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BIODIVERSITY IN TROPICAL MOIST FORESTS: A STUDY OF SUSTAINABLE USE OF NON-WOOD FOREST PRODUCTS IN THE WESTERN GHATS, KERALA

Monitoring and Evaluation of Ecological and Socio-economic Variables

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ABSTRACT

The present study on Monitoring and Evaluation of Ecological and Socio-economic Variables is a continuation of the earlier one on Biodiversity in Tropical Moist Forests: A Study of Sustainable Use of Non-wood Forest Products in the Western Ghats, Kerala. This was carried out in Wayanad and Nilambur forest areas during the period April to December 1998, with the aim to monitor, evaluate and update data on ecological and socio-economic variables which have been collected during the first phase of the study. In addition, an attempt was also made to examine diversity, distribution and biomass production patterns of selected Non-wood Forest Product (NWFP) species in Wayanad Forest Division.

All the NWFP species, enumerated at Wayanad and Nilambur in the previous study, were also recorded when inventory was done during this study. In Wayanad, the natural forests cover an area of about 243 km^2. In these forests, *Asparagus racemosus, Costus speciosus, Curcuma aromatica, Desmodium velutinum, Dioscorea pentaphylla, Hemidesmus indicus, Phyllanthus amarus, Pseudarthria viscida, Sida rhombifolia, Solanum indicum* and *Solanum viarum,* are some of the important NWFPs being collected by the tribal people during August-December every year. These species were studied for their density, distribution and biomass production patterns. Among the species studied, *Sida rhombifolia* showed highest density followed by *Costus speciosus.* However, standing biomass of useful part/s was highest in the case of *Costus speciosus* followed by *Asparagus racemosus.* The study also indicated that Wayanad harbours a biomass worth of about Rs.49,32,633 in respect of the above 11 NWFP species. There are differences in the distribution and quantity of biomass of useful part/s of any given NWFP species among the four Forest Ranges in Wayanad. Based on this the Forest Ranges are arranged in the descending order of harvesting intensity of NWFP species.

Most of the NWFPs, having medicinal properties, are consumed by the pharmaceutical companies and other traditional users. Based on their demand, nine medicinal plants such as *Adhatoda zeylanica, Aegle marmelos, Holostemma ada-kodien, Rauvolfia serpentina, Saraca asoca, Cosciniumfenestratum, Kingiodendron pinnatum, Symplocos cochinchinensis* and *Trichosanthes cucumerina* were selected for propagation and

enrichment planting in the study areas. Attempts were made to propagate these medicinal plants on large scale and results indicated that selected species can be propagated using simple methods.

An attempt was also made to update the data relating to socio-economic aspects of collection, marketing and living conditions of selected tribes collected during the first phase of the study. The analysis showed a significant increase in the quantity of NWFPs collected during the period 1982-83 to 1997-98 with variations in different years. Further, the collection charges received by the gatherers of NWFPs and sale value realised by the authorised marketing agency of the products, viz. Kerala State Scheduled Caste and Scheduled Tribe Development Co-operative Federation Ltd (an apex body of Tribal Service Co-operative Societies in Kerala) also showed an increasing trend. However, because of inflation, the increase in the collection charges of the gatherers has not brought about a corresponding increase in their real income. The socio-economic condition of the selected tribes during the study period did not change much from that of recorded earlier.

INTRODUCTION

Non-wood Forest Products (NWFPs), which include all goods of biological origin as well as services derived from forests except wood, are a group of economically and medicinally important plants/products. Majority of the rural people throughout the tropics rely on NWFPs primarily due to its importance in enhancing their income. On a global scale, for example, approximately 80 per cent of the world's population is believed to depend, to some extent, on medicinal plants (Famsworth, 1988). The idea that sustainable extraction of NWFPs to provide an alternative to deforestation and ensure biological diversity in tropical forest is also becoming popular (Plotkin and Famolare, 1992; Uma Shankar *et al.,* 1998).

Biological diversity encompasses the variety, variability and uniqueness of genes, species and the ecosystems. NWFPs form a significant proportion of the forest biodiversity in tropical countries. Of late, there is widespread concern over the depletion of biodiversity of NWFPs. This occurs mainly due to habitat destruction and over exploitation, which are resultant of a variety of factors such as population growth, increased demand, implementation of plantation programmes and inappropriate management practices and policies. These products are used by a variety of interest groups, ranging from individuals to multinational companies. NWFPs play a vital role in generating income and employment, especially among the weaker sections of the society. In this context, maintaining the biodiversity and promoting sustainable utilisation of NWFPs through appropriate management strategies are of great significance. The socio-economic and ecological factors, along with appropriate management practices affecting the sustainability of NWFPs, differ from state to state in a country and even within a state. Under such circumstances, a micro-level study of the topic is more revealing in formulating appropriate strategies for their development. Keeping this in view a study entitled "Biodiversity in Tropical Moist Forests : A Study of Sustainable use of Non-Wood Forest Products in the Western Ghats, Kerala", was undertaken during the period 1994 to 1997. The above study, carried out in three different localities in the State, viz. Wayanad, Nilambur and Attappady, brought out many interesting results regarding the subject (Muraleedharan *et al.,* 1997). The present study is a follow up of the earlier one mentioned above and aims to monitor, evaluate and update data relating to some of the ecological and socio-economic variables in the study areas.

Collection and management of NWFPs: Kerala scenario

The physical configuration of the State of Kerala is classified into lowland, midland and highland. With a total area of 38863 km^2, Kerala, which is spread along the west coast of peninsular India lies between 8^o 18' and 12^o 48' North latitudes and 74^o 52' and 77^o East longitudes. The forests of Kerala cover an area of 11,222 km^2, of which the moist forests consisting of evergreen, semi-evergreen and moist deciduous types constitute 80 per cent of the total forest area (KFD, 1994). Kerala, with a density of 749 persons/km^2 is one of the most densely populated States in India (Government of Kerala, 1993).

The moist forests in the State provide a variety of NWFPs besides major products, like timber, firewood and small wood. They can broadly be categorised into groups of edible products, medicinal plants, toiletries, tans and dyes, gums and resins, rattans, bamboos, grasses and animal products. In all, 500 species providing NWFPs are found in the forests of Kerala, of which .the Forest Department has listed out 120 as commercially important.

In Kerala, the tribal communities have been engaged in the collection of NWFPs since time immemorial. The dawn of colonial rule brought about vivid changes in the collection scenario. The Britishers allowed different agencies (private contractors) besides the tribal people to collect NWFPs on an annual lease basis. Since 1915, the local people were issued free passes to collect thatching materials by the government. Under the cover of 'seignorage permits' they were allowed to collect products like bamboos, reeds, rattans, manure leaves, etc. In the 1940s, the extraction of honey and wax, skins, ivory and gurjan balsam was done departmentally for a stipulated period and other items were leased out to private traders. The lessee collected only those items which fetched him a good remuneration.

In 1978, the right of NWFP collection was granted to the tribal people by the State government. Tribal Service Co-operative Societies (TSCS) meant for the welfare of the tribes were started with membership reserved only for the same. The ultimate aim of TSCS is to ensure a righteous amount for the products collected by the tribes and to protect them from being exploited by the middlemen. No evident change was observed in the gatherers' standard of living in spite of the establishment of TSCS. Thus, in perception of this problem, in 1981 an apex body of the TSCS was formed, viz., the Kerala State Scheduled Caste and Scheduled Tribe Development Co-operative Federation Ltd. (Federation). The Federation has been entrusted with the right of

monopoly procurement and sale of all NWFPs collected by the societies. The commercial extraction of selected NWFPs introduced by the Federation, keeping trading prospects in view, has led to its over exploitation.

Subsistence extraction of NWFPs, giving importance to sustainability, was followed by the tribal communities before the establishment of these institutions. Of late, the tribal people have resorted to unsustainable extraction practices. This is the result of population pressure, shrinking resource base, increasing demand, etc. Furthermore, the illegal collection by the non-tribals has led to the depletion of NWFPs. In Kerala, NWFPs are not properly exploited and managed, as some species are over exploited and some others are not fully extracted, resulting in change in the species composition, density, regeneration and availability and level of biodiversity (Muraleedharan *et al.,* 1997).

In the State most of the tribal communities depend on NWFPs for their subsistence and income needs. The interest groups who are concerned with the sustainable use of NWFPs in Kerala are the Forest Department, the Federation, the TSCS and the pharmaceutical companies, in addition to the tribal communities. A Minor Forest Products Committee (MFP Committee) chaired by the Chief Conservator of Forests, takes all the decision relating to collection, allotment of forest ranges, fixing lease rent, purchase and selling prices of the collected NWFPs. The Forest Department and Federation, as per the MFP Committee's decision, give instructions to the local Divisional Forest Officer (DFO) and Branch Managers for signing the contract for collection. Then, the Federation's branch managers engage the societies for collection who in turn employ the tribal people for the same. In general, the Forest Department Officials are supposed to supervise the collection procedure. In the management of NWFPs in the State, there is a participation of different interest groups unlike timber resources which are managed by the Forest Department. Among the different types participation the most important ones are participation from above and below. While the former is mobilisation from above, the latter constitutes distribution of power at the grass root level. The present system of management of NWFPs can be categorised as participation from above in which the decisions regarding collection and marketing are taken by the MFP Committee, the Forest Department and the Federation and thrust upon societies and tribes who obey the same (Muraleedharan *et al.,* 1997).

In the first phase of the study, altogether 229 NWFPs were recorded. Of this only about 50 commercially important items were being harvested repeatedly. However,

comparatively better density and distribution of population were observed only for 50 per cent of the commercially exploited species. Percentage of regeneration was found to be higher in the case of species regenerated through vegetative means while it was poor in the case of species regenerated through seeds. The relationship between regeneration rate and harvesting intensity was found to be negative. Furthermore, in the study area actual harvesting was noted to be significantly higher than sustainable harvesting. Thus, poor regeneration of certain species, especially those regenerating through seeds and intensive harvesting of commercially important species, affected the biodiversity of NWFPs in the selected areas. Apart from ecological factors, some of the socio-economic variables like illegal collection of the products by the non-tribals, repeated collection of certain highly demanded products and faulty marketing practices have also contributed significantly to the existing state of affairs.

Most of the NWFP species in the State are seasonal in nature. There are certain physical factors like temperature, rainfall, etc., that affect the growth and availability of the species, which calls for close monitoring of data. From the ecological and socio-economic stand point, one of the most essential ingredients required to achieve sustainable resource use is information. Continuous data on ecological, propagation and socio-economic aspects are essential to evaluate the change in the level of biodiversity and sustainable use of NWFPs. Keeping this in view, this study was undertaken with the objective to monitor, evaluate and update data on some of the ecological, propagation and socio-economic aspects of NWFPs in two selected places of the Western Ghats of Kerala, viz. Wayanad and Nilambur. In addition, a detailed study on spatial variation in the distribution, density and biomass production pattern of some selected NWFP species in Wayanad was also undertaken. This part of study attempts to identify sites with comparatively more biomass production of a given species so that specific areas could be suggested for relatively more intense biomass.

STUDY AREAS

This study was restricted to two localities, viz. Wayanad and Nilambur, in the Western Ghats, Kerala. Wayanad located in the north-eastern part of Kerala, lies between 11° 35' and 11° 51' North latitudes and 76° 02' and 76° 27' East longitudes (Figure 1). With an area of about 344 km^2 the forest areas of Wayanad form a part of the western portion of the Nilgiri Biosphere Reserve (Gopinathan, 1990). Here the natural forests

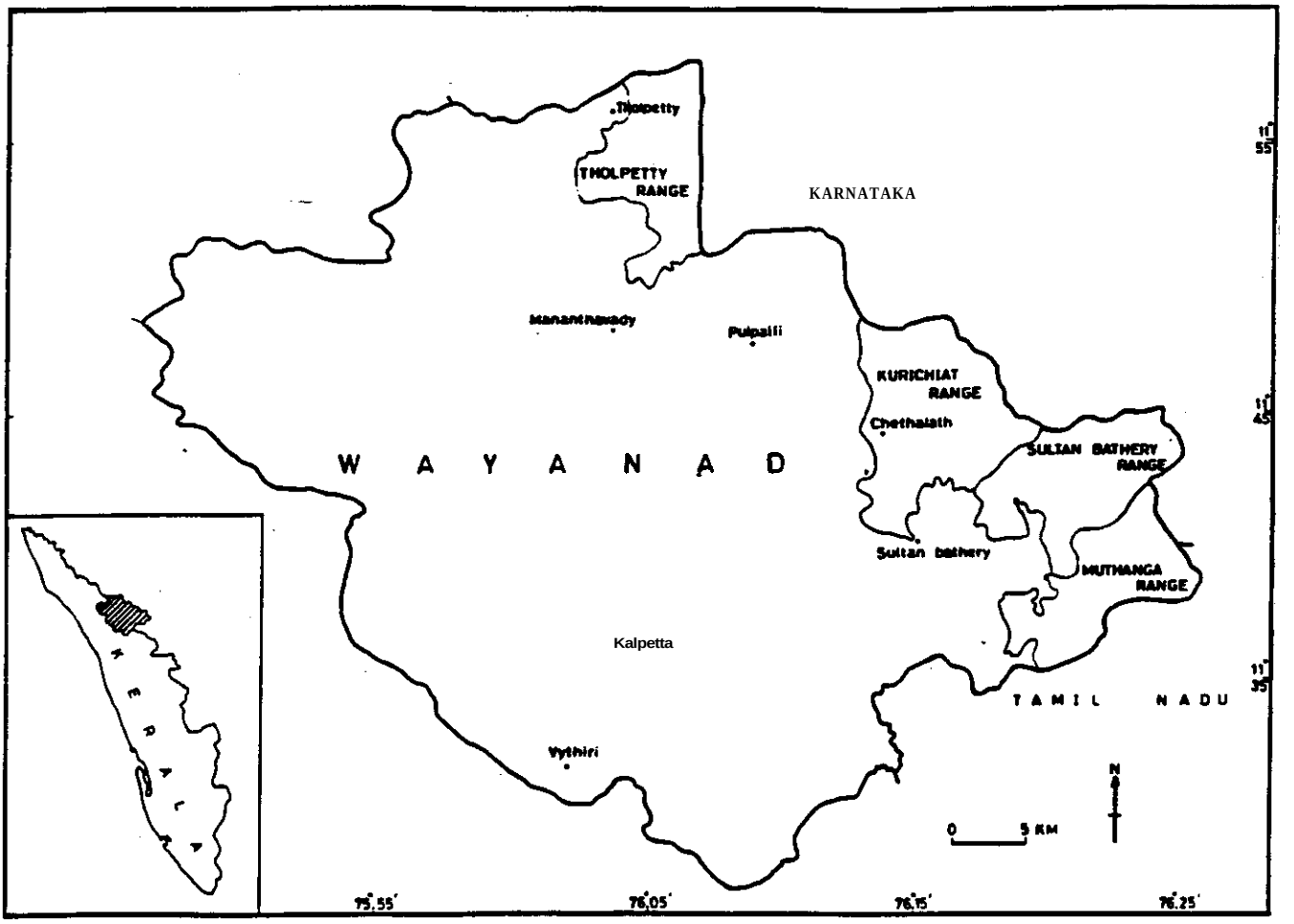


Figure 1. Map of Wayanad district, Kerala

cover about 243 km^2 while the remaining area is under plantations. The area is in the Wayanad plateau and enjoys a fairly cool climate. The temperature ranges between 15^o and 29^o C and the annual rainfall is between 2000 and 3000 mm.

Nilambur is located in Malappuram district of the State and has an elevation ranging between 40 and 2500 m above mean sea level. The temperature varies between 17^o and 37^o C and the annual rainfall ranges from 2500 to 3500 mm. Total area under forests is 760 km^2, consisting of evergreen, semi-evergreen, moist deciduous forests and plantations.

METHODS OF STUDY

Diversity of NWFP species

During 1995-1997, a list of NWFPs was prepared based on sample enumeration of plants by laying transects in the forests of the Wayanad and Nilambur Forest Division. Three replicate transects of 1 km length and 10 m width were laid at random to represent all vegetation types in each site. All the plants including herbs, shrubs and trees in the transects were identified (Muraleedharan *et al.,* 1997). During July-September 1998, these transects were revisited and enumeration of NWFPs plants was carried out, as done during 1995-97, with the assistance of tribal people engaged in the collection of NWFPs.

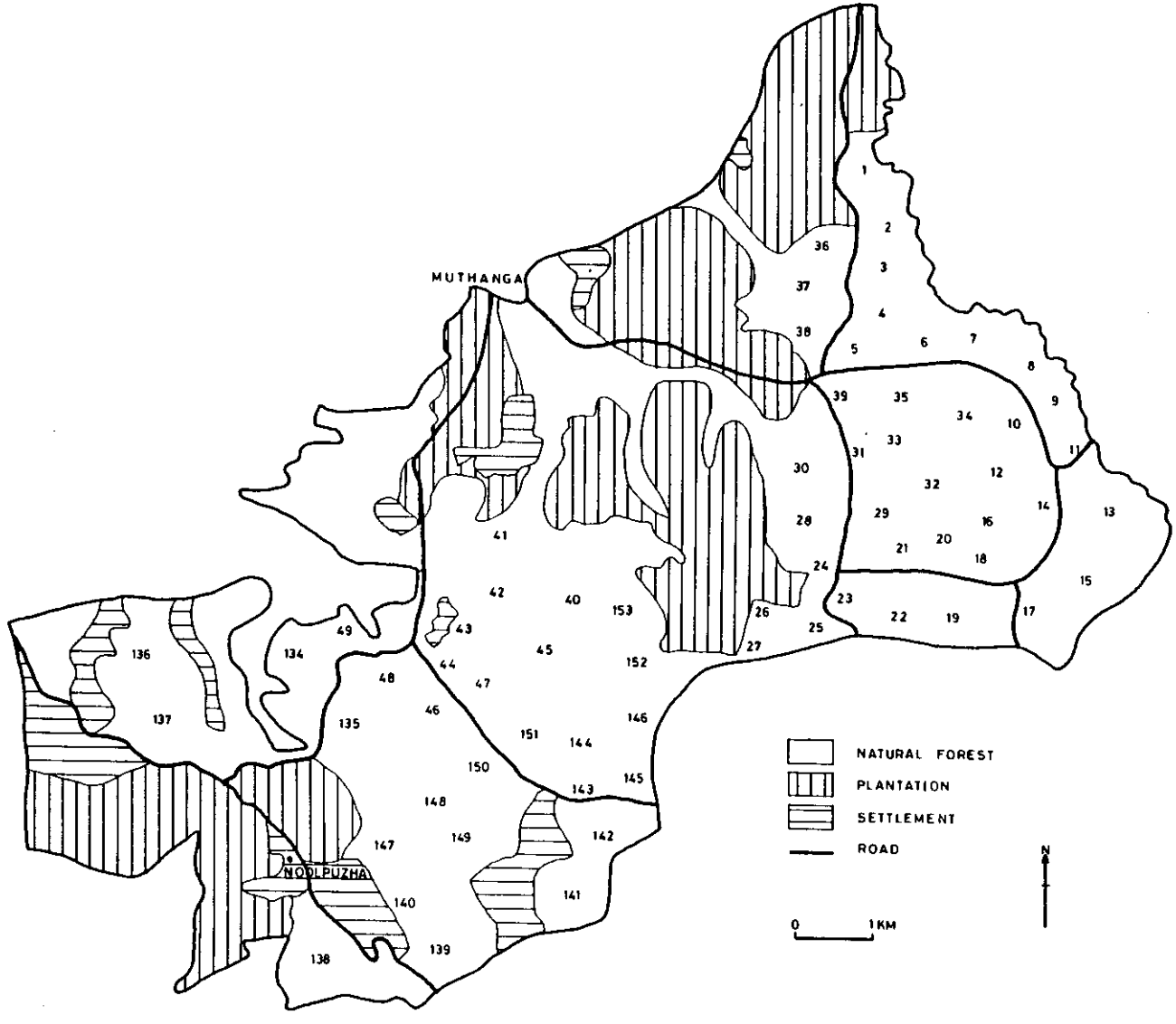
Fifteen quadrats, each of 20 m x 20 m size established in Wayanad and ten quadrats, each of 15 m x 15 m size established in Nilambur during previous study period were revisited and used for the quantitative analysis of NWFPs population. Density, abundance, frequency and Importance Value Index for the selected NWFP species and specics diversity of each study site were determined following the methods described by Phillips (1980).

Distribution, density and biomass production

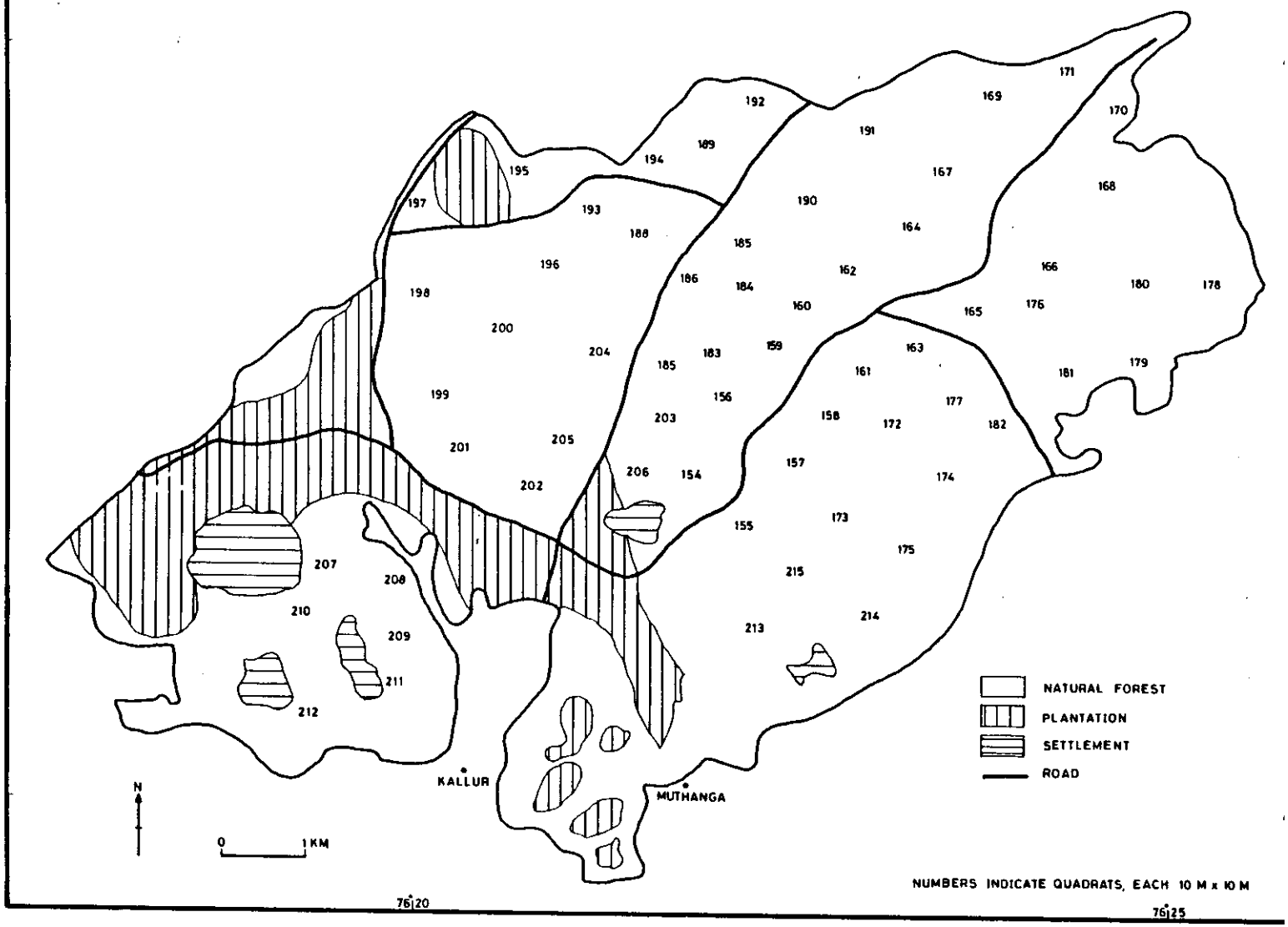
This study was restricted only to the Wayanad Forest Division. In the land cover map of Wayanad, grids of 1 km^2 were marked in the natural forest area (243 km2). In each grid, one quadrat of 10 x 10 m was laid. Thus, a total 243 quadrats : 83 in Kurichiat Forest Range (Kurichiat FR), 62 in Sulthan Bathery Forest Range (Sulthan Bathery FR), 70 in Muthanga Forest Range (Muthanga FR) and 28 in Tholpetty Forest Range (Tholpetty FR) were established (Figure

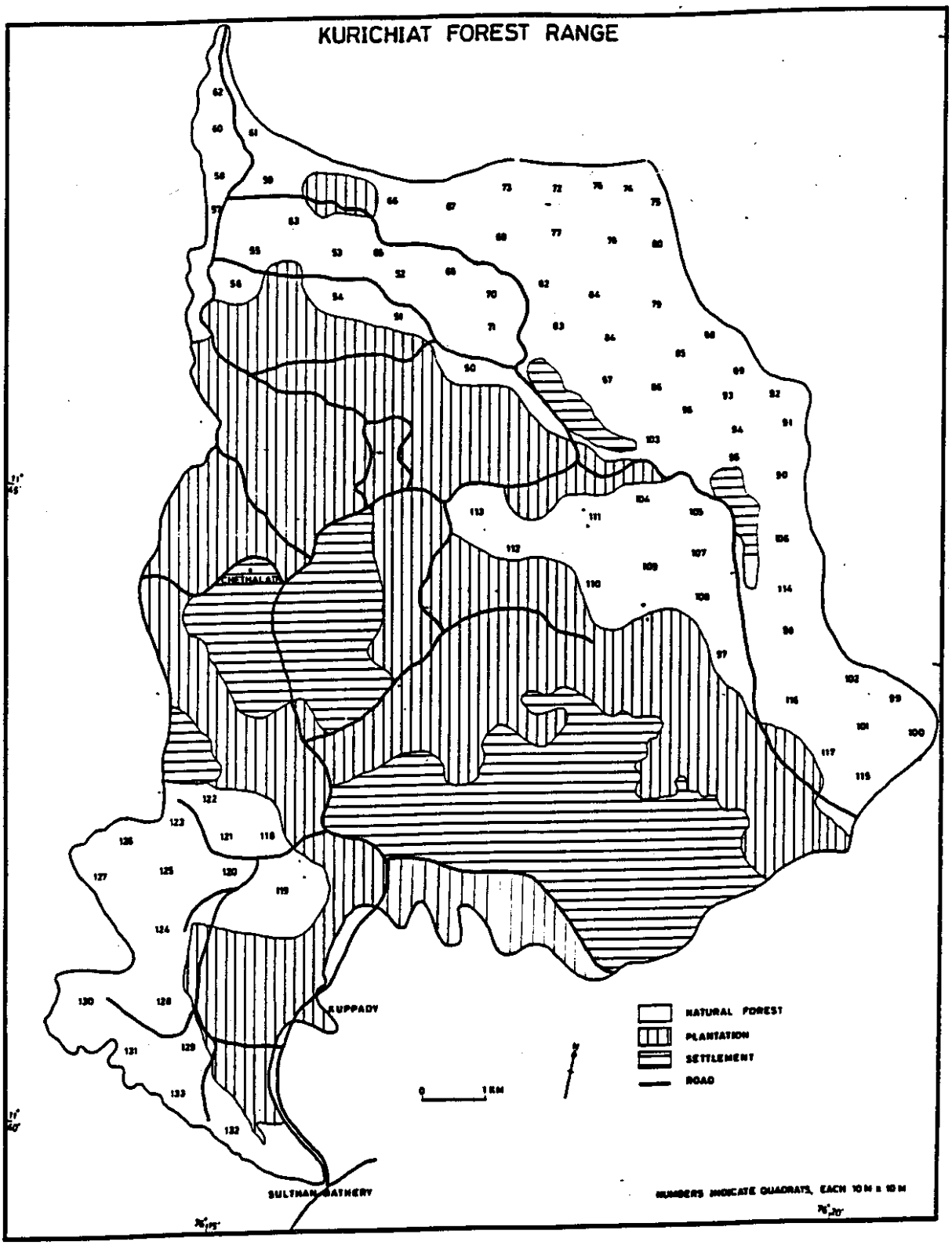
Figure 2. Maps of differentForest Ranges in the Wyanad Wildlife Sanctuary, Kerala showing quadrats established in the natural forests.

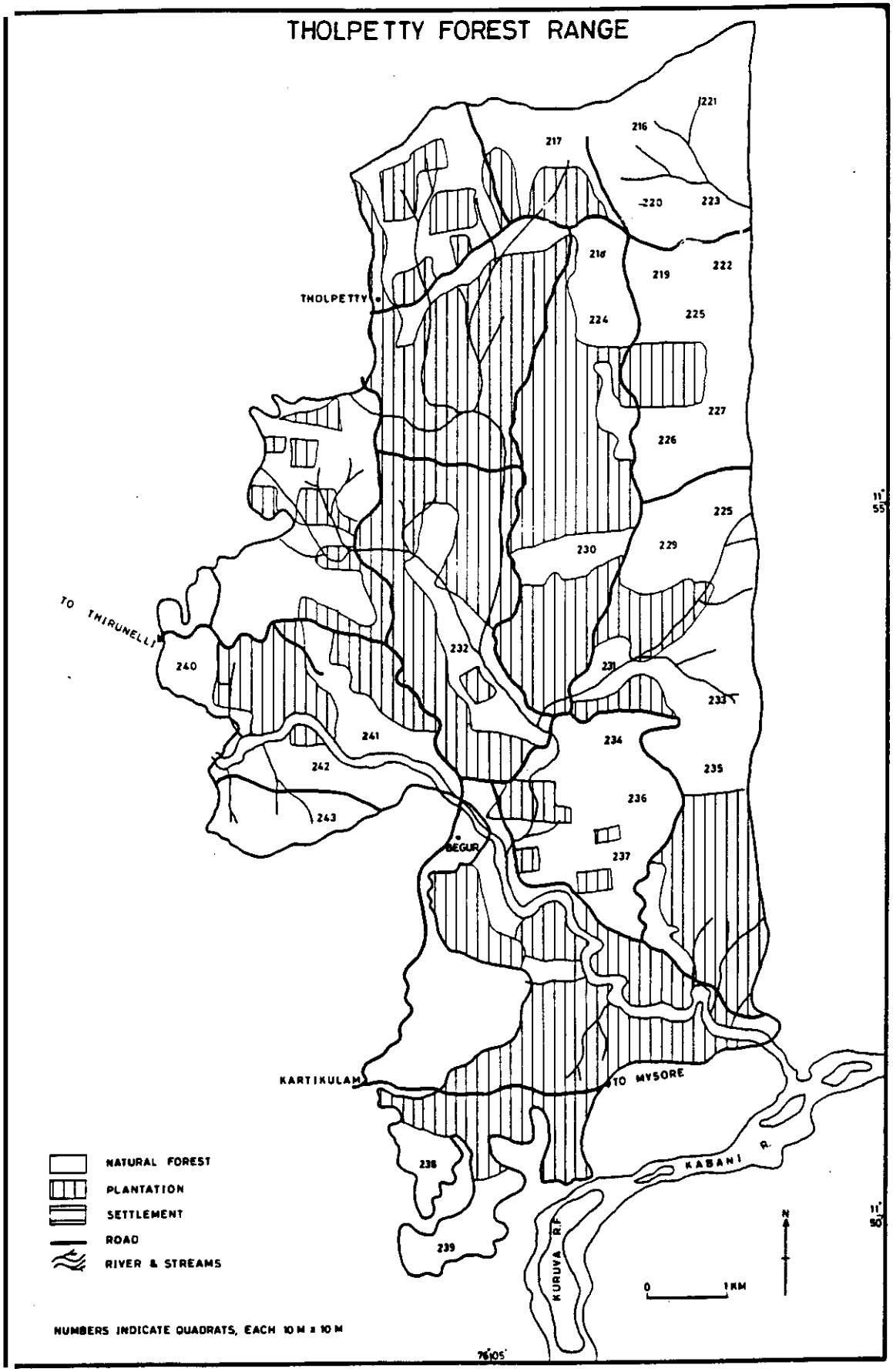
MUTHANGA FOREST RANGE



SULTAN BATHERY FOREST RANGE




KURICHIAT FOREST RANGE
KUPPADY
SULTHAN BATHERY
NATURAL FOREST
PLANTATION
SETTLEMENT
ROAD
0 1 KM
NUMBERS INDICATE QUADRATS, EACH 10 M x 10 M


THOLPETTY FOREST RANGE
THOLPETTY
TO THIRUNELLI
KARTIKULAM
TO MYSORE
BEGUR
KABANI R.
KURUVA R.
NATURAL FOREST
PLANTATION
SETTLEMENT
ROAD
RIVER & STREAMS
NUMBERS INDICATE QUADRATS, EACH 10 M x 10 M
0 1 KM
N
11° 55'
11° 50'
76° 05'

Eleven NWFP species extracted during the period August-December were selected (Table 1) to study their distribution pattern, density and stand biomass in the study area. The presence and absence of these selected species were recorded in each quadrat. If a given species was present in a quadrat, its individuals were enumerated. The density was calculated as the total number of individuals in unit sample area while frequency was calculated as number of quadrats of occurrence divided by the total number of quadrats studied.

Table 1. Non-wood Forest Product (NWFP) species studied at Wayanad

Botanical name	Common name	useful part/s	Use(s)
Asparagus racemosus Will	Sathaveri	Tuber	Fc medicine
Costus ***speciosus*** (Koenig) Sm.	Channakoova	Tuber	Medicine
Curcuma aromatica Sal.	Kasthuri mania1	Tuber	Medicine
Desmodium velutinum (Willd.) DC.	Orila	Root	Medicine
Dioscorea pentaphylla L.	Noora	Tuber	Food
Hemidesmus indicus (L.) R.Br.	Nannari	Root	Flavouring material and medicine
Phyllanthus amarus Schum.&Thonn.	Keezharnelli	Whole plant	Medicine
Pseudarthria viscida Wt. & Am.	Moovila	Root	Medicine
Sida rhombifolia L.	Kurunthotti	Root	Medicine
Solanum indicum L.	Puthirichunda	Root, stem	Medicine
Solanum viarum Dunal.	Kandakarichunda	Root	Medicine

To estimate the biomass, twenty five plants of each species were randomly harvested from each study site. The parts of individual plants of each species were further separated into the main stem, branches, leaves, roots and tubers and air-dried till constant weight was obtained and mean weight was calculated. Biomass of each species was estimated considering the density and the mean weight. Biomass of useful available from unit area of the forest was also estimated.

Methods employed for propagation of selected NWFP species and sources and type of data used to analyse socio-economic aspects are mentioned in the respective headings.

RESULTS AND DISCUSSION

Ecological aspects

Diversity of NWFPs

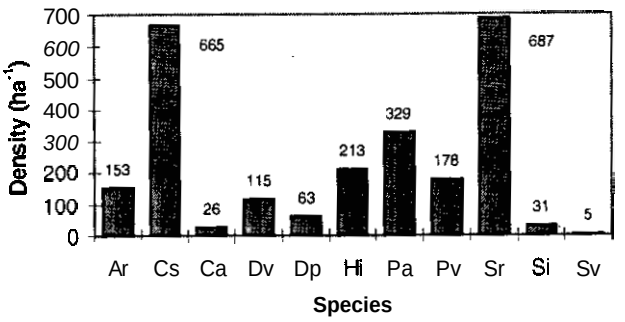
All the NWFP species : 153 species from Wayanad and 91 species from Nilambur recorded in the previous study (Muraleedharan *et al,*. 1997) were also recorded when inventory was done during July-September 1998 (Appendix I). Density of tree, shrubby and herbaceous NWFP species did not vary much in the one year period. The species diversity value remained comparatively higher in the Wayanad site than in the Nilambur site (Table 2).

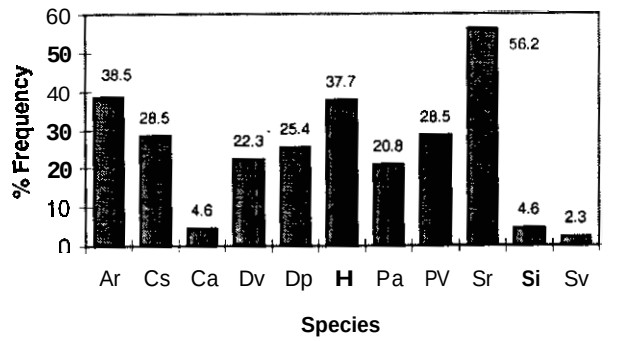
Table 2. Density (number of individuals ha^{-1}), species diversity and dominance of NWFP species in two study areas

Parameter	Locations	
	Wayanad	Nilambur
Density of the tree species	9.731	10.700
Density of the non-tree species	239.895	342.900
Species diversity (Shannon diversity index H')	3.9 I4	3.434

Distribution, density arid biomass production

In the natural forest of Wayanad, among the 11 NWFP species (Table 1) studied, *Sida rhombifolia* showed high density followed by *Costus speciosus* while *Curcuma aromatica* and *Solanum viarum* were low in density (Figure 3). The study also indicated that *Sida rhombifolia* is a well distributed species followed by *Asparagus racemosus* and *Hemidesmus indicus.* Even though *Costus speciosus* stood second in terms of density value, it has low frequency (28.5%) and its total biomass (kg ha^{-1}) was much higher than that of *Asparagus racmosus* and *Sida rhombifolia.* The standing biomass of *Phyllanthus amarus* was only 0.I18 kg ha^{-1} while that of *Hemidesmus indicus* was estimated to be 0.61 kg ha^{-1}.





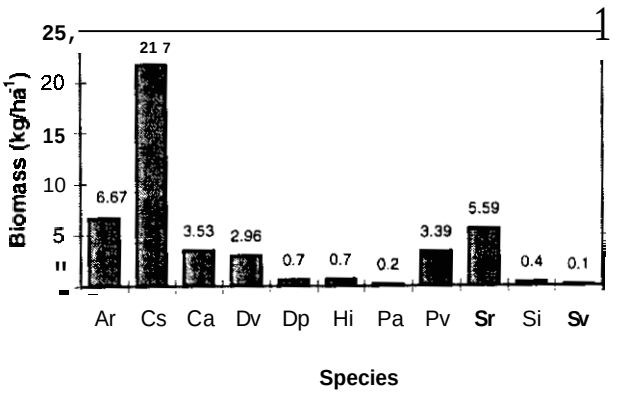


Figure 3. Density (No. of individuals ha^{-1}), % Frequency and Biomass (kg ha^{-1}) of different NWFPs of the moist deciduous forests in Wayanad.

Ar - *Asparagus racemosus,* Cs - *Costus speciosus,*
Ca - *Curcuma aromatica,* Dv - *Desmodium velutinum,*
Dp - *Dioscorea pentnphylla,* Hi- *Hemidesmus indicus,*
Pa - *Phyllanthus amarus,* Pv - *Pseudarthria viscida,* Sr - *Sida rhombifolia,*
Si - *Solonum indicum,* Sv - *Solanum viarum.*

A wide variation among the natural forests in the four Forest Ranges (FRs) of Wayanad was recorded in terms of density and standing biomass of NWFP species (Table **3).** For example, *Costus speciosus, Sida rhombifolia, Asparagus racemosus* and *Solanum indicum* produced more biomass in Tholpetty FR. Similarly, *Hemidesmus indicus, Curcuma aromatica* and *Pseudarthria viscida* are growing well in Sulthan Bathery FR than in other Forest Ranges when the biomass of *Dioscorea pentaphylla. Phyllanthus amarus* and *Solanum viarum* is comparatively more in Muthanga FR. The standing biomass of *Desmodium velutinum* was found to be more in Kurichiat FR followed by Sulthan's Battery FR.

It is generally assumed that the disturbance (human induced) followed by the dominance of grasses (eg. *Imperata cylindrica* P. Beauv.) and exotic weeds (eg. *Chromolaena odorata* (L.) King & Robins and *Lantana cainara* L.) in ground vegetation influence the density and biomass distribution pattern of NWFP species. Thus, all the established quadrats were categorised into two groups - highly disturbed and less disturbed quadrats, and the density/biomass values of NWFP species in quadrats representing these two categories were compared. However, the study did not indicate clear difference between two categories of quadrats for the density/biomass values of NWFP species. Thus, further studies are required to determine the factors responsible for the difference in density and biomass in different quadrats as well as among different Forest Ranges.

The proportion of useful part/s to the total plant biomass varied from species to species (Table 4). In the case of *Phyllanthus amarus,* the whole plant is used for its medicinal properties while in other species underground parts (roots or tubers) are used. In the case of *Solanum indicum* and *Solanum viarum,* even though the root is generally used, use of stem is also not uncommon. Since, the biomass of useful part of many NWFPs remained generally as a function of their total biomass, the standing biomass of useful part of *Costus speciosus* was high and that of *Solanum viarum* found low in Wayanad. However, the standing biomass of useful part of *Sida rhombifolia* was less than that of *Costus speciosus, Asparagus racemosus, Curcuma aromatico* and *Desinodium velutinum* (Figure 4). This could be attributed to the low proportion of useful part of *Sida rhombifolia* to its total plant biomass.

Table 3. Density (number of individuals ha^{-1}), frequency(%) and biomass (kg ha^{-}) of NWFP species in the natural forests of different Forest Ranges in Wayanad

Plant species	Parameters	Forest Range			
		Muthanga	Sulthan Bathery	Kurichiat	Tholpetty
Asparagus racemosus (Sathaveri)	Density	58.00	156.00	193.00	222.00
	Frequency	24.20	35.30	44.40	55.60
	Biomass	2.51	6.80	8.40	9.70
Costus speciosus (Channakoova)	Density	1233.00	179.00	153.00	1817.00
	Frequency	21.20	17.60	20.00	83.30
	Biomass	40.26	5.90	5.00	59.30
Curcuma aromatica (Kasthurimanjal)	Density	9.00	53.00	16.00	33.00
	Frequency	6.10	2.90	4.40	5.60
	Biomass	1.20	7.10	2.10	4.50
Desmodium velutinum (Orila)	Density	15.00	156.00	200.00	6.00
	Frequency	12.10	20.60	37.80	5.60
	Biomass	0.39	4.00	5.20	0.15
Dioscorea pentaphylla (Noora)	Density	155.00	27.00	40.00	22.00
	Frequency	36.40	14.70	26.70	22.20
	Biomass	1.60	0.30	0.40	0.23
Hemidesmus indicus (Nannari)	Density	218.00	338.00	180.00	50.00
	Frequency	39.40	47.10	40.00	11.10
	Biomass	0.71	1.10	0.60	0.16
Phyllanthus amarus (Keezharnelli)	Density	491.00	406.00	271.00	33.00
	Frequency	15.20	23.50	26.70	11.10
	Biomass	0.28	0.23	0.15	0.02
Pseudarthria viscida (Moovila)	Density	0	359.00	231.00	28.00
	Frequency	0	26.50	55.50	16.70
	Biomass	0	6.80	4.40	0.51
Sida rhombifolia (Kurumthotti)	Density	236.00	374.00	642.00	2217.00
	Frequency	21.20	67.60	64.40	77.80
	Biomass	1.90	3.00	5.20	18.01
Solanum indicum (Puthiri chunda)	Density	33.00	0	0	161.00
	Frequency	9.10	0	0	16.70
	Biomass	0.42	0	0	2.04
Solanum viarum (Kandakarichunda)	Density	12.00	6.00	0	0
	Frequency	6.10	2.90	0	0
	Biomass	0.37	0.18	0	0

Table 4. Biomass distribution in different parts of NWFP species and percentage contribution of useful part/s to the total plant biomass

Plant species	Useful part/s	Biomass (g plant^{-1})						% of biomass of useful parts
		Leaf	Stem	Fruit	Roof	Tuber	Total	
Asparagus racemosus (Sathaveri)	Tuber	1.31	1.49	-	-	40.80	43.56	93.60
Costus speciosus (Channakoova)	Tuber	2.08	7.90	-		22.70	32.65	69.50
Curcuma aromatica (Kasthurimanjal)	Tuber	2.74	25.40		1.07	95.40	134.70	70.80
Desmodium velutinum (Orila)	Root	3.07	11.70	-	0.80		25.86	41.80
Dioscorea pentaphylla (Noora)	Tuber	0.40	0.36	-	-	9.96	10.36	96.10
Hemidesmus indicus (Nannari)	Root	0.33	1.18	-	1.71		3.24	52.70
Phyllanthus amarus (Keezhamelli)	Whole	0.19	0.29	-	0.09	-	0.57	100.00
Pseudurthria viscida (Moovila)	Root	2.96	11.50	0.20	4.54		19.06	23.80
Sida rhombifolia (Kurumthotti)	Root	0.81	5.29	0.75	1.28	-	8.13	15.70
Solanum indicum (Puthiri chunda)	Root, stem	3.23	6.35	-	3.06		12.64	74.40
Solanum viarum (Kandakarichunda)	Root, stem	8.16	10.10	5.90	5.75		30.50	52.00

Table 5 shows the difference existing among four Forest Ranges in terms of the quantity of biomass of useful part/s of any given NWFP species. Thus, for sustainable management and utilisation of the studied NWFP species, different harvesting intensity of their biomass in four Forest Ranges may be adopted.

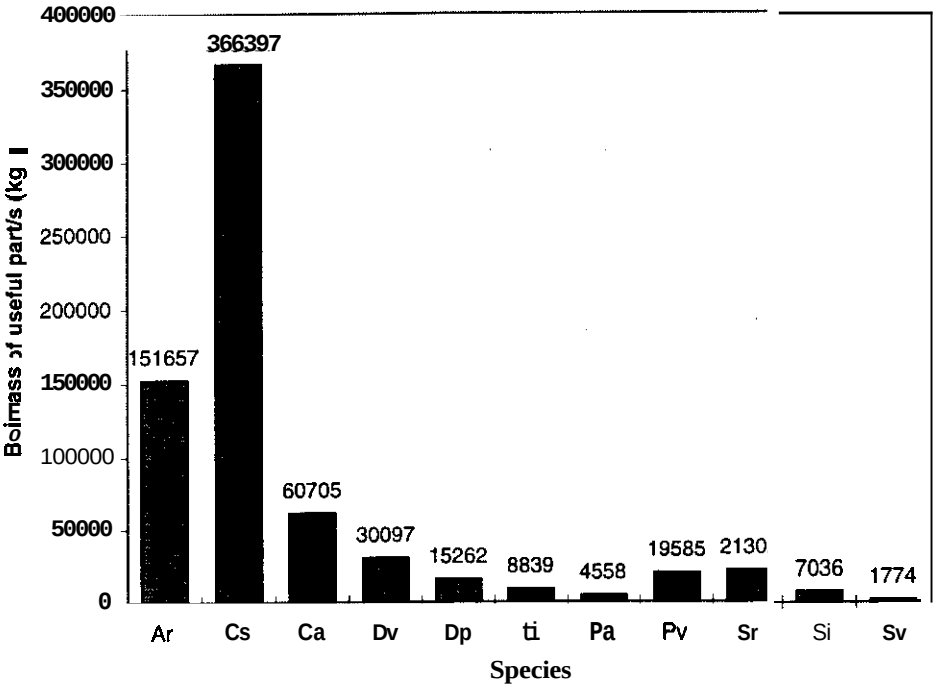


Figure 4. Biomass of useful part/s of NWFP species in the natural forests of Wayanad.

Total area of natural forest = 24295.5 ha.

Ar - *Asparagus racemosus,* Cs - *Costus speciosus,* Ca- *Curcuma aromatica,* Dv - *Desmodium velutinum,* Dp - *Dioscorea pentaphylla,* Hi- *Hemidesmus indicus,* Pa - *Phyllanthus amarus,* Pv - *Pseudarthria viscida,* Sr - *Sida rhombifolia,* Si- *Solanum indicum,* Sv - *Solanum viarum.*

Based on this study, Forest Ranges were organised in the descending order of harvesting intensity of each NWFP species given below:

Asparagus racemosus	Kurichiat > Sulthan Bathery > Tholpetty > Muthanga
Costus speciosus	Muthanga > Sulthan Bathery > Kurichiat > Tholpetty
Curcuma aromatica	Sulthan Bathery > Tholpetty > Kurichiat > Muthanga
Desmodium velutinum	Kurichiat > Sulthan Bathery > Muthanga > Tholpetty
Dioscorea pentaphylla	Muthanga > Kurichiat > Sulthan Bathery > Tholpetty
Hemidesmus indicus	Sulthan Bathery > Kurichiat > Muthanga > Tholpetty
Phyllanthus amarus	Sulthan Bathery > Muthanga > Kurichiat > Tholpetty
Pseudarthria viscida	Sulthan Bathery > Kurichiat > Tholpetty
Sida rhombifolia	Tholpetty > Kurichiat >Sulthan Bathery > Muthanga
Solanum indicum	Tholpetty > Muthanga
Solanum viarum	Muthanga > Sulthan Bathery

Table 4. Biomass (kg) of useful part/s of NWFP in the natural forests of different Forest Ranges* in Wayanad

Plant species	Forest Range			
	Muthanga	Sulthan Bathery	Kurichiat	Tholpetty
Asparagus racemosus (Sathaveri)	13437.7	45110.9	60842.9	34034.9
Costus speciosus (Channakoova)	160115.4	28891.6	26854.0	15487.8
Curcuma aromatica (Kasthurimanjal)	4966.0	35803.3	11484.9	11930.5
Desmodium velutinum (Orila)	940.1	11960.0	16689.7	227.3
Dioscorea pentaphylla (Noora)	8801.3	1872.2	3074.1	830.3
Hemidesmus indicus (Nannari)	2131.4	4098.5	2373.1	320.5
Phyllanthus amarus (Keezharnelli)	1601.0	1642.2	1192.7	71.4
Pseudarthria viscida (Moovila)	0	11551.0	8092.8	473.7
Sida rhombifolia (Kurumthotti)	1725.7	3383.8	6326.5	10629.6
Solanum indicum (Puthiri chunda)	1792.1	0	0	5691.6
Solanum viarum (Kandakarichunda)	1098.0	664.3	0	0

* Area under natural forests, Muthanga = 5722 ha; Sulathan Bathery = 7097 ha; Kurichiat = 7720 ha; Tholpetty = 3757 ha.

The average price of useful part/s of different NWFP species was determined after consulting the collectors, collection agents, tribal service societies and merchants in nearby markets. *Solanum viarum, Solanum indicum* and *Curcuma aromatica* fetch a low price (Rs. 2.50 to 3.00 per kg) while the price of *Dioscorea pentaphylla* was Rs.5 per kg and that of *Desmodium velutinum, Asparagus racemosus* and Costus *speciosus* were Rs. 6 per kg. In the case of *Pseudarthria viscida, Sida rhombifolia, Hemidesmus indicus* and *Phyllanthus amarus,* the price per each kg of their useful parts was Rs.8,

Rs.10, Rs.35 and Rs. 150 respectively. Thus, Wayanad is harbouring a biomass worth of about Rs. 49,32,633 for the 11 selected NWFPs species. Detailed investigations are necessary to quantify the biomass and estimate the economic value for other NWFP species in Wayanad.

Propagation aspects

Production of Planting Stock of Selected NWFP Plants

Based on demand from pharmaceutical companies and other traditional users, nine medicinal plants such as *Adhatoda zeylanica, Aegle marmelos, Holostemma ada-kodien, Rauvolfia serpentina, Saraca asoca, Coscinium fenestratum, Kingiodendron pinnatum, Symplocos cochinchinensis* and *Trichosanthes cucumerina* were selected for propagation and enrichment planting in the study areas. Of these, *Coscinium fenestratum* and *Kingiodendron pinnatum* occur naturally in Nilambur, *Holostemma ada-kodien* and *Trichosanthes cucumerina* are reported from Wayanad and *Rauvolfia serpentina* is found in both locations. The other species *Adhatoda zeylanica, Aegle marmelos, Saraca asoca* and *Symplocos cochinchinensis* are selected to introduce in suitable locations in the study areas. As the supply of these species is insufficient to meet current and future demand, it is anticipated that enrichment planting will conserve and enhance resource availability.

There are a couple of limitations to this part of the study. First, since the study period was very short, some of the experiments could not be completed. Second, as seeds of some of the species are available abundantly since November, that is, by the end of study period, large scale trails could not be carried out. However, details of the experiments which were conducted to develop simple methods for their large scale propagation are discussed below.

1. *Adhatoda zeylanica* (Adalodakam): A medium size shrub found in homesteads as a hedge. Preliminary trials showed that it is easy to produce planting stock by rooted stem cuttings. Cuttings of about 30 cm length with terminal bud and leaves intact when planted in nursery beds filled with soil, gave 90 to 100 per cent rooting. Large scale propagation of plants is being undertaken by this method for planting.

2. *Aegle marmelos* (Koovalam): A slow growing tree naturally occurring moist deciduous forests, grown in homesteads and temple premises due to its medicinal properties. Earlier observations have shown that *A. marmelos* can be propagated either

by seeds or through rooted stem cuttings. Parent trees have been located and seeds will be available only in January-February, 1999.

3. *Holostemma ada-kodien* (Adapathian): A large glabrous twining shrub with thick roots, largely found in moist deciduous forests. Preliminary trials indicated that planting stock can be produced by rooted stem cuttings.

4. *Rauvolfia serpentina* (Sarpagandhi): A small shrub or under shrub mostly seen in moist deciduous forests. *R. serpentina* can be propagated by seeds and vegetative methods. About 50 per cent of seeds were germinated when sown soon after collection. Stem cuttings treated with growth regulating substances showed 80 per cent rooting. Large scale propagation by both methods is being taken up for production of planting stock.

5. *Saraca asoca* (Asokam): A medium sized evergreen tree often grown in homesteads. High percentage of rooting was observed in young shoot cuttings treated with growth regulating substances. More quantity of seeds will be available only in February - May, 1999.

For other four species, *Coscinium fenestratum, Kingiodendron pinnatum, Symplocos cochinchinensis* and *Trichosanthes cucumerina* work will be taken up in due course.

Socio-economic aspects

This part of the study is intended to update socio-economic data which have been collected in the first phase of the study. Some of the socio-economic aspects such as collection, marketing, pricing of NWFPs, socio-economic conditions of tribes, etc. were analysed in detail in the first phase of the study. Here attempt is only to provide the broad trends of some selected socio-economic variables over a period of time (1982-83 to 1997-98) and their major changes during the study period (1997-98). The study has used both primary and secondary data. While the primary data collected from the selected hamlets have been used to analyse the socio-economic conditions of the tribal communities, secondary data gathered from the Federation and Tribal Service Co-operative societies have been used to study the trends of other socio-economic variables.

Collection

There has been a significant increase in the collection of NWFPs during the period 1982 to 1998. For instance, total quantity of NWFPs collected during 1982-83 was only 3 million kg which increased to 24 million kg in 1997-98. Side by side with this increase, there has been variation in the collection of these products in certain years (Figure 5). From 1991 onwards, the collection of the NWFPs in the State has shown an increasing trend with variation in certain years. For instance, the total collection has increased from 1991 to 1993, but it slumped down in 1994. In the year 1995 the collection again increased. The same trend can also be seen in the case of certain individual products. For instance, while the collection of honey was only 57000 kg during 1982-83, it was 0.12 million kg in 1992 and 82645 kg in 1997-98. The quantity collected by the Federation has increased since 1991 mainly because it started purchasing the products from tribal people at market price (Muraleedharan *et al*, 1997).

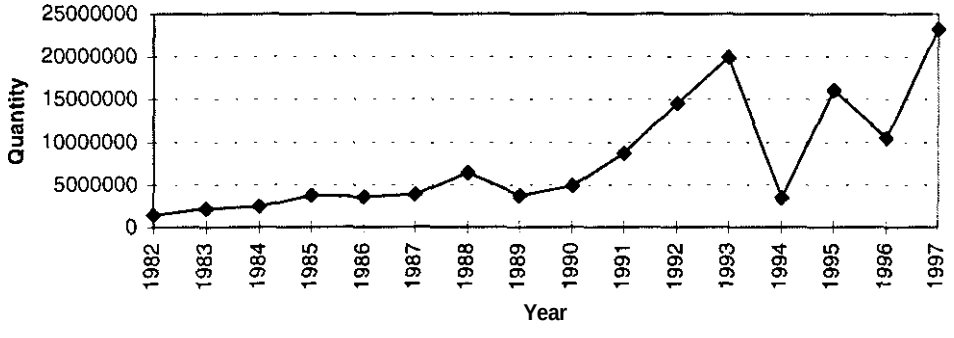


Figure 5. Total NWFPs collected (in Kg) by the Federation (1982-1997)

A more or less same trend can be seen at the selected societies level too. For instance, total collection of NWFPs at Wayanad was about 0.23 million kg during 1985-86 and 0.44 million kg during 1997-98, with variation in different years. Similarly, in Nilambur also there has been significant increase in the collection of NWFPs during 1986-87 to 1995-96 (Figure 6). Due to some differences in opinion regarding the collection and marketing of the products between the society at Nilambur and the Federation, no collection was carried out there during the period 1996-97. The tribal people hence sold the products in the open market.

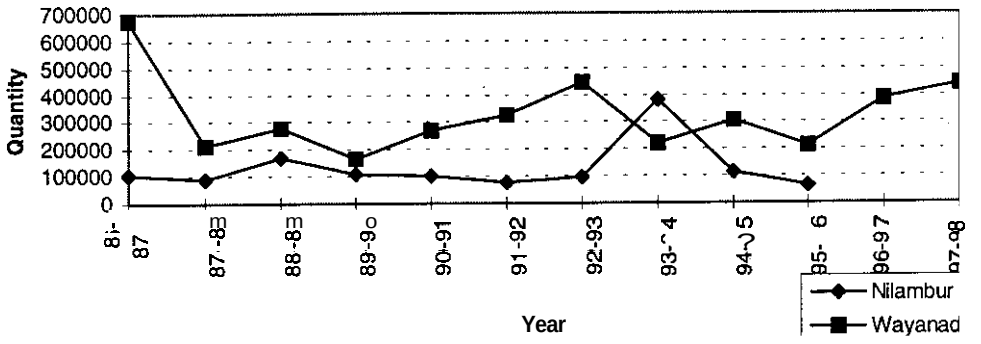


Figure 6. Total NWFPs collected (in Kg) by the Societies (Wayanad and Nilambur)

Variations are observed in the quantity collected between the hamlets and within the hamlets in different years. For instance, the selected hamlet at Wayanad collected 63000 kg of NWFPs in 1995 and 58345 kg in 1998. Similarly, the collection of NWFPs in the selected hamlet at Nilambur ranged between 1694 kg to 5905 kg between 1995 to 1998 (Table 6).

Table 6. NWFPs collected (in kg) by selected tribal hamlets

Year	Wayanad	Nilambur
1995	63305	1694
1996	61813	3998
1997	65782	2168
1998	58345	5905

The NWFPs are natural products and hence variations in their availability can be attributed to a variety of factors such as climatic changes, forest fire, unsustainable and unscientific harvesting practices and illegal collection by the non-tribal people (Muraleedharan *et al,* 1997).

Collection charge

Collection charge received by the gatherers also showed an increasing trend (Figures 7 & 8). Total collection charge paid by the Federation amounted to

Rs.0.99 million in 1982, which increased to Rs.12.9 million in 1997-98. The collection charge paid for individual items has invariably increased over a period of time (Table 7a). For example, the price of Cheevakkai *(Acacia sinuata)* was Rs. 3.25 per kg in 1982-83, and it increased to Rs. 14.25 per kg in 1997-98. Although there has been increase in the collection charge over a period of time, the increase in real terms was not very high (Table 7b), indicating the fact that the collectors real income has not increased significantly.

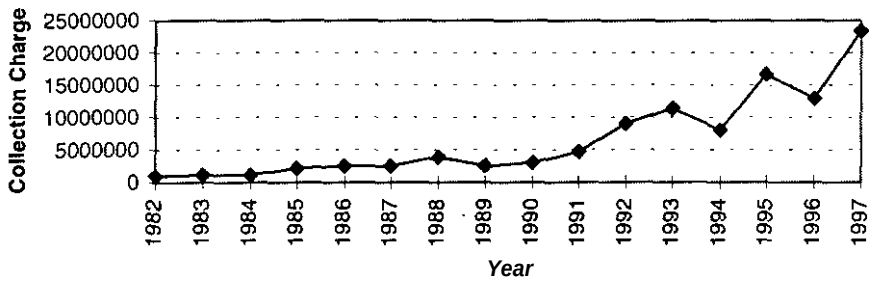


Figure 7. Total collection charge (Rs.) of NWFPs paid by the Federation (1982-97)

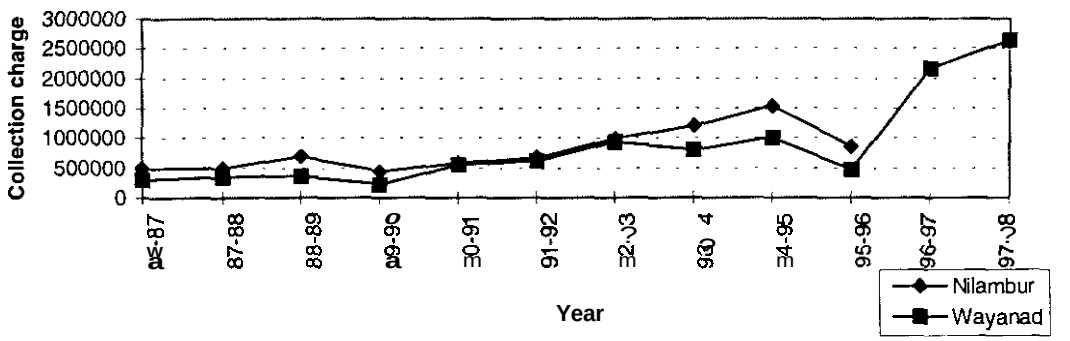


Figure 8. Total collection charge (Rs.) of NWFPs paid by the Societies (Wayanad and Nilambur)

Sale value

Sale value of the products is determined to a great extent by the market forces. Altogether, the sale value realised by the Federation as well as the societies has increased over a period of time (Figure 9). Total sale value realised by the Federation was estimated to be Rs. 1.39 million in 1982 and Rs.23.2 million in 1997-1998. As

Table 7a. Collection charge (Rs.) of NWFPs (per kg) for the period 1982-83to 1997-98

Species	1982-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98
Apis sp. Thaen (processed)	25.00	20.00	12.00	14..00	13.00	14.00	14.00	18.00	18.80	21.60	60.00	60.00	45.00	47.50	45.00	47.50
Phyllanthus emblica (Nellikka)	1.00	1.00	0.75	1.00	1.20	2.00	1.00	1.50	1.50	2.25	2.50	2.50	5.20	3.60	3.00	5.20
Canarium strictum (Kunthirikkam)	9.00	10.00	lo.m	12.00	14.00	16.00	18.00	20.00	20.00	25.20	25.20	25.20	32.25	71.00	25.00	71.00
Coscinium fenestratum (Maramanjal)	2.50	2.00	1.75	2.00	2.50	3.00	3.00	4.00	4.50	4.85	4.50	4.50	9.50	11.40	12.50	11.40
Acacia sinuata (Cheevakkai)	3.25	3.25	3.50	4.00	5.00	4.00	3.50	4.00	4.50	6.30	6.30	6.30	11.40	14.25	16.00	14.45
Curcuma aromatica (Kasthurimanjal)	3.75	3.75	3.25	4.00	9.00	9.00	9.00	9.00	9.00	10.80	10.60	10.60	13.30	15.20	15.00	15.20
Stereospermum colais (Pathiripoovu)	12.00	12.00	13.00	16.00	20.00	24.00	26.00	30.00	36.00	45.00	45.00	45.00	47.50	75.00	60.00	76.00

Desmodium velutinum (Orila)	4.00	3.00	2.50	3.00	3.50	4.00	4.00	4.50	4.50	4.95	7.50	7.50	8.25	11.40	2.50	11.40
Sida rhombifolia (Kurumthotti)	3.25	3.75	3.00	2.00	0.50	0.60	0.60	3.00	3.00	3.40	6.00	6.00	7.60	11.40	2.00	11.40
Terminalia chebula (Kadukka)	1.25	1.25	1.00	1.20	1.00	1.00	1.50	2.00	2.00	3.60	6.00	6.00	3.80	4.20	4.00	4.20
Pseudarthria viscida (Moovila)	4.00	3.50	3.00	3.00	3.00	4.00	4.10	4.25	4.25	4.85	8.00	8.00	8.55	14.25	2.50	14.25
Strobilanthes ciliatus (Karimkurinji)	0.70	1.20	1.00	1.50	1.00	0.30	0.30	1.50	1.50	2.05	8.00	8.00	4.75	6.65	9.50	10.00
Apis sp. (Thaenmezhugu)	28.00	28.00	24.00	25.00	20.00	20.00	25.00	40.00	40.00	43.20	60.00	60.00	62.70	85.50	60.00	85.50
Sapindus laurifolius (Urinchikkai)	2.50	1.25	1.50	2.00	2.00	1.75	2.00	2.00	2.00	3.40	3.40	3.40	3.80	6.65	5.00	6.65
Parmelia dialatata (Kalpasam)	1.00	1.00	0.75	2.50	5.00	6.00	7.00	8.00	8.00	8.65	8.65	8.65	9.50	38.00	38.00	42.00
Hemidesmus indicus (Nannari)	12.50	6.00	5.00	6.00	6.50	6.25	7.00	8.00	8.00	9.45	10.00	10.00	11.40	47.50	30.00	47.50

Table 7h. Deflated colection charge (Rs.) of NWFPs (per kg) for the period 1982-83 - 1997-98

Species	1982-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98
Apis sp. Thaen (processed)	24.37	17.81	9.98	11.01	9.71	9.72	9.05	10.86	10.29	10.39	26.24	24.21	16.38	16.06	14.03	14.0
Phyllanthus emblica (Nellikka)	0.97	0.89	0.62	0.79	0.89	1.39	0.65	0.91	0.82	1.08	1.09	1.01	1.89	1.22	1.14	1.1
Canarium strictum (Kunthirikkam)	8.77	8.90	8.31	10.22	10.46	11.10	11.65	12.07	10.95	12.13	11.02	10.17	11.74	24.00	7.95	20.9
Coscinium fenestratum (Maramanjal)	2.44	1.78	1.45	1.57	1.87	2.08	1.94	2.41	2.46	2.23	1.97	1.82	3.46	3.85	3.97	3.3
Acacia sinuata (Cheevakkai)	3.17	2.89	2.91	3.14	3.73	2.78	2.26	2.41	2.46	3.03	2.75	2.54	4.15	4.82	5.08	4.2
Curcuma aromatica (Kasthurimanjal)	3.65	3.34	2.70	3.14	6.72	6.25	5.82	5.43	4.93	5.19	4.63	4.28	4.84	5.14	4.77	4.4
Stereospermum colais (Pathiripoovu)	11.69	10.69	10.81	12.58	14.97	16.66	16.80	18.11	19.70	21.66	19.68	18.16	17.29	24.35	19.07	22.4
Desmodium velutinum (Orila)	3.89	2.67	2.08	2.36	2.61	2.78	2.59	2.72	2.46	2.38	3.28	3.03	3.00	3.85	0.79	3.3

Contd..

Sida rhombifolia (Kurumthotti)	3.17	3.34	2.49	1.57	0.37	0.42	0.39	1.81	1.64	1.64	2.62	2.42	2.77	3.85	0.63	3.37
Terminalia chebula (Kadukka)	1.21	1.11	0.83	0.94	0.75	0.69	0.97	1.21	1.09	1.73	2.62	2.42	1.38	1.42	1.27	1.24
Pseudarthria viscida (Moovila)	3.89	3.12	2.49	2.36	2.24	2.78	2.65	2.56	2.31	2.33	3.49	3.23	3.11	4.82	0.79	4.21
Strobilanthes ciliatus (Karimkurinji)	0.68	1.07	0.83	1.18	0.75	0.21	0.19	0.91	0.82	0.99	3.49	3.23	1.73	2.25	-	-
Apis sp. (Thaenmezhugu)	27.29	24.93	19.95	19.65	14.94	13.88	16.16	24.14	21.89	20.79	26.24	24.21	22.82	28.90	19.07	25.28
Sapindus laurifolius (Urinchikkai)	2.44	1.11	1.25	1.57	1.49	1.21	1.29	1.21	1.04	1.64	1.49	1.37	1.38	2.25	1.59	1.97
Parmelia dialatata (Kalpasam)	9.70	0.89	0.62	1.97	3.73	4.16	4.52	4.83	4.37	4.16	3.78	3.49	3.46	12.85	-	-
Hemidesmus indicus (Nannari)	12.18	5.34	4.16	4.78	4.85	4.34	4.52	4.83	4.43	4.55	4.37	4.04	4.15	16.06	9.53	14.04

collection charge is determined on the basis of sale value (80%), the gatherers have benefited from an increase in the sale value. A comparison of sale value and collection charge is shown in Figure 10. The gap between sale value and collection charge at the Federation level was large till 1993 and afterwards, this gap has narrowed down, indicating that the collectors are getting more or less a stipulated amount as collection charge in recent years. In 1996-97 and 1997-98, the collection charge was found to be slightly higher than the sale value mainly because the Federation could not market some products during that period due to low demand.

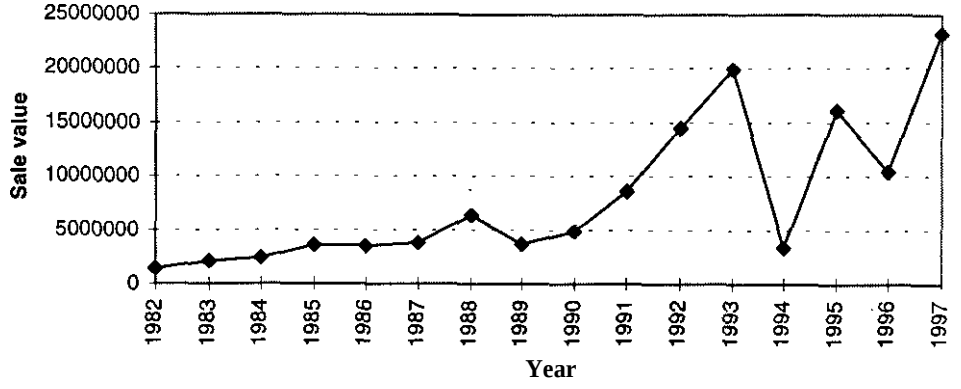


Figure 9. Total sale value (Rs.) NWFPs realised by the Federation

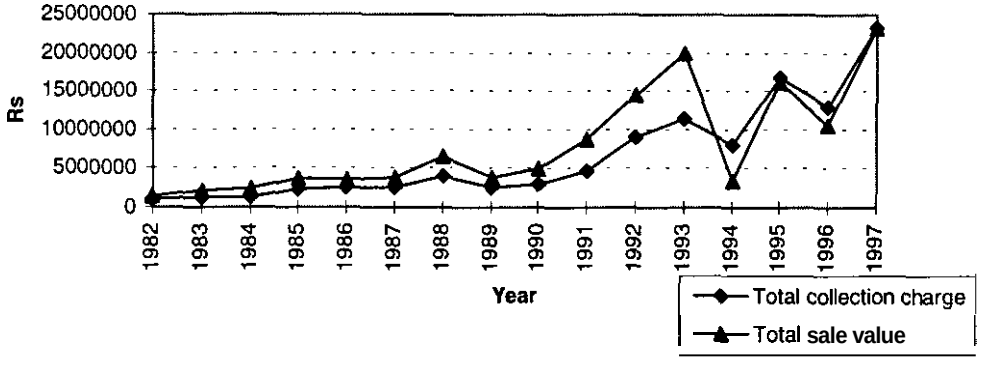


Figure 10. Total collection charge paid and sale value (Rs.) of NWFPs realised by the Federation

Marketing

Although the Federation has the monopoly right to market the products, some of the products have been sold by the societies using the Federation's bill book. This practice

has been stopped since 1997-98. The Federation took over the marketing of all the products, except for certain highly perishable products. This facilitated the Federation to have a control over marketing and avoid malpractices by the societies to a large extent.

Although the Federation has been able to market the products with a profit, in certain years they faced some unexpected and unfavourable market situation, which led to a decrease in demand. For instance, in 1996-97, there was significant increase in the collection of honey. According to officials of the Federation, honey production in the State accounts for only 50 per cent of the total requirement. In spite of this, it could sell only 40 per cent of the collected quantity in 1997-98 and that too at reduced price. Demand fluctuation was also observed in the case of Cheevakkai, another important item of NWFPs, and as a result, the Federation was forced to sell the products at a rate much below the collection charge.

Socio-economic conditions of the selected tribes

The selected hamlets at Wayanad (Kattunaickan tribes) and Nilambur (Cholanaickan tribes) were revisited in 1998 to update upon their socio-economic conditions. No significant change was observed in their socio-economic conditions, except for change in the total income of the family (Table 8). The Forest Department has employed tribes at Wayanad for various forestry operations, which provided higher family income to the tune of 30 per cent than that in the first phase. Similarly, some of the tribes at Nilambur got employment for three months in the plantations and they were able to collect more quantity of NWFPs during the period 1997-98. However, no significant change was recorded in the average indebtedness of the tribes in both the hamlets.

Table 8. Details of **socio-economic conditions of selected households**

Socio-economic variables	Cholanaickan	Kattunaickan
Households (Nos)	24	29
Population Male	65 (57)	65 (49)
Female	49 (43)	66 (51)
Literacy		
Literate	58 (51)	11 (8)
Illiterate	56 (49)	120 (92)

Socio-economic variables	Cholanaickan	Kattunaickan
Housing structure		
Room 1	20 (83)	--
2	4 (17)	--
3	--	8 (28)
4	--	9 (31)
5 & above	--	12 (41)
Roof : Tiles	22 (92)	10 (35)
Thatched with grass	1 (4)	--
Concrete	1 (4)	19 (65)
Floor : Cemented	13 (54)	5 (17)
Cow dung/ mud	11 (46)	24 (83)
Wall : Mud	3 (13)	19 (65)
Bamboo	1 (4)	--
Bricks	12 (50)	--
Cemented	8 (33)	10 (35)
Healthcare and Medicine		
Allopathy	12 (50)	27 (96)
Ayurveda	12 (50)	--
Moopan	--	1 (4)
Land holdings (in ha.)	nil	nil
Cropping pattern	nil	nil
Income : Different sources		
NWFP collection	4971 (79)	10533 (88)
Wage labour	1370 (21)	1410 (12)
Total Income	6341	11943
Indebtedness (Rs.)		
Average debt of households	1995	77

Note : Figures in parenthesis represent percentages

CONCLUSION

All the NWFP species at Wayanad and Nilambur enumerated in the first phase were also recorded when inventory was done during the period July-September, 1998. Density of tree, shrubby and herbaceous NWFP species did not vary much in the one year period. The species diversity value remained comparatively higher in the Wayanad site than in the Nilambur site. The study on distribution, density and biomass production carried out among the 11 NWFP species at Wayanad indicated that *Sida rhombifolia* is a well distributed species in the study area followed by *Asparagus racemosus* and *Hemidesmus indicus*. The analysis also indicated that Wayanad has a biomass worth of about Rs.49,32,633 for the above 11 NWFP species. The propagation trials indicated that large scale propagation of selected species is possible using simple methods.

The study on socio-economic aspects showed that there has been significant increase in the quantity of NWFPs collected over a period of time with variations in different years. Further, the collection charge received by the gatherers of NWFPs and sale value realised by the Federation also showed an increasing trend. However, because of inflationary trend, an increase in the collection charge of the gatherers has not brought about a corresponding increase in their real income. The socio-economic conditions of the selected tribals remained more or less the same when compared to that of the earlier study period.

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APPENDIX

Uses and distribution of NWFP species recorded from the two study areas (Wayanad and Nilambur)

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambu
Abrus precatorius	Kunnikuru	Climber	Seed	M	P	A
Abutilon indicum	Oorakara	Shrub	Root	M	P	A
Acacia caesia	Incha	Climber	Bark	T	A	P
Acacia sinuata	Cheevakkai	Climber	Fruit	T	A	P^1
Acampe praemorsa	Maravazha	Herb	Root	M	P^2	A
Acanthospermum hispidum	Gnerijal	Herb	Fruit	M	P	A
Achyranthes aspera	Kadaladi	Herb	Entire plant	M	P	A
Aerva lanata	Cherula	Herb	Root	M	P	A
Acronychia pedunculata	Muttanari	Tree	Root	M	P	A
Adhatoda zeylanica	Adalodakam	Shrub	Leaf and Root	M	P	A
Ageratum conyzoides	Appa	Herb	Leaf	M	P	A
Alangium salvifolium	Ankolam	Tree	Leaf	M	A	P
Albizia lebbeck	Nemmenivaka	Tree	Bark	M	p	P
Alstonia scholaris	Ezhilampala	Tree	Bark	M	A	P^2
Anamirta cocculus	Kollakkai	Climber	Seed	M	A	P^1
Anogeissus latifolia	Kalkanjiram	Tree	Bark	M	P	A
Aristolochia indica	Garudakodi	Climber	Entire plant	M	P	A
Artocarpus heterophyllus	Plavu	Tree	Fruit	F	A	P
Artocarpus hirsuta	Aanjili	Tree	Bark	M	P	A
Asparagus racemosus	Sathavari	Climber	Tuberous root	M/F	P^1	P^1
Atylosia goensis	Kattuzhunnu	Herb	Entire plant	M	P	A
Baliospermum montanum	Nagadandhi	Herb	Root	M	A	P^1

Contd...

Note : P = Present
A= Absent
1 =Trade through Co-operalive Societies
2 =Trade through private agencies
T = Toiletries
I = Industrial raw material
H = Household article
C = Cottage industries
M = Medicinal
F = Food
B =Pesticide
S = Spices

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Bambusa bambos	Mula	Bamboo	Stem and young shoot	H/C/F	P	P
Bauhinia racemosa	Mandharam	Tree	Bark	M	P^2	P^2
Biophytum sensitivum	Mukkutty	Herb	Entire plant	M	P^2	P^2
Bischofia javanica	Cholavenga	Tree	Bark	M	P	A
Blainvillea acmella	Murikutty	Herb	Leaf	M		
Boerhavia diffusa	Thazhuthama	Herb	Entire plant	M	A	
Bombax ceiba	Mullilavu	Tree	Fruit	H/C	P	A
Bridelia airy-shawii	Mulluvenga	Tree	Seed	-	P^1	
Bridelia scandens	Kanjikottam	Scandent shrub	Bark	M	A	P
Butea monosperma	Plasu	Tree	Bark	M	P	P^2
Calamus thwaitesii	Chooral	Climber	Stem	H/C	A	P
Callicarpa tomentosa	Nai-theak	Shrub	Root	M	P	P
Canarium strictum	Thelli	Tree	Resin	I	p	P^1
Canscora diffusa	Jeerakapullu	Herb	Entire plant	M	A	P
Cassia fistula	Kanikonna	Tree	Bark	M	P^2	P^2
Cassia tora	Thakara	Herb	Entire plant	M	P	P
Centella asiatica	Muthal	Herb	Entire plant	M	P	P
Chromolaena odorata	Communistpacha	Shrub	Leaf	S/M		A
Cinnamomum malabatrum	Patta	Tree	Bark	M	A	P
Cinnamomum zeylanicum	Patta	Tree	Bark	M	P^2	P^2
Clerodendrum serratum	Cheruteak	Shrub	Root	M	P^1	P^1
Clitoria ternatea	Shangupuzhpam	Climber	Entire plant	M	P	A
Colebrookea oppositifolia	---	Shrub	Bark	M	A	P
Commelina benghalensis	Thavalapottil	Herb	Entire plant	M	P	A
Cordia wallichii	Virimaram	Tree	Bark and root	M	P	P

Contd..

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Coscinium fenestratum	Maramanjal	Climber	Stem and root	M	A	P[1]
Costus speciosus	Channakoova	Herb	Rhizome	M	P	A
Crotalaria pallida	Kilukkampetty	Herb	Root	M	P	A
Crotolaria retusa	Kilukiluppa	Herb	Entire plant	M	A	P
Cryptolepis buchananii	Vallippala	Climber	Latex	M	P	A
Curculigo orchioides	Nilappana	Herb	Rhizome	M	P[2]	P[2]
Curcuma aromatica	Kasthurimanjal	Herb	Rhizome	M	P[1]	A
Cyclea peltata	Padakizhangu	Climber	Root	S/M	P[1]	P[1]
Cymbidium aloifolium	Maravazha	Epiphytic herb	Root	F/M	P	A
Dalbergia latifolia	Veeti	Tree	Bark	M		
Dendrocalamus strictus	Kallanmula	Bamboo	Stem	H/C	P	P
Dendrophthoe falcata	Ithikanni	Parasitic shrub	Flowers and bark	M	A	P
Desmodium gangeticum	Orila	Herb	Root	M	P	P[2]
Desmodium heterophyllum	Nilambaranda	Herb	Root	M	A	P
Desmodium motorium	Thozhukanni	Herb	Root and leaf	M	P	P
Desmodium pulchellum	Moovila	Herb	Root	M	P	A
Desmodium triflorum	Nilambaranda	Herb	Root	M	P	A
Desmodium triquetrum	Orila	Herb	Root	M	P[1]	P[1]
Desmodium velutinum	Orila	Herb	Root	M	P	A
Dioscorea pentaphylla	Noora	Climber	Tuber	F	P	P
Dioscorea oppositifolia	Noora	Climber	Tuber	F	P	A
Dioscorea spicata	Chaval	Climber	Tuber	F	P	A
Diploclisia glaucescens	Vattoli	Climber	Root	M	P	A
Eclipta alba	Kanjunni	Herb	Entire plant	M	P	A
Elephantopus scaber	Aanachuvadi	Herb	Root	M	P[2]	P[2]

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Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Emilia sonchifolia	Muyalcheviyan	Herb	Entire plant	M	P	A
Entada rheedii	Kakkumkai	Climber	Seed	M	P	P
Eucalyptus grandis	Eucaly	Tree	Leaf	M	P	A
Euphorbia hirta	Nilappala	Herb	Entire plant	M	P	A
Evolvulus alsinoides	Vishnukranthi	Herb	Entire plant	M	A	P
Exacum bicolor	Poochedi	Herb	Entire plant	M	P	P
Flemingia macrophylla	Korakattachedi	Herb	Root	M	A	P
Flemingia semialata	Korakkattachedi	Herb	Root	M	P	A
Garcinia morella	Kattupuli	Tree	Bark and fruit	M	A	P
Globba ophioglossa	Kattinchi	Herb	Rhizome	F/M	P	A
Gloriosa superba	Menthonni	Climber	Tuber	M	P	A
Glycosmis pentaphylla	Panalam	Shrub	Bark	M	P^2	P^2
Gmelina arborea	Kumizhu	Tree	Root	M	P	A
Grewia abutilifolia	Cheruchadachi	Shrub	Bark	M	P	A
Grewia tiliifolia	Chadachi	Tree	Bark	M	P	A
Habenaria sp.	---	Herb	Tuber	M	P	A
Helicteres isora	Edampiri/ Valampiri	Shrub	Fruit	M	P^1	P^1
Hemidesmus indicus	Nannari	Climber	Root	F/M	P^1	P^1
Heteropogon contortus	Kathipullu	Herb	Entire plant	M	P	A
Holarrhena pubescens	Kudakapala	Shrub	Bark	M	P	P
Holigarna arnottiana	Cheru	Tree	Root	M	P	A

Contd...

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Holostemma ada-kodien	Adapathiyan	Climber	Root	M	P	A
Hydnocarpus pentandra	Marotty	Tree	Seed	M/I	P[1]	A
Hydrocotyle javanica	---	Herb	Whole plant	M	P	A
Hygrophila auriculata	Vayalchulli	Herb	Root	M	P	A
Ichnocarpus frutescens	Palvalli	Climber	Root	M	P	A
Impatiens chinensis	Kashuthumba	Herb	Entire plant	M	A	P
Impatiens sp.	Kashuthumba	Herb	Entire plant	M	P	A
Imperata cylindrica	Kathipullu	Herb	Entire plant	M	P	P
Indigofera cassioides	Manali	Shrub	Leaf and flowers	M	P	A
Ipomoea pes-tigridis	Pulichuvadi	Climber	Root	M	P	A
Jasminum sp.	Kattumulla	Shrub	Root	M	P	A
Justicia simplex	Odichukutthi	Herb	Leaf	M	P	A
Kingiodendron pinnatum	Kulavu	Tree	Root and bark	M/I	A	P
Kydia calycina	Vellachadachi	Tree	Bark	H	P	P
Lagenandra toxicaria	Neerchengazhi	Herb	Root	M	P	A
Lagerstroemia parviflora	Manimaram	Tree	Bark	M	P	A
Lantana camara	Aripoo	Shrub	Leaf and root	M	P	P
Leea wightii	Njellu	Shrub	Root	M	P	A
Leucas aspera	Thumba	Herb	Entire plant	M	A	P
Leucas hirta	Thumba	Herb	Entire plant	M	P	A
Lobelia nicotianifolia	Kattupukayila	Herb	Leaf and young flower	M	P	A
Macaranga peltata	Vatta	Tree	Leaf	C	P[2]	P[2]
Malaxis rheedii	Jeevakam	Herb	Entire plant	M	P	A
Mallotus philippensis	Chenkolli	Tree	Bark and fruit	M	A	P
Mangifera indica	Mavu	Tree	Fruit	F	P	A

Contd...

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Mimosa pudica	Thottvadi	Herb	Entire plant	M	P	P
Mitragyna parvifolia	Neerkadambu	Herb	Root	M	P	A
Momordica charantia	Kattupavakkai	Climber	Fruit	F/M	A	P[2]
Monochoria vaginalis	Neerambal	Herb	Leaf	M	P	A
Murraya paniculata	Kattvepu	Tree	Bark	M	P	A
Mussaenda laxa	Vellilam	Shrub	Leaf	M	P	A
Myristica malabarica	Ponnampoo	Tree	Aril, seed and fruit	S/M	A	P
Myxopyrum smilacifolium	Chathuramulla	Shrub	Bark	M	A	P
Naregamia alata	Nilanarakam	Herb	Whole plant	M	P	A
Naringi crenulata	Narinarakam	Tree	Bark	M	P	A
Nervilia aragoana	Orilathamara	Herb	Root tuber	M	P	A
Ochlandra travancorica	Eetta	Reed bamboo	Stem	H/C	A	P
Olea dioica	Edana	Tree	Bark	M	P	A
Oroxylum indicum	Palakapayyani	Tree	Bark and root	M	A	P
Memecylon umbellatum	Kashavu	Shrub	Root and flower	M	P	A
Oxalis corniculata	Puliyaral	Herb	Entire plant	M	P	A
Pandanus tectorius	Kaitha	Shrub	Leaf	H/C	P	A
Parmelia dilatata	Kalpasham	Epiphyte (lichen)	Entire plant	S	P[1]	A
Pavetta indica	Manjapavatta	Shrub	Bark	M	P	A
Persea macrantha	Kulamavu	Tree	Bark	M	P[2]	P[2]
Phyllanthus amarus	Keezhanelli	Herb	Entire plant	M	P	P
Phyllanthus emblica	Nelli	Tree	Fruit and bark	F/M	P[1]	P[1]
Pimpinella heyneana	Kattumalli	Herb	Seed	M	A	P

Contd...

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Piper argyrophyllum	Kattukurumulaku	Climber	Stem, fruit and root	S/M	P[1]	A
Piper longum	Thippali	Climber	Stem, fruit and root	S/M	P[1]	P[1]
Piper sp.	Kattukurumulaku	Climber	Stem, fruit and root	S/M	P[1]	P[1]
Plumbago indica	Koduveli	Herb	Root	M	A	P[2]
Polygala arvensis	Kodashari	Herb	Root	M	P	A
Pongamia pinnata	Ungu	Tree	Bark and seed	M	A	P
Pothos scandens	Paaruvakodi	Climber	Entire plant	M	A	P
Pseudarthria viscida	Moovila	Herb	Root	M	P[1]	P[1]
Pterocarpus marsupium	Venga	Tree	Bark	M	P	A
Radermachera xylocarpa	Vedamkorana	Tree	Fruit and bark	M	P	A
Rauvolfia serpentina	Sarppagandhi	Herb	Root	M	P[1]	P[1]
Remusatia vivipara	Marachembu	Herb	Root	M	P	A
Rhynchosia rufescens	Moovila	Climber	Root	M	P'	A
Ricinus communis	Avanakku	Shrub	Seed and root	M	P[1]	A
Rubia cordifolia	Manjatti	Herb	Root	M	P	A
Ruta graveolens	Arutha	Herb	Leaf	M	P	A
Sapindus laurifolius	Ulurinjikkai	Tree	Fruit	M/T	A	P[1]
Schleichera oleosa	Poovam	Tree	Bark and seed	M	P	A
Scoparia dulcis	Kallurukki	Herb	Entire plant	M	P	A
Semecarpus anacardium	Alakkucheru	Tree	Fruit	M	A	P
Sida acuta	Kururnthotty	Herb	Root	M	P	A
Sida cordifolia	Kururnthotty	Herb	Root	M	P	A
Sida rhombifolia ssp. *retusa*	Kurumthotty	Herb	Root	M	P[1]	P[1]

Contd..

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambu
Sigesbeckia orientalis	Ottadachedi	Herb	Root	M	A	A
Smilax zeylanica	Valiyakanni	Climber	Root	M	A	P
Solanum indicum	Chunda	Shrub	Root	M	P^1	P^1
Solanum viarum	Kandakarichunda	Herb	Root	M	P^1	A
Spilanthes acmella	Vedhanachedi	Herb	Flower	M	P	P
Spondias pinnata	Ambazham	Tree	Fruit and bark	M/F	A	A
Stachytarpheta indica	Kadapananthu	Shrub	Leaf	M	A	A
Sterculia guttata	Kavalam	Tree	Bark	M	P	A
Sterculia villosa	Vadam	Tree	Bark	H	P	A
Stereospermum chelonoides	Poopathiri	Tree	Flower and bark	M	P	A
Stereospermum colais	Poopathiri	Tree	Flower and bark	M	P	P^2
Strobilanthes ciliatus	Karinkurinji	Shrub	Root	M	P^1	A
Strobilanthes sp.	Karinkurinji	Shrub	Root	M	P	A
Strychnos nux-vomica	Kanjiram	Tree	Seed	I	P^1	P^1
Symplocos cochinchinensis	Pachotti	Tree	Bark	M	A	A
Syzygium cumini	Njaval	Tree	Bark	M	P^2	P^2
Tamarindus indica	Puli	Tree	Fruit	F/M	P	A
Tectona grandis	Teak	Tree	Young shoot	M	P	P^2
Tephrosia purpurea	Kozhijal	Herb	Root	M	P	A
Terminalia bellirica	Thani	Tree	Fruit	M	P^1	A
Terminalia chebula	Kadukka	Tree	Fruit	M	P^1	A
Terminalia crenulata	Karimaruthu	Tree	Bark	M	P	P
Terminalia paniculata	Maruthu	Tree	Bark	M	A	P
Thespesia lampas	Kattuparathy	Shrub	Bark	M		
Tinospora cordifolia	Amrithu	Climber	Entire plant	M	P	A
Trichosanthes cucumerina	Kattupadavalam	Climber	Fruit	M	P^1	A

Contd....

Botanical Name	Malayalam Name	Habit	Useful part	Uses	Study Area	
					Wayanad	Nilambur
Triumfetta rhomboidea	Oothumkkai	Herb	Root	M	P	A
Uraria hamosa	Moovila	Herb	Root	M	P	P
Urena lobata	Uthiram	Herb	Root	M	P	A
Uvaria narum	Karivalli	Shrub	Young stem and root	M	P	A
Vateria indica	Kunthirikkam	Tree	Resin	I	P^1	P^1
Vernonia cinerea	Poovamkurinila	Herb	Entire plant	M	P	A
Vigna trilobata	Kattupayar	Climber	Fruit	M	P	A
Viola betonicifolia	---	Herb	Entire plant	M	P	A
Viscum orientale	Ithikanni	Parasitic herb	Stem and bark	M	P	A
Wedelia chinensis	Manjakurinji	Herb	Root	M	A	P
Wrightia tinctoria	Dandhapala	Tree	Leaf	M	P	P^2
Xylia xylocarpa	Irul	Tree	Seed and bark	B	P	P
Zanthoxylum rhetsa	Mullilam	Tree	Bark and seed	M	P	A
Ziziphus mauritiana	Elanthatta	Tree	Fruit	M	P	A
Ziziphus rugosa	Kotta	Climber	Root	M	P	A