of the early history of Wynaad and its forests. Archaeological finds indicate that Wynaad was developed very early on. Stone carvings in the Edakkal caves have been traced to the 5th or 6th century, while copper plates in Tirunelly temple show that the area was under the rajas of Kadathanad and Kottayam in the 8th century. The Wynaad seems to have changed hands several times, among the rajas of Coorg, Mysore and Malabar. Its history upto the British conquest and consolidation thereafter has been dealt with at length in Coode's Working Plan (1929-39).

The west coast of India carried on a flourishing trade with middle east countries like Persia and Arabia many centuries before the British conquest. Ships built of Malabar teak carried timber like ebony and rosewood, and spices like cardamom, pepper, etc. to these countries. Due to their proximity to the sea, the forests of the foothills were exploited much more than those of the plateau.

Forests were considered to be no man's land until the 10th century, when feudal lords took possession. Even then, it appears that the public had free access to the forests for extraction, lopping and burning. For a long time, the forests were also cleared for shifting cultivation. Commercial plantations followed. Records indicate the existence of pepper plantations in such cleared areas even in the 14th century. In 1840, large areas were put under coffee, but the crop was ruined by the insect <u>Hemelia vastatrix</u> and abandoned all over the Division in 1870.

The controlled extraction of timber from the forests ultimately resulted in the depletion of the stock of good sized teak trees, and Tippu Sultan had to declare teak a 'royal tree' in the 18th century to protect what was left. This protection was also nominal. Later, in 1809, a royalty on teak was introduced, but since it was unpopular, it remained a dead letter and was abolished in [illegible]. Thereafter, the forests continued to be worked under the 'stump fee system' (Rs. 1 per tree) until

1859. Departmental extraction of teak, <u>Terminalia tomentosa</u>, and <u>Pterocarpus marsupium</u> of saleable sizes from accessible moist deciduous forests was attempted near cart tracks. Inspection notes of this period show a desultory removal of trees of 'inferior' species, an appreciable fall in the percentage of teak in natural forests, and a lack of natural regeneration of teak. Because of this, a revision of the working of the plateau forests was proposed in 1895, and timber extraction limited to definite localities. The method adopted was to take up definite areas in regular rotation for selection felling. Dead, dying and overmature trees capable of yielding saleable timber were cut and removed under selection felling, along with improvement felling. An even, uninterrupted canopy was to be maintained during selection or improvement felling. The remoter evergreen areas remained less exploited except for casual felling for cardamom cultivation and removal of a few 'poor spar' for masts of sailing vessels, until regular and 'scientific' working of these areas was attempted a few decades ago.

Dr. Cleghorn, the first real Conservator of forests, visited Wynaad in 1859 in search of teak, which was getting scarce. He recommended the reservation of certain species valuable for timber or minor produce and the abolition of shifting cultivation. The recommendations were accepted by Government but could not be enforced for lack of proper settlement.

The first District Forest Officer, Captain Gib, began his duties in 1860. In 1863, Captain Beddome, the officiating Conservator, classed the Wynaad as one of the twelve first class forests of Madras Presidency. In 1866, Cleghorn wrote of the "great teak belt bordering Wynaad, extending from the boundary of Coorg in the north to the Moyar river in the south ... these are all rich forests but much devastated".

The earliest artificial regeneration work in Wynaad appears to have been a nursery at Allagadda on the Masal betta road (Begur reserve) between 1872 and 1878, to test the germinating power of teak seedlings. In 1826, Logan started teak plantations at Kanoth. The operations were continued till 1879 and the plantations handed over to the Forest Department.

The shooting of elephants was prohibited around 1867. The capturing of elephants is believed to have begun in 1885.

The reservation of the forests was taken in hand only in 1885, after the Madras Forest Act came into force in 1882. The private claims which had piled up between 1806 and 1885 involved prolonged litigation, and the reluctance of the government to press its claim led to the loss of much valuable land.

The Mavinhalla and Noolpuzha reserves were transferred to the Wynaad from the Nilgiris Division before 1885, possibly between 1876 and 1878. These reserves were believed to have been worked by the Government before transfer. In 1882-83, the Wynaad included the forests of Palghat, with the District Forest Officer's headquarters at Calicut. In 1896, Palghat was removed from his charge, and his headquarters was transferred to Manantody. Later in 1958 the Wynaad Division was reorganized and the southern parts (Kurichiyat Range, Muthanga Range and Sultan's Battery Range) were transferred to Calicut Division, while the northern part of Begur Range and other Ranges of Cannanore and

Karargod districts formed the Wynaad Forest Division. Later, the Wynaad Wildlife Division was formed, which included the whole of Wynaad Sanctuary.

In 1895 the system of felling trees from all accessible areas was abolished, and felling was restricted to specific localities each year. The felling of green trees was resumed, and the sale of dead and dying trees continued.

The oldest teak plantation was formed in Begur from the seedlings raised in 1892. The formation of plantations in areas subjected to shifting (ponam) cultivation was probably begun in 1894 when teak was raised in Alathur (Begur range) in crowbar holes at 6 x 6 ft distances. 14 acres of teak were raised in Chedleth range in 1896. Ponam cultivation continued, and the tract was further opened up by the construction of roads and buildings.

From 1888 to 1895, dead and dying trees of teak, *Terminalia tomentosa*, *Pterocarpus marsupium* and *Shorea talura* in Kuppadi, Rampur and Mavinhalla reserves were sold on contract. This contract might have contributed to the rarity of teak in Kuppadi reserve and to the open, grassy nature of the other two reserves.

Inspection notes of this period show that it was realized that the desultory removal of trees over large areas had resulted in a profuse growth of *Lantana* and miscellaneous shrubs and trees. The stunted, open grassy forests of Mavinhalla and Rampur reserves were rightly attributed to heavy overworking in the past. A large number of dead trees died as a result of fierce annual fires.

In 1896 Tireman, the District Forest Officer, improved the existing system by "fixing beforehand what coupes were to be felled, instead of choosing them at hazard, and abolished the deadwood contract which had given rise to so much mischief to the forests, being an irresistible temptation to dishonesty and a source of illicit removal of sound trees."

In 1900, sleepers were supplied to the railways from Wynaad from <u>Tectona grandis</u> and <u>Terminalia tomentosa</u> timber. The wastage of timber was high, the ratio of sleepers to logs being 38:1.

Foulkes' Working Plan, 1902-1921 was the first Working Plan for the forests of Begur and Chedleth Ranges (the latter including Sultan's Battery Range). The areas which were worked were: 1) the timber working circle of Begur Range, comprising Begur and Kudrekote Ranges; and 2) the northern working circle of the then Chedleth Range, comprising Kurichiyat, Kuppadi and Rampur reserves.

Fire protection was sought by a scheme of external fire lines and fire patrols. <u>Lantana</u> was to be "dealt with", and areas for 'takhal' cultivation were to be limited in extent.

Artificial regeneration was proposed over 30 acres annually, but no definite prescriptions appear to have been laid down. The intention was to restock takhalled areas with <u>Dalbergia latifolia</u>, <u>Pterocarpus marsupium</u> and <u>Tectona grandis</u>, planted at 4 x 4 ft distances.

In 1904, the Plan was amended and the felling was restricted to trees of 2 ft in diameter and above, no crooked trees being felled.

In 1905 a higher proportion of _Terminalia tomentosa_ trees was prescribed for felling, with a view to increasing the proportion of teak, _Dalbergia latifolia_, _Pterocarpus marsupium_ and _Lagerstroemia lanceolata_ in the crop. In 1906 it was decided to restrict the extent of annual planting considerably, to plant only teak and to introduce sandal.

In 1909, artificial regeneration was considered expensive and was to be resorted to only when natural regeneration was unsuccessful. Departmental exploitation was stopped in 1908 and coupes were sold standing following marking, but it was restarted in 1912.

The results of working from 1902-1927 may be summarized as follows:

1) large trees were removed in large numbers;

2) natural regeneration failed, and no provision was made in the Working Plan to ensure regeneration in the natural forests. The result was an absence of the youngest age classes and of saplings of valuable species;

3) the concentrated regeneration prescribed was not carried out properly. The practice was later abandoned, with the result that there are gaps in the age gradations of the plantations;

4) efforts were made to increase the proportion of valuable species by excessive felling of less valuable ones, without due regard to the saleability and to the canopy; this resulted in invasions of _Lantana_ and grass;

5) some efforts were made in the middle of the period to introduce teak in natural forests. The result was considered a

failure.

Foulkes' Plan was severely criticized as imperfect and unworkable in practice, but the main prescriptions were followed until 1921, with considerable modifications.

Longrigg's Working Plan, 1916-1921, was prepared for the South Canara Division, which contained some portions of the present Wynaad Forest Division.

The planting of teak after clearfelling was successfully carried out over a large area between 1921-28, based on Coode's Working Plan of 1929-39. He also prescribed the following:

1) experimental circle, including the proposed experiment to raise plantations in Begur Range in the areas which were clearfelled or partly felled by 1928. The working circle was later combined with the clearfelling working circle;

2) clearfelling working circle, consisting of good quality deciduous forest generally containing teak in appreciable quantities. He proposed clearfelling followed by artificial regeneration of teak. In Begur Range, 3.035 hectares were placed under this working circle;

3) selection working circle, with a felling cycle of 30 years and girth limit 210 cm for standing trees of teak, rosewood, vengai, venteak, and all dead trees (no girth limits). Gap regeneration was also prescribed and attempted, but was later given up due to poor results;

4) minor forest produce working circle: the whole area was covered by this circle. The main items obtained were honey, wax, soapnut (<u>Acacia concinna</u> pods), with gall nuts from Sultan's Battery Range and oranges from Neduthana top in Begur Range,

elephants' tusks, and occasionally skins, horns, antlers and ivory, and the bark of Cassia fistula;

5) grazing working circle: under these rules, the cattle licensed to graze in one Range were permitted to enter an adjoining Range upto a distance of half a mile. Grazing was not an acute problem, so there was no question of dividing the area into Blocks, etc.

Coode's Plan was extended to 1940.

Only one out of the two felling series in the selection working circle was worked during this period. The other series contained little or no teak and its exploitation was suspended by the Chief Conservator of Forests.

P.W. Davis' Working Plan covered the South Canara Division. Kasargod Range in this Division was later transferred to Wynaad Division

Kesavavittal's Working Plan for 1943-44 to 1957-58 also covered South Canara Division. It covered Kasargod Range, which later came under Wynaad Division.

T.V. Venkateshwara Iyer's revised Working Plan for Wynaad Division (1940-50) was sanctioned for the whole of the old Wynaad Division in 1941, and the period of the plan covered 1940-41 to 1949-50. The working circles of this plan are:

1) conversion working circle, consisting of all existing plantations of teak and other valuable species. Subsidiary felling in areas not proposed for conversion during the Plan period was also prescribed. Thinning, both mechanical and silvicultural, was proposed for planted areas;

2) deciduous working circle: this circle for deciduous forests was not included in the conversion working circle. Dead, dying, fallen and overmature trees of marketable species were to be extracted on a 30 year felling cycle;

3) evergreen selection working circle, including the best and most accessible areas of Hegur Range. Marketable trees were extracted on a 20 year cycle, the girth limit being 180 cm for *Mesua* and 195 cm for other species;

4) minor forest produce working circle: this circle covered the whole area and the main products collected were ivory, honey, wax, and cardamom. The cultivation of cardamom in evergreen forests by creating gaps was tried, but was stopped in 1943 by the Chief Conservator of Forests, as he thought that cardamom would occur naturally where suitable conditions existed, and that its cultivation was therefore unnecessary;

5) grazing working circle: cattle with permits were allowed to graze. Goats were prohibited. Cattle belonging to Ponamdars, Kurichiyars, forest leaseholders and contractors were to be allowed free grazing. Plantations were generally closed to grazing, but the Conservator of Forests could open particular plantations over 6 years old, should closure of all plantations prove a hardship to the public;

6) protection working circle: areas which were not included in other working circles were placed in the protection working circle. Grazing and minor forest produce collection were permitted in this working circle. The area was not intended to be exploited for timber, other than that obtainable from the dead and windfallen trees of saleable species, except when sanctioned

by the Chief Conservator of Forests. Some areas under this working circle were worked for softwood species during 1943;

7) non-Reserve working circle: the non-Reserve Forests were prescribed for working by forming 10 coupes and working one or more per year, according to demand. The prescription was made with the object of exploiting the saleable timber and valuable species before they were stolen.

B.A. Cariappa revised the whole of Wynaad Division in his Working Plan, 1950-51 to 1959-60. The following seven working circles were prescribed by him:

1) conversion working circle, including all existing plantations and natural forests found suitable for clearfelling, as in the earlier Plan. The practice of subsidiary felling of areas not earmarked for conversion during the Plan period was also followed with a girth limit of 180 cm. Teak and softwoods were planted and extracted on a 70 year rotation;

2) deciduous selection working circle, for those deciduous forests on the plateau not covered by the conversion working circle. The felling cycle of 30 years and girth limit of 180 cm continued to be followed in working the area;

3) evergreen selection working circle: the best evergreen and semi-evergreen forests were prescribed for working. The girth limit was reduced to 180 cm for all saleable species, except for <u>Xylia</u> (120 cm) and for <u>Evodia</u> (60 cm);

4) fuel working circle in Sultan's Battery Range: this comprised the easternmost portion of Mavinhalla reserve. The vegetation was poor mixed deciduous forest with an undergrowth of

grass, subject to annual fires. There was only one felling series, its extent being 750 acres divided into coupes with a tentative rotation of 30 years. Only two coupes were worked till 1952, after which the entire working circle was deleted from the Working Plan;

5) minor forest produce working circle: this circle covered the entire area. The right to collect minor produce was leased out for one year at a time. The main produce collected was cardamom, honey, wax, shikakai, pepper, coffee, cinchona bark, canes, wild turmeric, white and black dammar, horns, gall nuts and ivory (collected departmentally);

6) grazing working circle, comprising all the reserved forests of the Division. The grazing fee was 25 np. per cow and 50 np. per buffalo. The grazing of goats was strictly prohibited. Hill tribes were allowed to graze their cattle free. This concession was also extended to leaseholders and forest contractors;

7) protection working circle, including all the areas not included in the other working circles. No extraction of timber was allowed, except for dead and windfallen trees.

Elephant capturing operations were carried out according to the prescriptions of the Working Plan in Sultan's Battery Range between 1960 and 1962. 15 elephants were captured.

Natarajan Chettiyar's Working Plan for 1962-63 to 1971-72: With the reorganization of the Forest Divisions in 1958, parts of the areas under Wynaad Division were transferred to Kozhikode Division. Of the area dealt with in the Working Plan, only Begur Range lies in the Biosphere Reserve area, and includes the Alathur, Begur, Edakad, Kartikulam, and Kudrekote Reserve

Forests.

S. Parameswar Iyer's Working Plan, 1964-65 to 1973-74: Since Wynaad Division was reorganized, the southern portions of Wynaad plateau and the Thamerasseri Ghat, and the Kuttiyadi Ranges were included in Kozhikode Division. The Wynaad plateau forests of Kurichiyat, Alathur, Edathorai, Kallur, Kuppadi, Mavinhalla, Neminad, Noolpuzha and Rampur are included in the Biosphere area. The unique Kuruva Reserve Forests of the Kuruva islands in the Kabini river, and a few other reserves lie outside the area of the Nilgiri Biosphere Reserve.

Parameswar Iyer's Plan contained the following circles:

1) conversion clearfelling working circle, including all existing plantations and all natural forests considered suitable for conversion to plantations. The area was divided into felling series and all species above 120 cm girth at breast height were prescribed for extraction. In areas to be planted with hybrid species of eucalyptus and <u>Eucalyptus grandis</u>, rosewood above 210 cm girth was to be extracted. Rotation for eucalyptus was fixed at 8 years. Since eucalyptus was a fast growing species prone to branching, no field crop was to be cultivated in eucalyptus plantation coupes;

2) deciduous selection working circle: half of the Kurichiyat and Rampur reserves were allotted for working, with a felling cycle of 20 years;

3) bamboo working circle: almost all the bamboos in the Division had flowered and were dead or dying. The seeds had already started germinating and a good growth of bamboo was found

in the bamboo areas of the Division. The dead bamboo was to be collected and supplied to the Gwalior Rayon Silk Manufacturing Co., Ltd., Mavoor, Kozhikode. The daily bamboo requirement of this company was 450 tons, to produce 150 tons of rayon grade pulp. Due to the flowering and consequent death of bamboo in Wynaad, it was not possible for the factory at Mavoor to depend on the bamboos of this Division alone for its daily supply. The deficit was to be met by the wood available from the *Eucalyptus grandis* plantations of the state. Systematic extraction of bamboo could only be considered after 10 years;

4) experimental sandal regeneration working circle: this working circle included 40 hectares of open deciduous forest considered suitable for the propagation of sandal (*Santalum album*) by the gap regeneration system. A slightly modified silvicultural system was also applied. The sandal was to be regenerated in patches on lines 20 m apart;

5) minor forest produce working circle: this circle covered the whole Division. The main products were cardamom, honey, wax, shikakai, canes, wild turmeric, white and black dammar, ivory, horns, avaram bark, myrabolams, roots, and other items for which there was a demand;

6) grazing working circle, including all the Reserved Forests and reserved lands of this Division. The rate was 25 p. per cow and 50 p. per buffalo. Grazing of goats was prohibited.

P.N. Adiyodi's Working Plan for the period 1974-75 to 1983-84 followed Natarajan Chettiyar's Plan and included Begur Range and some Reserve Forests included in the Nilgiri Biosphere Reserve. His Plan contained the following working circles:

1) teak plantation working circle: this circle contained teak plantations raised until 1972, and some natural forests suitable for conversion. The rotation period was 70 years. The selected area was divided into four felling series. In Begur Range, 1200 of the 2000 hectares fit for conversion were to be converted to teak;

2) softwood plantation working circle: the objective of this circle was to convert relatively less valuable forests into valuable softwood plantations, to cater to the wood-based industries of Cannanore, Kozhikode and Kasargod districts. Clearfelling and artificial regeneration methods were adopted;

3) miscellaneous plantation working circle: the planting of eucalyptus was undertaken through the scheme for fast growing species. Eucalyptus grandis failed in the first year of its introduction into Begur. Eucalyptus hybrid (Mysore gum) was said to be successful in some areas of the Division. Planting of various other species was also tried. The prescriptions of this working circle described and assessed methods of raising new plantations;

4) cashew plantation working circle: this working circle prescribed the raising of cashew plantations and management of new plantations. The areas of operation do not lie within the boundary of the Biosphere Reserve;

5) selection-improvement working circle: this circle contained evergreen and semi-evergreen forests. They lie outside the Biosphere Reserve;

6) minor forest produce working circle: this circle covered the

entire Division. The main products collected were bamboo, cashewnuts, cardamom, honey, wax, ivory, horns, skins of wild animals, flowers, fruit, resins, and leaves of various species. Roots of *Rauwolfia serpentina* and *Rauwolfia canescens* were also collected;

7) protection working circle: this included all steep and precipitous slopes from which timber extraction was uneconomical or damaging to the ecology. Apart from minor forest produce collection and cattle grazing, no other operations took place.

VEGETATION

Southern tropical moist deciduous forests occur on Wynaad plateau, between 700 and 1000 m of elevation, and also in the plains, below 300 m. Large areas in accessible localities are secondary forests, the result of regression from evergreen or semi-evergreen types due to shifting cultivation or heavy exploitation in the past. In lateritic soil, *Xylia* tends to become gregarious. In the plains, bamboos occur sporadically. Bamboos, mostly *Bambusa arundinacea*, occur extensively on the plateau. The forests are subject to annual fires. The moist deciduous forests of the plateau are characterized by the presence of appreciable proportions of teak, *Terminalia tomentosa*, *Grewia latifolia* and *Kydia calycina*. *Xylia xylocarpa* and *Terminalia paniculata* are conspicuous by their absence. Tree growth in these forests is far from homogeneous, the main variations being 1) the irregular distribution of teak; 2) the changes from good quality forest to open grassy areas; and 3) the localized occurrence of areas predominated by bamboo.

There is a subtype of the moist deciduous forests found on lateritic soils and poor exposed areas degraded by overcutting, shifting cultivation, and constant fires. It is also found on hilltops. This type varies from an association of low, scattered clumps of principally evergreen xerophytic shrubs with occasional trees to a considerably closer, more rank growth of a mesophytic character, containing herbaceous shrubs and thorny climbers.

List of Working Plans available in the C.E.S. collection:

1. Adiyodi, P.N. (1977). Seventh Working Plan for the Wynaad Forest Division, 1974-75 to 1983-84.

2. Cariappa, B.A. (1955). Revised Working Plan for the Wynaad Forest Division, 1950-51 to 1959-60.

3. Chettiar, I.N. (1965). Revised Working Plan for the Wynaad Forest Division, 1962-63 to 1971-72.

4. Coode, J. (1930). Working Plan for the deciduous forests of the Wynaad plateau, Wynaad Division, 1929-30 to 1938-39.

5. Iyer, S.P. (1964). A Working Plan for Kozhikode Forest Division, 1964-65 to 1973-74.

6. Sarma, A.N. (1934). Working Plan for the Wynaad Ghat forests, Wynaad Division, 1932-33 to 1942-43.

VESTED FOREST DIVISIONS: AN INTRODUCTION

All forests and other unoccupied lands in the Old Province of Malabar had been considered private property. The Civil Courts of Madras and Bombay passed laws on the land tenure in Malabar. The Province of Malabar was wrested from Tippu Sultan in 1792 but no steps were taken to exercise the right of possession of the forests. The landowners in the neighbourhood of the forests grabbed the forest land. However, certain forest areas came to be leased or purchased outright by the government. Some forest lands passed under escheat to government, owing to social conditions prevailing at that time.

After the Seringapatam treaty of 1792 Wynaad was claimed by the British, and Pychy Raja was allowed to retain his right and authority over the area subject to the Company's right over supervision, revenue, tribute and the right to intervene in cases of oppression. This agreement, drawn up by the British, was not accepted by Pychy Raja. His arrest was ordered in 1794 but could not be carried out. In 1796, an attempt was made to arrest Pychy Raja but he escaped to the Wynaad forest and held up all the traffic on the Kuttiadi pass. In 1796, Pychy Raja entered into treaty with Tippu Sultan and the British troops were savagely attacked and compelled to withdraw to Kuttiadi. In 1799 occurred the last war between the British and Tippu Sultan, and he was presumed killed in that year. Under the Partition Treaty of 1799 with Mysore, the British claimed Wynaad. From 1797 onwards, a series of battles was fought between Pazhassi Raja and the British. In 1805 the former died fighting and the forests became the property of the British.

As early as 1793 the British government tried to enter into some sort of agreement with the rulers who owned the forests. In 1887 William Logan recorded the devastating effects of ponam cultivation.

The reports of the Joint Commission from Bengal and Bombay appointed to inspect the condition of the Province of Malabar in the year 1792-95 state that most of the forests of Wynaad were private property and that Tippu Sultan made an allowance to the proprietors.

From 1799 onwards, the Britishers claimed these forests as a part of their Partition Treaty with Mysore and in 1805, these forests became the property of the British by conquest.

It is seen from the Malabar Gazetteer that till 1805, there were no definite distinctions between government-owned and private forests. In 1812, the British government enforced certain rules on forests and ordered collection of forest taxes. This resulted in the Kurichiyar and Kurumba Revolts in 1812 which were finally suppressed by the British. Between 1812 and 1859, the British government was more concerned about the Revenue settlements than about regulations in forest areas.

In 1859 certain steps taken by the government indirectly allowed the private claims on certain areas to be retained by the previous occupants. This critical situation in 1859 was the main cause of the formation of private forests in the Malabar area. The concentrated exploitation of the private forests increased with the demand for timber and until the introduction of the

Madras Forest Act in 1882, the government was not able to institute Reserved Forests.

The formation of the Jenmy system had considerable consequences for the private forests of Malabar. The originally unoccupied areas automatically became the 'Jenmam' of some prominent Jenmies. As late as 1945, a survey was conducted by the Madras Government which revealed that the private forests at that time measured 1200 sq mi (7.5 lakh acres approximately) and belonged to 116 individuals. The lands owned by them varied from 10 to 100,000 acres.

Until World War II, the private forests of Malabar retained their pristine glory. But by 1945, the area was thoroughly damaged, causing concern to the government.

The Madras Preservation of Private Forests Act was intended to prevent the indiscriminate destruction of private forests and interference with customary and prescriptive rights therein. This was enacted, pending further legislation, as Act XXVII of 1949. This Act provided mainly that prior permission from the Collector of the concerned district was necessary before any alienation of private forests took place, and that prior permission was to be taken before cutting trees or denuding the forests.

This Act was intended to be a temporary measure to safeguard the private forests pending further legislation. For various reasons this was delayed. The formation of Kerala changed circumstances and legal questions. This Act was extended from time to time but its implementation was not always possible. The areas remained unsurveyed.

On January 1, 1957, Malabar district was divided into Cannanore, Calicut and Palghat districts. For various reasons such as the formation of Kerala, changing circumstances and legal questions prevented the passing of further legislation to replace the Madras Preservation of Private Forests Act. It was extended from time to time. Penalties provided were on paper only, because prosecutions were not successful. Since the areas were mostly unsurveyed, felling permits could not be strictly policed. The owners preferred the easy money obtained by felling the timber to the proper management of the areas for which they had neither interest nor incentive. The land-hungry people obtained money receipts from the owners and destroyed these forests mercilessly. This system of occupying forest land on the strength of money receipts was a clever ruse because while there was no clear alienation of the land, the owner allowed some other person to cultivate the area from year to year, contravening only the conditions regarding the regeneration of felled areas. The result was that, in general, the objective of preserving the forests was not achieved.

Consequently in 1971, the Kerala Private Forests (Vesting and Assignment) Act was passed by legislature and after a long legal tangle, the Supreme Court of India approved the legislation in 1973. Thus all the lands governed by the M.P.P.F Act 1949 lay vested with the Government from May 10, 1971 onward.

For speedy implementation of the Kerala Private Forests (Vesting and Assignment) Act, 1971, a special officer was appointed (T. Madhava Menon, IAS). A Committee known as the

Vested Forest Committee was constituted with Madhava Menon as its Chairman. The Committee published its report known, as the 'Vested Forest Committee Report' at the end of 1975.

The Kerala Government, after consideration of the report of the Vested Forest Committee decided that "about one-third of the total area of the Vested Forests consisting of rocks, rivers and stream beds and the areas not available for agriculture of any sort, will be reserved; another one-third of the area consisting of land necessary for soil and moisture conservation, hydro-electric and other silvicultural purposes beneficial to the agricultural community will also be reserved and the remaining area of approximately one-third of the total area will not be reserved, but be made available for assignment". Subsequently, as per the directions of the government, the Committee recast the list of areas proposed for permanent reservation. The approximate area for permanent reservation according to this recast list was 110,134.82 hectares.

In the Malabar area the vested forests occur mostly along the Western Ghats, linking up with stretches of Reserved Forests.

In the north at Panathady, the Vested Forests adjoin the Reserved Forests of Karnataka state along the boundary down through the A.K. Forests in Kothaparamba until they join the Kottiyur Reserved Forests. South of the Baliapattam river the depleted Vested Forests, once belonging to the Kottiyoor Devaswami and now settled, link up with the Periyar and Kannoth Reserves, with Vested Forests interspersed. The line of forests then bifurcates, one traversing and almost ringing the Wynaad plateau, the other following the escarpment of the Ghats. This latter line is resumed by Vested Forests around the Banasuram Peak and the ridge line until it strikes a patch of denudation around the Thamarasseri Ghats. This area falls within the Kozhikode Special Division.

Turning toward the east, the escarpment rises to the towering peaks of Velleri (2208 m) and Vavalmala (2339 m). The line curves through the Manjeri, Nilambur Kovilakkam, Gwalior Rayons private forests, is filled in by the New Amarambalam Reserve Forests, and resumes with the Vested Forests in Punchakkolli etc. forming the edge of the basin of the Nilambur Valley. This area falls within the Nilambur Special Division.

It then bifurcates again, one branch following the curve of the northern lip of the Palghat Gap, through the Silent Valley RF, in, through, and out of Attappadi Valley, is filled in by the Reserve Forests of the Palghat Division, resumes at the Emoor Bhagavathy and ends at the Vadasseri forests right at the Coimbatore boundary of the state. The other line straggles through hillocks and scrub jungle irregularly across the Bharathapuzha Valley with a few low peaks, e.g. Anangamudi (360 m), Vishumala (about 300 m), and Aylamudi (542 m), until it joins up with the southern lip of the Palghat Gap at Akamalavaram and the Kollengode forests on the east, and the Puzhakalidam and Mellikalidam forests west of the Parambikulam Reserve Forests. The whole area falls within the Palghat Special Division.

By 1971, most of the desirable and accessible portions of these forests had already been converted to settled areas exempt from the Act and, while litigation continued in the Courts, the forests were thoroughly denuded of all valuable timber. What remained were mostly steep, rocky and remote patches beyond the margins of economic cultivation. But unfortunately the constraints in policy making led to the assignement of approximately one-third of the area to cultivation. While making its recommendations, the Committee tried to strike the best compromise between the need for conservation and the demand for land.

The Committee proposed the exclusive allottment of suitable stretches of land in the Vested Forests in Wynaad, Attappadi and certain other areas for the settlement of tribal populations.

In areas assigned to cultivation, on which were steep hills and patches with thin soil cover, cashew was recommended as the only crop to be propagated. The Committee suggested soil conservation measures and prepared sample schemes for land utilization.

The Committee also prepared a list of areas proposed for reservation. Accordingly, four Special Forest Divisions were set up and steps taken to prepare regular Forest Working Plans. The Special Divisions were:

1. Tellicherry Special Division
2. Kozhikode Special Division
3. Nilambur Special Division
4. Palghat Special Division.

The last three contain areas lying within the Biosphere Reserve area.

KOZHIKODE SPECIAL DIVISION

Forest		Area (in sq km)
Kalpatta Range	)	
Kuttiadi Range	)	110.0
Thamarasseri Range	)	

LOCATION

This tract falls between latitudes 10^{o} 30' and 12^{o} 40N' and lontitudes 75^{o} and 76^{o} 60'E. All the Vested Forests of Kalpatta, Kuttiadi and Thamarasseri Ranges are situated in the Kozhikode Revenue District. All Vested Forests of Kalpatta Range fall within the South Wynaad taluk and the Vested Forests of Kuttiadi Range fall partly within the Quilandy taluk and partly within the Badagara taluk. The tract is bounded on the north by the Wynaad Forest Division, on the east by the Sultan's Battery and Chedleth Ranges of Kozhikode Territorial Division, on the south by Nilambur Division and on the west by the Arabian Sea.

GEOLOGY AND SOIL

Two main rock types are found in the area: a) laterites and b) ancient crystalline rocks.

Soils in the area have well developed profiles as a result of intensive leaching. Appreciable amounts of gravel are found and the surface soils are generally granular in structure.

CLIMATE

The temperature at the foothills and on the face of the Ghats varies between 21 and 38^{o} C, the diurnal and seasonal variations being moderate. The plateau temperature varies between 13 and 32^{o} C. Frost is unknown.

Both the southwest and northeast monsoons bring rain, but the former contributes to the bulk of the rainfall. The rainfall along the foothills and on the western slopes of the main ridge varies from 3800 to 5500 mm, diminishing rapidly toward the east.

WATER RESOURCES AND DRAINAGE

Unlike most other areas in Kerala, the rivers in this Division mostly originate in the plateau forests and flow east, following the general aspect. They follow the ravines and ultimately force their way out toward the west, and drain into the Arabian Sea except for the Kabini, which flows toward the east.

The main rivers and their tributaries are:

1. Kalpetta:

Chaliyar: at first it flows eastward, then it takes a southeasterly and westerly course in the Nilambur-Kovilakkam area and flows toward the west.

Tributaries - 1) Aranapuzha; 2) Vellarimalapuzha and 3) Kalladipuzha.

2. Kabini - eastward flowing river:

Tributaries - 1) Kalamanthodu; 2) Vallampuzha and 3) Panamarampuzha.

3. Thamarasseri - Chaliyar:

All tributaries of the Chaliyar in Thamarasseri flow east.

Tributaries - 1) Kuderanji puzha; 2) Poligal puzha; 3) Kaliyan puzha; 4) Muthappan puzha; 5) Kaniyat puzha and 6) Chali puzha.

Future management prescribed by P. Gopinathan:

1) Conversion of suitable areas into plantations of valuable species;

2) Conversion of suitable areas into plantations of cash crops such as coffee and cardamom where the stand was inferior;

3) Tending and thinning of the existing plantations;

4) A modified selection system to be followed in evergreen and semi-evergreem forests.

Ten working circles were constituted to achieve these objectives. The circles and the areas in each are given below:

Working circle	Range-wise distribution	Area (ha)
Plantation	Kalpetta	695.70
	Thamarasseri	25.00
Conversion	Kalpetta (existing *Eucalyptus*)	2147.00
	Kalpetta	742.50
	Kuttiadu	440.00
	Thamarasseri	180.00
Selection cum improvement	Kuttiadi	1300.00
	Kalpetta	1640.00
	Thamarasseri	3200.00
Protection	Kuttiadi	8500.00
	Kalpetta	3543.00
	Thamarasseri	7274.00
Social village forestry	Kuttiadi	200.00
	Kalpetta	529.00
	Thamarasseri	300.00
Coffee	Kalpetta	500.00
Cardamom	Kuttiadi	500.00
	Kalpetta	500.00
Wildlife	Whole area	
Minor forest produce	Whole area	
Miscellaneous	Whole area	

NILAMBUR SPECIAL DIVISION

Forest	Range	Area (sq km)
Gwalior Rayons forests	Chungathara II	122.0
Nilambur-Kovilakkam forests	Chungathara I	100.0
Madhavanam estate	Chungathara II	?
Chakkikuzhi Malavaram	Kalikavu	6.0
Kozhippara mala	Kalikavu	17.d
Punchakolly Malavaram	Chungathara II	32.0

LOCATION

This tract lies between latitudes 10° 45' and 11° 32'N and longitudes 75° 52' and 76° 28'E.

The Vested Forests in this Division consist mainly of three stretches linked with Reserved Forests:

1) The areas under present Kalikaru and Perinthalmanna Ranges form a single stretch of forest land. This adjoins portions of the Palghat Vested Forest Division in the south and stretches toward the north from Kannoth Malavaram to Puzhuthutti Malavaram. It is bounded on the north by the New Amarambalam RF, on the east by the Kundah Reserve Forests and Silent Valley RF and on the west by rubber estates (mainly Kerala Estates), tea estates (Arthala) and cultivated land.

2) The second stretch of forests comes under the present Chungathara Ranges I and II and Edavanna Range. Starting from Punjakkolli Malavaram lying adjacent to the New Amarambalam RF, the Vested Forests run along the western boundary of Nilgiris district upto the Kozhikode district boundary. In the west, cultivated lands border the other portions of these forests.

3) The third bit is the Hedumchery Malavaram in Edavanna Range. It is bounded by cultivated lands on the east and south, Manjeri

Kovilakkam on the north, Urangattiri on the west and Kolappad mala on the south.

All the areas of Nilambur Special Division come under the Ernad taluk of Malappuram district.

GEOLOGY

Since the Vested Forests lie contiguous to the various Reserved Forests of the Nilambur Division, the geology of the area is much the same as the Nilambur Forest Division, described elsewhere.

CLIMATE

The climate, also, is more or less similar to that in the Nilambur Valley. The locality is subject to the southwest monsoon and northeast monsoons. There is rarely any precipitation between December 15 and March 15. The annual average rainfall for the area varies from about 1300 mm to 3600 mm.

WATER RESOURCES AND DRAINAGE

Most of the areas in this Division are drained by the Chaliyar and its tributaries. The Olipuzha, when it is a tributary of the Kadalundi puzha, is another river which drains the southernmost portion of the Nilambur Vested Forest Division.

The main part of the Chaliyar starts from the Elambileri hills at an altitude of 2054.55 m. It is formed by the confluence of numerous rivers. The important tributaries which contribute to the flow in the main river are the Cherupuzha, Iringipuzha, Kurumbaranpuzha, Kunjirapuzha, Karipuzha, Punnapuzha, Vadapurampuzha, and Chaliyarpuzha.

The two main rivers draining the Vested Forests of this Division are not harnessed by irrigation or hydro-electric projects.

HISTORY

The following treatments were to be adopted:

1) Maintenance of existing evergreen forests as protection forests wherever the terrain was precipitous and the elevation was more than 1500 m;

2) Protection of forests growing on both banks of watercourses to maintain river flow;

3) Conversion of suitable areas into valuable plantations;

4) Adoption of the latest silvicultural techniques in existing plantations;

5) Working of bamboos and reeds on a 3 year felling cyclo;

6) Improvement of the living standards of tribals by providing reasonable facilities for cultivation;

7) Taking measures for the protection of fauna;

8) Introduction of species like cardamom in the evergreen forests to increase revenue;

The whole area was divided into working circles. They were: 1) Village forestry minor forest produce; 2) Bamboo; 3) Reed; 4) Erankola; 5) Minor forest produce; 6) Protection cum improvement 7) Plantation; 8) Wildlife and 9) Rubber working circles.

1) Village forestry minor forest produce working circle: portions of the Gwalior Rayons forests and Manjeri-Kovilakkam forests were brought under this circle;

2) Bamboo working circle: all the areas in the Division, especially the Gwalior Rayons forests were included in this working circle;

3) Reed working circle: the Blocks in this circle were Chorumba, Kannoth, Kottapuzha and Ex-Gwalior Rayons;

4) Erankole working circle: Ex-Manjeri-Kovilakkam, Ex-Gwalior Rayons, and Punchakkolli Blocks were included in this circle;

5) Minor forest produce working circle: all areas in the Vested Forests were in this working circle;

6) Protection cum improvement working circle: Chemban Block (570 ha), Kannoth Block (2005 ha), Kottapuzha South Block (710 ha), Kottapuzha North Block (1387 ha), Punchakkolli Block (425 ha), Ex-Gwalior Rayons-Madhuvanam Block (3825 ha), Ex-Nilambur-Kovilakkam (5275 ha) and Nedumechery Malavaram (1080 ha) were included in this working circle;

7) Plantation working circle: this working circle included the teak plantation raised by the Nilambur Special Division after vesting, i.e. in Chungathara (Ranges I and II, 1500 ha), Manjeri Kovilakkam in Edavanna Range (1237 ha), Punchakkolli Malavaram in Chungathara II Range (1200 ha), and Kottapuzha North in Kalikavu Range (Chakkikuzhi Malavaram, 300 ha). There were about 325 ha of plantations already extant and the rest (4937 ha) had to be cleared and converted, mainly to teak and softwood;

8) Wildlife working circle: in the east these forests adjoined the Silent Valley and Kundah RF. They lay sandwiched between the Punchakkolli Malavaram and Vadakkakottamala. The whole area was to be protected with wildlife as top priority;

9) Rubber working circle: this circle was constituted to plant rubber in the Ex-Nilambur Kovilakkam, Ex-Gwalior Rayons-Madhuvanam Block and Punchakkolli Blocks.

VEGETATION

The main forest types found in the Vested Forests are:

1. West coast tropical evergreen forests:

These can be seen in portions of Kuttiadi, Kakkajam and Thamarasseri Ghat regions in Kozhikode Division, Chungathara I and II Ranges of Nilambur Special Division, top portions of the Nilambur-Gudalur Ghat road near Kaduvakunnu, top portions of Kannoth Malavaram and Kozhiparamala near Kalikavu of Nilambur Special Division, Kalladikodanmala near Muthikulam, and the top portion of Emoor Bhagavathy Devaswami forests of the Palghat Division.

2. West coast semi-evergreen forests:

These are found in portions of Nilambur Kovilakkam, Vadakkakottamala of Nilambur Division, portions of the South Wynaad plateau falling in Kalpetta Range, Mukkali and Attappadi in Palghat Division, etc.

3. Moist mixed deciduous forests:

These are seen in portions of the Gwalior Rayons Forests, Nilambur Kovilakkam and Punchakkolli Malavaram of Nilambur Valley, Cheeyambam and Perambar forests of South Wynaad, top portions of Vadasseri forests and portions of Akamalavaram, etc. in Palghat Division forests.

4. Dry deciduous forests:

These are found in Valtappara, the lower reaches of the Vadasseri forests and most of the lower regions of the Palghat Range of Palghat Division such as Walayar, Vallikodemala, Ayyarmala, Choolannir, etc.

5. Grasslands:

There are vast stretches of grasslands, often with poor soil depth, near Lakkidi in Vythiri Ghat, the top of Chembra Peak estate, the top of the Attappadi and Nilambur Valleys adjoining Nilgiri district and the top of Varagampady in Agali Range, also adjoining Tamil Nadu. There are some grasslands in the Palghat Range of Palghat Special Division also.

The forest types described above come under the following vegetation classes according to Puri et al., (1983):

I. Medium elevation evergreen forest: Cullenia-Mesua-Palaquium series;

Moist evergreen forests and all the degraded stages described in the chapter on vegetation can be found in the area.

II. High elevation evergreen forest: Shola montane forest and Grasslands can also be found in the Vested Forests area.

III. Climax moist deciduous forest: Tectona-Dillenia-Lagerstroemia lanceolata-Terminalia paniculata series;

Moist deciduous forests and all degraded stages are found in the area.

IV. Dry deciduous forests: Terminalia-Anogeissus latifolia-Tectona grandis series;

Dry deciduous forests and their several degraded stages described in the chapter on vegetation are found in the Vested Forest areas.

Reports and Working Plans available in the C.E.S. collection:

(1) Report of the Vested Forests Committee. 1975.

(2) Provisional list of vested forests in the erstwhile Malabar area.

(3) The Palghat Special Division Working Plan by P.K. Zachariah 1980-90.

(4) The Kozhikode Special Division Working Plan by P. Gopinathan 1980-1990.

(5) The Nilambur Special Division Working Plan by P.K. Zachariah 1980-1990.

PALGHAT SPECIAL DIVISION

LOCATION

This tract lies between latitudes $10^{o}\ 15'$ and $11^{o}\ 15'$N and longitudes 76^{o} and 77^{o} E. The total area of the forests under this Division is 42,372 hectares. The Division is divided into:

Range	Headquarters
1. Thenkara Special Range	Mannarghat
2. Agali Special Range	Agali
3. Palghat Special Range	Olavakkot
4. Nemmara Special Range	Nemmara

Only the first three Ranges are included in the Restoration Zone of the Nilgiri Biosphere Reserve.

The Ranges are all divided into sections and beats.

The Thenkara Special Range has three sections, viz. Mannarghat, Cherplassery and Pottasseri. Mannarghat section alone has three beats, namely Mannarghat, Arakkurissi and Thenkora.

The Agali Special Range has four sections - Pudur, Sholayur, Agali and Kakkuppadi. The beats in Pudur Special Range are Mulli, Pudur North and Pudur South. The beats in Sholayur section are Sholayur, Śiruvani and Kulukkur and those in Agali section are Onimala, Thumbapara and Agali. Kakkupadi section has two beats - Chindaki and Kakkupadi.

GEOLOGY

The Palghat Gap may represent the original drainage which was dismembered as a result of the faulting of the west coast in the early Miocene. The tectonic framework, geomorphic features, development of soil types and alluviation of river valleys of the

Gap area indicate that it is a tectonic feature which might have been formed by repeated uplifts of the plateaux and subsequent erosional cycles in its geological past. The shear zones, valley fills and alluvial plains are found to be favourable for ground water development. The Palghat Gap proper is composed of pegmatites.

The rock formations found in the area just north of the Gap in the Western Ghats are of Archaean age and comprise gneisses and granulite of the Khondolite suite of rocks, intruded by later granites, pegmatite and vein quartz.

The rock units found in the area are: Garnetiferous-sillimanite-biotite (muscovite) gneiss, biotite gneiss, biotite gneiss, cale-granulite, amphibolite and crystalline limestone, granites etc.

SOIL

The major types of soils seen in the area are formed as a product of destruction of the ancient crystalline and metamorphic rocks. They can generally be called red earth and mixed red and yellow soils. They are moderately deep to deep in profile with distinct A, B, and C horizons. In addition, there are: 1) the transitional red to yellow loams; and 2) the transitional alluvial soils and recent alluvial soil on the river and stream terraces.

CLIMATE

There is a remarkable variation in climate due to the differences in altitude of various localities and their differences in aspect. The plains are hot and humid, and the hilltops cool and less humid. Areas within the corridor formed by the Palghat Gap experience high velocity winds from the west and southwest during April to September and from the north and northeast from October to March.

Both the southwest and northeast monsoons bring rainfall to this tract. The greater proportion of precepitation is brought by the former in almost all areas except Aralikkonam, Kinnakkara and Thoova.

The tract is divided into three according to the intensity of rainfall:

1) Heavy rainfall areas (2000 mm and above):

These comprise all areas under Thenkara Special Range and the areas under Palghat Special Range forming the catchment of the Malampuzha;

2) Areas receiving fairly heavy rainfall (1400-2000 mm and above):

These consist of the Emoor Bhagavathy and Vadasseri forests constituting the northern lip of the Palghat Gap and eastern portions of Pulamalavaram constituting the southern lip of the Palghat Gap;

3) Areas receiving poor rainfall (895-1400 mm):

Aralikkonam, Kinnakkara and Thoova receive less rainfall due to their easterly aspect.

The place receiving highest rainfall is the northern portion of Karappadam and Pothapadem, near Neelikkal, of Silent Valley Reserve, where the average rainfall is around 5000 mm annually.

The lowest recorded rainfall is at Pudur near Aralikkonam, with an annual average of 895.5 mm. Both these areas lie within the Nilgiri Biosphere Reserve area.

WATER RESOURCES AND DRAINAGE

The rivers in this Division are perennial in nature. A few of them originate in the Reserved Forests lying adjacent to, but on a higher level than, the Vested Forests of the Palghat Special Division. The others originate in the Vested Forests.

The river Kundipuzha originates in the Silent Valley RF. Vested Forests drained by this river are Thathengalam, Paruthimala, Mezhukumpara, Anamooli and Urulankunnu.

The river Bhavani originates in the Attappadi RF and the Vested Forests drained by the river are Aralikkonam, Thoova and Kallamala.

The river Noolpuzha originates in the Attappadi RF and the Vested Forests drained by the river are Urulankunnu and Mukkali range.

Only these three rivers flow in the Biosphere Reserve area. The other rivers in the Division are the Thuppanadu, Kunjirapuzha, Malampuzha, Walayar. Gayathipuzha, Mangalim and Thekkadi.

Future management prescribed by Zachariah:

In considerating the objectives of the Vested Forest Committee, the following methods of treatment were prescribed:

1) maintenance of existing evergreen forests as protection forests wherever the terrain was precipitous and the elevation more than 1500 m;

2) protection of forests growing on both banks of watercourses;

3) conversion of suitable areas into valuable plantations within the minimum time possible;

4) adoption of the latest silvicultural methods for tending and thinning existing plantations;

5) working of bamboo and reeds on a three year basis;

6) working of bamboo and reeds on a three year felling cycle;

7) improvement of the production of minor produce;

8) introduction of fodder trees and grass in suitable areas;

9) improvement of the living conditions of the tribals through opportunities for the scientific utilization of their land;

10) taking measures to protect the fauna;

11) afforestation of grasslands with suitable species;

12) introduction of coffee and species like cardamom in the evergreen forests to increase the revenue;

13) introduction of fruit trees in suitable localities to raise the tribal income.

The forests were divided into several compartments and Blocks and twelve working circles. The working circles were:

1) Village forestry fuel and small wood working circle - low country series - 300 ha: this included areas lying in Vadasseri Block adjacent to private lands. An area of 52.98 ha was converted to teak plantations;

2) Village forestry fuel and small wood working circle - tribal series - 2300 ha: Aralikkonam, Thoova and Vadasseri Blocks lying within the Biosphere Reserve area have been included in this working circle;

3) Village forestry minor forest produce working circle - tribal series - 2400 ha: the areas included in this working circle were the evergreen and semi-evergreen forests of Mundanadu, Karimala, Mukkali venga, Emoor Bhagavathy and Vadasseri;

4) Village forestry minor forest produce working circle - low country series - 1958 ha: the areas included in this working circle were portions of the Palghat Special Range and Urulakunnu, Anamooli and Kalladikode Malavarams of Thenkara Special Range;

5) Grazing working circle - 1150 ha: all the areas in the Aralikkonam and Thoova Blocks adjacent to villages continued to lie under the grazing working circle;

6) Bamboo working circle - 7474 ha: all the Blocks in the Division including those set apart for other types of working were included in this circle. A felling cycle of 3 years was fixed;

7) Protection cum improvement working circle - 27,394.36 ha: all the areas lying in inaccessible places and higher altitudes where exploitation was not possible and which formed the catchments of rivers were to be perpetually protected. 2539 ha in Thathenkulam, 2890 ha in Karimala-Mundanadu, 7323 ha in Aralikkonam, 100 ha in Kallamala, 100 ha in Mukkali venga, 3615 ha in Emoor Bhagavathy-Nellisseri, 207 ha in Vadasseri and 1556 ha in Puthakkalidam were to be protected;

8) Plantation working circle - 5350 ha: 2145 ha of forests in Vadasseri and Venganad Kovilakkam had already been converted to teak plantations. 2000 ha in Thathenkulam, 300 ha in Vettilachola, 800 ha in Mukkali venga, 1050 ha in Emoor

Bhagavathy, 717 ha. in Vadasseri and 1000 ha in Puzhakkalidam were to be converted to teak and softwood species like *Ailanthus* and *Albizzia*. Accordingly, these areas were to be clearfelled of natural or plantation vegetation and converted;

9) Minor forest produce working circle: all the areas in the Division were to be exploited for cardamom, honey, wax, medicinal plants, canes, reeds, etc.;

10) Wildlife working circle: all the forests in this Division contained wildlife which was threatened by poaching, habitat degradation, etc. The proposals for wildlife management put forward by the Working Plan were for areas that do not lie within the Nilgiri Biosphere Reserve;

11) Coffee working circle: this working circle lies outside the Biosphere Reserve area.

The rocky portions of Thathenkulam, Emoor Bhagavathy, Nellisseri, Akathethara, Vadasseri, Nellikkalidam and Puzhakkalidam Blocks were to be planted up with *Ficus bengalensis*.

THE NILAMBUR DIVISION

Forest	Range	Area (in sq km)
New Amarambalam RF	Karular	249.3
Karimpuzha RF	Karular	16.2

LOCATION

The Nilambur Forest Division includes all the forests and teak plantations in Nilambur Valley and the western slopes of the Kundahs, with the exception of the coconut plantation at Beypore. The total area of the tract dealt with is 80,285 acres.

The forests are situated within 11^{o} 10' and 11^{o} 30'N latitude, and 75^{o} 55' and 76^{o} 35'E longitudes. In the eastern part of the Division, the New Amarambalam, and Karimpuzha and Nellicutta Reserves form one large compact area, 67,632 acres in extent and covering the greater part of the outer slopes of the Kundah range of hills, the western escarpment of the Nilgiri plateau and a stretch of plains at their foot. The remaining forests are scattered along the banks of the Karimpuzha and its tributaries, the individual Reserves, or Blocks in the case of the leased forests varying in extent from 1 to 2800 acres.

The Nilambur Forest Division is located in Malappuram district of Kerala and is bounded on the northwest by the Nilambur Special Division, on the northeast by the Gudalur Division, on the east by the Nilgiri South Division and on the south by the Nilambur Special Division.

TOPOGRAPHY

The outstanding topographical feature of the country is its sharp division into plains and hills. The plains of South

Malabar, except for a bit of practically level ground of varying width along the seaboard, are characteristically undulating. The higher ground rises generally to not more than about 90 m above msl, although in exceptional cases it rises as high as 455 m. The hills, on the other hand, are strikingly precipitous. Even the lower slopes are steep, becoming more and more precipitous with increasing elevation. The hill forests vary in elevation from about 76 m to 2485 m above msl, the area above 1818 m being almost sheer precipice. The Kundah range is crescent shaped, facing the west, but owing to the rugged nature of the ground all conceivable aspects are found in the slopes, which tend to descend in a southwesterly or northwesterly direction.

WATER RESOURCES AND DRAINAGE

The whole area is traversed by a network of rivers and streams. The main river, the Chaliyarpuzha, runs more or less northeast to southwest. It has three main headwater streams, the Chaliyarpuzha, the Karimpuzha awd the Punnapuzha. The first originates in the southeast of the Wynaad plateau, while the sources of the last two are in the Kundah hills. The Karimpuzha and Punnapuzha meet on the edge of the teak plantation in the south of the Vallasseri Block and within two miles of their confluence, they join the Chaliyarpuzha at Chaliyarmukku, in the northwest corner of the same Block.

The fall of these rivers, even near the foot of the hills, is surprisingly small. The elevation of the river bed at the confluence, Chaliyarmukku, is only 9 m above msl, and this point is as far as 51 km, as the crow flies, from the mouth of the river. Again the elevation of the river beds of the Karimpuzha and Punnapuzha at the foot of the hills, at Kanhirakadavu and Moochikal respectively, is only about 71 m. Above these points, the rivers and streams are torrents.

The summit of the Kundah range forms a crescent, the points of which face to the west. The general aspect is therefore western. The many spurs descending from the ridge either converge toward the main valley of the Karimpuzha running from northeast to southwest or run from southeast to northwest toward the valley of the Punnapuzha.

GEOLOGY

The underlying rock formation is of complex crystalline structure and consists of metamorphic gneiss. In the foothills and over a greater part of the plains, the rock is foliated to a much greater degree. Veins of quartz and felspar appear in varying thickness and outcrops of mica and garnet are not uncommon. The foliated gneiss forms laterite. The distribution of the laterite is so extensive that all trace of the underlying gneiss is often lost over large areas. Intrusive veins of quartz are found throughout the area. In the laterite areas particularly, the quartz veins have broken down quartz boulders, and rocks of all sizes are found scattered over the surface.

SOIL

By disintegration, the granite gneiss forms a very fine loam of varying depth. This varies mainly according to position and slope; shallow and stony on the ridges, deep and fine in the valleys. The laterite is found in varying degrees of disintegration, from hard rock to a fine gravel. The gneiss or the laterite is along the rivers and streams, overlaid by river alluvium generally to a great depth, as much as 21 m in many places. This alluvium is a fine sandy loam, rich in organic matter and minute particles of mica. It generally contains a large number of waterworn pebbles and boulders of quartz and gneiss. The river alluvium is overlaid near hillocks in the plains by laterite aluvium clay.

In lowlying localities liable to inundation, the soils are overlaid by a very fine clayey silt, which may in part be washed down into the air spaces in the upper surface of soil. From the nature of the soils this action takes place to a greater degree in the case of laterite alluvium than in other soils.

CLIMATE

The difference in elevation above mean sea level between the Ghats and the plains has considerable effect on the climatic conditions. The extremes of temperature in the shade in the plains vary approximately between 15 and 40 °C. The differences between extremes within 24 hours exceed 30 °C. These considerable extremes are due to the proximity of the forests to high hill ranges. The temperature at the summit of the Kundah range at night sometimes descends to freezing point.

The locality is subject to the southwest monsoon. It is preceded in April and May by thunderstorms which affect the length of the fire season, the commencement of the growing season and the germination of seeds. They are, however, uncertain and irregular.

The period of heavy precipitation is followed by breaks in August and September, followed again by precipitation in October which may or may not be an indirect result of the northeast winds.

The annual rainfall varies from about 2000 mm to about 3500 mm.

HISTORY

The first step toward the inauguration of forest management in British India was taken as far back as 1828. Since 1841, the initial information and correspondence have been collected together in the form of files of Inward and Outward letters of the Forest Department. These old records are far from complete. From 1862, a few registers were maintained in the Forest office but it was not until the passing of the Madras Forest Act in 1881 that really detailed records became available. Even so, information was often recorded in insufficient detail.

All forests and other unoccupied lands in the old province of Malabar had been considered private property. Lushington (1920) lamented the devastated state of the forests in accessible areas because of this legal position. The civil courts of Madras and Bombay had long ago made laws on the land tenure in Malabar. The province of Malabar was conquered territory, wrested from Tippu Sultan by the British in 1792 but no steps were taken to exercise the right of possession over the forests. This was due to the unsettled state of the country and the disputes of neighbouring Rajas. The large landowners in the vicinity of the forests took possession of them. Whether the landowners were in possession of all the forests prior to Tippu's conquest of Malabar is questionable.

However, certain forest areas came to be leased or purchased outright by the government. Some forest lands were acquired by the government by escheat. Though they did not belong to the Nilambur Forest Division, they constituted the sole area of forest in the possession of government prior to 1840. At that time the forests of Kanara and Malabar were the source of the teak timber required for the Bombay Naval Dockyard. The felling of teak went on so rapidly that the authorities in Malabar became extremely anxious as to the permanency of the supply. As far back as 1828, Sheffield, then Principal Collector of Malabar, drew the attention of government to the wanton destruction of young teak, proposing a total prohibition of the felling of such trees. However, nothing was done until 1840 when H.V. Conolly, Collector of Malabar, brought to the notice of the government the inaccessibility of the government escheat lands, their small extent, the poor quality of teak timber which they contained and the fact that most of the mature timber had already been felled and removed by Captain Williams, the Government Agent for Naval timber in Malabar. He estimated that the average annual quantity of teak required for the Public Service at Bombay, based on the assumption that one government vessel would be constantly under construction at the Dockyard, at 6000 candies of 13 cu ft, or about 2000 trees. He calculated that to supply this quantity annually would require 120,000 trees planted in succession, since the teak tree reaches maturity in about 60 years. For this he recommended the acquisition of 260 sq mi of forests. The initial attempts at raising teak by Conolly with the assistance of many officers including Smith and Graham during 1840-1843 ended in failure. Conolly then entrusted the work to Chathu Menon, a sub-Conservator in 1844, under whose zealous and honest endeavors, the first successful teak plantations were raised. His efforts led to the formation of extensive teak plantations in Nilambur. A portion of the oldest teak plantation raised in 1846, Elenjeri, measuring 5.7 acres is now retained as a preservation plot and is called Conolly's Plot.

Period 1844-1862:

The record of general history from 1844 to 1862, the period during which Chathu Menon was in charge of these forests, can be derived chiefly from the reports of Conolly, McIver of the Ooty Botanical Gardens, Gibson, the Conservator of Forests in Bombay, and others. By 1857 Chathu Menon was unable to attend to extension, tending and thinning in all the plantations. From 1857 onward, the areas became reduced, mainly due to lack of labour.

Period 1862-1883:

This second period in the early history of the plantations coincides with Ferguson's charge of the Division. He paid much attention to the maintenance of records. Unfortunately, these records were destroyed during the Mopla rebellion.

In 1878, R.H. Beddome (Conservator) prepared a detailed 'Report on the Nilambur teak plantations'. He proposed departmental extraction of timber and saplings and the opening of a sale depot at Calicut in order that the government take full advantage of the market prices prevailing on the coast. This depot was opened at Kallai in 1863, met with immediate success and ultimately became world famous.

In 1865, Ferguson drew attention to the difficulty he experienced with limited staff in protecting the Government forests, the more so as they were situated on river banks in scattered Blocks, surrounded by private forests. This difficulty has been experienced upto recent times.

Acquisition of further forests:

In 1868, negotiations were begun for the acquisition of Chatomborai Block from the Wandur Namboothiri. These were completed in 1871 and the Block was planted up, commencing from the following year. Chatomborai was leased on rather favourable terms to the owner, the Amarambalam Raja. As a result, in 1871, he offered the government the old Amarambalam forests, containing a teak plantation, planted partly in 1862 and partly in 1869, together with Karimpuzha forest. The main reason for this offer was the Raja's need for ready cash to liquidate his debts. On receipt of a report dated May 6, 1872 from MacGregor, then Collector of Malabar, the government decided to accept the offer and pay Rs 80,000 for these lands, Rs 10,000 for the teak plantation and Rs 70,000 for the rest. Further extension of plantation in the area was found to be impossible owing to the extremely unhealthy nature of the locality and the scarcity of healthy areas.

The extension of planting during this period was not continuous. In 1876 Colonel Beddome visited the area and advised that further extension be stopped because of the heavy work involved in tendering the plantations, and more money be given to the mountain teak forests. He was doubtful of the ultimate value of Nilambur teak as compared to mountain teak. Logan, the Collector, pointed out that the Karimpuzha Block had been purchased for the express purpose of planting. Nevertheless no planting was carried out between 1877 to 1885, both years inclusive. By 1876, 3100 acres of teak plantations had been raised.

Ferguson in 1878 started an experiment, on a large scale, with exotics particularly Swietenia mahogoni, Hevea braziliensis etc. in Ramalur and Aravallikara. With Ferguson's arrival, departmental fellings were considerably extended.

Period 1883-1895:

This period coincides with Gordon Hadfield's charge of the Division. With the passing of the Forest Act in 1882, an office with records, general rules etc. was organized. The

Division was divided into three Ranges - Nilambur, Amarambalam and Palghat, the last of which on the formation at a later date of the Central Coimbatore Division, was reduced to the Mennarghat Range.

Acquisition of further forests:

In December 1887, the New Amarambalam forests were purchased from Edavanna Kovilagam in public auction and taken possession of in March 1888. In 1892, the Jenmam title of the Old Amarambalam and Karimpuzha Blocks was purchased so that these two Blocks passed into the absolute possession of the State. During this period the Chatamborai, Nellicutta, Old Amarambalam and Karimpuzha Blocks were notified as Reserved Forests under section 25 of the Forest Act V of 1882, in notification No. 757, dated 25th June, 1885.

While the New Amarambalam forests were in private ownership, it is fairly certain that some exploitation was carried out, confined to the best species - teak and rosewood -and that the fellings were not extensive owing to the remoteness of the locality. The semi-deciduous forests of the tract probably suffered considerably from fire, but subsequent to purchase by Government no exploitation of timber was attempted until 1930-31, when sleeper operations were undertaken on a small scale. The right to collect minor forest produce had been leased for the whole of Amarambalam Range for a great many years and the right to collect canes had been leased at intervals. Bamboos had been worked from the more accessible regions. But the locality remained practically unknown, until mechanical extraction dominated the policy of management of Madras timber forests and a search was made for a forest tract big enough to supply the Olavakkod Sawmill, since the Dhoni and Sappal forests could not continue to do so. The lofty evergreen forests of New Amarambalam are a most impressive sight and it was not unnatural that they aroused the enthusiasm of J.K. Pearce who, lacking both experience of the country and knowledge of the existing or prospective market demands, inaugurated a "cruise" on a lavish scale while he acted as Chief Engineer in 1926. From then, until 1929, an army of surveyors, topographers, baseline men, cruisers etc. with their attendant coolies were employed in mapping and enumerating the forests. The army was disbanded in 1929 and the records were transferred to R.S. Browne with instructions to make a Working Plan. He was the DFO of Nilambur and later of the Nilgiris, so did not have time to finish the report until 1935. In the meantime heavy exploitation was undertaken. 1380 broad gauge and 504 metre gauge sleepers were extracted departmentally in 1930-31 and in 1934-35. An experiment was tried in selling selected trees to a contractor. Some roads and buildings were constructed, and experimental regeneration was tried.

Rights and concessions:

The right to collect minor forest produce for the whole of the Amarambalam Range had been leased fairly regularly for many years. This resulted in the destruction of *Canarium strictum*, from which dammar was obtained. In some of the gaps caused by felling Hopea and Mesua for sleepers an attempt was made to introduce Hopea parviflora, Artocarpus hirsuta etc. but the success rate was negligible.

All rights enjoyed in the Reserved and leased forests, except rights of leasers to the payment of 'kuttikanam' (stump fee) were rights of way and rights of dragging and floating timber. A concessional payment of cloth, rice and spirit to the value of Rs 5 was paid to the headman of the Cholanaickas, the hill tribe in the area, on the capture of any elephant in the area.

In 1930-31 an abandoned cart track from Kanhirakadavu at the foot of the hills was reopened and was extended to the Valiathodu stream on the western slopes of Arson Hill. There were no other roads in the tract. A number of inexpensive foot paths were made in the course of enumeration. The Log Cabin built in 1927 was destroyed during a fire. Another was built on Arson Hill in 1930-32. A big serambi was built at Meenmutti in 1931-32. R.S. Browne's "Working Plan for the Nilambur Hills came to force from 1937-38 to 1947-48".

R.S. Browne prescribed that three working circles be formed - selection, minor forest produce, and bamboo working circles. A period of 11 years was chosen to coincide with the third revision of the Nilambur Valley Working Plan, when the whole of Nilambur was brought under one Plan.

The selection working circle consisted of 18,425 acres of the less inaccessible portions of what was described as the inaccessible working circle. The regeneration was to be mainly natural, but artificial regeneration with valuable species was prescribed in the gaps. The whole forest was to be worked in 20 years.

In 1885 Campbell Walker proposed the extension of fellings in the natural forests which had been commenced by Ferguson. These fellings were not heavy, and the newly purchased New Amarambalam forests were not worked at all.

When Campbell Walker drew up the second thinning scheme for 1890-94, he proposed the appointment at the close of this period of a special officer to prepare a regular Working Plan dealing not only with thinnings but with final fellings, regeneration, etc. Accordingly, P.M. Lushington, Deputy Conservator of Forests, was appointed in October 1894. His Working Plan is divided into: 1) history with appendices; 2) Working Scheme for the plantations with appendices; and 3) Working Scheme for all the natural forests covered by the current Plan except New Amarambalam reserve. The work was completed by April 1895. It covered 10 years and was revised by Lushington himself in 1904-05.

Period of Lushington's Working Plan - 1896-1905:

The principal prescriptions of Lushington's Working Plan were:

1) to treat all plantations as a high forest to be clearfelled and artificially regenerated. The rotation was 95 years for I class and 140 for II class soils; 2) to increase the severity of thinnings; 3) to extend plantations by about 80 acres a year; 4) to clearfell exotic plantations and replant with teak; 5) to cease experiments with exotics; 6) to put a stop

to regular clearing of undergrowth except prior to thinning; 7) to carry out selection fellings in the natural forest.

There were considerable failures in plantation from 1850 onward due to extensive planting on lateritic soils, marshy places etc. which were unsuitable for teak. While proposing the extension of plantations in the Karimpuzha Block, Lushington stated that there were not less than 2500 acres (allowing over 1000 acres for marshes, hills and places far from rivers) chiefly of first class soil. Unfortunately he did not distinguish between open swampy forest and fully stocked swampy forest - stocked with _Terminalia tomentosa_, _Lagerstroemia_ spp., etc. The areas clearfelled and planted with teak failed and became open grass swamps. From 1897 several such areas were included in the new sites. In 1905, when selecting further sites, Lushington excluded only the open swamps. There are many examples in Karimpuzha, where the plantations border on forest, where one can prove this fact. Those places which were selected for planting, but not planted are seen to be swampy.

Period of Lushington's second Working Plan - 1906-1915:

Lushington emphasized that correct espacement of the trees of the final crop was most essential, and that this should be more strictly attended to than in the past decade. He prescribed that in plantations over 50 years of age, the 60 trees per acre likely to provide the 40 trees of the final crop be permanently marked and not removed in thinnings until the number of trees per acre had been reduced to 60. In marshy areas he prescribed the planting of *Ficus elastica*. The extension of planting was stopped in 1912.

Modifications and supplements to Lushington's Plan were suggested by Grenfell and Wilmot.

Period of preparation of Bourne's Working Plan - 1915-1918:

During this period, particular attention was paid to thinnings, and the felling cycle introduced by Lushington was continued. In 1916, planting was restarted on a small scale and extended in the following years. One of the oldest plantations was clearfelled and replanted that year and such fellings continued in following years. The large quantity of teak supplied in these two years resulted in a great expansion of the ship building industry on the coast. Finally, in 1918, the fellings in natural forests were started.

Period of Bourne's Working Plan - 1918-1928:

"The previous decade though it commenced in an era of unprecedented presperity has provéd to be the darkest period in the whole history of the forests" (R.S. Browne, 1928). It was the time of a boom in the timber market and prices were rising. All species were saleable at a profit. Recent teak planting had been uniformly successful. But the prevailing optimism was shortlived. The Malabar Rebellion broke out in 1921. The main object of the rebels at Nedungayam was to convert the DFO and others to the Muslim faith. About 300 armed rebels burned all the forest buildings and turned the government elephants loose in the forest. However, the Range

Officer was able to send 4 elephants (on loan from the Nilgiri Division) upto the Nilgiris surreptitiously by a way known to their mahouts to find the elephants by various ingenuous methods. The Range Officer set things right, managed to save the DFO and his party and even protected the plantations from fire. No damage to the forests by fire is recorded, so it is unlikely that any serious injury was sustained. However all the plantations grown in 1921 failed and had to be replanted.

Period of R.S. Browne's Working Plan - 1928-1938:

This Plan constituted a plantation working circle, a conversion working circle, a bamboo working circle, a minor forest produce working circle and an inaccessible working circle. The rotation fixed was 70 years for teak, irrespective of quality. The method of regeneration was the dibbling of seeds in the Amarambalam (Karulai) Range and the transplanting of nursery seedlings in the Nilambur Range. The method of stump-planting was started in 1934. Thinnings were carried out with meticulous care.

No specific operation was prescribed for the inaccessible working circle. R.S. Browne, however, prepared a Nilambur Hills Working Plan in 1936 which is dealt with separately.

Period of A.R. Brand's Working Plan for Nilambur Forest Division - 1938-39 - 1962-53:

Brand formed five working circles: plantation, conversion, selection, bamboo and minor forest produce.

The rotation for teak was fixed at 70 years. In actual practice the rotation came down to 61-64 years to accommodate the advance fellings done during the period of World War II. Nurseries were to be raised. Stump planting, however, came to be the standard practice. The method of raising paddy, cereals, tapioca and other seasonal crops along with teak came into active practice with the advent of the "Grow More Food" campaign during World War II.

In the conversion working circle were included all the natural forests of the Nilambur Range, all the plains forests of the Karulai Range, and all areas converted into plantations during 1916-1937. The total area of 25,535 acres, deducting 3000 acres for swamps and another 3000 acres for pure bamboo growth, was roughly estimated to make 19,000 acres suitable for conversion. Assuming that a total period of 60 years would be necessary for converting this area into plantations, Brand divided the area into six Blocks of 3200 acres each.

All areas in the Karulai Range right down from the Kundah ridge to the limits of the conversion working circle, making up a total area of about 48,000 acres, were put under the selection working circle. It was divided into the Karimpuzha felling series (with an annual felling coupe of more than 500 acres) and Thalipuzha felling series (with an area of 100 acres or more).

Period of R.S. Browne's Working Plan for the Nilambur Hills - 1936-1947:

The objective of the Working Plan was conservation of the hill forests of New Amarambalam reserve in order to protect the catchment of the water sources and to prevent erosion and landslides. The removal of mature and overmature trees and the assisting of natural regeneration along with introduction of valuable species in blanks were also recommended. Three working circles were constituted - 1) selection working circles with 18,425 acres to be selection felled; 2) minor forest produce working circles covering the whole area; and 3) bamboo working circle, to be worked as required in the whole area.

Period from 1953-54 to 1954-55:

There was some delay in getting Brand's Working Plan revised by Thangam, and in the absence of a definite Plan for working the forests during the intervening years, the Divisional Officer himself drew up a Scheme which was virtually an extension of Brand's prescriptions. New areas were clearfelled and planted with

teak over an area of 150 acres annually. In 1953 a coupe of about 245 acres was worked in the Thalipuzha series.

Period of E.S. Thangam's Working Plan - 1955-56-1965-66:

There were minor deviations in the yearly plantations when Thangam's Plan was being put into practice, necessitated by the policies of the Second and Third Five Year Plans. Deviations consequent on the agreement with Gwalior Rayons and the gregarious flowering of bamboos were factors which resulted in major changes in the bamboo working circle prescribed by him.

Thangam divided the area into 3 major working circles, viz., the teak working circle, the softwood working circle and the selection working circle. The bamboo and the minor forest working circles were merely overlapping working circles.

Thangam added 8738 acres from Brand's selection working circle to the plantation and conversion working circles which he combined into one - the teak working circle. All teak plantations, all convertible natural forests, all miscellaneous patches of plantations other than teak, and all unproductive Blocks, blanks, swamps, laterite hilltops etc. came into this circle. He prescribed annual clearfelling of 80 acres of the oldest plantations and restocking of the areas with second rotation teak. He also prescribed annual clearfelling and planting in the natural forest belt included in the circle, at the rate of approximately 150 acres in Karulai Range and 50 acres in Nilambur Range.

Period of K.G. Vasudevan's Working Plan - 1967-68 to 1976-77:

K.G. Vasudevan prescribed six working circles: plantation, conversion, selection, protection, bamboo and minor forest produce working circles. His Plan was followed from 1967 to 1977 and thereafter from 1977-78 to 1981-82, as he had foreseen difficulties in getting the Plan revised in time. The main objects of management were to bring the existing teak plantations to a normal series of age gradations and a normal growing stock and to convert all possible natural forests into teak and other valuable plantations. The problems of meeting the rising demand for timber and firewood, providing protection to precipitation slopes, meeting the bamboo needs of the Gwalior Rayons factory and also producing food under the "Grow More Food" campaign made the task more critical. The rotation fixed for teak was 60 years. The areas of teak and miscellaneous felling series were 4,729.23 hectares and 1,366.72 hectares respectively. The selection working circle comprised an area of 8887.45 hectares traversing the evergreen and semi-evergreen forests of New Amarambalam reserve in Karulai Range, occupying the slopes and summits of the Kundah ranges below the 1250 m contour. The area was divided into Thalipuzha and Karimpuzha felling series with a cycle of 20 years, annual coupes being about 200 hectares in both the series with a restriction of 230 trees per hectare.

Period of P.B. Ranganathan's Working Plan - 1982-83 to 1991-92:

P.B. Ranganathan has also divided the area into six working circles - plantation, selection, protection, bamboo, reed, and minor forest produce workfng circles.

He prescribes clearfelling of mature and underplanted teak plantations, followed by artificial regeneration. In the selection working circle, he prescribes that 8850 hectares of the New Amarambalam RF in Karulai Range be selection felled on second silvicultural lines with cultural operations including artificial regeneration in gaps. The rest of the area in New Amarambalam, consisting of rocky and precipitous slopes, measuring about 9340 hectares, is to be included in the protection working circle.

The minor forest produce was to be given to Tribal Cooperative Societies and, in their absence, to be sold in auction.

VEGETATION

The main types of forests found in the Nilambur Division according to the classification by Champion and Seth (1968) are:

1. West coast tropical evergreen forest (1A/C-4):

These forests occur in the Kundah hills in the New Amarambalam reserve at an elevation of 800 to 1250 m, the rainfall being 2500 mm and above and mean annual temperature about 27 °C. The dry season is not long and there is some precipitation during this season also. The resultant growth is luxuriant, with lofty trees of 45 m or more in height.

2. West coast semi-evergreen forest (2A/C-2):

It is a belt between the wet evergreen and moist deciduous types, ranging between 500 and 800 m in elevation. It appears as a transitional stage toward a climatic climax, i.e. wet evergreen. This type occurs on the northern side of the Arson Hill slopes, on either side of the Karimpuzha, and on the lower reaches of the Thalipuzha, over Pulinunda.

3. Very moist teak forest (3B/C-1a):

This type is found immediately below the semi-evergreen belt, the teak occurring only upto 5-10%. Component species are mostly semi-evergreen or moist deciduous.

4. Southern secondary moist deciduous forest (3B/C-2,2s1):

All the natural forests of the plains and of smaller hills of the Nilambur Range constitute this type. Biotic interference has resulted in this type, which would otherwise have been a climatic climax, i.e., evergreen. The climate here warrants a more luxuriant growth than that found. Most of these areas have been converted into teak plantations.

5. Southern subtropical hill forests (8A/CT):

The upper reaches of the Kundah ranges from 1250 m to 1800 m consist of evergreen forests of this type. The average rainfall is over 2500 mm, and humidity relatively high. The dry season is very short. The trees are stunted due to the shallowness of the soil. Where the soil is deep enough, taller trees are also found. The stunted trees have crooked boles covered with epiphytes.

6. Southern montane wet temperate forest (2A/C-1):

Higher up on the Kundah ridges this type is present in the folds of the hills. Growth is sparse, with Rhododendron as the main species.

7. Secondary moist bamboo forests (2A/E-3):

Bambusa bamboos are present as almost a pure crop throughout the moist deciduous forests. Above 200 m, the pure crop tends to become gregarious patches mixed with moist deciduous species. Some clumps contain more than 200 culms, and some culms attain a height of 20-30 m. This type is evidently secondary succession, either progressing slowly to the moist deciduous type which is the climatic climax, or vice versa.

The corresponding vegetation classes in the Puri et al. (1983) classification are:

I. Evergreen forests:

1) Low elevation evergreen forest:

Dipterocarpus-*Mesua*-*Palaquium* series;

2) Medium elevation evergreen forest:

Cullenia-*Mesua*-*Palaquium* series;

3) High elevation evergreen forest:

Shola montane forest;

II. Climax moist deciduous forests:

Tectona-*Dillenia*-*Lagerstroemia lanceolata*-*Terminalia paniculata* series.

All the degraded stages of these series are found in the Nilambur Division.

FAUNA

The important animals found in the Nilambur Division are similar to those in the Palghat Forest Division listed earlier.

The Working Plans Reports in CES collection.

(1) Report upon the Nilambur Teak Plantation by R.H. Beddone. Govt. Press, Madras.

(2) Report and working scheme of the Nilambur Teak Plantation 1896-1905.

(3) Nilambur Valley Working Plan P.M. Lushington & G.C. Robinson 1919-1920 to 1928.

(4) Nilambur Valley Working Plan by R. Bourne 1918-1928. Govt. Press Madras 1921 Vol I-III

(5) The Working Plan for the Nilambur Forest Division by R.S. Browne 1928-1938 P.200.

(6) Working Plan for the Nilambur Forest Division 1938-39 to 1952-53. By A.R. Brand. Govt. Press Madras. 1941. P.228.

(7) Working Plan for the Nilambur Hills by R.S. Browne 1937/38 to 1947/48.

(8) Working Plan for the Nilambur Forest Division by K.G. Vasudevan. 1967-68 - 1976-77. CCF, Trivandrum 1967. P.236.

(9) Seventh Working Plan for the Nilambur Forest Division by P.B. Ranganathan 1982-83 to 1991-92 P.249

PALGHAT FOREST DIVISION

Forest	Range	Area (in sq km)
Slient Valley reserve	Mannarghat	89.5
Attappadi Block I	Mannarghat	75.1
Attappadi Block II-IV	Mannarghat	11.7
Attappadi Block V	Mannarghat	55.2
Attappadi Block VI	Olavakkod	63.9
Walayar reserve	Olavakkod	12.0

TOPOGRAPHY

The Palghat Forest Division is situated between latitudes 10^{o} 45' and 11^{o} 15'N, and longitudes 76^{o} 26' and 77^{o} E. All the reserves except the Silent Valley Reserved Forest are situated within the Palghat and Mannarghat taluks of Palghat revenue district, and the Silent Valley Reserved Forest is in the Perinthalmanna taluk of the Malappuram revenue district. The reserves of this Division are distributed in 5 discontinuous bits. The Division is bounded on the north by the Nilgiri South Division of Tamil Nadu, on the east by Palghat Special Division and the Coimbatore Division, on the west by the Nilambur Special Division, on the northwest by the Nilambur Forest Division, and on the south by the Nemmara Forest Division.

The terrain over which the Reserve Forests lie exhibits a range of altitude and diversity in general configuration.

The Walayar Reserve:

The Walayar Valley lies on the northern lip of the Palghat gap adjoining Tamil Nadu. The elevation varies from 150 m to 670 m above msl. It is shaped like a horseshoe opening towards the west. It is comprised of two blocks, the Pulampara block with the highest peak being Palakambu Malai (355 m), and draining towards the south; and the Varalapadi Block going upto an elevation of 670 m, draining towards the east. Except for these two blocks, one in the northwestern corner of Pulampara Block and the other in the northwestern portion of Varalapadi Block, the land is generally free of undulations. The reserve lies contiguous to the Vadasseri Mannadiar vested forests in the west and northwest. The Walayar river forms the eastern and northeastern boundary, and the old road of National Highway No. 47 forms the southern boundary of the reserve.

Silent Valley reserve:

This reserve, comprising 8951.65 hectares of good forests, lies entirely on a plateau situated to the north of Mannarghat. The outer slopes of the hills forming the tableland are vested forests. There are many hills within the reserve, all of which drain into the Kundipuzha. This river originates in the Silent Valley reserve and forms the only drainage system of the area. It flows from north to south and empties its waters into the Bharathapuzha. The hills outside the reserve on the south also drain into the Kundipuzha. The lowest point on the plateau is at 685 m on the southern boundary, where the Kundipuzha runs down the Ghats in a series of rapids. There are two north-south ridges, one along the western border and the other along the eastern border of the reserve. The southwestern edge of the plateau rises gradually from 1210 m at Vannamparai to 1164 m at Madamudi. It falls to 1162 m at Cherumbankumban, and again gradually rises to 1244 m at Valiamullu malai and culminates in 1904 m at Koilpara on the northwestern corner. To the east of

Kundipuzha, the plateau rises gradually from 1162 m at Aruvamparai to 1429 m at Kattuvora mudi, then to Kattimudi at 1637 m, and finally to Anginda peak on the Nilgiri boundary at 2383 m the highest point in this tract. This eastern line runs along the watershed and separates the Bhavani and Kundipuzha drainage systems. The western and eastern slopes of the reserve drain into the Kundipuzha in a series of parallel valleys running east-west, and are characterized by extensive grasslands in the southern portion. There are good high evergreen forests below an elevation of 1370 m. Above this elevation, growth becomes poor and stunted, and the hillsides become rocky and highly precipitous as a result of extensive denudation by the force of the southwest monsoon. A wonderful view of the whole reserve can be had from Kanjikomban peak.

Attappadi Blocks I - V:

These five Blocks lie adjacent to one another, and hence are dealt with as a single unit in describing the configuration of the ground. The eastern boundary of the Silent Valley reserve forms the western boundary of the Attappadi Block. The Bhavani river, after originating in the Kundahs of the Nilgiris, flows almost due south along the middle of these Blocks and parallel to the Kundipuzha river. On both banks of this river are forest-clad hills with grasslands and bare rocks interspersed. The Bhavani, after flowing south, turns sharply eastwards at the southwest corner of Attappadi Block V where the Panthanthodu joins it, and flows on into Coimbatore district to drain into the Cauvery. This river collects water from the heavy rains in the forests to feed the dry plains of the Carnatic. The lowest point is 533 m, where the Bhavani exits the Reserve Forests. The hills rise rapidly towards the north, upto over 2225 m on the Nilgiri border. To the east of the Bhavani, in Attappadi Blocks IV and V, the ridge rises precipitously from the river and culminates in a bare needle-shaped rock called Malleswara malai, the highest point of which is 1664 m, which hill tribes have worshipped on Shivarathri since time immemorial. The eastern half of Block V on the south, and Block II slope toward the east and drain their waters into the Manilarthodu, Yaragar, etc., which in turn empty into the Bhavani. This portion supports poor shola-grasslands and some deciduous teak forests.

Attappadi Block VI:

This is a detached Block, with forest-clad hills and valleys except for the grassy area around Muthikulam to the southeast and the high hills of the Elival range to the south. It is a plateau, with elevation varying from 610 m at the exit of the Siruvani river to 2065 m at Elival malai, the highest peak in this hill range. This area forms a basin surrounded by the hills of the outer boundaries of the reserve. The important hills, starting from the north are: Purhi malai (946 m), Periyamandamudi (1007 m) to the west, Amanthamudi (1173 m), Chinnappara malai (947 m), Patiyamukam malai (1692 m), Elival malai (2027 m) to the south, and Periyakunjira malai (1996 m) to the southeast. The peaks are lower toward the east, with the following peaks: Kunjiramudi (1798 m), Poraithi malai (975 m), Vellingiri malai (1183 m) and Vellingiri malai peak (1800 m), to

Thambe mudi (1523 m) in the northeastern corner. The slope is inward as the area is surrounded by the hills mentioned above. The Siruvani, a tributary of the Bhavani, originates in these hills and flows northward through the Attappadi plateau and joins the Bhavani before the latter enters Tamil Nadu. This river is very important in that it supplies drinking water to the Coimbatore township. Its dam is located within the Reserved Forests near Muthikulam, Kerala.

Chenat Nair and Dhoni reserves:

These lie outside the area of the Nilgiri Biosphere Reserve, but adjoin Attappadi Block VI and their high elevation shola grasslands are continuous along the Elival ridge.

GEOLOGY

The Palghat Gap may represent the original drainage that was dismembered as a result of the faulting of the west coast in the early Miocene. Seismic zoning of the Indian peninsula is believed to have its origin in the Tertiary and Quaternary faults of the Western Ghats in Kerala. The Nilgiri and Cardamom hills are said to have been uplifted in the Tertiary and Quaternary periods.

The tectonic framework, geomorphic features, development of soil types, and alluviation of river valleys of the Palghat Gap area indicate that it is a tectonic feature which might have been affected by repeated uplifts of the plateaux and subsequent erosional cycles in the geological past. The shear zones, the valley fills and alluvial plains are favourable for ground water development. The Palghat Gap is one of the very marked physiographic features of the southern part of the peninsular shield. The Gap proper is composed of migmatites. The rock formations in the area north of the Gap are of Archean age and are composed of gneisses and granulite of the Khondolite suite of rocks, with intrusions of later granites, pegmatites and vein quartz.

Rock types:

The rock units found in the area are: garnetiferous-sillimanite-biotite (muscovite) gneiss, biotite gneiss, cale granulite, amphibolite and crystalline limestone, granites (hornblendic and biotite types), pegmatites and quartz veins intruding on the Khondolite formation.

SOIL

The major type of soil in the area is formed as a product of destruction of the ancient crystalline and metamorphic rocks under the influence of semi-arid to sub-humid climate and vegetation. These can generally be called red earth and mixed red and yellow soils. They are moderately deep to deep in profile, with distinct ABC horizons. The A horizon is usually reddish brown loamy sand to sand with single grained to weakly granular structure. The B horizon is moderately thick to thin with weak argillation, and gradually merges with weathered parent rock. Both the B and C horizons contain appreciable amounts of ferruginous gravels and concretions of varying hardness. The soils are essentially kaolinitic in nature, acidic in reaction, and highly porous and friable. The variation in colour of these soils is considered to be due to iron minerals in varying states of exination and hydration. Pure lateritic soils are found in the foothills. In addition, the following types of soils also occur: 1) transitional red to yellow loams on piedmont fans: these are very deep, brown to yellowish red to red, loamy to clay loam soil with well expressed ABC horizons, usually found on the lower slopes of the hill ranges; and 2) transitional alluvial soils and recent alluvial soils on the river/stream terraces: these are greyish brown to yellowish white, sandy to coarse loamy, moderately deep to deep AC soils formed as stream bed sediments which are near neutral in reaction.

CLIMATE

There is considerable variation in climate and rainfall in the area, mainly due to the change in elevation from the plains to the Ghats. There is a large difference in temperature in the plains and the hills. The temperature in the plains varies from $21^{o}C$ to $40^{o}C$ in the hottest months, and in the hills, it ranges from $10^{o}C$ to $32^{o}C$.

Winds:

The prevailing winds are from the west and southwest during April to September, and from the east and northeast from October to March. From March onward, the area experiences a light westerly sea breeze in the evenings which gradually develops into the southwest monsoon. From November to March, there are strong dry east winds causing the drying up of forest areas with resulting forest fires. There are thunderstorms in April and May which foster seed germination. Very strong, desiccating winds sweep the Walayar valley during both monsoons as well as in the months of January and February.

Rainfall:

Both southwest and northeast monsoons are experienced in the tract discussed. The major share of the precipitation is from the southwest monsoon. The prevailing high temperatures, combined with abundant rainfall during the growing season, favour a luxuriance of vegetation and conditions suited to the growth of tropical rain forests. The Walayar valley also gets considerable rain during the southwest monsoon. The plains and outer hills receive scarcely any rainfall between December and March. But the high sholas often get minor showers during this season.

The rainfall distribution in this area reveals that the evergreen forests of the higher elevations receive more precipitation than the forests in the plains and foothills. Irrespective of elevation, a characteristic change in vegetation with change in rainfall is evident.

Rainfall average data is available for 17 stations, of which 3, namely Agali, Moolakombu and Pudur fall on the leeward slopes of the Attappadi hills. Within the tract dealt with, the average annual rainfall varies from 1152 mm in the Walayar hills to 4732 mm in the Attappadi hills.

There is an increase in annual rainfall from the foothills to the crests of the ranges. Olavakkode (85 m) in the foothills receives 1573 mm, while Sappal (230 m) receives 3104 mm. Thiruvizhamkunnu (75 m) receives only 2717 mm, while the hilly areas of Silent Valley (e.g. Neelikkal, 1005 m) receive 4543 mm and Silent Valley itself receives 3180 mm of rain.

The highest rainfall in the tract occurs in the northern portion of Silent Valley, and is estimated to be considerably higher than that recorded at Neelikkal, probably about 7500 mm yearly. The higher rainfall in Silent Valley is due to the fact that it is situated just behind the first high range of the Ghats. Attappadi Block VI receives 4732 mm per year. The lowest record of rainfall is in Walayar, due to its peculiar location on the northern edge of the Palghat Gap.

The increase in intensity of rainfall with altitude shows a different aspect as one travels west to east. The first high hills west of Silent Valley catch the heaviest rainfall which progressively lessens as the clouds cross the successive ranges. The vegetation types also reflect this, as successive valleys show variation in vegetation. The western slopes of the ridge that bounds Silent Valley on the west are the first to catch the southwest monsoon clouds, and receive about 4550 mm of rainfall. They are covered with evergreen forests, even to an elevation of 300 m. Except for some portions, these forests were destroyed by private landowners before the promulgation of the Kerala Private Forests (Vesting and Assignment) Act of 1971. East of the western ridge, the valley receives about 3200 mm of rainfall, and does not support a shola of wet evergreen below 900 m. The nearest parallel valley on the east is the Bhavani valley with an average rainfall of 2300-2800 mm. This valley supports poorer and drier types of evergreens. The eastern slopes of the last range of hills on the left bank of the Bhavani support a poor type of shola down to about 1100 m and deciduous forests below 1100 m. The next valley to the east receives very little rain (900-1000 mm) and supports very poor semi-deciduous shola on the upper reaches and dry deciduous forest on the lower slopes. Gotiarkandi is an area falling under this category, with dry deciduous teak forests.

The common belief that well developed wet evergreen forests occur in the Western Ghats with 2500 mm of rainfall and a five month dry season is false with regard to the forests of the Palghat Division. Here, wet evergreen forests generally occur above 3000 mm rainfall areas, but there are also exceptions, since moist deciduous forests are found in Dhoni and Sappal which receive 3104 mm and 3513 mm respectively.

Average rainfall data for the various periods show that the intensity of rainfall is on the decline, perhaps due to past destruction of the private forests surrounding the Reserve Forests of this Division (Basha, S.C., 1976).

WATER RESOURCES AND DRAINAGE

Many of the streams and rivers described are perennial, due to the heavy rainfall in the area. The rivers and streams, listed reserve-wise, are:

1. Chenat Nair reserve: Karumpuzha, Sappal thodu, Plakattampalli thodu, Puliampatty thodu, and Minpallam puzha;
2. Silent Valley reserve: Kundipuzha and its main tributaries;
3. Attappadi Blocks I - V: Bhavani and its main tributaries;
4. Attappadi Block VI: Siruvani, Pambar, Pothuparapallam;
5. Walayar reserve: Walayar.

AGRICULTURE

In hilly localities like parts of Attappadi and in the drier areas of Walayar, dry crops like groundnut, cotton, gingelly, millet, ragi, maize, etc. are cultivated. Although modern agricultural methods have been introduced in the area, the hill tribes of Attappadi still follow their old system of slash and burn cultivation, multiple cropping with a variety of indigenous dry cereals, etc. In this respect, the area has a tremendous variety of cultivars,and hence of genetic resources of conservation value.

HISTORY

General history:

The process of declaring an area a Reserved Forest under the Madras Forest Act was more intricate and prolonged in Malabar district than in most other parts of Madras presidency. Instead of claimants to rights over forests notified for reservation being in the position of plaintiffs who had to make out their title, as was necessary elsewhere, it was judicially upheld that in Malabar, it rested on the government to prove that the forest in dispute was at their disposal.

The civil appellate courts appear to have regarded the following propositions as established: 1) no forest in Malabar was at the disposal of government unless required by escheat contract or prescription; and 2) all forests not belonging to government by escheat or contract must be the absolute property (janmam) of someone.

It was useless to plead that the forest was unoccupied, for the inevitable elephant pit was always forthcoming and was accepted as sufficient proof of occupation. This disability largely accounted for the extensive stretches of privately owned forests in Malabar, and for the small proportion of 'Reserved Forests', which in consequence were usually more remote and inaccessible than the former.

It is worthy of note that out of the 89,134 acres of reserves in Malabar dealt with by T.V. Venkateshwara Iyer's "Working plan for the Ghat forests of the Palghat division (1933-1943)", 29,726 acres of Attappadi blocks V and VI and a small part of Silent Valley were acquired by government under the Land Acquisition Act for a sum of Rs. 1,03,694-5-6, and another 13,405 acres (most of Chenat Nair reserve) became the absolute property of the State by escheat in 1790. The Panakadan reserve, 1086 acres in extent, was also acquired by escheat.

History of Silent Valley reserve:

The title of the government to the whole of the watershed of Silent Valley or the Kundipuzha river above the point of its descent into the Mannarghat plains was investigated as early as 1847, and it was found that the whole of the watershed was at the absolute disposal of the government, with no private rights whatsoever in it. This investigation was followed by grants to planters of about 400 hectares of land between 1847 and 1873 for coffee plantations, subject to rent payable to government after the expiry of a prescribed period in each case. The lands were taken up by planters and worked, but the estates were finally abandoned and bought in by government in 1889 for arrears of government revenue. The land so granted and subsequently bought in for Rs. 18-12-0 lay in the upper reaches of Silent Valley and was known as the Walghat or Mary Elliot's Estate.

During 1888, the whole of the watershed of Silent Valley or Kundipuzha river was constituted 'reserved land' under Section 26 of the Madras Forest Act as "land at the disposal of the government". During the course of reservation, a portion of the land lying west of Kundipuzha river in S.No. 235 of Kandamangalam, and No. 51 of Payyanadam desams of Walluvanad taluk, aggregating to 785.75 acres, was acquired for Rs. 743-6-5 (the rest of the forests lying in Ernad taluk). Neelikkal is situated in this acquired land.

The forests were finally reserved in 1914 as per Notification No. 291 dated May 18, 1914, and published on page 823 of the Fort St. George gazette dated June 9, 1914.

The nearer portions of the forests were worked for Dysoxylon malabaricum under the selection system and sold on a stump fee basis. Minor forest produce was leased out every year.

The bridle path from the plains of Malabar to Sispara which passes Walakad is believed to have been one of the earliest lines of access to the Nilgiris for pack animals. It was constructed long before the reservation of Silent Valley.

Serambi rest houses were constructed at Neelikkal, Walakkad, Poochipara and Poonmalai for effective management of the area. Now they are all in a ruined condition.

A scheme for working shola forests was prepared by the

Conservator of forests. With government sanction, selection felling was begun in 1928 for working only marketable shola species like Mesua, Palaquium, Calophyllum, Hopea and Artocarpus for railway sleepers. The work was done departmentally.

T.V. Venkateshwara Iyer brought these forests under the regular Working Plan in 1933-34. He was succeeded by van Haeften in 1943-44 to 1957-58. Both of them introduced rigorous methods of selection felling, artificial regeneration, etc. T.V. Venkateshwara Iyer (1934) prescribed light working of the sholas and of a part of the deciduous forests under a modified selection system, followed by artificial regeneration of some of the gaps created thereby. 11,651 acres in the Silent Valley RF were assigned by him to selection working, and the high elevation areas (10,261 acres) were assigned to the protection circle for climatic and watershed protection purposes. 208 acres of virgin shola in Silent Valley were assigned for permanent preservation. Gap regeneration was begun in 1929. Artocarpus, Hopea parviflora etc. were introduced. They were all failures. Natural regeneration of other species was tended to.

Van Haeften (1943-44 to 1957-58) advocated in his Working Plan the method of concentrated artificial regeneration. Consequently, blocks of forest were selected near Poochipara and Singaparai and in each, 10 acres of land were cleared and planted with important species. This experiment was also a failure. Tending natural regeneration seemed to be the only solution for successful restocking of the forests. He also gave prescriptions for protecting the area from fire. The southern and western boundaries of this reserve from Aruvamparai peak to Cherumban kumban and the boundary line for half a mile on either side of the Choolakal-Walghat path were cleared to a width of 40 ft and burnt annually from 1918-1932. After this period, burning was restricted to the width of the boundary and portions of it lying in deciduous forests only. Clearing the remaining portions of the western boundary was done triennially.

E. Muhammad (in his working plan 1959-60 to 1973-74) assigned 13,479 acres in Silent Valley for light selection working without changing the evergreen character of the forests. Only 6 trees were allowed to be cut in one acre. For want of suitable extraction routes, most of the coupes in Silent Valley were not felled and others were worked out of turn.

Chand Basha (in his Working Plan 1975-76 to 1985-86) anticipated the Silent Valley H.E. project to submerge 795 hectares of the forests and hence assigned 6206 hectares to selection felling in 6 compartments. 100 hectares of forests were assigned for conversion to eucalyptus.

History of Attappadi Blocks I - VI:

According to the Madras District Gazette Vol. I (Malabar and Anjengo) 1915, the Attappadi valley was inhabited by Tamil and Kanarese Gowndas, Badagas, Irulas, Kurumbas and other hill tribes who practised shifting cultivation extensively. Twenty one 'hills' and part of another belonged to government and the rest were in dispute among the powerful jenmies. The valley was malarial, and Europeans seldom visited it. The following description reveals the conditions of the forests of the Attappadi valley: "Unscientific forestry, the ravages of the timber thief, the destructive ponam cultivation fatal to tree growth, the average jenmi's anxiety to turn his tree into money with the least possible delay, the Moppila in the guise of an honest merchant, removing on payment of 'Kuttikanam' ten times as many trees as he paid for, all these contributed to the slow but steady denudation of the forests in the accessible areas and these gradually became almost destitute of good timber".

The Attappadi Blocks I - IV were constituted as Reserved Forests as per Notification No. 332 dated July 13, 1900.

As both Attappadi Blocks V and IV belonged to private parties they had to be acquired under the Land Acquisition Act. Attappadi Block V was purchased for Rs. 11,379-4-0 and block VI was acquired for Rs. 91,571-12-0. These two Blocks were notified as Reserve Forests as per Notification No. 314 dated June 22, 1912.

The primary idea was to keep the above Blocks as protection forests in order to protect the catchment area of the Bhavani river and its tributaries. During 1920-28 these forests received a great deal of attention, largely owing to post-war activity in the timber trade. A number of rest houses and bridle paths were constructed with a view to developing these forests.

Except for the lease of minor forest produce, none of the reserves had been worked since reservation upto 1932. During this year, selection fellings were first started in Panthanthodu valley in Attappadi Block I. The Blocks were brought under the regular Working Plan by T.V. Venkateshwara Iyer for the first time in 1934. He prescribed 32,225 acres of shola forest in

Attappadi Block I, 9546 acres in Attappadi Block VI, 2301 acres of deciduous forest in Attappadi Block I and 519 acres in Block III for selection felling. He also proposed that 248 acres in Attappadi Block I and 464 acres in Blocks IV and V be clearfelled and converted to teak by artificial regeneration. 12,294 acres in Attappadi Block I, 10,660 acres in Blocks II to V and 5435 acres in Block VI were assigned for protection as they contained immature mixed deciduous forest and were necessary for catchment protection. In Chindaki, teak was grown in the midst of field crops by the kumri method. Work progressed quickly in the Attappadi series due to the construction of many roads in the reserve. The kumri method of regeneration, which was introduced in 1942 in Chindaki with the cooperation of the hillmen of Attappadi was extended by Van Haeften (1943-44 to 1957-58). Experimental undersowing with <u>Xylia</u> was carried out in one-acre plots. Van Haeften also prescribed fire tracing of the boundaries of Attappadi Blocks I - VI.

E. Muhammad's Working Plan (1959-60 to 1973-74) prescribed clearfelling of suitable areas of deciduous forest for conversion to teak or other softwood species. 3795 acres in Attappadi Block I and 9546 acres in Block VI were to be selection felled for marketable species. The planting of teak in Chindaki was continued, though there was a break from 1937-46 and again from 1948-50. The annual planting area was 40 acres in the Chindaki series. He prescribed a 70 year rotation for all teak plantations except Walayar which had a 40 year rotation.

Chand Basha in his Working Plan (1975-76 to 1985-86) prescribed 1536 hectares in Attappadi Block I and 3011 hectares in Block VI for selection felling. 600 hectares in Gotiarkandi of Attappadi Block V were assigned for conversion to teak, and 200 hectares in Block VI for conversion to eucalyptus. The growth of teak and other softwood species in Chindaki (12.5 hectares) and Panthanthode (114.22 hectares) was found to be poor, so no further expansion was prescribed, also due to lack of area.

History of Walayar reserve:

This is a detached block of forest lying adjacent to the Kerala-Tamil Nadu border. This bit of forest has experienced several types of working due to its easy accessibility. The first attempt at artificial regeneration appears to have been undertaken in this Division as early as 1872, when Tamarindus indica and Pongamia glabra were planted in the Puliampatty thope reserve adjoining the Chenat Nair reserve.

The two Blocks comprising this forest, namely Pulampara and Varalapadi, were purchased by government in 1873 for Rs. 24,426-4-0 and in 1874 for Rs. 21,310-0-0 respectively, with a view to ensure a permanent fuel supply to the Madras Railways. They were notified as Reserved Forests in 1883. These two lands, separated by a small stream only, were called the Walayar fuel reserve and placed under the Tahsildar of Palghat. This arrangement was found to be unsuccessful.

A Working Plan, the oldest for this Division, was prepared for the management of these forests in 1891. The forests were worked under the coppice with standards system with a 15 year rotation. The Plan expired in 1894 and as the rotation prescribed was found to be too short, the reserve was rested upto 1902 as far as fuel was concerned. Bamboo felling, however, was continued. In 1902, Foulkes revised the Working Plan. The forests were to be worked under the same system, with a 20 year rotation. The most important administrative feature of this Working Plan was the amalgamation of the Walayar reserve in Malabar district with those portions of the Walayar forests lying in Coimbatore district. The coppice with standards system was found to be a failure after two rotations. Apart from a bad silvicultural system, the gravest charge against the Walayar forest management in the past was that cultural operations were not carried out. The Walayar forests therefore slowly deteriorated. A nursery was founded in 1919-20, and teak stumps were planted. It was a total failure. After 1924-25, clearfelling was adopted.

Hicks revised the Working Plan in 1925 and the forests were mainly worked under pole and fuel working circles under a simple coppice system, assisted by artificial regeneration with teak on a 30 year rotation. At the time of revision of the Plan by T.V. Venkateshwara Iyer (1937-46) the resultant growth in the Walayar valley was best in the Pulampara and Varalapadi Blocks, where there was a high proportion of teak averaging 4 to 5 ft in girth. Iyer prescribed that the simple coppice system continue to ensure supplies of firewood and charcoal, with augmented natural regeneration by coppice or sowing of fuel species in combination with field crops - the ponam system. Bamboos in Walayar were to be intensively exploited by increasing the number of felling series.

Van Haeften (Working Plan 1943-58) states that the less fertile areas were planted with trees, whereas the well-stocked and more fertile areas were just allowed to coppice. Therefore, there was not much difference between the planted and unplanted areas. The existing teak was found to be heavily suppressed by fast growing fuel species. The total area planted with teak was then 1320 acres, and the area under simple coppice 760 acres. E. Muhammad in his Working Plan (1959-60 to 1973-74) found that the total area suitable for retention in the plantation working circle was 2000 acres, and hence he prescribed that 50 acres be dealt with annually. Chand Basha (Working Plan 1975-76 to 1985-86) proposed conversion of the area remaining after conversion, felling and replanting to softwood plantations. The natural growth of Bombax was found to be encouraging, as was the demand for it, so he prescribed the raising of Bombax. He also recommended that plantations be given on the taungya system through open auction.

VEGETATION

The important forest types found in the Palghat Division are classified by Chand Basha (1975) under the following heads (the corresponding classification, as per the revised survey of forest types of India by Sir Harry G. Champion and S.K. Seth is given in brackets):

1. Wet evergreen forests (west coast tropical evergreen forests, 1A/C-4);

2. Semi-evergreen forests (west coast semi-evergreen forest,

2A/C-2);

3. Moist deciduous forests (south Indian moist deciduous forests, 3B):

a) moist deciduous teak forests (moist teak bearing forests)

i) poor teak forests (very moist teak forests, 3B/C-1a)

ii) good teak bearing forests (slightly moist teak forests, 3B/C-1c);

b) moist mixed deciduous forests (southern moist mixed deciduous forests, 35/2-C)

c) secondary moist deciduous forests (southern secondary moist mixed deciduous forests, 3B/C-2s1)

d) low level semi-deciduous shola forests;

4. Dry deciduous teak forests (southern tropical dry deciduous - dry teak bearing forests, 5A/C-1);

5. Subtropical hill forests (southern subtropical hill forests, 8A/C-1);

6. Temperate hill forests (southern montane wet temperate forests, 11A/C-1);

7. Grasslands:

a) lowland grasslands (below 1500 m)

b) level 8 grasslands (above 1500 m).

A clear line of demarcation between the different types is not always possible since the transition is so slow that one gradually merges into the other. The tropical evergreen forests are maximally developed between 750 m and 1050 m, but are seen to descend to about 600 m and even lower under favourable conditions of aspect and humidity, gradually merging with the semi-evergreen forests below. They ascend in some parts upto 1220 m to merge with the subtropical forests in Silent Valley and Attappadi.

1. Wet evergreen forests (tropical wet evergreen forests):

These forests occupy undulating hills and valleys between 300 m and 1100 m. In favourable localities with shelter and good rainfall, these forests reach even to 1200 m, e.g. Silent Valley, Attappadi Block VI and, to a lesser extent, Attappadi Blocks I and V and the Chenat Nair reserve.

2. Semi-evergreen forests (west coast tropical semi-evergreen):

These forests are found in the Anangathodu valley west of Chindaki, in Attappadi Block I, and seem to be a stable formation. Secondary semi-evergreen forests are found to occupy the Thodikki area, formed after shifting cultivators abandoned their sites. These can reach upto 1200 m elevation, and are seen on the left bank of the Bhavani, beyond Ummenarai malai. Optimal development of these forests is seen in Attappadi Block I.

Secondary semi-evergreen forests:

These forests were originally evergreen forest which were destroyed by fire and shifting cultivation. They are found in the Thodikki area.

3. Moist deciduous forests (south Indian moist deciduous forests):

General description:

These are forests of more commercial value, consisting of deciduous trees reaching up to 35-40 m in height. Compared to the evergreens, the number of species is low, and the crown is mostly round. These forests are usually subject to annual fires which destroy the ground vegetation and young regenerating trees.

Distribution:

In the Attappadi valley, these forests are found on either side of the Bhavani river in the Anavai, Thadikundu, Murugalai, Kadugumanna, Chindaki and Sundanari areas. Major portions of the Walayar reserve fall into this category, except a small part in the Pulampara area which supports dry deciduous forests.

4. Dry deciduous forests (southern tropical dry deciduous forests):

The main type found in this Division is the dry teak bearing forest.

General description:

The dominant species do not form a very closed canopy. The trees are 15-20 m tall, with somewhat straight boles. The most important species are Tectona grandis and Anogeissus latifolia. Almost all the dominant species remain leafless during some months of the dry season. There are no lianas.

Distribution:

The elevation where these forests are found varies from 750 m to 1125 m on the leeward eastern slopes of the last range of the Attappadi hills. The presence of this type at such an elevation is solely due to the limited rainfall (1000 mm). This type of forest is also found in Pulampara Block in the Walayar reserve (elevation 275-400 m). In Attappadi, most of these forests have been destroyed by the native hillmen for cultivation. Patches of forests are found in Gotiarkandy, Kurakathikalli and Yedavani.

5. Subtropical hill forests:

These are floristically rich. They are evergreen, but have fewer species than wet evergreen forests. The trees are stunted, with irregular boles. A transition zone may be distinguished between the wet evergreen and this type, between 1200 and 1500 m elevations.

These forests are found north of Walakkad in the Silent Valley Reserved Forest, above an elevation of 1500 m, and are found upto 1900 m. They are also found in the upper reaches of the Attappadi and Chenat Nair reserves.

6. Temperate hill forests (southern montane wet temperate forests):

General description:

Above the subtropical hill forests are the temperate forests, containing unrelated species and a dense, closed canopy with rounded crowns. The trees are highly branched with short boles, often forming a clear bole of not more than 5-10 m. Some woody climbers are also found. The leaves are thick, dark green and coreaceous. The foliage, with its varied tints during certain seasons, is often beautiful. The boles and branches are festooned with mosses, lichens, ferns and other epiphytes.

Distribution:

These forests are usually found above an elevation of 1900 m, where they are interrupted by rocky cliffs. The patches of sholas occur in the folds of converging slopes and hollows, where there is more moisture and soil. The rainfall is above 5000 mm in upper Silent Valley and in Attappadi blocks I and V. The forests are found in the northern portion of Silent Valley and Attappadi adjoining the Nilgiris.

7. Grasslands:

Grasslands can be classified into 1) lowland grasslands (below 1500 m) and 2) high level grasslands.

Low level grasslands:

Low level grasslands are distributed within the wet evergreen forests of Silent Valley and, to a small extent, in Attappadi. They are evidently of secondary origin, the larger ones on the hilltops gradually spreading to the valleys, ultimately reaching the sholas down below. A closer study made in some of the grasslands shows that they have attained an edaphic climax due to poor soil and rocky land. The regular fires and torrential rain impoverish the soil yearly. Fire hardy species like Phyllanthus, Dalbergia, Phoenix, Carva arborea, etc. colonize these grasslands wherever they are left undisturbed.

The lowland grasslands have been further classified into: a) grasslands adjoining shola forests; b) grasslands apart from sholas but below the ridges; and c) grasslands on ridges and hilltops.

High level grasslands:

Few such grasslands are found in the upper reaches of Silent Valley and Attappadi reserves. The grass is stunted and the soil is shallow. The direct wind and the moisture loss are the reasons for the stunted growth of grass and inhibition of succession of plant communities. Lower down, these grasslands merge into the sholas. These grasslands can be regarded as a climatic-edaphic climax. Chand Basha (1975) is of the opinion that these are in the gradual process of succession, which is evident from the gradual advancement of adjoining sholas into these grasslands, if left undisturbed.

The vegetation types described above correspond to the following vegetation classes under the classification system of Puri et al. (1983):

I. Evergreen forest

1. Medium elevation evergreen

a) _Cullenia_-_Mesua_-_Palaquium_ series

2. High elevation evergreen

b) Shola montane forest

II. Climax moist deciduous forest

a) _Tectona_-_Dillenia_-_Lagerstroemia lanceolata_-_Terminalia paniculata_ series

III. Dry deciduous forest

a) _Terminalia_-_Anogeissus latifolia_-_Tectona grandis_ series.

The various degradative stages of the vegetation types described in this chapter can be seen in the Palghat Division.

Working plans of the Palghat Forest Division available in the C.E.S. collection:

1. Basha, S.C. (1986). Revised Working Plan for Palghat Forest Division, 1975-76 to 1985-86. Parts I & II. CCF, Trivandrum.

2. Hicks, H.G. (1927). Revised Working Plan for the Walayar Forests of Palghat Division, 1926-35. Government Press.

3. Iyer, T.V.V. (1935). A Working Plan for the Ghat forests of

the Palghat Division, 1933-34 to 1942-43. Government Press, Madras.

4. Iyer, T.V.V. (1939). A revised Working Plan for the forests of the Walayar, Bolampatty and Thadagam valleys of Palghat Division, 1937-46. Government Press, Madras.

5. Muhammad, E. (1967). Revised Working Plan for Palghat Forest Division, 1959-60 to 1973-74.

6. Van Haeften (1943). Working Plan for the Palghat Forest Division, 1943-44 to 1957-58. Typed copy.

7. Wimbush, A. (1926). Working Plan for the Bolampatty valley forests of the Palghat Forest Division.

TAMIL NADU

MUDUMALAI WILDLIFE SANCTUARY

Forest	Area (in sq km)
Kargudi Range	54.6
Theppakadu Range	89.5
Mudumalai Range	96.6
Masinagudi Range	80.4

TOPOGRAPHY

The Mudumalai Wildlife Sanctuary is situated in the northwest portion of the Nilgiri plateau, and lies between latitudes 10^{o} 30' and 11^{o} 39'N and longitudes 76^{o} 27' and 76^{o} 43'E. The land is more or less undulating; numerous rounded hills rise some 100 m above the general elevation of about 1000 m. The highest point is Moyarbetta (1258 m)/Markundaribetta (1266 m). Toward the north of the Sanctuary is the Jainbarribetta ridge running from the Kakanhalla stream in the east to the northwest corner of Benne reserve and rising to 1181 m (Angattibathbetta). A typical feature of the western portion of the Sanctuary are the numerous grassy swamps, lying between the low hills. Some of these are cultivated.

GEOLOGY

The underlying rock is Archaean biotite and hornblendic gneiss, with intensive bands of charnockites, granite, pegmatite, and basic doleric dykes. Good ruby mica of fine grain occurs in some of the pegmatites.

SOILS

Soils in these forests are of two distinctive types: 1) a black loamy soil, containing over 50% coarse sand and gravel, and 2) a red heavy clay loam. The red soil is confined to the southern and western parts of the Sanctuary, where the rainfall is heavier. The dark colour of the black soil is not due to organic matter but to its infertile mineral content. It is formed from disintegrated gneiss. This type of soil occurs in the northern portions of the Sanctuary.

WATER RESOURCES AND DRAINAGE

There are numerous streams and streamlets throughout the forest, the larger of them being perennial. The most important are the Moyar river, the Bidarhalla flowing through the south of Teppakadu Range, the Kakanhalla which forms the Mysore border on the east and northeast, the Imbarhalla in the north and the middle of the Mudumalai Range, the Benne hole and Mukkatti hole in the Benne RF, the Chinnakolli, a tributary of the Bidarhalla, and the Mavinahalla which forms the northern border between Mudumalai Range and Mysore, flowing into the Nugu hole.

The Jainbaribetta ridge forms the watershed, all streams south of it with the exception of the Benne hole and the Mukkatti hole draining into the Moyar flowing eastward. The Imbarhalla drains into the Kakanhalla which, flowing eastward, joins the Moyar. The Benne hole and the Mukkatti hole flow westward and join the Nugu hole. Other minor streams are Avarahalla, Kallahalla, Karimara hole, and Hambatta todu, all flowing into the Moyar.

There are nearly 30 water holes in the Sanctuary. A few of them do not dry up even during the summer season.

CLIMATE

The climate is generally equable and moderate in the Sanctuary. The hot, wet, and cold seasons are marked. The cold season commences in November, and lasts upto the middle of February. Later the hot season starts, and lasts upto the middle of June. Though heavy pre-monsoon showers fall in April and May, the actual wet season starts from the middle of June and lasts upto September. The northeast monsoon showers set in again from the middle of October and persist until the middle of November.

The southwest part of the Sanctuary (Benne RF) is a heavy rainfall zone, receiving 1600 mm annually. The rainfall decreases sharply toward the eastern and northern parts of the Sanctuary. Mudumalai receives 1300 mm of rainfall, whereas the eastern part of the Sanctuary, beyond Masinagudi, gets very low precipitation, about 800 mm.

AGRICULTURE

The entire southern boundary of the Sanctuary is flanked by cultivated private lands and tea estates. On the western side is the Benne RF, having a few private lands as enclosures practising paddy cultivation in the swamps. There are also a group of Chetti tribals cultivating private lands in the Mudumalai RF. On the southeast border of the Sanctuary, two villages, Masinagudi and Bokkapuram, practise dry cultivation.

ANIMAL HUSBANDRY

Only the Moyar RF and the Avarahalla RF are open to grazing. All other RF's are closed to grazing except for the cattle belonging to the forest colony and the right-holders inside the Mudumalai RF. A grazing fee is collected for slaughter cattle that move from Mysore to Kerala through the Sanctuary zone.

FORESTS

The Sanctuary consists of extreme types of forests, varying from open thorny scrub to semi-evergreen. While the vegetation in the eastern part of the Sanctuary is open thorny scrub to dry deciduous characterized by poor and stunted growth, the vegetation in the western portion tends to be semi-evergreen forest. To the north lie dry deciduous forests, while the central and southern portions are moist deciduous. The entire tract is exceedingly rich in wildlife, harbouring a wide variety of animals. It includes a large population of elephants, a good population of carnivores, and a variety of other animals such as sambar, gaur, Indian giant squirrel, sloth bear, jackal, hyaena, wild dog, bonnet macaque, common langur, and Nilgiri langur. The avian, reptilian and amphibian fauna are also rich and varied.

TRIBALS

Kurumbas, Irulas, Chettis and Paniyas are the hill tribes who have lived in the Sanctuary for a long time. The Chettis cultivate numerous enclosures within the Sanctuary, for which annual permits are given.

HISTORY

Pre-Working Plan period:

The Mudumalai forests, an indefinite tract of more than 500 sq km, were the property of the Tirumulapad of Nilambur. During the first half of the last century they were leased out to a timber merchant by name Muddannah, who, on payment of a stamp fee, exploited the more accessible portions of it for several years. In 1835, the forests were inspected for the availability of sleeper material. The sleeper contractor for the Madras Railways reported that the forests contained a fine stock of timber which, in his opinion, was being endangered by uncontrolled and unsystematic felling by local inhabitants. In the same year, Captain Campbell, Assistant Engineer in charge of Public Works on the Nilgiris, took a lease on these forests for two years. When the lease expired in 1857, the Government rented the forests from the Tirumulapad for a further period of ten years for the continued supply of teak for buildings on the Nilgiri plateau. During this period, massive extraction of timber took place. By 1862, when Beddome visited the Mudumalai forests, he reported that little teak would be left in the forests, at the current rate of extraction, but that there was still a large quantity of vengai, karimathi and rosewood which had not been included in the conditions of the lease and therefore not been felled. Also, the forest teak was in the process of regenerating itself, and thus he advised extension of the lease for another 99 years. During subsequent years, till 1894, massive logging operations were continued and timber used for the buildings of the Nilgiris. That this rate of extraction could not be indefinitely continued was beginning to be realized.

Two small teak plantations were started in 1864-65. Still, heavy felling continued due to the increasing demand, and could be sustained only due to the discovery of hitherto untapped sources of teak in the somewhat inaccessible northwest corner of the Mudumalai forests. The continued heavy felling, accompanied by accumulation of branch wood in the forest and opening of the forest canopy, produced the inevitable results of an immense growth of grass and severe forest fires. By 1875, all the good teak trees were extracted, and a proposal was made to fell the locally unsaleable crooked teak with the idea of supplying the English dockyards with curved wood. The teak plantations were a disaster because of the poor soil conditions of the area. By 1878, as a result of complete denudation, departmental felling was temporarily stopped. In 1884, Gamble inspected the forests and made recommendations regarding protective measures and scientific working, with the aim of gradually improving the forests. He considered the future prospects of the forests under conservancy to be very promising, and introduced a scheme for dividing portions of the forest into annually worked compartments for felling, for rigid fire protection, and for regulation in grazing. After the passing of the Forest Act, Mudumalai was reserved in 1889, and Kumbarakolli added in 1892. The measures suggested by Gamble were not carried out for want of funds, and the Government appointed Popert in 1895 to report on the decrease of revenue from the forests. He said: "The outlook has to be faced in the shape of an indefinite outlay in a deficit district, and in a forest where the plums have been effectively picked out of the cake, but if the game is worth the candle, it should be played out till the end. The alternative is to let the forests go from bad to worse." Thus he recommended that forest protection be rigidly enforced, the 'taungya' system be started, and improvement felling continued. The taungya system involved the offering of incentives to local inhabitants for regeneration of the trees. Arbuthnot was placed on special duty to draw up a Working Plan for Mudumalai and Benne forests, and on his suggestion, the forests were opened for sleeper felling between 1898 and 1902. He estimated that there were only 1800 teak trees which contained saleable timber in the whole area of 11191 acres, and between 3000 and 4000 blackwood, vengai, and venteak. The dominant tree was no longer teak but karimathi (Terminalia tomentosa), of which he estimated 2000 to be ripe for removal. His proposal was to convert this timber into sleepers and, at the same time, to introduce rigid protection to restore the teak which was being exterminated by fire.

The Working Plan period:

In 1907, Jackson's Plan attempted to localise the random fellings by dividing the forests into four Blocks. The timber was contracted to the Kolar Gold Fields. Improved felling was continued on a more extensive and localized scale. The importance of fire protection was not realized and protection was confined to only those compartments in which fellings had occurred for a period of five years. The Plan, in short, was one of exploitation of the already degraded forest, and aimed only at showing a profit on the working, to the detriment of the forest's future.

Cox's Working Plan came into force from 1910. The forest was rendered more accessible by cutting many internal roads. Improvements on the fellings introduced by Gamble were continued. The Block lines were permanently demarcated. But by 1923, all improvement fellings were stopped by the Chief Conservator on the grounds of their ineffectiveness and difficulty of supervision. In 1922-23, a huge area around Kargudi was clearfelled for artificial regeneration; the result was largely a failure. Elephant capturing operations were commenced in 1910. Between 1910 and 1926, 130 elephants were captured. The main emphasis of the Plan was on making a determined effort to cope with the fire problem; conservancy, and not exploitation, was the overall guiding principle of management. During this period, extension of artificial teak regeneration was done in selected localities. Between 1920 and 1924, 125.5 acres in the Mudumalai Range were regenerated with sandal, which turned out to be a failure. In 1925, the taungya system was reintroduced. This system, which was introduced in 1896, was dropped after the 1907 plan and was reintroduced in 1925. Fire protection measures were introduced for the first time for the forest as a whole. The scheme consisted of the fire tracing of a system of exterior and interior fire lines. Fire patrols were employed during the fire season. Despite these costly efforts, however, not much was achieved.

In 1927, a revised Working Plan by Hicks was introduced. As far as timber working was concerned, this Working Plan constituted a clearfelling working circle and a selection-improvement felling working circle. Of the total area allotted to the clearfelling working circle on the basis of a hundred year rotation, the Plan prescribed that one-tenth of this area be clearfelled and regenerated with teak and other valuable species during this 10 year Plan period. 75% was sown with teak, and the balance sown with seeds of miscellaneous species. The selection-improvement felling working circle was adopted for the rest of the area. The object was to realize revenue by extraction of mature and dead trees, and to stimulate the growth of all reasonably well-grown, immature, saleable trees, (especially teak) by freeing their crowns. A felling cycle of 2d years was adopted and an exploitable girth of 6 ft at breast height was fixed for selection fellings. Elephant capturing operations were continued and from 1927 to 1936, 37 elephants were captured. The Working Plan provided for annual regeneration of 25 acres of sandal, but the operation proved to be a complete failure. In 1929, sandal plantations were raised by the tuckle, or taungya, method. Fire protection proposals aimed at a compromise between the cheap but discredited system of early burning and the expensive but safer and more efficient system of line burning. The basis of protection was a network of interior and exterior fire lines. But after two or three years of trial, the new proposals turned out to be more expensive than the orthodox method of burning fire lines, as early burning proved ineffective. Thus, the method of early burning was dropped, and the old system of burning fire lines was readopted. The successful protection during this Plan period was due to the fact that the Range Officers had developed a better relationship with the jungle tribes, and had involved them in fire prevention. During this Plan period, all regeneration areas in the clearfelling working circle were closed to grazing for a period of 10 years after their formation.

C. R. Ranganathan's Plan was introduced for the period 1938-48. Although his Plan came into force in 1938 and was to be effective until 1948, the work was carried on within the general framework of the Plan till 1954, because of delays in revision caused by the repercussions of World War II. The management objectives were: 1) to exploit, with due regard for silvicultural principles, mature teak trees and trees of other saleable species, and to improve the quality and density of the forests; 2) to improve the value of these forests by raising teak plantations on a small scale in carefully selected sites. The Plan included a selection working circle and a teak plantation working circle for timber production. The selection working circle covered an area of 28,829 acres and included adequate stocks of teak, mathi, vengai, rosewood and venteak, which are usually exploited for marketable timber. The prescription included the working of one compartment every year on a felling cycle of 24 years. The marking of selected trees was confined to those trees of and above 6 ft girth at breast height and based on other silvicultural principles like freeing the healthy younger classes from suppression. The prescriptions of the Plan were generally followed until the war years, when everything went out of gear. Operations were suspended from 1943 to 1947, as the military occupied the area for training. The teak plantation working circle included 201 acres. Provision was made for tending the young regeneration areas and for thinning the older plantations. Elephants were captured sporadically during this period. The same orthodox approach to fire protection was followed during this Plan period by burning fire lines only. An area of about 23 sq mi (58 sq km) in the forests of Mudumalai Range was converted into a Wildlife Sanctuary in 1940. All shooting, hunting, etc. was prohibited. Unfortunately, from 1943 to 1947, a jungle warfare training camp was held within the core area of the Sanctuary. During this period, many animals fell prey to both trainees and officials. Lac cultivation was taken up during 1938-40, but the operation was far from satisfactory.

During T. Jayadev's Working Plan, introduced in 1954, the same objectives were aimed at as in the previous Working Plan. The selection working circle covered an area of 33,924 acres. The rotation was 150 years, and the felling cycle 30 years. The timber yield was regulated by area with a check on the number of trees to be removed, 80% of the exploitable-sized trees being the maximum number that could be extracted. The Plan prescribed the upper limit for the number of trees that could be extracted, but nevertheless there was overexploitation in the years 1961-62 to 1963-64. Silvicultural operations to encourage the growth of teak and other valuable trees were continued. The teak working circle covered an area of 1981.51 acres, including 1153.01 acres already under teak plantations. The annual planting area was 30 acres. Elephant capturing operations were carried out sporadically during this period. In 1960, all the bamboo of the Mudumalai forests started flowering simultaneously, and this spread all over the forest. This special situation was met by leasing the area for bamboo extraction to private contractors. The minor forest produce of the forests: honey, wax, horns, shikakai, and gall nuts were collected departmentally till 1949. Subsequently, they were publicly auctioned. Fire protection was carried out along the same lines as the previous plan period. The Wildlife Sanctuary was expanded to 310.70 sq km in 1958, but working of the forests still continued.

M. Thyagarajan's Working Plan for the period 1964 to 1974 was effective from 1966. The objectives of the Plan were similar to the previous two Plans. This Plan was revised by V. Jayaraman for the period 1974-84, effective from 1976.

With effect from October 1977, the Mudumalai Wildlife Sanctuary was constituted as a separate territorial Division with four wildlife Ranges for more effective management. Consequently, the previous Plan was abandoned and a Management Plan for Mudumalai Wildlife Sanctuary was drawn up by S. John Joseph.

VEGETATION

The forests of the Mudumalai Wildlife Sanctuary fall under the following forest types of Champion and Seth (1968):

1. Southern high level thorn forest (6A/C):

This is a variant of the southern thorn forest type with many dry deciduous species, and is found at the foot of the Nilgiri hills receiving an annual rainfall of 600-800 mm.

2. Southern tropical dry deciduous type:

Dry teak forest subtype (5A/C1b):

A relatively dry deciduous type of forest is found in parts of Doddagatti, Mudumalai and Teppakadu Blocks. This type of forest has a mixture of species most of which are deciduous during the dry season. The incidence of fire is high. Shorea talura and Tectona grandis occur in higher proportions.

Southern dry mixed deciduous forest subtype (5A/C3):

This subtype is found in areas where the annual rainfall is less than 800 mm, as in parts of Doddagatti Block, in the northern and eastern parts of Mudumalai and Teppakadu Blocks, the eastern parts of Masinagudi, and in other areas where the soil does not permit survival of teak. Anogeissus latifolia is very common in this subtype.

3. Southern tropical moist deciduous type:

Slightly moist teak forest subtype (3B/C1):

Teak is found on the borders of 'moist' deciduous forests in the region: those receiving rainfall of 1000-1200 mm, and also in moist soils in drier regions. The ground vegetation is mostly grass.

Southern moist mixed deciduous forest subtype (3B/C2):

This subtype is found in regions with rainfall ranging from 1200 mm to 1600 mm, such as in Benne Block and the southwestern parts of Mudumalai and Teppakadu Blocks. Though the dominant species are mostly deciduous, there are also some evergreen species. These occupy mostly the understorey. Such forests have

Bambusa arundinacea along the margins of watercourses and wet areas. The ground vegetation is mostly herbaceous.

4. Southern tropical semi-evergreen forest (2A/C2):

There are several patches of small evergreen forests in the Benne area of Mudumalai.

5. Moist bamboo brakes (2/E3):

Clumps of *Bambusa arundinacea* occur along the Moyar in Teppakadu Block, and around the swamps in Benne Block where the principal vegetation type is moist deciduous.

6. Riparian fringing forest (4E/RS1):

Along the perennial watercourses is found, in a narrow belt, a plant community that has some large semi evergreen trees with smaller trees and shrubs interspersed. This is the riparian fringing forest type.

Plantations:

The Sanctuary is sprinkled with artificial plantations of teak, eucalyptus, and other species. There are also some very old 'tuckle' plantations of teak inside the Sanctuary.

The corresponding vegetation classes in Mudumalai of the Puri et al. (1983) classification are:

1. Dry deciduous fôrests with *Terminalia-Anogeissus latifolia-Tectona grandis* series; and

2. Climax moist deciduous forest with *Tectona-Dillenia-Lagerstroemia lanceolata-Terminalia paniculata* series. Some of the degradative facies of these two series are also found.

List of Working Plans available in the C.E.S. collection:

1. Hicks, H.G. (1929). Revised Working Plan for the Mudumalai Forests (Nilgiri-Wynaad) 1927-1937.

2. Jeyadev, T. (1953). Working Plan for the Nilgiris Forest Division for the period 1st April 1954 to 31st March 1964.

3. Joseph, J. (1969). Management Plan for the Mudumalai Wildlife Sanctuary.

4. Ranganathan, C.R. (1941). Working Plan for the Nilgiris Division, 1941.

5. Thyagarajan, M. (1964). Working Plan for the Nilgiris Forest Division 1964 to 1974.

NILGIRI NORTH FOREST DIVISION

	Area (sq km)
Coonoor Range:	
Bergami Block	1.73
Burliar	0.29
Denad	3.39
Hulical Durg	6.05
Kunnavarai and Additions I - III	0.30
Konakorai Slopes and Addition	3.31
Kolakumbe	1.19
Kallar and Addition	0.61
Màdanad and Additions I and II	2.67
Nadukadu halla and Addition I	1.71
Nirburrahalla	0.29
Nilgiri Eastern Slopes	43.34
Rangaswamy Peak	2.34
Vagappanai	4.59
Sigur Range:	
Bokkapuram and Additions I - III	3.25
Kalhatti and Addition	8.21
Kalmalai and Addition	1.54
Sigur I and II	81.07
Singara and Addition	3.62
Northern Hay	6.43
Udhagai North Range:	
Bikkepathimund	2.99
Ebbanad and Addition	1.05
Kambatti	0.11
Kambatti Block	1.20
Kukal Valley	0.44

TOPOGRAPHY

The general elevation is about 853 m. Toward the west, in the vicinity of Masinàgudi, the ground is gently undulating, but east of Anaikatti, the country becomes rugged and broken by numerous ravines and low ridges. The ground slopes to the north towards the Mysore Ditch and to the east gradually to meet the Coimbatore plains. Though the general elevation is more or less the same as that of Nilgiri-Wynaad, swamps do not occur in the region because of the nature of the terrain and amount of rainfall. In fact, the Sigur plateau includes vast stretches of arid tract not common in other parts of the district. The eastern and southern slopes facing the Coimbatore plains are less precipitous.

GEOLOGY

The rocks are a great mass of foliated gneissose rock, of the class termed charnockitic, with a few later dykes of olivine-norites, from 2.5 to 300 cm width, clearly visible at Coonoor. The area consists chiefly of the rounded hills and undulations which usually result from marine sections, but escarpments can be discerned in places.

The faces of the cliffs have been altered as much by the heat of the sun as by the action of rain. The weathering causes splits in the outer layers of the rocks, peeling them away from the core. During the rains, landslips are caused by the action of water on the decomposed hillsides.

SOIL

Two kinds of soils may be distinguished, a black sandy loam containing over 50% coarse sand and gravel, and a red, heavy, clayey loam. The red soil is confined to heavier rainfall areas and shows much better height growth than the black. The dark colour of the black soil is apparently not due to the infiltration of organic matter but to its infertile mineral content.

CLIMATE

The range of temperatures in this Division is more or less similar to the Nilgiri-Wynaad, i.e., 13-35 ^{o}C, but the humidity is much less, as the annual rainfall in the area is less than 900 mm. The climate ranges from dry in the western part to arid in the eastern part. Moyar betta, lying on the western edge of Sigur range, and the main mass of the Nilgiri hills shut out the southwest monsoon to a great extent from northern and eastern parts of Sigur range. At Coonoor and Kotagiri, the rainfall is about 165 cm.

WATER RESOURCES AND DRAINAGE

The Coonoor river, which races down the ravine along which the Mettupalayam-Coonoor Ghat road passes, is principally made up of the Coonoor stream, which drains the regions around Coonoor and Wellington, and the Kateri stream which rises on the Kateri and Ketti valleys. The Coonoor river joins the Bhavani at the foot of the Ghat.

The Kedarhalla, which rises near Ebbanad at the northern edge of the plateau is joined by the Karithorehalla before it quits the plateau, flows past Anaikatti in Sigur Range, and then falls into the Moyar.

VEGETATION

There are seven main types of forest found in this Division:

1. Dry deciduous forest;
2. Deciduous scrub forest;
3. Southern tropical thorn forest;
4. Tropical secondary dry deciduous forest;

5. Nilgiri subtropical evergreen forest;

6. Deciduous savannah type forest;

7. Man-made forests (plantations).

The corresponding Puri et al. (1983) classifications are:

1. Dry deciduous forest: _Terminalia-Anogeissus latifolia-Tectona grandis_ type;

2. Shola montane forest.

The various degraded types of the above two types are also found.

HISTORY

The Nilgiri North Forest Division was originally part of the Nilgiri Forest Division. Hence, the history of this Division is the history of the Nilgiris itself. No separate history of the area is necessary.

Compiled with excerpts from:

1. Jeyadev, T. (1953). Working Plan for the Nilgiri Forest Division for the period 1st April 1954 to 31st March 1964.

2. Ranganathan, C.R. (1941). Working Plan for the Nilgiris Division 1941-51.

3. Thyagarajan, M. (1964). Working Plan for the Nilgiris Forest Division. Part I. 1964 to 1974.

SATHYAMANGALAM DIVISION

Forest	Range	Area (in sq km)
Talamalai RF	Talamalai Range	530.7
Talamalai Extension RF	Talamalai Range	12.4
Gulthiyalathur RF (part)	Satyamangalam Range	200.0

TOPOGRAPHY

This Division forms a part of the north Coimbatore plateau. The tableland has an elevation of 800-900 m and is bounded on the south by a chain of lofty hills rising steeply from the level of the plains (300 m). This belt of hills falls off eastwards and northeastward to meet the Moyar basin. The hills culminate in numerous high peaks. The highest among them, Kambatrayan boli (1696 m) is in Sathyamangalam Range. There are a few gaps in this range of hills, which provide access to the plateau from the plains below. From the Moyar basin on the western side ascends the abandoned Sultan road which negotiates the slopes through Gazalhatti pass, affording a gentle approach to the Talamalai plateau.

A series of double or treble hill ranges running north-south start at right angles to the southern belt of hills and dissect the tableland into a number of valleys. The land is generally undulating (except in Talamalai Range, where it is flat), and is nearly engulfed by exclosures of cultivation. The Minchikuli valley nestles between this range of hills and a parallel range on its western side.

GEOLOGY

All rocks belong to the gneissic series. Dolerite, pegmatite, granite gneiss, charnockites, and biotite gneiss occur in this Division. The meta sediments occur in bands and are classified as quartzites, amphibolite, hornblende schist, pyroxene granulite, and garnet pyroxene rock.

The mineral wealth of the tract is not insignificant. Felspars of the finest quality are abundant; both the translucent pink and opaque white varieties occur on the surface of the red soil on which they are found. Corundum occurs in several places as scattered crystals. Outcrops of limestone occur near Talamalai.

SOIL

The soils of the area differ widely and it is rare for a block of 100 hectares to have only one type of soil. Major variations in the soil types are brought about by the weathering and disintegration of two rock formations - charnockite and granite gneiss. Most of the soils are residual. The soils derived from charnockites which are widespread in the region are the most fertile and vary in thickness from 30 to 70 cm. The soils derived from the banded granite gneiss are the least fertile and vary in thickness from 10 to 30 cm. The soils derived from other rock formations are seen to be very localized.

The soils commonly found in the forests of the Division are red in situ soils, lateritic soils, black soils, skeletal soils, colluvial soils, alluvial soils and kallar soils.

WATER RESOURCES AND DRAINAGE

The general slope of the plateau is toward the north. The drainage is effected mainly by the Palar. The Moyar is a perennial stream flowing into the Bhavani, forming the southern boundary of Talamalai Range, and does not owe its perenniality to any of the streams draining the plateau.

The important streams in Sathyamangalam Range are the Swarnavathi, Minchikuli halla, Palar, and Kansagiripallam, which are perennial. The semi-perennial streams include the Kumutu halla, Karmadai halla, Dodda halla, Kalkombai halla, Arecadavu halla, Devar halla, Thenravaipallam, Chenikadavan halla, Jodumathi halla, Sagar halla, Bellanathur halla and Kilalathur halla.

In Sathyamangalam Range, drainage is effected by numerous small streams which empty themselves into two big hallas called Jodumathi and Haleru. The Jodumathi is a tributary of the Haleru halla, which in turn empties into the Palar.

The Talamalai basin is chiefly drained by the Jogatti and Balapadagan halla, which unite to form Halibidda halla, again flowing northwards.

CLIMATE

An amazing variety of climate and rainfall is found. Within a short distance of 12 km, the climate changes from the sweltering heat of the hot, arid plains to the cool breezes of the bracing mountains. The plateau enjoys a mild and equable climate favourable to vegetation and, in particular, to sandal. The plains at the foot of the plateau are subject to a hot and dry climate. The conditions obtained in this Division generally range from 'tropical accentuated bioclimate' in the plains to 'tropical moderate bioclimate' on the plateau. This is characterized by a monthly temperature above 20 °C, and an annual rainfall ranging from 500-1500 mm, with a prolonged dry spell.

The normal annual rainfall in this Division is 834 mm, with 49 rainy days. The annual rainfall varies considerably from place to place and year to year. It can fall as low as 399 mm.

Though the Division gets the benefit of both monsoons, the bulk of the rainfall is obtained from the northeast monsoon during the months of September, October, and November. The period from January to April is usually dry, though occasional showers may occur unpredictably. From May onwards, rain falls intermittently upto July, increases slightly between July and September, becomes heavy during October-November, and tapers off in December-January.

FAUNA

A variety of fauna exists in sheltered and secluded locations in the Division. The animals found are the elephant, tiger, leopard, sloth bear, leopard cat, gaur, blackbuck, wild pig, wild dog, fruit bat, langur, slender loris, porcupine, black naped hare, mongoose, etc. The game birds, grey jungle fowl and red spur fowl are found in abundance. The grey quail is most common. Flocks of green pigeons are commonly seen. Several other species of birds are also found.

VEGETATION

Five basic vegetation types are found:

1. Tropical evergreen shola-grassland;
2. Tropical moist deciduous forest;
3. Tropical dry deciduous forest;
4. Tropical southern dry thorn forest;
5. Man-made forests (plantations).

The corresponding Puri et al. (1983) classifications are:

1. a) Shola montane forest;

   b) Grasslands;

2. Climax moist deciduous forest; Tectona-Dillenia-Lagerstroemia lanceolata-Terminalia paniculata series;
3. Dry deciduous forest; Anogeissus latifolia-Hardwickia binata series;
4. Degraded stages of the above.

HISTORY

The Coimbatore North plateau, due to its elevation and the difficulty of the passes that led upto it, climate, dense jungles, and the black fever that ran rife over it, was a territory not much sought after. Hence, an account of its early history is hard to obtain.

However, Tamil literature dating back to the Sangam era abounds with glowing accounts of the Kongu country, comprising Coimbatore and Salem districts. There are graphic descriptions of the forests and wildlife of this tract in early and late literature like Mullaipattu, kurinjipadal of Pathupattu, Purananuru, Pathitripattu of Ettuthogai, etc. During the Chera, Chola and Pandian dynasties, many honoured men of letters described the dense and verdant jungles with trees reaching to the skies.

During the first three centuries of the Christian era, the Kongu country was inhabited and ruled by tribes known as the Mavalar, the Kasar, and the Kongar. In the course of time, they fell under the sway of their powerful neighbours, the Cheras.

At that time, the country was occupied by the Rattas of Maharashtra, and passed on to the Gangas. Till 1279, the Kongu country was under Chola rule. Then, for a short time, it was under the Pandian dynasty, before it passed on to the Sultans of Delhi. In 1368, it fell under the rule of the Hindu kings of Vijayanagar. Krishnadevaraya (1509-1529) appointed Nayakas to rule this land, and they ruled till 1700. The Kongu country was gradually acquired by the Mysore rulers from the Nayakas, and later became a part of Mysore. The Mysore throne was usurped from the ruling dynasty by Hyder Ali, and his son Tippu Sultan succeeded him after his death.

In the days of Tippu Sultan, forests were given special importance. Sandal trees were elevated to the status of 'royal tree', i.e., no private right over the tree was recognized.

With Tippu's death and the fall of Seringapatam to the British in 1799, this area was passed on to the East India Company. For more than half a century after this, no systematic exploitation of the forests was carried out. In 1856, the Forest Department was organized under Dr. Cleghorn and Sathyamangalam, Talamalai and Bhavani were brought under the charge of Morgan.

Sandal:

Regular working of sandal started in Sathyamangalam taluk in 1865. No early records make any mention of timber, bamboo and other forest produce. In 1884-85, Peet explored the area for the selection of Reserved Forests.

The first comprehensive Working Plan embracing the entire Division was prepared by C.R. Ranganathan in 1932. Ranganathan's Plan was revised by V.S. Krishnaswamy and the revised prescriptions brought into force from 1942. Mahmood Hussain took up revision of this Plan in 1954; this came into force from 1956-57. John Joseph's Working Plan (1970-71 to 1979-80) was a revision of the previous Working Plans.

The working of the sandal forests of this Division was begun as early as 1860 and continued till 1895 in an asystematic and irregular fashion. In 1896, P.M. Lushington introduced a provisional Working Scheme for 62 sq mi. The Scheme provided for the extraction of trees over 32 inches (81 cm) in girth. The provisions of this Scheme could not be implemented as the number of workable trees was very large. C.M. Hodgson, in 1917-18, provided for a scheme of extraction of only dead and spiked trees.

These Schemes expired in 1921, and revised Schemes were drawn up by Du Pre Thornton. These Schemes were based on a 3 year felling cycle in Talamalai Range, and only spiked areas in Sathyamangalam Range.

After the expiry of these Schemes in 1924 and 1925, similar Schemes concerning Talamalai and Sathyamangalam were sanctioned.

C.R. Ranganathan drew up the first Plan in 1924, and prescribed formation of two sandal working circles, one for the Reserves and the other for Patta and non-Reserved lands.

The Working Plan of Krishnaswamy, Shanmuganathan and Mahmood Hussain prescribed the same felling series with the same prescriptions. John Joseph (1970-71 to 1979-80) and J.C. Kala (1980-81 to 1989-90) prescribed felling cycles of 3 years also.

Fuel:

In the early years, the practice was to allow tree removal for fuel, excepting teak, rosewood, sandal and tamarind. When the Jungle Conservancy Department was formed, the removal was regulated by issue of free permits for bona fide purposes. Later, a price was fixed for these permits. This practice continued till 1908, when the fuel areas in Sathyamangalam were brought under a Plan. Fuel working circles were formed and worked under a coppice with standards system. It was not until 1915 that the system of leasing coupes to contractors came into vogue. By 1918, an elaborate programme of prickly pear eradication was launched.

To meet the sudden spurt in demand at Mettur due to the project work, a special series was opened in 1927-28. All the areas which were worked for fuel in an asystematic manner were cast into a regular fuel working circle under Ranganathan's Plan. Nineteen fuel series were constituted on a 40 year rotation.

Under Krishnaswamy's Plan, 3 additional Reserve series were created to meet the heavy demand for producer gas charcoal. With the demand for charcoal falling after the war, these heavily worked areas were ordered rest.

Hussain's Plan proposed 16 felling series for Sathyamangalam and Talamalai Ranges on a 30 year rotation. Shanmuganathan's Plan proposed 6 felling series on a 40 year rotation.

John Joseph's Plan provided for the closing of fuel series for some time for recuperation. Seven fresh felling series were proposed.

Kala's Plan provides for a simple coppice system with reservation of sandal, tamarind, neem, soapnut, pongam and gallnut. Coppice rotation is on a 30 year basis. Each series has been divided into 30 coupes of more or less equal extent.

Bamboo:

Bamboos of both large and small variety occur in abundance all over the Division. Under Ranganathan's Plan, a regular bamboo working circle was created on a 3 year felling cycle for 26 felling series. Hussain's Plan continued these series and abolished the distinction between commercial and regular series. All coupes were leased out under open auction. Under John Joseph's Plan, the entire Division was stock mapped. Under Kala's Plan, the system of selection thinning of clumps has been continued. It provides for artificial regeneration by direct sowing of seeds in certain areas. The practice of a 3 year rotation is continued. Each bamboo series has been divided into 3 coupes.

Grazing:

Cattle breeding is one of the major occupations of the people in this Division. In 1912, a grazing fee was being collected. In 1921, the Forest Advisory Committee suggested abolition of grazing blocks. Penning was made free and graziers were permitted to carry knives. Grazing rates were halved in 1938-39. These prescriptions continued in the later Plan, by V.S. Rangaswamy. A rotational system was introduced. However, it was not a success. John Joseph's Working Plan suggested closure of certain grazing areas for silvicultural reasons from time to time. Kala's Plan has also prescribed the same procedure.

Compiled with excerpts from:

1. Hussain, M. (1956). Working Plan of Coimbatore North Division 1956-57 to 1970-71.

2. Joseph, J. (1969). Working Plan for the Coimbatore North Forest Division 1970-71 to 1979-80.

3. Kala, J.C. (1979). Working Plan for the Coimbatore North Forest Division 1980-81 to 1989-90.

4. Ranganathan, C.R. (1934). Working Plan for the Coimbatore North Forest Division, Madras.

ERODE DIVISION

Forest	Range	Area (sq km)
Nilgiri Eastern Slopes RF	Bhavanisagar Range	49.28

TOPOGRAPHY

The forests of this Division lie between longitudes $76^{\circ}59'$ and $77^{\circ}4'$E, and latitude $10^{\circ}31'$ and $10^{\circ}37'$N. They are situated in the Satyamangalam taluk of Periyar district. The Reserve Forest forms the eastern face of the Nilgiri plateau. The ground falls sharply eastward from a maximum altitude of 1300 m to 450 m, and then very gradually to the Moyar valley (274 m) in the north and the Bhavani valley (280 m) in the west. This Reserve Forest extends to the edge of the Bhavanisagar reservoir.

GEOLOGY

Geologically, the entire area belongs to metamorphic terrain of Archean age, comprised of peninsular gneisses intruded by a number of basic and acidic dykes. The direction of foliation of these gneisses varies from NNE-SSW to NE-SW, with varying dips. The major rock types seen in this area can be divided into three broad groups: 1) gneisses group; 2) charnockites group; and 3) acid intrusive rocks, such as granites and pegmatites.

SOIL

Along the hill slopes, the soil varies from patches of black clayey soil to a shallow reddish loam. The soil is mostly devoid of humus. The leaf litter mould which forms each year crumbles into powder in the dry season.

CLIMATE

The lower slopes of the Nilgiri hills are subject to a very hot and dry climate. Strong winds are common in the hot months. During November, December and January, the weather becomes pleasant but never cold. The upper slopes are cooler on account of their higher elevation.

The average rainfall is about 600 mm along the foothills, increasing to about 1000 mm at the upper elevation of the hills. Though some showers of rain are received during the southwest monsoon, the bulk of the precipitation comes from the northeast monsoon. In May, thunderstorms with occasional bursts of rain are common. During the southwest monsoon period from June to September, the tract is subject to strong, desiccating winds.

WATER RESOURCES AND DRAINAGE

Numerous small seasonal streams drain the Nilgiri eastern slopes into the Bhavanisagar reservoir. The northern portion of these slopes drains into the Moyar river upstream of the Bhavanisagar reservoir. In fact, a part of the Reserve Forest lies submerged by the reservoir. The Pungam pallam and Kotagiri halla streams arise on the Nilgiri plateau and drain the eastern slopes.

FORESTS AND VEGETATION

The forests of this tract fall under the following main types:

1. Southern thorn forests (6A/C-1): this type occurs all over

the lower slopes of the Nilgiri Eastern Slopes RF below 600 m;

2. Southern dry mixed deciduous forests (5A/C-3): these occur on the higher slopes of the Nilgiri Eastern Slopes RF above an elevation of 600 m;

3. Phoenix savannah (5/E-8a): this type occurs as a fire subclimax along the upper reaches of the Nilgiri Eastern Slopes RF. These forests originally belonged to the dry deciduous type of forest, but repeated burning has retrogressed them into a phoenix savannah type.

The corresponding Puri et al. (1983) classifications are:

1. Dry Deciduous Type: Terminalia-Anogeissus latifolia-Tectona grandis series.

2. Dry Deciduous Type: Anogeissus latifolia-Hardwickia binata series.

FAUNA

In the comparatively better wooded regions of this Reserved Forest the commoner south Indian fauna are fairly well represented. Elephants are seen moving in herds, and during the dry season, are clustered around streams and sheltered localities. Spotted deer, sambar, mouse deer, wild dog and jackal are common. Carnivores such as tiger and panther are also said to be present.

Many kinds of birds are found. Around the Bhavanisagar reservoir, a variety of water birds like the pond heron, grey heron, kingfisher, etc. are also found.

The reservoir abounds with a variety of fish like catla, rohu, mrigal, labeo, mahseer, and catfish. Other aquatic animals like crocodiles and turtles are also present.

AGRICULTURE AND ANIMAL HUSBANDRY

The area around the Reserve is sparsely populated. It is mainly an agricultural region, although cattle are penned on the outskirts of the forest to supply neighbouring farms. Owing to the low water table and comparatively low precipitation, the rural people mainly cultivate dry crops like millets, maize, groundnut, cereals and pulses. Wet cultivation is practised in some places with water from the Bhavanisagar dam, and paddy, sugarcane and banana are extensively grown in these areas. Inside the Reserve are a few pockets of dry cultivation husbanded by the tribals. Grazing and penning rights are issued by the Forest Department for these forests.

TRIBALS

The hill tribes inhabiting the area are mainly Irulars. There is only one settlement in this RF, totalling 77 members in 1981. They grow dry millets and are employed as unskilled labour for agricultural and forest works.

HISTORY

The early history of these forests would be the same as that of the forests of the Coimbatore Division, since they are contiguous with them and share the same history of the kingdoms which ruled the entire area. Thus this history will be confined to the management and exploitation of these forests since their reservation.

Administration:

The Nilgiris Eastern Slopes RF was notified on March 5, 1886 and revised and amended in 1900 and 1906 respectively. After reservation, it was included in the Mettupalayam Range of the Coimbatore South Forest Division. In 1909-10, it was transferred to Coonoor Range of the Nilgiri Forest Division but was returned to Mettupalayam Range in July 1920. In 1921, Coimbatore Central Forest Division was abolished and the Mettupalayam Range was transferred to the Coimbatore North Forest Division. In June 1961 the Coimbatore North and South Forest Divisions were divided into North, South and Central Divisions and Mettupalayam Range was transferred to the Coimbatore Central Forest Division. In August 1980, the Bhavani Range, along with the Nilgiri Eastern Slopes RF, was seceded from the Coimbatore Central Forest Division and added to Erode Division. This was with the idea of keeping the Forest jurisdiction co-terminous with the revenue district of Periyar district. Coimbatore Central Division was renamed Coimbatore Division.

Working:

Ever since the organization of the Forest Department, sandal was exploited departmentally. No working schemes were drawn up to work these sandal forests till the introduction of C.R. Ranganathan's Plan.

There is no record of any organized fuel working until 1925, when a provisional Working Scheme for three years was introduced. This Scheme provided for a fuel working circle covering 1533.77 hectares, divided into coupes. The method of treatment described was 'simple coppice', with reservation of sandal, rosewood and tamarind. This was continued when the first integrated Working

Plan was drawn up by C.R. Ranganathan.

There was no organized working of bamboo till 1922, when the bamboo areas in the entire Reserve were leased out for a two year period. In subsequent years, permits for bamboo were issued. In 1927-28, all silvicultural restrictions on fellings were withdrawn on account of the seeding of the bamboo.

C.R. Ranganathan included the forests of the Nilgiri Eastern Slopes RF in his Working Plan for the period 1932-42. He included the sandal forests of the Mettupalayam Range (Nilgiri Eastern Slopes forming a part) under a Reserve sandal working circle consisting of two felling series. A felling cycle of 6 years was fixed and only dead sandalwood trees were extracted. He also prescribed regeneration of sandal in small propagation centres along stream banks in favourable localities. However, within a few years it was noticed that no sustained success was possible.

C.R. Ranganathan also constituted a fuel working circle, including the Nilgiri Eastern Slopes. The simple coppice system with a rotation of 40 years was prescribed, reserving sandal, tamarind, kadukkai and rosewood. The area was contracted out and the trees not required by the contractor were also felled in order to reduce the proportion of "useless" species. Artificial regeneration by the method of rab sowing with kumri in worked coupes was prescribed, but the method had no sustained success.

Parts of these forests were included in the village section for bamboo workings. Selection thinning of bamboo clumps was followed, along with the regulation of yield by area.

V.S. Krishnaswamy in his Revised Plan (1943-56) prescribed concentrated plantation of sandal in conjunction with spike resistant hosts like neem, perumungil, etc., but these suggestions were not carried out.

In the fuel working circle, the same prescriptions as C.R. Ranganathan were recommended, excepting the fact that no artificial regeneration was prescribed in the felled coupes, since the resulting coppice was expected to fill the area. Moreover, the Plan specifically prescribed that only those trees required by the contractor be felled. A reserve felling series was created to meet the heavy demand of charcoal during the war years. The whole circle was divided into compartments and subcompartments instead of traditional coupes. Each subcompartment was prescribed to be sold every year. Later, village series were abolished and all coupes were sold in public auction. The felling cycle continued to be three years.

A.M. Mahmood Hussain revised the Plan and his revision came into force on April 1, 1956, valid for a period of 15 years. In the sandal working circle, his prescriptions were the same as that of V.S. Krishnaswamy, except that no tending, climber cutting, or artificial regeneration was prescribed except when necessary.

The fuel working circles of these forests were deleted from working as direct communications to these areas were lost following construction of the Bhavanisagar reservoir. No bamboo working was done in many areas due to their inaccessibility. Thus, only four series were prescribed and worked.

J. Wilson prepared a Revised Plan for the Mettupalayam and

Bhavani Ranges, covering a period of 10 years from 1961 to 1971. The sandal bearing slopes were exploited on a 6 year felling cycle along with enumeration. No fuel working was prescribed in these areas. Bamboo working was followed according to the prescriptions of the Plan.

V. Jayaraman prepared a consolidated Plan for the whole of the Coimbatore Central Division for the period 1972-1982. He reduced the felling cycle of the sandal bearing slopes to 3 years, and prescribed general tending and climber cutting along with enumeration. No fuel working was prescribed in these areas. Bamboo working was carried out according to the previous Plan.

P. Soundarapandian revised the previous Plan in 1980; his revision to be operational from 1982-83 to 1991-92. His is the Plan in current operation. Its stated objectives are: 1) to conserve forests, especially on steep hill slopes, and 2) to exploit the forest resources of sandal and bamboo.

List of Working Plans available in the C.E.S. collection:

1. Jayaraman, V. (1973). Working Plan for the Coimbatore Central Division.

2. Ranganathan, C.R. (1934). Working Plan for the North Coimbatore Forest Division.

3. Soundarapandian, P. (1981). Working Plan for the Bhavani Range 1982-83 to 1991-92.

4. Wilson, J. (1966). Working Plan for the Mettupalayam and Bhavani Ranges of Coimbatore Central Forest Division.

NILGIRI SOUTH DIVISION

(INCLUDING THE RECENTLY FORMED NILGIRI TAHR SANCTUARY)

	Area (sq km)
Udhagai South Range:	
Hiriyashige and Addition	11.86
Kundah Reserve Addition I and V	5.13
Melur Slopes	3.74
Melur West	0.04
Pykara Range:	
Naduvattam	14.20
Naduvattam Extension I - III	2.88
Naduvattam Shola I and II	0.37
Nilgiri Peak and Addition I	24.10
Ouchterlony	3.93
Parson's Valley Range:	
Kadcuppe	6.56
Mukurthi Peak	5.35
Porthimund	28.27
Pichalbethi	6.75
Korakundah Range:	
Kundah	152.05
Mikkerubettu and Addition	5.22
Thaishola	6.21

TOPOGRAPHY

The Nilgiri plateau is an extensive one, about 56 km long and 32 km wide, with an average elevation of 1981 m above mean sea level at the junction of the Eastern and Western Ghats. The western edge of the plateau is bounded by a range of high hills called the Kundah range. This range rises steeply from Silent Valley, Nilambur Valley and Ouchterlony Valley and forms an unbroken wall, except for the Sispara Pass, rising frequently along its length to a series of high peaks, mostly over 2438 m in height. The highest of these are Pichalbetta (2558 m), Mukurthi peak (2554 m), and Nilgiri peak (2475 m). The Kundah range forms an effective barrier to the violence of the southwest monsoon, causing a steep gradient in the rainfall distribution of the area. The Division is situated between longitude 76^{o} 27' and 76^{o} 52'E and latitude 11^{o} 11' and 11^{o} 31'N.

CLIMATE

Although situated in the tropics, the Nilgiri plateau enjoys a subtropical to temperate, equable climate by virtue of its altitude. At Ootacamund, the maximum temperature is 29^{o} C which occurs in July, while the minimum temperature, 4^{o} C, occurs in January. The maximum of the monthly average temperatures is 19^{o} C (in April), while the minimum is 15^{o} C (in January). The intensity of solar radiation is very high and the daily range of temperature considerable except during the monsoons.

The first three months of the year are almost rainless, with many bright clear days during which a dry wind blows from the northeast through January and February, and veers around to the southeast in March. Frost at night is common from December to February. Thunderstorms occur during April and May, and the southwest monsoon bursts during mid-June and lasts until end August. Together, these give almost continuous rain to the plateau. The Kundahs and the western part of the plateau receive heavy continuous rains, whereas the inland areas receive showers alternating with scotch mist. After a break in the rainy weather, the northeast monsoon brings cyclonic rain in mid-September. In November and December, the skies are clear and ground frosts reappear.

The Nilgiri plateau is shaped like a wedge with its apex to the south, and so situated that it receives both monsoons. In the Nilgiri Tahr Sanctuary, the rainfall is around 4000 mm annually. The rainfall diminishes toward the interior of the plateau, but never falls below 1000 mm.

GEOLOGY

The chief rock types present in the area are charnockites, leptynites, and other gneissic rocks of Archaean age, profusely intruded by veins of pegmatite. The rock structures of the region may indicate that they were under the sea at the time of their formation. The rock formations have a distinct ENE-WSW foliation. Dips lie toward the south, and at a few places, a NE-SW foliation has been recorded. The charnockitic series of rocks varies in composition from acidic to ultra basic. Besides the above, ferruginous rocks occur as lenticular patches or ridges amidst the charnockites.

The subtropical climate has facilitated the leaching out of silica from the leptynite charnockite in the process of alteration, and has given rise to bauxite and clay deposits. The deposits of iron ore and bauxite are confined to the hilltops in a few places.

SOIL

The report of the All-India Soil and Land Use Survey places Nilgiri district under the Red and Laterite Soil Region II and has classified the soil of the plateau as Ootacamund soil series. The soils in the area vary in depth from a few centimetres to some metres.

The pH of the soils ranges mostly from 5.0 to 6.5, although in some localities higher or lower values may prevail. The typical soil is of the red variety, with an overlying layer of dark grey porous topsoil of varying depth. In highly eroded areas, the underlying pinkish or yellowish layer is exposed, resulting in small nodules of iron concretions of varying size.

The soils may be roughly classified into: 1) black soil, which is a rich loam; 2) brown soil, which is a clayey loam; 3) yellow soil; and 4) red soil.

A low percentage of calcium is an important feature of the soils. Widespread soil erosion of all types and intensities, including landslips, are common. Bank erosions of streams and rivers resulting in meandering beds are frequently found. Very often streamlets in vulnerable areas form large gullies and deep ravines.

WATER RESOURCES AND DRAINAGE

The general aspect of the plateau is toward the east and the south. The plateau is drained by innumerable little perennial streams. The vast majority of them drain eventually into the Moyar or the Bhavani, and the Moyar itself flows finally into the Bhavani at Peerakadavu on the Coimbatore plains. The Bhavani may therefore be said to drain the entire Nilgiri plateau. The Bhavani is an important tributary of the Cauvery, and waters vast agricultural tracts in Trichy and Tanjore districts.

The network of streams rising from the Nilgiri plateau resolves itself into the following principal river systems:

1. The Pykara river, which arises as Mukurthi stream on the grassy slopes of Mukurthi peak, receives the Krurmund and Parson's valley streams and, draining the extensive western side of the plateau, plunges down a steep valley in a series of waterfalls into the low country near Gudalur. The Pykara is the largest river on the plateau.

2. The Kundah river rises near Avalanche on the inner range of the high hills referred to above, carries the drainage of Emerald and Nanjanad Valleys, flows in a deep ravine separating the Kundahs from the rest of the plateau, and eventually falls into the Bhavani river in the low country, where it is known as the Manar river.

3. There are many dams and reserviors on the plateau used for power generation. They constitute the Kundah Hydro-electric scheme and the Pykara Hydro-electric scheme.

VEGETATION

The forests of this tract exhibit considerable variation in composition, quality, and condition due to altitude, physiography and biotic influences. The geological formation and the differences in rainfall and soil conditions are not sufficient in themselves to account for the diversity of forest types found. The main types occurring in this Division are:

1. Southern montane wet temperate forests;
2. Grasslands;
3. Evergreen scrub vegetation.

The corresponding Puri et al. (1983) types are:

1. Shola montane type;
2. Grasslands; and their degraded stages of
3. Medium elevation evergreen.

FAUNA

The outer slopes and outer ends of valleys and hills which have scrubby vegetation do not contain much wildlife, except for hares, snakes, wild dogs and some common birds.

Elephants are common in Bison swamp localities of Kundah RF. The surrounding areas are a favourite retreat of theirs during the rainy season. Carnivores like tigers and panthers are represented but are rare. Sambar, spotted deer, jackal, wild dog, bear, Nilgiri langur, etc. are common. The Nilgiri tahr or ibex occurs above 1200 m on grassy slopes. Common birds are found, and also crow pheasant, small green barbet, paradise flycatcher, golden backed woodpecker, owls, and hoopoe. The reservoirs have many trout fisheries, handled by the Fisheries Department.

HISTORY

During 1104 and 1141, the Hoysalas in power in Mysore captured the Nilgiri plateau. The first mention of the Todas and the Nilgiris occurs in a record of 1117 A.D., relating to the conquest of the 'Neela Mountains'. In 1310, when the Hoysalas were overthrown by the Mussulmans of Delhi, authority over the Nilgiris descended to Madhava Dannayaka, the son of a Hoysala minister, who took the title 'Subedar of the Nilgiris'.

Early in the 16th century, the plateau fell under the rule of the Hindu kings of Vijayanagar. This dynasty was also overthrown by the Mussulmans, and their vassals became independent rulers. In 1610, Raja Wodeyar of Mysore became the titular possessor of the Nilgiris. There is no information on the activities of the Mysore kings on the Nilgiris, nor on the internal history of the district. No historical material is available for the period from 1610 to the British occupation in 1799. With the fall of Tippu Sultan in 1799, the Nilgiris were ceded to the East India Company. Any direct influence on the forests of the Nilgiris appears to be from the Todas and Badagas, and not from the invaders. The Todas, a pastoral tribe, settled in the Nilgiris at least four centuries ago, a reference being made of their presence there as early as 1602. They only burned the grasslands annually, and so may not have been the ones to destroy the forests. However, the Badagas followed shifting cultivation, and during this time, sholas were rapidly destroyed.

The plateau gained recognition following various adventurous expeditions of British officials from 1812 to 1820. For example, in 1819, John Sullivan made an expedition to the Nilgiris and made the government realize their importance as a site for convalescent sanatoria for army officers. European settlements grew in the area between 1820 and 1830. In 1852, the Nilgiris became a separate district, apart from the Coimbatore and Malabar districts of which it earlier formed a part. Development of the district and the consequent need for timber and firewood destroyed the sholas. The insidious destruction for agriculture by the Badagas also continued. In 1882 the Forest Act was introduced and areas to be protected were selected, mapped and reserved. Efforts to grow eucalyptus eased the fuel problem and saved considerable numbers of sholas from felling.

To prevent large scale destruction of the forests, a clause was introduced in the title deeds of lands granted to private owners, compelling them to replace with saplings all trees felled. Certain better classes of trees were reserved from felling on both private and public land. Apparently, this did not do much good, and hence all fellings in the sholas were completely stopped. In 1852, a conservancy establishment was formed to protect the sholas. In 1858 Dr. Cleghorn was chosen to suggest methods for conservation of the shola forests. He suggested that shola fellings be limited to minimum requirements. However, protection continued to be ineffective. In 1875, all the forests came under the care of the Forest Department. In 1880 all the woods on the plateau were reserved. In 1882, the Forest Act was introduced, as mentioned above.

The Australian blackwood and silver wattle were first introduced in the Nilgiris around 1832 by Captain Dun. The bluegum was first introduced in 1843 by Captain Cotton. In 1853, systematic planting of blackwood and wattle was begun. From 1869-1875, large areas were planted with bluegum in preference to exotic acacias. In 1882, schemes for future management were drawn up by Gamble. He was responsible for the extension of the bluegum plantations. Gamble's Working Scheme (1882-1914) was the first systematic scheme for raising eucalyptus plantations.

Around 1892, there was a glut in the fuelwood market, and Cherry suggested the conversion of plantations into high forests in 1894. Cox's Plan was introduced in 1914. According to his Plan, the bluegum plantations were worked on a 15 year rotation, under the simple coppice system. His Plan was in force till 1928.

Dyson's Working Plan for bluegum plantations was followed from 1928 to 1938. He changed to a 20 year rotation, and converted all acacia plantations to bluegum.

C.R. Ranganathan's Plan (1938-1948) was the first comprehensive Plan, covering all the forests of the Division. This Plan provided for an 18 year rotation for bluegum. Old plantations were worked for timber. Subsidiary acacia felling was given up during this period. The prescriptions of the Plan were followed until 1945. Later, large areas had to be worked for fuel during World War II, and the rotation was reduced to 12 years.

In 1942-43 the practice of selling the coupes in public auction was abandoned. However, the demand increased after 1948 and relief shops were opened to cater to retail purchases. The system of relief shops ceased in 1952. Later, the coupes were sold twice a year to facilitate uniform supply. During the period of Ranganathan's Plan, bluegum timber was tested for use as sleepers, with unsatisfactory results.

In 1905, Sir Francis Spring suggested that hardwood trees from Australia be introduced in the Nilgiris. From 1910 to 1912, several species were planted. Cox's Plan of 1914 did not provide for extension of hardwood plantations. Under Tireman's orders, the planting of grasslands with hardwood species was abandoned.

Dyson's Plan (1928-38) included a hardwood working circle and planting of felled acacia areas. When Ranganathan's Plan came into force in 1938, hardwood plantations were raised, but since the experiments to use the wood for railway sleepers were failures, they were abandoned.

During the period of Jeyadev's Working Plan, most of the remaining areas of hardwood eucalyptus were converted to bluegum plantations. The main changes introduced by Thyagarajan's Working Plan were the reduction of the rotation from a 15 to a 10 year cycle, the increase in the number of felling series from 11 to 25.

Sandal occurs over a small area in Melur slopes RF, Hiriyashige RF and Hiriyashige Addition RF. Prior to 1926, the sandal areas had never been worked on a large scale. In 1926, Dyson's scheme for the extraction of sandalwood came into force. All trees over 91 cm in girth as well as dead trees were to be extracted. In 1932, Bridge's scheme to extract only dead sandal on a 3 year cycle was introduced. C.R. Ranganathan's Plan (1938-48) for the sandal working circle included all sandal areas in the Reserves and non-Reserves. The sandal was extracted on a felling cycle of 3 years and the exploitation was confined to the uprooting of dead trees above 7.6 cm in girth. Thyagarajan's prescriptions included the system of extraction of sandal without rough cleaning.

Since the introduction of regular Working Plans, the rights of minor forest produce collection were sold in open auction. A separate lease unit for each Range was constituted by Thyagarajan's Plan.

From the time they were reserved, the forests were opened to grazing subject to payment of prescribed fees. In earlier years prior to 1895, there was a distinction between agricultural and non-agricultural cattle. In 1914 it was decided that the Division would be divided into grazing blocks and the right of free grazing would be discontinued. In 1926, instead of a grazing permit issued to each block, the permit was made valid for the whole Range. In 1932 the validity was extended to the whole Forest Division. Though grazing was allowed under a permit, certain areas were always closed, or closed for a specified period for silvicultural reasons. Thyagarajan's Plan prescribed the routine closure of all worked coupes and regeneration areas for a period of 5 years including the year of formation.

Scraped fire lines were provided in plantations as a measure of fire protection; nevertheless, fires were all too common, especially in wattle plantations. The protection of the sholas has always been complicated by the longstanding practice of burning the grasslands by the Todas and Badagas to raise new shoots for fodder. This custom was officially sanctioned until 1905. In 1920 Tireman submitted proposals for the regulation of grass burning on the plateau. In 1924, a modified scheme allowing four acres for each buffalo, and allowing burning in one half of the areas allotted to each Toda mund or hundi in rotation, as well as departmental burning were proposed by Currie. In 1926, Dyson revised the scheme by dividing the Kundahs and the adjoining Reserves into five Blocks using natural features as their boundaries. In 1934, Browne effected certain changes: even where the graziers were permitted to burn, this had to be done under departmental supervision. Provision for migratory cattle was made in Ranganathan's Plan by the constitution of grazing blocks around 19 hundis. The burning had to be done once in two years. Under Jayadev's Working Plan, large areas of the Kundah grasslands came under wattle plantations.

The importance of Pyrethrum as an anti-malarial insecticide and in the destruction of ticks and lice was realized during the years of World War II. Cultivation of Pyrethrum began in the Nilgiris in 1943. However, the cultivation of potatoes prior to cultivation of Pyrethrum brought about a decline in the production of the latter. With the cessation of hostilities, the Government of India left the cultivation of Pyrethrum entirely upto the State. Subsequently, the area under Pyrethrum was decreased. According to Larrado's scheme (1948-53), cultivation of Pyrethrum was to be carried out on a 6 year rotation. Jayadev's Working Plan contained a Pyrethrum working circle, but the prescriptions were not followed in fact.

The Working Plan for the Nilgiri South Forest Division for 1974-75 to 1983-84 was prepared by V. Jayaraman. The major part of the two important forest products of this Division, namely wattle and bluegum, had to be set apart for two forest-based industries in the private sector, the South India Viscose and Tan India Wattle Extracts Companies. In the past, a rotation of 15 years was adopted mainly out of consideration for the demand for larger sized billets. The system of allotting areas to the private companies continued, and the standing growth of plantations sold in open auction. All the trees in the lease units were completely clearfelled. Replanting of these areas was done after 5 rotations. Grazing was not allowed for 3 years in new plantations.

The pine plantation working circle had no useful growth, hence no system of exploitation was prescribed. These plantations were also closed for grazing for 5 years from the date of planting.

The minor forest produce in this Division was allotted to the highest bidder in open auction.

Grazing was regulated by the issuing of permits. A maximum grazing incidence of one hectare per cow unit was prescribed for all the Reserves. The entire Division was formed into one unit for the purpose.

Compiled with excerpts from:

1. Jayaraman, V. (1978). Working Plan for the Nilgiri South Forest Division, 1974-75 to 1983-84.

2. Jeyadev, T. (1953). Working Plan for the Nilgiri Forest Division for the period 1st April 1954 to 31st March 1964.

3. Ranganathan, C.R. (1941). Working Plan for the Nilgiris Division 1941-51.

4. Thyagarajan, M. (1964). Working Plan for the Nilgiris Forest Division. Part I. 1964 to 1974.

COIMBATORE DIVISION

Forest	Area (sq km)	Range
Small Sholakkarai	0.39	Bolampatti Range
Bolampatti Block I	58.79	"
Bolampatti Block II	106.51	"
Bolampatti Block III	32.03	"
Th[illegible]agam Block IV	119.35	Perianaickenpalayam Range
A[illegible]ikatti North	7.52	"
Annaikatti South	18.22	"
Annaikatti South Ext'n	4.69	"
Gopinari	98.44	"
Melur Slopes	15.21	"
Pillur Slopes & Additions	15.17	"
Nellithurai	43.30	Perianaickenpalayam Range (25.54 sq km) Mettupalayam Range (17.76 sq km)
Kallar	2.89	Mettupalayam Range
Kallar Additions I & II	10.43	"
Hulical Durg (portion)	10.70	"
Kallur	15.94	"
Adatturai Addition I	0.12	"
Adatturai Addition II	0.24	"
Adatturai	3.16	"
Jakkanari Slopes	25.99	"
Odanthorai	23.52	"
Nilgiri Eastern Slopes	64.60	"
Kandiyur	21.24	"

TOPOGRAPHY

The tract falls between latitudes 10°51' and 11°27'N and longitudes 76°39' and 76°57'E. The forests form the southeastern part of the Nilgiri Biosphere Reserve, covering the eastern slopes of the Nilgiri plateau. Further east stretch the Coimbatore plains. All forests are situated in Coimbatore, Mettupalayam and Avanashi taluks of Coimbatore district. Certain other small Reserved Forests such as Aduthurai and Kallur which fall into Coonoor taluk of Nilgiris district are included in the Mettupalayam Range for administrative convenience. The forests of this Division form an almost compact block lying in the northwest sector of Coimbatore district, bounded on the north and northwest by Sathyamangalam Division and Nilgiris Forest Divisions and on the south and southwest by the Palghat Forest Division of Kerala state.

The tract covered by these forests exhibits a wide range of altitude and diversity in general configuration. Thus, it may be divided into the following units for easy description:

1. The Nilgiri Slopes Reserved Forests:

These forests form the eastern face of the Nilgiris. They may be divided into the Northern Block and the Western Block with reference to the town of Mettupalayam. The Northern Block comprises the Nilgiri Eastern Slopes RF, the Jakkanari RF and the Kallar RF. These Reserves are situated on the outer slopes of the Nilgiri plateau. The ground falls abruptly in all directions except toward the west from a maximum altitude of 1450 m to 450 m, and then gradually to the Moyar valley (275 m) in the north and the Bhavani valley (245 m) in the south and east. The Jakkanari and Kallar RF's lie on uniformly sloping ground. The Western Block includes the Hulical Durg RF, the Pillur Slopes RF, and Nellithorai Block VII. Of these, the Pillur Slopes are the steepest, the ground falling from 1530 m to 450 m. Hulical Durg and the Melur Slopes are on the lower hills at 631.5 m and 1113 m maximum elevation respectively.

2. The Plains forests:

These include level tracts of about 300 m elevation in the Coimbatore plains, at the foothills of the Nilgiri plateau. They include the Velamudy RF and the Odanthorai RF. A part of these

Reserves are submerged by the Bhavanisagar reservoir. They also include the Nellithurai RF and the Gopinari RF, an undulating region with elevation ranging from 400 m to hills of 800 m. The undulating land is dissected by the Bhavani river as it girdles the Nilgiri plateau.

3. The Velliangadu valley:

The Velliangadu valley is shaped like a horseshoe, open to the Coimbatore plains. Its southern limb rises sharply from an elevation of 457-518 m on the plains to over 1500 m, the maximum elevation being 1614 m on Kurudi malai (Nadukandaboli). The northern slopes are gentle, ranging from an elevation of 760 m to 930 m. The head of the valley, which drains eastward, rises gently to 762 m toward the west; beyond this, the country consists of low, undulating hills. The highest peak in these hills is Pullikuttimudi, which is 893.67 m above sea level. This area includes the Thadagam RF, the Annaikatti North RF, and the hilly tract of the Gopinari RF.

4. The Naickenpalayam valley:

The Naickenpalayam valley is also horseshoe shaped, but is much smaller and lies sandwiched between the Thadagam and Velliangadu valleys at their eastern ends. The southern limb of the horseshoe rises sharply from 462.38 m on the Karuvandarayan Koil at the easternmost end to 1614 m on the Kurdimalai (Nadukandaboli), which forms a trijunction from which all three valleys diverge. The western limbs of the horseshoe are much gentler, the slopes rising from an elevation of 457 m at the foot of the hills to 762 m and then petering out into the Palamalai plateau, at the centre of which is the sacred shrine of Sri Ranganathar. The valley includes parts of Thadagam RF and Annaikatti South RF.

5. The Thadagam valley:

The Thadagam valley is horseshoe shaped, opening eastward. The hills on the north and south rise sharply from an elevation of 518-610 m on the plains to over 1534.97 m on Kurdimalai and 1614.53 m on Kurdimalai (Nadukandaboli) to the north, and 1641.35 m on Perumalmudi to the south. But the head of the valley, which drains eastward, rises gently to an elevation of 700 m toward the west, beyond which the country consists of low hills broken up by numerous streams draining westward and northward. The highest peak in these hills is 1032.36 m above mean sea level (Kerkkalmukki).

6. The Bolampatti valley:

The Bolampatti valley is shaped like a horseshoe, opening eastward. In the lower portions of the valley, the ground slopes gently to the east, and the elevation there ranges from 458 m on the Noyilar to 553 m. Above the 553 m contour, the ground rises sharply to the crest of the hill ranges to the north, west and south, the maximum elevations attained being 1996 m on Periakunjira malai at the southwest corner, 1800 m on Vellingiri peak at the northwest corner, and 1523 m on Varadamudi to the north. The hills forming the sides of the horseshoe fall gradually as they run eastward until they merge with the plains near Coimbatore at an elevation of 457 m. The valley includes the Bolampatti RF's.

7. The Walayar valley:

The Walayar valley lies in the Palghat Gap, south of Bolampatti valley. Only a small portion of the valley lying east of the Walayar river in the Bolampatti Block II RF belongs in the Nilgiri Biosphere Reserve. The Bolampatti hills run from west to east, diminishing gradually in height from about 1520 m at the western end until they merge with the plains at Madukkarai.

GEOLOGY

Geologically, the entire area belongs to metamorphic terrain of Archean age, comprising many varieties of rock types. The plains are mainly composed of peninsular gneisses which are intruded by a number of acidic and basic dykes. The direction of foliation of these gneisses varies from NNE-SSW to NE-SW, with varying dips. The hilly regions exhibit a greater diversity of rock types.

The Thadagam, Naickenpalayam and Velliangadu valleys are mainly composed of highly weathered peninsular gneisses. These comprise schists, amphibolites, micaceous and ferruginous quartzites, etc. The schistose and amphibolitic rocks are often garnetiferous.

The northern and northwestern hill ranges are composed of charnockites, basic granulites, norite, crystalline limestone, periodoite, pyroxinite, serpentinite, etc.

Granites and pegmatites occur at many places in the Thadagam valley. Excepting in these places, the hard rock formations are overlaid by greyish, dirty white to pale yellow calcareous rocks known as 'kankar'. These are normally seen along watercourses and are locally known as 'odaikallu'. Limestone occurs at

Madukkarai in the Walayar valley.

SOIL

There are different types of soils in the area, generally shallow in depth. The plain areas are mostly covered by red loamy and sandy soil, reddish brown and brown soil, black clayey soil, etc. Red loamy and sandy soils develop in areas where the country rocks are gneisses, granites, and other leucocratic varieties. In other areas, brown and reddish brown soils and black clayey soils are noticed. Black cotton soil is only present in the Walayar valley and in a portion of Bolampatti valley, where it overlies kankar. In the plains forests, the soil is shallow, thin and stony.

WATER RESOURCES AND DRAINAGE

The area forms the drainage of the Bhavani, the Moyar, the Noyilar, and the Walayar. The northern portion of the Nilgiri hills is drained by the Coonoor, Kallarpallam, Halur halla and Thattapallam rivers, all forming a perennial river system draining into the Bhavani. The RF's drained by them are the Jakkanari, Kallar, Hulical Durg, Melur Slopes, Pillur Slopes and Nellithurai RF's. The northeastern portion of the hills drains into the Patticombai halla, a feeder of the Moyar. This drainage comprises the Nilgiri Eastern Slopes RF. On the Bhavani river system are two reservoirs, adjoining the Nilgiri Biosphere Reserve area: 1) the Bhavanisagar reservoir, into which drain the Velamudy and Odanthurai RF's, and 2) the Pillur dam across the Bhavani, creating a small reservoir within the Biosphere

Reserve. The Nellithurai and Gopinari RF's are adjacent to the dam. The Velliangudi valley is drained mainly by the Bhavani and its tributaries like the Kodungarapallam, the Thekkanpatti pallam and the Manthoraipallam. The Naickenpalayam valley is drained by a number of small streams, of which Rayar uttu is the only one of some importance; this finally flows into the Elerumal pallam and thence into the Bhavanisagar reservoir. All these streams go dry during the summer. The western portions of Thadagam valley drain into the Kodungarapallam and the eastern portions are drained by the Sanganurpallam, a non-perennial stream which joins the Noyilar. The Bolampatti valley drains eastward into the Noyilar, a tributary of the Cauvery. These waters are extensively used for irrigation. The Walayar valley, a part of which is in Tamil Nadu, drains into the Walayar river which flows westward, but which has now been dammed to form the Walayar reservoir.

CLIMATE

Since the area is very heterogeneous, the tract exhibits an amazing variety of climate and rainfall. Within a short distance of 12 km, the traveller is transplanted from the sweltering heat of the hot, arid plains to the cool breezes of the bracing mountains. The tract in general is subject to a very hot and dry climate. The plateau portions enjoy a mild and equable climate. The plains at the foot of the plateau are subject to a hot and dry climate. The average rainfall ranges from about 750 mm on the plains and along the foothills, to about 2000 mm on the hilltops. Generally, the western portions of the area receive more rainfall and are cooler. Though the area receives both monsoons, the northeast monsoons contribute more to the annual precipitation. Thunderstorms with occasional bursts of rain are common during May. During the southwest monsoon, strong monsoon winds rush through the Palghat Gap, and, while emerging onto the Coimbatore plains, form eddies all along the horseshoe shaped valleys of the forests. These winds, when they do not carry moisture, have a desiccating effect. Similarly, the Bolampatti valley gets more wind, and the Walayar valley is swept by strong winds, during both the monsoons.

FORESTS AND VEGETATION

The forests of this Division exhibit considerable variation in composition, quality and condition due to altitude, physiography and biotic influences. The forests as a whole are composed of mixed deciduous species of poor girth and height. In a few favoured and naturally protected localities, the forest attains the density and dimensions of good quality high forests. But a major part of the area consists of dry mixed deciduous species receiving constant setbacks through fire, theft, and overgrazing.

The main forest types occurring in this Division are:

1. Southern thorn forests (6A/C-1):

This type occurs on the shallow and bouldery soils and on the outcrops of limestone, kankar, and gneiss rocks upto an elevation of 1100 m, annual rainfall being 600-700 mm, and climatic conditions being extremely dry. This type of forest occurs all along the lower slopes of the limbs of the horseshoe forming the outer ends of the three valleys upto an elevation of

1067 m in Perianaickenpalayam Range. It also occurs along the head of the three valleys except in the interior Annaikatti South, Annaikatti South Extension, and Gopinari Reserves. It occurs at the eastern ends of the Bolampatti Range also. In the Mettupalayam Range, this type occurs all over the scattered plains forests of the region, as also along the foothills of the hill slopes upto an elevation of 610 m. It is believed that the sandal in these areas originally spread from the Nilgiri hill slopes and the plateau region of Coimbatore North. Natural regeneration of exploited species is generally inadequate in this type of forest.

2. Southern dry mixed deciduous forests (5A/C-3):

In Perianaickenpalayam Range, this type occurs on the slopes of all three valleys above 1000-1200 m, and in the interior areas of Annaikatti South, Annaikatti South Extension, and Gopinari RF's east of Kodungarapallam; in Bolampatti Range, west of the Chunnambu odai in the Walayar valley; and the bulk of the forest in the heart of Bolampatti valley below an elevation of 1066 m. In the Mettupalayam Range, this type occurs along the hill slopes above 160 m, to 1200 m. This type contains sandal growing on almost every type of soil.

3. Phoenix savannah (5/E-8a):

This type occurs as a fire climax in patches on the middle slopes at the head of both Thadagam and Velliangadu valleys in Perianaickenpalayam Range, and along the upper reaches of the Nilgiri Eastern Slopes RF in Mettupalayam Range. These forests originally belonged to the deciduous type mentioned earlier, but repeated burning has retrogressed them to a dry savannah type.

4. West coast semi-evergreen forests (2A/C-2):

In Perianaickenpalayam Range, these occur above 1200 m, in patches in the Thadagam valley. One such patch is seen in Melmudi Rangaswamy koil. In Mettupalayam Range, this occurs above 1200 m along the Nilgiri slopes. A few patches occur in Aduttorai Extension Reserves; in the sholas above Kadamakombai in Pillur Slopes RF; and in Singamalai Kullankeraimalai in Nilgiri Eastern Slopes RF. In Bolampatti Range, it occurs above 1524 m in small patches on Periakunjiramalai, Vellingiri, Koppudukalmalai, and Varadamudi.

5. West coast tropical evergreen forests (1A/C-4):

These occur in small patches on the upper slopes of Bolampatti Block II RF, on the Varadimalai plateau and along the valleys of the Walmukkiar, the Kanavaraiar, the Noyilar, the Anear, the Chinnar and the Mundanthoraiar. The Vateria-Cullenia association occurs at elevations greater than 1200 m along streams throughout the Bolampatti Block II RF. The Mesua-Calophyllum association is seen at elevations greater than 1143 m in the sholas on the Varadimalai plateau of Bolampatti Block II RF.

Plantations:

In addition to the natural forests that have been classified and discussed so far, this Division contains extensive plantations of eucalyptus, teak and miscellaneous species, distributed over a wide range of localities. Farm forestry plantations have been raised on tank bunds and beds under five-year plans.

AGRICULTURE AND ANIMAL HUSBANDRY

Agriculture is the mainstay of the rural population, both dry and wet crops being grown. But wet cultivation is very limited, as the tract is not served by any irrigation canals, precipitation is poor, and the water table is low. Wells are the main source of irrigation, supplemented by tank fed canals. The chief crops raised are paddy, cholam, ragi, maize, groundnut, pulses, sugarcane, cotton, millets and tobacco. About 70% of the population of the tract lives in rural areas. Their holdings are usually small. In spite of scanty and precarious rainfall, the the population has used its water resources judiciously to create lush, green farms all over the harsh and rugged countryside.

The number of cattle grazed is very large. The villagers maintain large herds for dairy products and for farmyard manure. Many of these cattle graze in the forests. During the summers, when water and fodder supplies dwindle in the accessible regions, the cattle are taken into the interior areas and penned there.

TRIBALS

These are Irulars, Muduvars, and Valayars, who live in forest settlements. They work as labourers for the minor forest produce contractors and for the Forest Department. They generally raise millets and ragi, but also a little paddy in some places. There are about 2000 tribals in the Perianaickenpalayam Range, 500 in the Bolampatti Range, and about 120 in the

Mettupalayam Range, according to 1980 estimates.

HISTORY

Tamil literature dating back to the Sangam era abounds with glowing accounts of the Kongu country, comprising Coimbatore and Salem districts. There are graphic descriptions of the forests and wildlife of this tract in early literature like the Mulllaipatti and Kurunji padal of Pattupattu, the Purananuru Pathitrupathu of Ettuthogai, etc. During the Chola, Chera and Pandiyan dynasties, numerous court honoured men of letters have referred to the dense, verdant jungles, with their trees reaching to the skies.

The same Tamil literature gives a glimpse of the region's early history. During the first three centuries of the Christian era, the Kongu country was inhabited and ruled by tribes known as Mavalars, Kasars, and Kongars. In course of time, they fell under the sovereignty of their powerful neighbours, the Cheras. Due to internecine quarrelling between the Cheras, Cholas and Pandiyans, the Kongu country constantly changed hands.

Later, this country was occupied by the Rattas of Maharashtra and passed into the hands of the Gangas, who ruled it from 405-870 A.D. From 880 A.D., the Cholas held sway over the area until 1279 A.D. Then for a short time it was under the Pandiyan dynasty before it passed on to the Sultans of Delhi. In 1368, the Kongu country fell under the Vijayanagar Empire, which appointed Nayaks to rule over it. When this kingdom grew weak in 1700, the Mysore kings acquired the area. The Mysore throne was usurped by Hyder Ali in 1759.

Hyder Ali's successor Tippu Sultan had an intimate knowledge of these forests, and the two chief routes laid by him to the Kongu country bear witness to this even today. In his time, teak and sandal were elevated to the status of "royal tree" and guards called 'Nayyars' were employed to protect the forests.

Coimbatore district came into the possession of the East India Company in 1799, on the capture of Srirangapatna and the death of Tippu Sultan. The Madras Forest Department was constituted in 1859, and in the early years free removal of fuel and other forest produce was allowed, excepting teak, rosewood, vengai, sandalwood and tamarind. In 1860, the Jungle Conservancy rules were passed and came into operation in Coimbatore district in March 1868. Permits for removal of forest produce were introduced. The Monigars of the villages and the Tahsildars were the permit issue officers. These rules failed and no revenue was collected on forest produce. Denudation continued as before. Added to this, the advent of railways gave further impetus to the clearing of jungles for the supply of engine fuel. To consolidate its hold on the forests, the Government next introduced the Madras Forest Act of 1882. The reservation of these forests under the Act started from 1884 onward.

History of administration:

Soon after reservation, the forests of the Bolampatti and Thadagam valleys were constituted as the Bolampatti Range. These were put under Coimbatore South Division. The Walayar valley forests were placed in Palghat Range under the South Malabar Division. The Velamudi RF was included in the Coimbatore North

Forest Division as part of Sathyamangalam Range. In 1906, the Palghat Range, with the Walayar valley, was transferred to Coimbatore South Division. In 1909, when the forests in Coimbatore district were divided into four (North, South, Central and Kollegal) Divisions, all the forests now in the Perianaickenpalayam Range, the forests of Bolampatti and Thadagam valleys, and those of the Mettupalayam Rangewere included in the Coimbatore Central Forest Division. The Nilgiri Eastern Slopes of the Mettupalayam Range was transferred to the Coonoor Range of the Nilgiris Forest Division, but was restored to the Mettupalayam Range in 1920. In 1918, the Attappadi Block IV RF was also transferred to Bolampatti Range. In 1921, the Coimbatore Central Forest Division was abolished and the Mettupalayam Range was transferred to the Coimbatore North Forest Division. In the same year, the Palghat Forest Division was formed, and the Bolampatti and Palghat Ranges were included as part of it. The southern halves of the Thadagam Block IV and Annaikatti North RF's, together with the Bolampatti valley were included in the Palghat Division as a separate entity, the Bolampatti Range. In 1926-27, the Odanthurai RF was transferred to Panchayat management. In 1932, the forests were rearranged, with the Bolampatti Range constituting the whole of the forests of Coimbatore district, and Attappadi Block IV was transferred to the Palghat Range. However, in 1950 this was reversed. In 1951, Panchayat managed forests were abolished and the Odanthurai RF was included in the Mettupalayam Range. In 1956, a new plantation Range was formed at Mettupalayam for raising irrigated teak plantations in Odanthurai RF. Following the reorganization of states in 1956, a general reorganization of the forests occurred in 1957. Attappadi Block IV RF was re-transferred to the Palghat Range, and the Bolampatti Range was included in the Coimbatore North Forest Division. Mettupalayam Range and Mettupalayam irrigated plantation Range were transferred to Coimbatore South Division. In 1958, the Bolampatti Range was transferred to Coimbatore South Forest Division, and Mettupalayam Range and Irrigated Range transferred to Coimbatore North Forest Division in 1959. In 1960, a new Range was constituted, called the Perianaickenpalayam Range, including Thadagam Block IV and Annaikatti North, northern block, and Kandiyar and Gopinari RF's. In 1961, Coimbatore North and South Forest Divisions were reorganized into three Divisions: the North, South and Central. Bolampatti, Perianaickenpalayam, Mettupalayam and Bhavani Ranges constituted the Coimbatore Central Division. In 1980, the Coimbatore North Division was bisected into two Divisions, called Sathyamangalam and Erode Forest Divisions, and Bhavani Range was seceded from Coimbatore Central Division and added to Erode Division. Coimbatore Central Division has since been renamed Coimbatore Division.

History of forest working:

The first attempts to regulate fellings were made by Porter in 1887 for the Bolampatti Block II RF and the portions of Bolampatti Block I RF lying in the Bolampatti valley; but the first Working Plan was written by Gass in 1896. It mainly aimed to regulate the uncontrolled permit system for extraction of wood for fuel from the forests. It prescribed a coppice with standards system of felling, with a rotation of 20 years. Fire protection measures commenced in 1895 were continued by adopting a network of fire lines.

In 1902, this Plan was revised by Foulkes. He drew up separate Plans for the Mettupalayam and Bolampatti Ranges, and the Walayar valley, to fulfill fuel requirements. In the Mettupalayam Range, six fuel working circles and a "compensation" working circle (apparently felling series) were formed. The coupes were to be worked on a 25 year rotation. The Plan came into effect in 1905. The working deviated considerably from the provisions of the Plan, due to great demand. In the Bolampatti Range and Walayar valley, a 'coppice with standards' system with a 20 year rotation was introduced. It was unsuccessful and bamboo, Lantana, etc. got a firmer hold each time the coppice was cut. This system of working was changed to "simple coppice" in Bolampatti valley in 1920 an in Walayar valley in 1923-24. The Plan expired in 1921, but its prescriptions were continued till 1926 for the Walayar valley. In 1908-10, teak plantations were raised in the Bolampatti Range. The results were good and thus the plan was continued. Early burning as a method of fire protection was introduced in 1919.

In 1915, Chengappa prepared a scheme for working bamboos in the Bolampatti valley. The areas worked were those that had then flowered or which were expected to flower shortly. McCarthy introduced a stricter system of exploitation of sandal for the Mettupalayam and Perianaickenpalayam Ranges.

In 1915, Panchapakesa Ayyar prepared a general Working Plan for the whole of the Mettupalayam Range, but it was not approved.

Still, the forests were worked according to its prescriptions from 1920 onward as bamboo coupes. The rotation adopted was 3 to 4 years.

In 1917, Habibullah wrote a Plan for the Mettupalayam and Perianaickenpalayam Ranges. In the Mettupalayam Range, he created two working circles for the timber from vengai, rosewood, velvengai, vellanagai, etc. Improvement fellings on a felling cycle of 15 years were prescribed. These prescriptions were not consistently carried out. By 1929, the Plan was abolished due to poor stocks. Fuel working circles were set up with a coppice with standards system and a rotation of 30 years. The Plan also provided an elaborate scheme for the eradication of prickly pear and _Lantana_, but this was unsuccessful and was abandoned in 1919. In the Perianaickenpalayam Range, four fuel working circles were prescribed, and the coppice with standards system (25 standards per acre) on a 30 year rotation was adopted.

In 1917, the first Working Plan for the Velamudi forests, then a part of Thadagam Range, was prepared by Hodgson. In 1918, a separate Working Plan for the Velamudi forests was drawn up by Dupre Thornton; this continued to operate until the Reserve was transferred to Panchayat management in 1926-27. The two fuel working circles that were opened in 1914 were brought under the simple coppice system, with a 40 year rotation.

In 1925, a Working Scheme was prepared for three years for the Nilgiri Eastern Slopes. Permits for the removal of bamboo but not timber or fuel, were issued, and coupes were completely worked. In 1928, the Working Scheme was revised by Law, who reduced the size of the coupes. But the Scheme was not sanctioned, pending preparation of a general Working Plan for the whole Division.

In 1926, Hicks prepared a revised Working Plan for the Walayar valley for a period of 10 years. In the same year, a Working Plan for Bolampatti Blocks I and II was made by Wimbush. In these Plans, three working circles for fuel were prescribed. The pole working circle prescribed a simple coppice system on a 30 year rotation, assisted by artificial regeneration of blanks with teak. The fellings were carried out according to the Plan, but artificial regeneration was confined to the portions west of the Walayar river in Kerala state. The ponam working circle areas were clearfelled annually and regenerated with teak and other species, but teak regeneration was poor. In the coppice working circle, the simple coppice system was adopted, on a 20 year rotation. Clearings were prescribed but with no artificial regeneration. These Plans also included a bamboo working circle.

In 1930, a Working Plan for the forests of the Thadagam valley was prepared by M.H. Krishnaswamy. This covered a period of 10 years and included prescriptions for the Bolampatti Block III RF also. It included all the fuel forests in the coppice working circle of Thadagam valley. It prescribed a simple coppice system with a 30 year rotation. In the Bolampatti Block III, two fuel series in a coppice working circle were created, and Wimbush's prescriptions were continued. A separate bamboo working circle was adopted for the first time for the Annaikatti South Reserve, and was worked on a 3 year felling cycle.

In 1932, C.R. Ranganathan drew up an integrated plan for the

Coimbatore North Forest Division for a 10 year period. This included the remaining forests in the Velliangadu and Naickenpalayam valleys, comprising Thadagam, Annaikatti North (part), Kandiyur and Gopinari RF's. In his Working Plan, he included the sandal forests under a reserve sandal working circle consisting of two felling series. A felling cycle of 6 years was fixed. The Plan also prescribed the regeneration of sandal in small propagation centres along stream banks in favourable localities. But the tending operations were never seriously attempted. Even village sandal was included in the Plan.

In the Plan, two localities were chosen to raise an irrigated teak plantation in the Mettupalayam Range. Only one of these, the one along the Coonoor river, was taken up in the Hulical RF. The plantation, raised by the kumri method, was a success over a 2 acre plot and the experiment was repeated over adjoining areas in successive years. A rotation of 20 years was fixed for the plantations.

A fuel working circle was constituted in the Mettupalayam and Perianaickenpalayam Ranges, covering all areas on the plains. A 40 year rotation was adopted. Regeneration was mainly carried out by coppice and was supplemented by rab sowing. But the method failed, and the entire area closed to grazing. However, this could not be enforced.

For bamboo extraction, the Plan had two sections, the commercial section and the village section, differing in the agency of exploitation. The method followed was selection thinning of bamboo clumps with regulation of yield by area, and with a felling cycle of 3 years. The Plan constituted a grazing working circle. Complete closure of all the fuel working circles and regeneration areas was prescribed.

Elaborate fire protection measures were prescribed in the Working Plan, but they were drastically reduced in view of their doubtful utility and high cost.

In 1943, the Plan revised by V.B. Krishnaswamy came into force. He prescribed raising sandal in concentrated plantations in conjunction with spike resistant hosts like neem, perumungil, sembulichan, manjakkonai, elandai, etc. None of these prescriptions was fully carried out. General prescriptions were the same as the last Plan.

A new feature of the Plan was the creation of four reserve felling series in the Mettupalayam Range, to meet the heavy demand for charcoal. He also constituted a fuel plantation working circle and kumri regeneration with Casuarina in irrigated areas; Acacia and Albizzia species were also prescribed. The prescriptions were found to be unsuccessful, however, and were abandoned.

In the Perianaickenpalayam Range, the Plan prescribed no artificial regeneration in the felled coupes. This resulted in the complete filling up of the worked coupes with thorny shrubs and climbers.

For bamboo extraction, the distinction between commercial and village series was abolished and all the coupes were leased out in open auction. The felling cycle continued to be 3 years.

The grazing prescriptions continued as in C.R. Ranganathan's Plan. Prescriptions were laid down for the introduction of deferred and rotational grazing, but these were unsuccessful due to poor public cooperation.

Softwood plantations were started in 1953, replacing fuelwood plantations under the 5 year Plans. They failed badly, however, owing to inadequate rainfall and damage by wild elephants.

The Plan restricted fire protection measures to plantations, and prescribed fire tracing of sholas above settlements.

In 1932, T.V. Venkateswara Ayyar prepared plans for the Ghat forests of the Palghat Forest Division, which covered an area of 1035.20 hectares of evergreen forest in the Bolampatti Range. It was worked under the selection felling system. Saleable shola species were extracted. A rotation of 150 years with varying felling cycles was prescribed. This timber was used for railway sleepers. Gap regeneration with useful indigenous shola species and senkurunji (Gluta travancoria) was prescribed for the gaps caused by fellings. Tending of natural regeneration over one tenth of the annual coupe was prescribed to benefit more valuable local species. Since there was a slump in the timber market, these prescriptions were held in abeyance. Later, from 1935, only Mesua was worked for sleepers. Gap regeneration was given up in 1937. No assessment of the tending of natural regeneration was made. This Plan covered a 10 year period, but was not revised till 1956 by van Haeften.

In 1937, a revised Working Plan for the forests of Walayar, Bolampatti and Thadagam valleys was drawn up by T.V. Venkateswara Ayyar. He grouped all the areas in Bolampatti valley fit to grow teak under a ponam working circle. Its object was to replace the existing natural forests of miscellaneous species with even-aged crops of teak in localities suitable for it, and, in the poorer drained areas with _Terminalia tomentosa_ (karimaradu) and _Pterocarpus marsupium_ (vengai) on a 40 year rotation, by the kumri or ponam method. Teak plantations came up well, but the miscellaneous species plantations had only patchy success. Venkateswara Ayyar brought fuel forests under two working circles. In the pole working circle, the rotation was increased to 40 years, 20 years more than the previous rotation. In the fuel working circle, all the workable fuel forests in the plains and on the lower slopes of the valley were considered unsuitable for teak. The simple coppice system was adopted, with a 30 year rotation. The coppice was to be supplemented artificially by rab or ponam methods; these did not fare well.

In Thadagam valley, the Plan replaced the coppice working of M.H. Krishnaswamy by the fuel working circle. Rotation was on a 30 year period, but the coppice was to be supplemented artificially by rab or ponam regeneration with fuel species in suitable patches. Regeneration was not satisfactory. All the bamboo areas in the Bolampatti Range were divided into six felling series and worked departmentally. The Plan prescribed the continuation of the fire protection measures laid down by Wimbush and, in addition, fire tracing of additional lines was prescribed. This Plan covered a 10 year period, but was not revised until 1956 by van Haeften.

In 1956, van Haeften's Plan was introduced, coinciding with the reorganization of the states. Because of this reorganization, the Plan was not adopted on time. Consequently van Haeften's prescriptions were extended, though most of the working circles had been subjected to several amendments.

In 1956, A.M. Mahmood Hussain revised the previous Plan; his revision was in force for a period of 15 years. Sandal was worked just as in the previous Plan. More area was brought under the irrigated teak plantation in the Mettupalayam Range. The Plan constituted a fuel working circle with only three felling series. The method of treatment prescribed was the same as simple coppice, but the rotation was reduced to 30 years. No artificial regeneration was prescribed. In the Perianaickenpalayam Range, two felling series were prescribed. For bamboo working, there were four series in the Mettupalayam Range. Grazing was closed in all worked coupes and regeneration areas for a period of five years. Fire protection was carried on along as in the previous Plan.

In 1961, J. Wilson wrote three Working Plans, one for the Bolampatti Range (1962-72) revising van Haeften's Plan; the second for the Perianaickenpalayam Range (1963-73) revising van Haeften's and A.M. Mahmood Hussain's Plans; and the third for the Mettupalayam Range (1963-73), revising A.M. Mahmood Hussain's Plan.

For the sandal Reserves of the Mettupalayam and Perianaickenpalayam Ranges, the prescriptions were the same as those of the previous Plans. Sandal propagation centres were suggested for the Bolampatti Range, but the suggestions were not carried out.

The timber bearing areas of the Bolampatti Range were placed in two series under the selection working circle. All timber of exploitable girth could be removed. The rotation was 120 years, with a felling cycle of 20 years. No work was done till 1969-70 due to the difficult nature of the terrain. Later, a few coupes were worked.

In the Perianaickenpalayam Range, the Plan had 19 fuel series, with a 30 year rotation. The artificial regeneration prescribed was not taken up consistently.

The usual routine of closing all worked coupes and regeneration areas for a period of five years was continued.

The Plan prescribed fire tracing all around residential areas. Other prescriptions similar to those of the previous Plan were also suggested.

In 1972, V. Jayaraman revised J. Wilson's Plan and made a single Plan for all the Ranges of the Coimbatore Central Forest Division.

In this Plan, the felling cycle of sandal was reduced to 3 years; since the sandal bearing tracts near the Kerala border were vulnerable to theft, a shorter felling cycle was used. The village sandal felling series was to be worked every year.

In the Bolampatti Range, timber extraction of all exploitable girths was carried out, with a felling cycle of 20 years and a rotation of 120 years. No gap regeneration was considered necessary.

In the Perianaickenpalayam Range, fuel working circles were worked according to the previous Plan. To arrest further degradation of the forests, a ban on the felling of natural forests was imposed. It was stated that fuel coupes had to grow back to their original status after completing their rotation period. Thus, working of many of the fuel coupes was discontinued.

Bamboo exploitation from the Bolampatti Range was continued. Bamboo coupes were sold by public auction to paper mills.

Teak plantations in Bolampatti were worked, but no new plantations were proposed.

Fire protection measures were continued as in the previous Plan. V. Jayaraman also prescribed payment of rewards to hill tribes in settlements, as an incentive to fire protection.

In 1980, the previous Plan was revised by P. Soundarapandian for the reorganized Coimbatore Division which is currently operational.

Compiled from excerpts from:

1. Hussain, A.M.M. Working Plan of Coimbatore North Division.
2. Jayaraman, V. (1973). Working Plan for the Coimbatore Central Division.
3. Raganathan, C.R. (1934). Working plan for the North Coimbatore Forest Division.
4. Soundarapandian, P. (1981). Revised Working Plan for the Coimbatore Division.
5. Wilson, J. (1965). Working Plan for the Perianaickenpalayam Range of Coimbatore Central Forest Division.
6. Wilson, J. (1966). Working Plan for the Mettupalayam and Bhavani Ranges of Coimbatore Central Forest Division.