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STUDY OF SOCIAL AND ECONOMIC DEPENDENCIES OF THE LOCAL COMMUNITIES ON PROTECTED AREAS - A CASE OF PEECHI-VAZHANI AND CHIMMONI WILDLIFE SANCTUARIES

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Final Report of Project KFRI / 352 / 2000

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A project sponsored by KERALA FOREST DEPARTMENT (WBP)

Kerala Forest Research Institute,
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ABSTRACT OF PROJECT PROPOSAL

1. Project number : **KFRI 352/2000**

2. Title of the project : Study of Social and economic dependencies of local communities on Protected Areas : A case of Peechi-Vazhani and Chimmoni Wildlife Sanctuaries.

3. Objective :

1. Survey on the economic and social status of local communities in the Protected Areas and classification of the local communities based on their dependencies on the Protected Areas.
2. Quantification and classification of NTFP collected from the Protected Areas by the local communities (both legal and illegal).
3. Assessment of grazing pressure on the Protected Areas.
4. Enumerations of other human-related problems affecting conservation and management of the study areas and evolve suitable management strategies through a workshop with the participation of local community representatives and forest officials.
5. Assessing the level of conservation awareness among the local people and their attitude towards conservation activities by the Department
6. Suggest scientific methods for the collection of various important NTFPs and methods for their value-addition (based on literature).
7. Develop a training programme for the local people for scientific collection of NTFP for its sustainability and value-addition.

4. Expected outcome :

1. Quantify the level of socio-economic dependencies of the local communities on the sanctuary
2. Highlight human problems relating to resource management in the study area and suggest measures to solve it
3. Project indigenous knowledge of the local communities about conservation

5. Date of commencement : April 2000

6. Scheduled date of completion : March 2002

7. Funding agency	:	Kerala Forestry Project (World Bank) Kerala Forest Department
8. Project team		
Principal Investigator	:	V. Anitha
Co-investigator	:	P.K. Muraleedharan
Project Fellow	:	A.S. Binilkumar

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Abstract

The establishment of Protected Areas (PAs) to conserve and to reduce human interactions has resulted in a series of repercussions, which generate new kinds of management issues. Conservation efforts create conflicts among local communities and between the local communities and the enforcing authorities. Local communities see these efforts as government-imposed restrictions on their socioeconomic systems, which affect their livelihood. In this context, this study made an attempt to assess the socioeconomic conditions of the forest-dependent local communities (including tribals) in Peechi-Vazhani and Chimmoni Wildlife Sanctuaries (WLSs), which were found to be the major determinant of their dependency level. This was done by analysing the key socio-economic indicators of development. In comparison, socioeconomic dependence was found much more in Peechi-Vazhani than in Chimmoni where there are no habitations within. These attributes of the local communities are very much similar to any other area in the State with heterogeneous community features and an agrarian economy. Given the complexities of a heterogeneous population, it does not rule out the possibility of management and development of resources through the participatory mode of management, considering the dependency factor on the WLSs. In the light of the literacy rate (82%) and prevalent livelihood patterns reflecting the quality of life, the study indicates dependence mainly for fuelwood (75%), fodder (21%), and NTFPs (34%). These factors alone can promote forest enhancement schemes in a participatory mode of management in the WLSs.

Among the socioeconomic dependency, NTFPs plays an important role in the livelihoods of the tribals, particularly. The marketing scenario in Peechi-Vazhani shows a dominant role of private traders that has led to large-scale commercial exploitation of the resources compared to that of Chimmoni WLS. Resource depletion is indicated by variations in the availability of the resource, increase of prices of the products over a period of time, reduction in the quantity of the product, increase in distance covered in collection and the economic extinction of non-premium products.

Along with the socioeconomic assessment and dependency level, human related constraints in management were also enumerated. Besides, an attempt has been made to put the historical information in an analytical framework to elucidate the genesis of such constraints in conservation. It is understood that the constraints relate mainly to an insufficient attention to (i) the approach of involving local communities and others who care about the PA in the planning, management and decision-making for the area, (ii) the social and economic dependencies of the local communities, that conflict with the objectives of the PAs, and (iii) actual commercial threats facing the PAs. Some of the

causatives relate to tenure issues, lack of community awareness, unclear institutional arrangements, policy and legal framework, among others.

The situation in which the sanctuaries have come to be treated as *open access areas* (in particular, Peechi-Vazhani) has resulted in escalating degradation over the years as predicted in the *tragedy of commons*. Thus, if sustainable forest resource management is the goal to achieve, management should consider the basic needs and aspirations of the dependent local communities (including tribals) residing in and around the WLSs and simultaneously deal in an appropriate and timely basis with the conflicting situations created by large number of users of the natural capital. In other words, it is necessary to adopt a landscape-livelihood approach in PA management, thereby satisfying the concept of optimum social welfare as envisaged in Paretian Welfare Economics.

1. INTRODUCTION

1.1 Background

All forestry contributions (goods and services) have socioeconomic significance in that they help to meet the basic needs of the society (Chandrasekaran, 1996). Forests help to maintain an ecological balance and biodiversity, protect watersheds and wildlife, store carbon and influence weather and climate patterns. In addition, forest-based activities help to increase rural employment, income and living standards of the rural people. These multiple roles of the forests covering a wide range of environmental conservation and rational utilisation of forest resources are crucial for human welfare and sustainable socioeconomic development. Forest resources directly contribute to the livelihood of 90 per cent of the 1.2 billion people in the developing world and some 33 to 69 per cent of the livelihood needs of Indian tribal population are derived from forests under traditional and customary rights (Baird, 2001).

The pressure of a growing population and ever expanding human activities has increased the demand on the scarce land resources. The decrease in land-man ratio has put immense pressure on forest land for agricultural, industrial and settlement needs. The mainstay for the majority of the rural population is agriculture, forestry, animal husbandry and allied activities (GOI, 1984). Human-environmental relations are confronted with major problems due to degradation of forests. Recent reports by the World Resources Institute have shown that more than 80 per cent of the planet's natural forests have already been destroyed (Hatch, 1997). The risk of deforestation and environmental degradation in the developing countries still remains very high since the population of these countries grew from 2 to 4 billions during 1960-1990 and is expected to grow further by about 3 billions during 1990-2020 (FAO, 1993 a.). Considering the dependency of a sizeable per cent of the people on the forests, deforestation will have many social, economic and ecological effects. Underlying causes include such issues as poverty, unequal land ownership, women's status, education and population. Immediate causes are often concerned with a search for land and resources, including both commercial timber and fuelwood. In the

tropical forests of the world, the clearing of the land for agriculture and livestock are the primary activities resulting in deforestation and the main cause is unequal distribution of land (Anderson, 1990). The market and policy changes also act as driving forces of deforestation (Gutman, 2001). Several government agencies are having policies that are uncoordinated in nature (Anderson, 1990). Another underlying cause of the ecological crisis is social inequality.

Considering the economic theory and the market function in efficient resource management, the very relevant question here is, why is then the natural capital getting depleted? This is probably because of the easy availability of the resources without much restriction (like *open access resource*) and the consequent over-exploitation. Forestry contributions have a negative connotation, i.e., deforestation, caused due to over exploitation, unauthorised activities, adverse socioeconomic pressures, management lapses and inefficiencies (Chandrasekharan, 1996).

The creation of some 30,000 PAs around the world has been one of the great achievements of the 20th century. Unfortunately, not many are effectively managed. Some have great and growing difficulties as governments cut their subventions, forcing PA managers to raise their own revenue. Many still have conflicts with the people who live inside or alongside. A growing number suffer from their own success as visitors pour in. Most PAs are under pressure at their periphery from anthropogenic dependence, need to extend farmland, build roads and so forth. PAs have a long tradition of beautiful places and refuges for wildlife. But, now we need to see PAs in their wider context - as vital reservoirs of biodiversity for the world, often as a key component of national prosperity, and as providers of sustainable benefits for people living nearby.

Presently the PAs in India cover an area of 150809.6 km^2 encompassing about 14 per cent of country's forest area and 4.58 per cent of its landmass (Kutty and Kothari, 2001). From six National Parks (NP) and 59 Wildlife Sanctuaries (WLSs) in 1970 the number increased to 85 NPs and 462 WLSs in 1998 (WII, 1998). PAs do face threats from local communities who have to heavily depend upon the local resources for their sustenance

needs because in India these PAs are the only remaining sources of fuel, fodder, other forest produce, fish and other aquatic resources, with most surrounding areas having been degraded (Kutty and Kothari, 2001). The ability of PAs to provide benefits is being undermined by commercial threats occurring and the forecasts for posterity are even more discouraging.

All PA programmes reflect a conflict of interests between alternative uses of scarce resources, and therefore, involve an economic component. In developed countries, the focus on environmental protection has been for recreational or aesthetic reasons. In developing countries, the immediate concern is the disappearance of the resource base on which the very survival of billions of people depends. The dominant conservation assumption has been that people damage natural ecosystems and therefore they should be kept away from PAs. Another assumption has been that the local people's practices and knowledge are either irrelevant or contradictory to conservation initiatives. Conservationists have, therefore, excluded local communities from policies and programmes for the management of PAs and in most cases severely restricted access to livelihood resources. As a result of the above factors conflicts have been growing between local communities and PA managers. There is a vast disparity between the economic benefits that conservation can realistically be expected to deliver and the needs and aspirations of rural people.

In this background, the corpus of the study is to assess the socioeconomic status of the local communities, the dependency factor and enumerate the human-related constraints in management as a result of conflicting PA goals and basic livelihood needs on two WLSs, viz. Peechi-Vazhani and Chimmoni. As these two PAs are being treated as *open access areas* there has been severe degradation in the past. There is no published data on the extent of denudation of forests in the sanctuaries over a period of time. However, an estimate on the same in the earlier Trichur Forest Division, in which Peechi-Vazhani constituted about 90 per cent of the area indicates that the sanctuary area witnessed a massive denudation of forest cover over a period of time (Menon,1986). One of the recent studies, based on remote sensing data, pointed out that about 29 per cent of the

forest areas of Peechi part of Peechi-Vazhani sanctuary are grouped under the category of highly and moderately degraded areas (Mammen, 2000).

1.1.1 Objectives

The specific objectives of the study thus were:

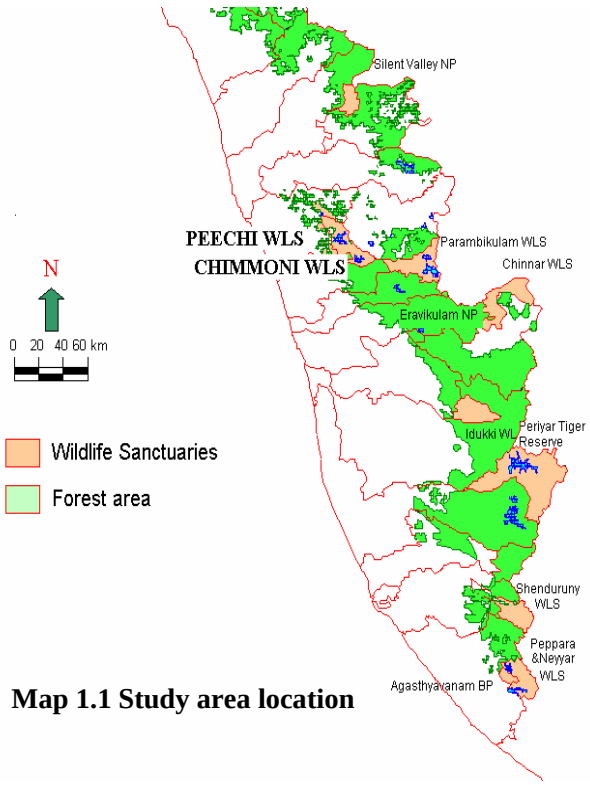
8. Survey on the economic and social status of local communities in the PAs and classification of the local communities based on their dependencies on the PAs;
9. Quantification and classification of NTFP collected from the PAs by the local communities (both legal and illegal);
10. Assessment of grazing pressure on the PAs;
11. Enumerations of other human-related problems affecting conservation and management of the study areas and evolve suitable management strategies through a workshop with the participation of local community representatives and forest officials;
12. Assessing the level of conservation awareness among the local people and their attitude towards conservation activities by the Department;
13. Suggest scientific methods for the collection of various important NTFPs and methods for their value-addition (based on literature); and
14. Develop a training programme for the local people for scientific collection of NTFP for its sustainability and value-addition.

1.2 Study area

The socioeconomic dependencies of the local communities and their consequences were assessed in two Wildlife Sanctuaries (WLS), viz. Peechi-Vazhani and Chimmoni lying contiguous to each other and located in the central circle of the Kerala forests (Map 1.1). The following gives a brief profile of the study areas, description of location, biophysical features and some specific management issues.

1.2.1 Peechi-Vazhani: Peechi-Vazhani WLS is a Protected Area, located in Thrissur district in Kerala State, covering two taluks Thrissur and Thalapilly. Combining some portions of Peechi, Pattikad and Machad ranges of Thrissur Forest Division, Peechi-Vazhani WLS was formed in 1958. The Government of Kerala, in exercise of the powers conferred by sub section (1) of section 18 of the Wildlife (Protection) Act 1972 (Central

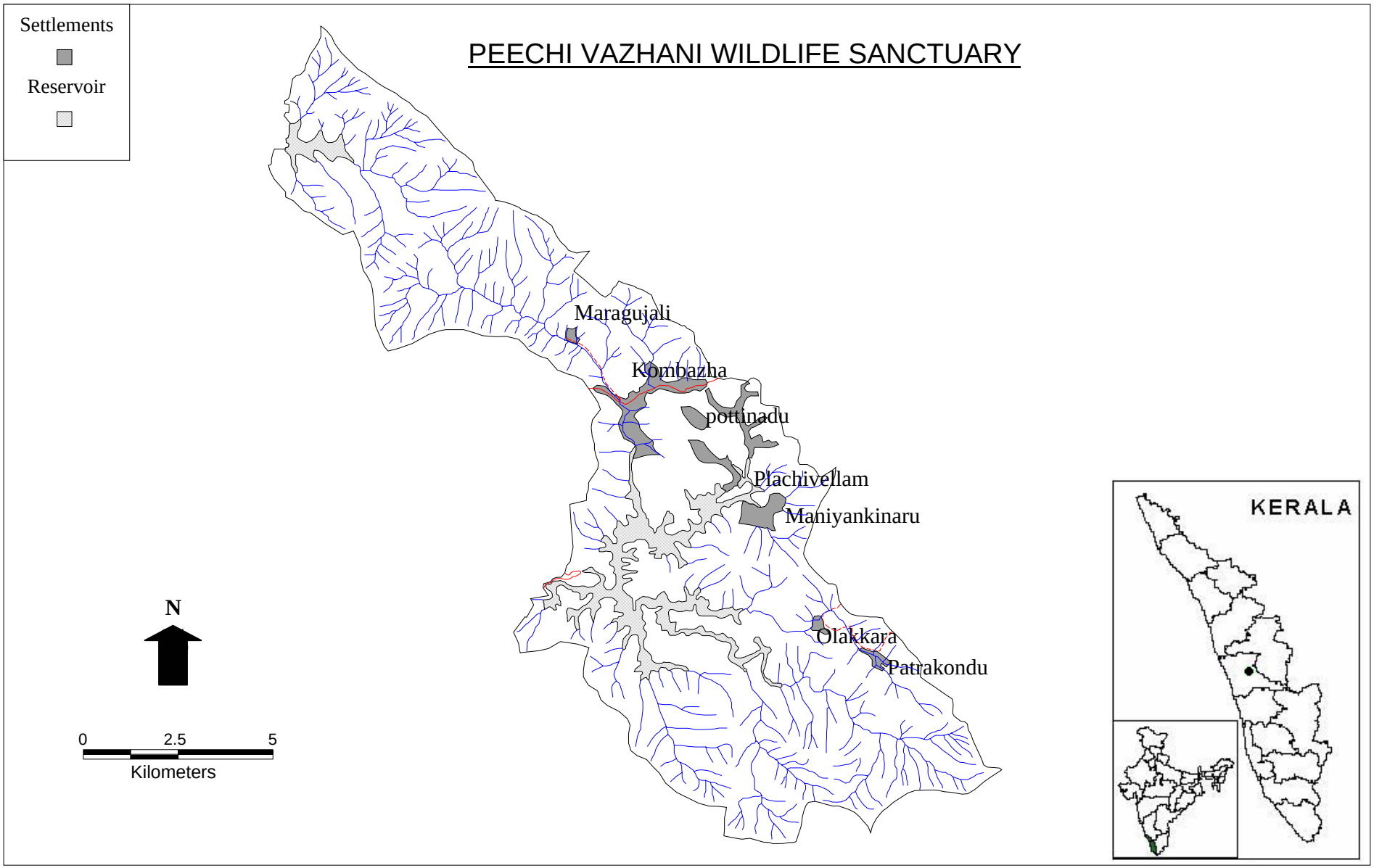
Act 53 of 1972), declared the tract to be Wildlife Sanctuary vide G.O. (MS) No. 871 dated 6-8-1958. The Sanctuary consists of parts of Paravattanimala Reserve, Machadmala Reserve, and Bharanipachamala Reserve. This tract is highly remarkable for its natural beauty and the floral and faunal wealth.



Map 1.1 Study area location

Location: Peechi-Vazhani WLS is about 20 km east of Thrissur town. The tract forms part of the Western Ghats and is a true representation of the gene pool of the Western Ghats with all its complexity and diversity. It is located between 10^0 28' and 10^0 40' N latitudes and between 78^0 18' and 78^0 28' E longitudes (Map 1.2) and has a total area of 125 km^2. The National Highway 47 passes through the sanctuary, which breaks the corridor between Peechi on the south and Vazhani forest tract on the north. This has resulted in the isolation of Vazhani half of the sanctuary from the Peechi forests, which is contiguous with the forests of southern Kerala.

Boundaries: The tract is bounded by portion of Bharanipachamala Reserve on the north; Moodal, Kuthiran, Vazhukkumpara Reserve, and areas of Paravattanimala Reserve on the south; and Machad Mala Reserve on the east and west.



Map 1.2: Peechi Vazhani WLS - Location

Climate: The sanctuary has a warm humid climate, which is characteristic of the region. Southwest and Northeast monsoons are the main sources of atmospheric precipitation of the area. Greater portion of the rainfall of the area is from the Southwest monsoon between June and September. The annual rainfall varies between 2500 and 3000 mm. *"Vrischika Kattu"*, the warm dry wind from mid November to mid January, accelerates the transition from the wet season to dry season. The wind is caused due to the tunnel effect, as the sanctuary lies close to the Palakkad gap. The dry months are from December to March. March, April and May are the months when the temperature goes up to about 38^0 C in the lowland and about 32 ^{0}C in the hills. During December, January and February the temperature in the lowland falls to 21^0C and in the hills, as low as 15 ^{0} C.

Physiography: The terrain is highly rugged, undulating, the altitude ranges from 100 m to 926 m. The area is well drained with two west flowing rivers, Wadakkancherry river and Manali river. There are two irrigation projects within the sanctuary, viz. Peechi and Vazhani, which irrigate the lowlands towards the west.

Geology: The predominant parent material seen is of metamorphic rocks of the gneissic series, weathering in large sheet, especially on the upper elevations. However, the rocks tend to become lateritic. Owing to active weathering, the ground is very much bouldery, especially in the moist deciduous forest areas. The soil is blackish or reddish and loamy.

Vegetation: Moist deciduous and semi-evergreen forest formations are seen in the sanctuary, which include 500 hectare of mixed plantations of teak and bombax (Mohanan, 2000). During the dry season, the canopy remains leafless in the moist-deciduous forest. The main species of the top canopy are *Albizia odoratissima, Bombax ceiba, Dalbergia latifolia, Dillenia pentagyna, Grewia tiliaefolia, Haldina cordifolia, Lagerstroemia microcarpa, Pterocarpus marsupium, Tectona grandis, Terminalia bellerica, Terminalia paniculata and Xylia xylocarpa. The lower canopy consists of species like Bridelia retusa, Careya arborea, Cassia fistula, Erythrina stricta, Schliechera oleosa and Sterculia urens*. Annual fire during dry season is common in this

forest formation. The semi-evergreen forest formation comprises evergreen species as well as a few deciduous species, which generally occupy the upper canopy.

People : There are human settlements in and around the sanctuary. They are the pioneer rice cultivating settlers, migrant farmers, the scheduled caste (*Kavaras, Vettuvas, Parayas, Pulayas*) and the major forest-dependent tribal community (*Malayan* and *Kadars*) and other backward castes. There are 21 tribal settlements residing in and along the periphery of the sanctuary, 17 in Peechi and three in Vazhani forest tracts. All the 21 settlements in total constitute 331 households, with a total population of 1315, among which males constitute 46 per cent and females 54 per cent *(primary data estimates*). Maniyankinar, Poovanchira and Thirumani are settlements with high population density; their prevalence being attributed to ancestral roots. Language spoken is Malayalam.

Importance of the sanctuary: Peechi-Vazhani Wildlife Sanctuary is a wide forest area lying on the southern side of the Palakkad pass. It is the catchment area of two reservoirs, contributing as a source of drinking water to Thrissur town and the nearby panchayats and irrigation for paddy fields of Thrissur and Thalappilly taluks. In order to facilitate an uninterrupted flow of water into the reservoirs and protect the reservoirs from siltation, conservation of the sanctuary is very much essential. There are two dams within this sanctuary, viz., Peechi and Vazhani and the former was commissioned in 1959. The reservoir irrigates an area of 17256 hectares spread around the nearby panchayaths. Vazhani dam is an earthern dam having 792.48 m length and was commissioned in 1959. Its waterspread area is 1.82 km^2 having a catchment area of 20.48 km^2. The storage capacity of the dam is 18.121 Mm^3. The reservoir irrigates an area of 4313 ha spread around the nearby panchayaths.

1.2.2 Chimmoni Wildlife Sanctuary

Chimmoni Wildlife Sanctuary is a protected area under the control of the Peechi Wildlife Division, which was formed in 1984. The Sanctuary was notified as per G.O (P) No.259/84/A D dated 25-9-1984. The area as per the notification is 10 km^2 (approx.). The Chalakudy Forest Division, till 1988, administered it. In April 1988 it was brought

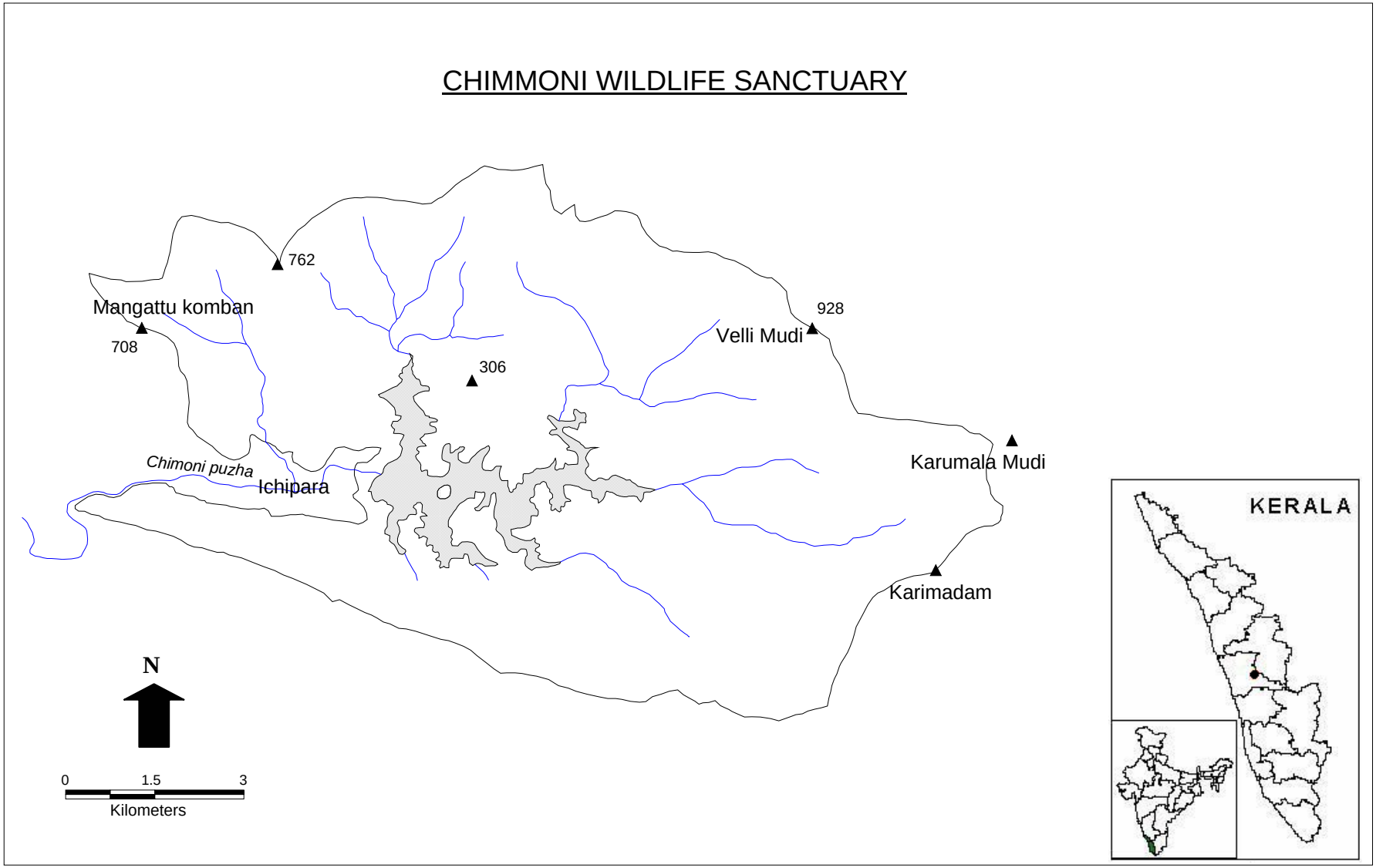
under the administrative control of the Parambikulam Wildlife Division and later given to Peechi Wildlife Division. The present area of the WLS is 85 km^2 .

Location: Chimmoni Wildlife Sanctuary is situated west of the Parambikulam Wildlife Sanctuary, Thrissur district, from 10^0 22' N to 10^0 26' N latitudes and from 76^0 31' E to 76^0 37' E longitudes (Map 1.3), on the western outer slopes of the *Nelliampathies*. The western slopes of Nelliampathies have gently descending hills finally emerging with the Chalakudi-Thrissur plains. The tributaries *Kurumalipuzha*, *Chimmoni* and *Mupli* rivers drain these forested western slopes.

Biogeography: The ecosystem of the sanctuary comes under, South Indian Moist Deciduous Forest of the *Tectona -Dillenia -Lagerstoemia lanceolata -Terminalia paniculata* series. This ecosystem occurs on the western side of the Western Ghats below the evergreen-wet evergreen belt and along the plains. Tropical semi-evergreen and moist deciduous forests are the prominent biogeographic characters.

Geomorphology: The landform of the sanctuary has an extremely varying topography-altitude ranging from 40 m at the proposed dam site on the low margin of the sanctuary, to 1110 m in the eastern end. The highest peak Ponmudi (1116 m) of the Chimmoni Wildlife Sanctuary is located here. The territorial boundary of the sanctuary roughly coincides with the watershed of Chimmoni River. The innumerable channels of the river had carried the entire landscape into such a diverse topography that it is unique to this region.

Climate: The climate is fairly balancing in the sanctuary. The dry season is from December to April and wet season is from May to November. March, April and May are the hottest months. The tract gets a few pre-monsoon showers in April. The main portion of the annual rainfall is from the Southwest monsoon. The tract receives an average rainfall of about 2980 mm annually. The temperature varies between 36^0 c and 24^0 c in the hottest months. The sanctuary also receives rain from the Northeast monsoon



Map 1.3: Chimmoni WLS - Location

during October to November. During the December-January the minimum temperature falls to 15^0 C.

People: Compared to Peechi-Vazhani Wildlife Sanctuary, Chimmoni Wildlife Sanctuary is free from acute or high human pressure. The local community includes tribes and employees of Chimmoni irrigation project and labourers of Chimmoni Rubber Estate. There are only three tribal settlements at present in and around the sanctuary named as Kallichitra Nadampadam, Echippara and Karinkayam VRT colony, which are depending mainly on the sanctuary for their livelihood. The whole three settlements constitute 76 households and a population of 380.

Two major events that adversely affected the management of forests of this area were the cyclone of 1940 and the clearance of forests for the 'Grow more food' campaign of 'hill paddy scheme'. Chimmoni Dam, constructed in the Chimmoni river at Chimmoni was commissioned in 1992. The main objective of the Dam was to irrigate of 13,000 ha. of paddy fields of Thrissur district. The waterspread area of the reservoir is 10.10 km^2 and catchment area of the Dam is 72.13 km^2 which covers almost 90 per cent of Chimmoni Wildlife Sanctuary. An area of 80 hectares was leased out by Forest Department to Irrigation Department between 1975 and 1983 for construction works and quarry. An area of 990 hectares of forest land has been identified as the submergible area and necessary directions have been issued to clearfell this area. Between 1976 and 1983, an area of 546.481 ha. was clearfelled.

Management issues: The rate of forest denudation in Thrissur Forest Division shows about 23 per cent of the forests were cleared for various purposes during the 30 year period between 1930 and 1960 and during the period 1960 to 1984, the rate almost doubled (50%) (Menon, 1984). The major management issues arise here out of the long gone process of conversion and the resultant anthropogenic dependence / pressures facing the sanctuary and the consequent human related constraints in conservation. There exits a strained relationship between the sanctuary managers and the local communities.

1.3 Methodology

1.3.1 Primary data and sampling design

Socioeconomic assessment: The study based mainly on primary data was supplemented with secondary data wherever necessary. A multistage stratified random sampling method was adopted for the selection of samples, the unit of study being the household. The socioeconomic survey covered the basic household details; land use and cropping pattern; forest-dependence and conservation awareness among the local community. There are a total of 11 panchayaths within which the two sanctuaries lie; they are Pananchery, Puthoor, Pazhayannoor, Chelakkara, Thekkumkara, Mulloorkara, Madakkathara, Varandarappilly, Mattathoor (all in Thrissur District), Kannampra and Kizhakkenchery (both in Palakkad District). Among these panchayats the study area covered 39 wards hosting approximately 6,000 households in and around the PAs. Taking these households as population, approximately 10 per cent sample i.e., 600 households were selected for the socioeconomic assessment giving more weightage to the tribal households on the fact that they are more dependent on the forest resources. There are a total of 25 tribal settlements (Appendix 1.1) covering both the WLSs. The socioeconomic survey was conducted using pre-formulated interview schedule and the Participant Observation method. The criteria for sample selection were proximity (current users), encroachment, tribal settlements, fringe areas (boundaries), enclave settlements and extraction of NTFPs.

NTFPs: Primary data on NTFPs were generated through a questionnaire survey along with the socioeconomic survey, targeting the actual foragers (183 households) from among the sample. Among them a meager 2 per cent comprised non-tribes. Proximity to the WLS and the dependence for NTFPs were the two criteria behind the sample selection. In order to understand the price differences, primary data were also collected from the private traders operating in Thrissur town, Wadakkanchery, Wadakkenchery, Mangalam Dam, and Pazhayannoor.

Fuelwood: With a view to supplement primary data on fuelwood collected from sample households, data relating to the same were gathered from different paths (footpath survey) through which the people traversed the sanctuary in order to collect the fuelwood. Of the total 40 entry paths, four entry paths, one each in four directions, were randomly selected for observation, verification and estimation of quantity collected. This exercise was carried out one week each in a month for about one year and average values were estimated (partly by visual observation and partly by weighing). Printed survey schedules were also used to record the information.

Training programmes: Three training workshops for the NTFP foragers of Peechi-Vazhani and Chimmoni on *Sustainable harvesting and semi-processing of NTFPs* were conducted, two at Peechi and one at Vazhani. This was done in collaboration with the Wildlife Division, Peechi and Divisional Forest Office, Thrissur. Resource persons in the field were brought in to impart training in the scientific collection and value addition methods of NTFPs. The topics covered in the workshop were: (1) General description on the available NTFP species in Peechi-Vazhani / Chimmoni WLS; (2) Methods of sustainable harvesting of NTFPs; (3) Methods of Semi-processing of NTFPs and value addition. Field training in collection of NTFPs was also imparted to the foragers. Details on the sustainable harvesting methods were also gathered from discussion with the actual foragers.

Conservation awareness covered perceived opportunities, threats and benefits of the local communities on PAs, reasons of past and present degradation of PAs, attitude toward FD officials, value of conservation, problems and solutions of PA conservation, willingness to work together with FD for conservation and finally, their attitude towards participatory management.

Human-related constraints in management were enumerated based on PRA conducted, informal discussions with the local communities and the Forest Department. Besides, an attempt was made to put the historical information in an analytical framework to elucidate the genesis of human-related constraints in management.

1.3.2 Secondary sources

Secondary data were collected from the Forest Department, Palappily Tribal Service Co-operative Society (PTSCS), and the Kerala State Scheduled Caste and Scheduled Tribe Development Co-operative Federation (Federation), Department of Tribal Welfare, Irrigation Department, Fisheries Co-operatives (Peechi and Vazhani), Land Use Board, and the Excise Department.

For suggesting the scientific methods for the collection of NTFPs and for their value addition, the major NTFPs collected from the study areas were identified, and through literature the sustainable methods to be adopted by the foragers were detailed.

1.3.3 Tools and techniques

Simple statistical tools like percentages were employed for the analysis of socioeconomic data. In order to measure the socioeconomic standards of the selected communities, conventional yardsticks like income, employment, operational holdings and the various social parameters were used.

To test the existence of association between poverty and social group, a chi-square ($\chi 2$) test was employed. Cramer's V index was also used for measuring relative strength of two kinds of association. Odds ratio is used to capture the relative degree of departure from homogeneity. Homogeneity here refers to the hypothesis that the probability of `being poor` is same in the two groups being compared. If p_1 is the probability that a person belonging to the ST is poor and p_2 the probability that a non-ST person is poor then the odds ratio `in favour of ` poverty with respect to ST or others is given by

$$O_{ST/Others,poor} = \frac{\left(\frac{p_1}{1-p_1}\right)}{\left(\frac{p_2}{1-p_2}\right)}$$

Grazing pressure is measured by the estimating the livestock density in the area and the level of dependence of the local communities on the WLSs for grazing. For that both secondary and primary information was resorted to. The dependence of the local community on the study areas for fodder was assessed using the primary information. The livestock population of the study area was calculated using the secondary information available in the panchayath level statistics of the adjoining 11 panchayaths. Livestock population of approximately 6000 households adjoining the study areas was estimated. The buffer zones of the study areas were taken as the impact zone (125 km^2).

One way Analysis of Variance (ANOVA) (Das and Giri, 1979) was used for the comparison of income. A Multiple Regression analysis (Snedecor and Chochran, 1967) was conducted in order to understand the contribution of NTFPs to the income of the tribal households. The model used was of the form: $Y=b_o+b_1X_1+b_2X_2+\ldots\ldots.. +b_9X_{9\ +u}$; Where, Y= household income from NTFPs (Rs); X_1= family size in numbers; X_2= age of the head of the households; X_3= experience in foraging, X_4= income from agriculture (Rs), X_5=number of adult members, X_6=number of educated adults, X_7=income from wage labour (Rs), X_8= total asset value (Rs), X_9= distance traveled for collection (in km), b_0= intercept , $b_1,b_2,b_3\ldots\ldots b_9$= the partial regression coefficients , and u=error term. An exponential function of the form, yt = a + bt was fitted to work out the compound growth rates for the quantity collected, collection charge given to the tribes and the sale value realised by the PTSCS for 18 years.

Scaling techniques were used to measure subjective responses in relation to the assessment of conservation awareness. Rating and ranking scales (on a scale of 0-10) were used in respective situations.

2. SOCIOECONOMIC ASSESSMENT AND DEPENDENCY

2.1. Background

People in forest environments are likely to draw heavily on that forest and its output. Elsewhere, the importance of forest products is more likely to be in the way they complement other sources of subsistence, inputs and income, than in their absolute share of overall household inputs. There are divergent views as far as the relationship between socioeconomic conditions (poverty) and resource degradation is concerned, which is attributed mainly to the population, agriculture and environment nexus (UNSO, 1994). Natural resource depletion is closely related to human activities and hence can be checked provided these linkages are well understood. Literacy and institutional credit are too important policy variables for checking forest degradation (Reddy *et al*., 2001). The contribution of forests to the livelihoods of the local communities and the options faced when seeking to enhance the role of forests in the poor people's livelihoods, highlight many of the policy constraints to lie beyond the realm of the forest sector (Arnold and Bird, 1999).

The role of the forest products activities varies depending on the availability and profitability of alternative employment, the seasonal availability of the forest products, the need for cash income, access to the forest resource, the composition and condition of the forest resource, and access to markets (Falconer and Arnold, 1989; Beer and McDermott, 1989). There is a seasonality of the forest activities, which maybe related to the activities of non-forestry sector. For example, fuelwood collection for the market was concentrated during the off-peak agriculture period, providing cash income in a period when food supplies are generally at their lowest (Kamara, 1986). The degree of dependence on forest is determined by several factors. These factors include socioeconomic status, living conditions, cultural and religious norms, literacy level, etc.

Here, in this part of the study, the immediate focus is to understand the human activity, assess the socioeconomic background, occupation, land use in and around the forest area

and identification of the stakeholders and in the following sections, an explanation of the patterns of use and reliance on the forests in survival strategies of the local communities (LC) is detailed. The study finally touches upon the potential in participatory mode of management.

Peechi-Vazhani and Chimmoni WLSs, located in the Peechi Wildlife Division lie contiguous to each other. Although the altitude, original vegetation and microclimate are very similar, the history of human interactions has made the two sanctuaries different. There is no habitation within the Chimmoni WLS whereas within Peechi-Vazhani this is very prominent. No significant differences are observed in the landscape elements, their interactions, their dynamics, differences in landscape chronology, health of the ecosystem and the socioeconomic status of the people. Basically the differences in both the landscapes stem from the biotic interactions that have taken place during the last century. Keeping this in view the socioeconomic assessment is done for both the sanctuaries taking them as a single unit.

2.2. Socioeconomic assessment

Prior to understanding the interactions of the different stakeholder groups between themselves and with the natural resources, the land use in the area, the settlement pattern, the population pressure, the socioeconomic status of the households, their livelihood, dependence on forests, etc. were assessed.

2.2.1. The people

A reconnaissance survey revealed that all the local stakeholders in Peechi-Vazhani had migrated to their present habitation during the last many decades and is dependent on agriculture. They had cleared the forests during earlier periods when the Government promoted forest clearance for food production. The Forest Policy during the last 20 years do not allow any more clearance of forests for agriculture or other purposes.

Socioeconomic survey of the sanctuaries has helped to identify the local communities as consisting of tribes, pioneer rice cultivators, migrant farmers (new settlers who came during the last 40 years), scheduled castes and other backward communities. The labour class mainly came from the latter two groups and tribes. Among the sample households 33 per cent constitute the general category of settler farmers and pioneer rice cultivators (Hindus, Christians, others). The scheduled tribes (Malayan, Kader) constitute the largest section (44%) and the smallest section of 11 per cent comprise the scheduled caste (Kavaras, Vettuvas, Pulayas, Parayas). The tribal households had been identified as the most dependent community on the sanctuaries.

The demographic features give a clear idea of the population dynamics of the study area. The average size of the household is 4.5 against the 5.3 persons in the State with a total population of 2687 from 600 households (Table 2.1). The sex ratio shows the preponderance of the females over males, which is in par with the State situation, which is indicative of good community health. The population density of the 11 panchayats in which the study area is spread through is only 501 per km^2, which is lower than the state average of 749 per km^2. The rural population presents a heterogeneous picture and the political structure is based on the Panchayathi Raj, i.e., the system of local self-governance.

Table 2.1: Population dynamics

Indicators	**Sample population**
Total population	2687 (600 hh)
Male	1331 (49.5%)
Female	1356(50.5%)
Avg. family size	4.5
Community feature	Heterogeneous

Primary data estimates

The literacy rate and level of education are indicators of awareness level among the local communities and thus have a great impact on the conservation of the natural resources. The overall literacy rate among the sample households is 81.71 per cent (Table 2.2), which is less than the State average i.e. 90.92 per cent and the District average i.e. 92.56 per cent (Census, 2001). The

Table 2.2: Literacy level of the local communities (5 years and above age group)

Sex	Literate	Illiterate	Total
Male	1032 (84.87)	184 (15.13)	1216 (100)
Female	992 (78.67)	269 (21.33)	1261 (100)
Total	2024 (81.71)	453 (18.29)	2477 (100)

Primary data estimates

literacy rate among males and females is also low when compared to the State level figures of 94.2 per cent (male) and 87.86 per cent (female) and District level rates of 95.47 per cent and 89.94 per cent. The low literacy level when compared to the State and the District average may be attributed to the poor literacy campaign programmes or the in-accessibility to the educational facilities and lack of awareness about the value of education among the local communities.

The level of education also does not project satisfactory figures among the local communities. Only a meager 1 per cent (Fig. 2.1) of the sample has availed degree level education, whereas 44 per cent has only primary level of education. This again is a poor indicator of general awareness. There are several reasons attributing to this. The most detrimental factor is the lack of interest and motivation primarily and then inaccessibility.

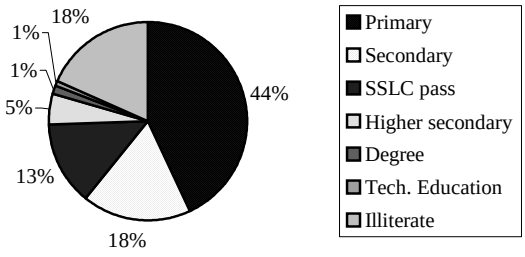


Figure 2.1: Level of education among the local communities (5 years and above age group)

The occupational pattern of the local communities is analysed here in order to understand the level of economic dependency on forest among the stakeholders by way of employment and to understand the alternative sources available to them. Among the adult members of the local communities 22 per cent are engaged in forest-based activities like, NTFP collection, casual labour, firewatching, etc. (Table 2.3). Farmers and agricultural labourers constitute 10.95 per cent and 12.62 per cent respectively. Only 2.87 per cent are government employees. Daily wage labourers

Table 2.3:Occupational pattern of the sample population (15 years and above age group)

Nature of Employment	Males (%)	Females (%)	Total (%)
Govt. Employee	2.27	4.27	2.88
Farmer	14.27	3.35	10.95
FD Employee	0.27	2.74	1.02
Fire Watcher	1.33	0.00	0.93
Agri. Labourer	11.60	14.94	12.62
Other Labour	32.80	26.22	30.80
NTFP Collection	22.40	41.16	28.11
Others	15.07	7.32	12.71
Total	100.00	100.00	100.00

Primary data estimates

constitute a large section of the rural population. The variables taken to understand the situation are (a) the number of working days available per worker per year and (b) daily money wage rate. Wage employment forms the major source of income. Thus, the largest component in the employment sector is labourers (30.8 %). In short, the occupational pattern shows dominance in the primary sector.

The work participation rate among the population above 15 years of age is found to stand at 52.84 per cent. It highlights an unemployment rate of 47.16 per cent within the communities. The work participation rate among males is much higher than that of females (Fig. 2.2). This shows the poor participation of women in the visible or economically rewardable jobs and remaining in the invisible household jobs.

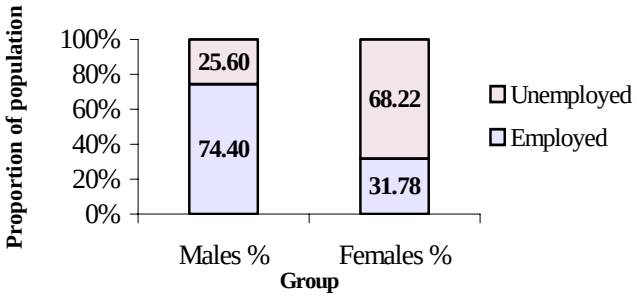


Figure .2.2: Employment Status of the local communities (15 years and above age group)

2.2.2 Land use and operational holdings

The general land use pattern of the study area is commensurate with the land use pattern of the District as such. The cropping pattern existing in different land holding classes is more or less same though the intensity and composition are different. As most of the local stakeholders are migrants or settler farmers their economy is basically agrarian in nature. Their dependence on agriculture for the livelihood is either by way of cultivation in own land or as agricultural wage labourer. Over the years change in the land use pattern resulted in paddy being replaced by crops like rubber, coconut, arecanut, etc. The cropping pattern as seen now consists of mixed crops (rubber, plantain, vegetables, coconut, arecanut, pepper, ginger, tapioca and other tubers). This is probably due to high cost of cultivation, price changes, conversion of paddy fields into garden fields and for non-agricultural purposes (like construction of houses, roads, etc.), labour shortage, peoples preference for wage employment, and also lack of interest among the younger

generations. On account of the intervention of market forces, the traditional crops like ragi, millets, etc. have given place to diversified agriculture with commercial crops. There has been a gradual but steady shift from annual and seasonal crops to commercial crops.

The agricultural technology, which exists in the study area, is basically labour intensive than capital intensive. Most of the farmers undertake traditional cultivation practices although many have started adopting new, scientific agricultural technology too in their traditional methods. The recent trend of using unhealthy chemical fertilizers and pesticides has resulted in polluting the soil as well as the water of the cultivated lands, particularly in the catchment area.

There is an interesting land holding scenario in the study area. The ownership of land shows the asset value of a household. Among the tribes it is a symbol of pride and existence. The land holding among the local communities is being analysed here in order to understand the quantum of land owned by them. Majority of them are marginal holders. Among the sample households 6 per cent have no land at all and majority (91 %) are marginal holders (below 1.5 ha) and there is no household which owns land above 5 ha (Fig. 2.3). Large land holdings have been fragmented in the last 10-15 years. As a result over just a decade, the number of small and marginal farmers has increased. The increasing division of joint families into nuclear units may be a major reason for the large fragmentation of lands. Majority of the holdings are in the periphery of the sanctuaries and hence lack proper documents of the legal ownership. This shows the low asset level and resource entitlements that the local communities possess. Tenurial insecurity is thus an issue here.

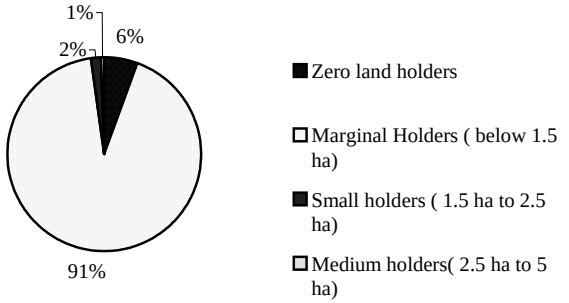


Figure 2.3: Size of land holding of local communities

In order to understand the real picture of land holding size and its distribution, the mean land holding was worked out by classifying the local communities into tribes and the non-tribes. The mean land holding of the tribes is as low as 0.13 ha indicative of their lack of title deeds whereas that of the non-tribes is 0.41 ha (Table 2.4). The distributional inequality among the local communities is evident from the calculated standard deviations (SD). The low SD of the tribes showed comparatively low inequality of the distribution of land among the tribes and highly unequal distribution among the non-tribes.

Table 2.4: Mean and standard deviation of land holding (local communities)

Local communities	Mean land holding (in ha.)	Standard deviation
Tribal	0.1347	0.2095
Non-tribal	0.4180	0.5709
Total	0.2927	0.4698

(significance at 1 % level)

As in the case of the local communities of most of the PAs, the local stakeholders in the study area constitute a low-income segment of the society. The annual income of the stakeholders varies between less than Rs. 5000 and higher than Rs. 1 lakh (Fig. 2.4). Among the sample 3.85 per cent of the local stakeholders are having the annual income of less than Rs. 5,000. Majority of them (51.33 %) fall in the annual income range of Rs.10,000 – 25,000, all of who belong to socially and economically weaker sections of the society. Only 1.83 per cent show an income level of Rs.1,00,000 and above per annum. This again reflects the low resources or entitlements among the local communities. The real income status calculated for the two groups of tribes and non-tribes illustrated wide inequality in the income distribution in the rural

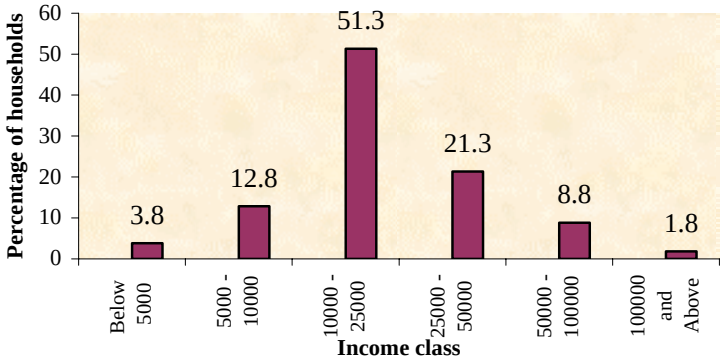


Figure 2.4: Income level of the local communities

areas adjacent to the PAs (Table 2.5). The standard deviation of the income of the two groups stood at Rs. 14591 and Rs. 27524 respectively, indicating less inequality among the tribes and high inequality among the non-tribes. The mean income of the local communities when equated with the mean operational holdings clearly indicates a direct relation with significant variations.

Table 2.5: Mean and standard deviation of annual income (local communities)

Local communities	Mean annual income(inRs.)	Standard deviation
Tribal	19018	14591
Non-tribal	30079	27524
Total	25167	23349

(significance at 1 % level)

Savings of any society directly depends on the income level of the society together with the propensity to save or propensity to consume. The propensity to save becomes relevant only if any household has income over and above its subsistence requirements. As the high-income group households are very less in the study area, the propensity to save within the local communities is low. It may be due to lack of sufficient income even to meet their daily requirements. Another consequence of the low income is the high dependence on debts or credit, which is visible in the study area also. Low income also caused high rate of debts among the households. For meeting the credit requirements, they resort to banks, both private and commercial, and also money lenders, both indigenous and those from Tamil Nadu. Many of the tribes are in a debt trap, which compels them to sell the Non-Timber Forest Products at a very low price. Tribes resort to indigenous money lenders only because of the failure of the supporting agencies like the Girijan Service Co-operative Societies (GSCS), which are supposed to help them in need. This is the case of the tribes mainly in the Peechi-Vazhani Wildlife Sanctuary where the Tribal Co-operative Society is defunct.

Among the local communities (sample) only 38 per cent own cattle. Proportions of cattle owned by tribals and non-tribals are 31.6 per cent and 43.1 per cent respectively (Fig. 2.5). This is primarily because of non-affordability, non-availability of fodder, debt problems, lack of people to rear cattle and a lack of interest among the younger generations in the activity. The system of dairy farming and poultry rearing was an

important avocation in the rural areas with active participation of the women. It has declined with increasing urbanization and the present situation is causing change in the attitude towards farming and also due to a shift in the cropping pattern. Due to a continuous depletion of food and fodder base as a result of a shift in cropping pattern in favour of cash crops and further fragmentation of the operational holdings, the feed and fodder base has become very weak. For instance, the area under rice being low, the availability of straw from internal sources has declined drastically.

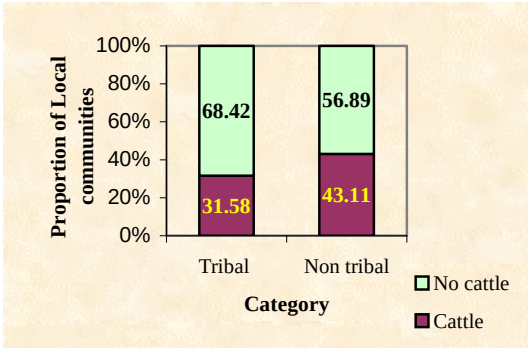


Figure 2.5:Classification of local communities on the basis of cattle possession

2.2.3 Infrastructure

Accessibility to the modern amenities of life is a problem in certain enclosures of the PA where there is habitation. There is acute shortage of water in the summer months from March to June. Water drains off quickly due to the terrain and also because of the land based activities in the catchment areas in the dry months. Of the sample, 95 per cent have access to safe potable water. The health status of the local communities is not so distressing. The prevalence of fatal diseases is less among the local communities. The commonly occurring diseases observed are fever, cough, and dysentery. Some of them, particularly among the tribes, are suffering from asthma, tuberculosis and leprosy. There also exists a high level of awareness among certain groups of the tribes on indigenous knowledge of medicines. The good climatic condition available to them due to the proximity of forests may be the reason for their good health.

Majority of the households own a house and live in hygienic conditions. Average plinth area of a non-tribal household is 30 m^2 and of tribal households is only 18 m^2. The failures of the government agencies, which are implementing housing schemes for tribes

and the inherent laziness among tribes to build up good houses for themselves, are the main reasons. Among the local communities 52 per cent have no toilet facilities. Lack of toilet facilities among non-tribes and tribes accounts for 41% and 67% respectively.

2.2.4 Poverty-Social group association

The incidence poverty in the study areas was measured using the head count ratio method. The poverty line was fixed at Monthly Per capita Consumption Expenditure (MPCE) of Rs. 335.46. Among the local communities the incidence of poverty found to be high among the tribes (59.3 %) while the non-tribals recorded a low rate (38.6 %). To prove the existence of association between the poverty and social groups, a Chi-square (χ^2) test was employed for each site and also for a combined set.

Chi-square test indicates there is a significant association between poverty frequency and social groups in Peechi-Vazhani (Table 2.6). Very marginal association exists between the two as far as Chimmoni WLS is concerned, mainly due to the low level of inequality among tribes and non-tribes. The association between the two was found to be significant in the combined group also. Cramer's V index also reflects similar results, suggestive of relative strength of the associations.

Table 2.6: Results of association between poverty and social groups

Group	Chi-square value	Cramer's V index
Peechi-Vazhani WLS	24.578**	0.202
Chimmoni WLS	0.136*	0.015
Pooled	23.801**	0.199

** significant at 1 % level
* non-significant

Odds ratio is calculated in order to understand the relative degree of departure from 'homogeneity', which refers to the hypothesis that the probability of `being poor` is same in the two. Odds ratio (Table 2.7) is less in Peechi-Vazhani WLS (2.53) than in Chimmoni (5.63). It indicates proportion of poor among tribes and non-tribes in Peechi-Vazhani is more homogenous.

Table 2.7: Degrees of homogeneity (Odds ratio)

Group	Percentages of poor		Odds ratio
	Tribes	Non-tribes	Tribes/ Non-tribes
Peechi-Vazhani WLS	60.95	38.13	2.5326
Chimmoni WLS	52.83	46.15	5.6290

2.2.5 Human Resource Development

The standard of living of the non-tribes, when compared with the tribes, is fairly good. Due to low level of literacy coupled with a low level of awareness of present day farming techniques, non-affordability, market situations and lack of government assistance, the local communities, specially the tribes, are not able to get sufficient returns from their land. Majority of the rural population are dependent on agriculture. Due to lack of proper irrigation facilities, agricultural yields are largely dependent on rains and productivity is low. The human development indicators of the study area, that is, literacy rate, per capita income, health status, basic entitlements, sex ratio, work participation rate, and accessibility to infrastructural facilities, etc. give a comparatively low level of human resource development.

2.3 Socioeconomic dependency on forest resources

2.3.1 Background

The local communities in the study area depend on the sanctuaries for their subsistence and complementary or supplementary uses. These dependencies may be in the form of collection of food, fuel, fodder, green manure, poles, NTFPs, fish, cultivation, water source, or catering to their social needs like cultural and religious. Based on these, dependencies can be classified as social and economic. The dependencies of the tribes and non-tribes vary considerably. Thus, it becomes imperative to understand these dependencies separately, in order to get a clear picture of the dependency level of the local stakeholders in the study area.

2.3.2 Social dependence

Social dependence of the stakeholders may be in the form of meeting their cultural, religious and medicinal needs.

2.3.2.1 Cultural / Religious dependencies : As the name signifies, they are hill men whose principal occupation was exorcism, which they perform by various methods in the

deep forests. These people are said to have deep cultural links with the forest landscape, as far as their religious practices, customs and traditions are concerned.

Unspoiled by the advancing wave of the mainstream of life the Kadars still retain some of their simple customs and manners (Thurston, 1909). Living in an isolated existence confined within thinly populated forests, they possess very little knowledge of agriculture. Superstition too is very high among these groups. Beliefs in spirits were predominant among the older generations. Most of their cultural and religious festivities are connected with the forest. Faith in God expressed in the form of idol worship was widely observed. They worship 'Mala daivangal' i.e., 'hill gods' before initiating any work or risky extraction of NWFPs like honey and other important occasions. They offer milk, arrack, meat to appease their deities in order to gain a good harvest. They fear the wrath of the hill gods which can destroy everything.

The non-tribes and other castes, *parayans*, *pulayan*, and *kavaras*, have had no specific affinity with the forests they draw upon. For them it is merely a source of economic independence.

2.3.2.2 Medicinal dependencies: This dependency is both social and economic in nature. The indigenous knowledge on medicinal plants and their uses, particularly among the tribal households in the study area, is very strong and well pronounced. The use of forest products for medicinal and other health purposes is widespread, where they frequently use large number of forest plants, and often some animal products (eg. honey, bee wax, etc.) for treating certain ailments. Medicinal usage tends to overlap with that of various forest food products; indeed particular items added to foods serve both to improve palatability and act as a health tonic or prophylactic. There are also often strong links between medicinal use and cultural values; for example, where illnesses are thought to be due to the ancestral spirits, certain medicinal plants have acquired symbolic importance for such treatments. Such values often underlie the division between use of traditional and modern medicines that is widely observed in current times.

Interactions with the Malayans highlighted that the use of indigenous medicinal plants generally lessen as people move to towns, and in situations where changes in attitudes and practices favour more reliance on modern medicine, where supplies have become scarce or costly, and where knowledge of traditional uses has declined (with fewer or less effective traditional healers). Here, NTFPs having medicinal and cultural values and traditional uses (Table 2.8) are regularly collected. Among the tribal households in Peechi-Vazhani and Chimmoni wildlife sanctuaries, the use of medicinal plants for domestic purposes is widespread. Their indigenous knowledge of medicinal value and uses of several medicinal plants is very high. They use these medicinal plants to cure many of the common ailments. It shows the importance of each product, which has to be

Table 2.8:Commonly used medicinal plants by *Malayans* and their uses

Sl No.	Item	Usable part	Uses
1	Adalodakam	Leaf, stem, root	Cough, Asthma
2	Adpathiyan	Root	Back pain
3	Alpam	Root	Snake bite
4	Amalpori	Stem, Root	Stomach ache
5	Ammimuriyan	Root	Back pain, body pain
6	Analithole	Bark	Snake bite
7	Analivetham	Stem	Snake bite
8	Cheenikkai	Fruit	Soap, shampoo (hair conditioning)
9	Etta	Stem	Headache
10	Ekanayakam	Root	Back ache
11	Incha	Stem	Toiletries
12	Inchippullu	Whole plant	Headache
13	Kakkinkaya	Seed	Back pain
14	Kalloorila	Root	Controls vomiting
15	Kallooruvanchi	Stem	Kidney stone
16	Kanchikkuru	Fruit	Stomach ache
17	Kattucheera	seed	Chest pain
18	Kurunthotti	Root	Rheumatism
19	Madhurakurinji	Root, stem	Body ache
20	Mattipasa	Resin	Mosquito repellent
21	Moovila	Stem, root	Rheumatism
22	Nannari	Root	Cool drink syrup
23	Nurungankaya	Root	Back pain
24	Padamchurukki	Leaf, root	Snake bite, gas trouble
25	Thippali	Fruit, root, stem	Toothache
26	Uruvanchikkaya	Fruit	Detergent
27	Uynnuvalli	Whole plant	Body ache
28	Vallithuva	Root	Headache
29	Vellakkoova	Rhizome	Stomach ache
30	Venga	Root	Back pain, blood purifier

Source: *primary data estimates*, PRA.

sustained for posterity, so that it also enjoys the benefits of natural resources. This knowledge base of the tribal community has to be documented and enhanced in order to reap the benefits of this indigenous knowledge base in totality.

2.3.3 Economic dependencies

Forest products can also provide an important supplemental source of income that people fall back on. Numerous studies document how the number of people involved in selling the forest products rises in hard times. These products, therefore, become very vital to the dependent poor in situations where they are unable to raise sufficient income from agricultural or wage employment and when they have no other options left.

2.3.3.1 Food : Dependence on forest for food though social in nature, occasionally supplements their income too. Plant parts collected as food include tubers, honey, fruits, seeds, etc. While interviewing and during PRA exercise, mention was made of various species being used as food. It was understood that foods add variety to the diet, improve palatability, and provide essential vitamins, minerals, protein and calories. The most common supplementary foods are leaves of some wild plants (*Kattupayar*), tubers (*Nootakinzhangu*) and wild fruits, which accompany staple foods. Some species are noteworthy as particularly rich sources of vitamins, minerals, proteins and fats. For example, many forest fruits and leaves are good sources of Vitamin A, shortage of which is a common cause of blindness. These products can thus be used to combat nutrient related health problems. Some forest products are also valued throughout the year as snack foods, commonly collected and consumed on foraging trips. Forest fruits and nuts are the most common snack foods, especially for children. Before consumption they are also treated to eliminate their toxic nature and also enhance their taste. They are also extensively used to meet dietary shortfalls and to supplement household income during lean seasons, mainly monsoon when the income of most of the tribal households, particularly NTFP forager families, falls nearer to zero.

A total of 17 per cent dependence for food is noted among the local communities. Among them, only the tribes (38 %) rely on forest products for consumption needs whereas, in the case of non-tribes the proportion is zero (Fig. 2.6). This is mainly due to their higher socioeconomic status and accessibility to other staple food items. It is only in the lean seasons that non-tribes depend heavily on the forest products for meeting their food requirements. In the other seasons they consider these products as supplementary items in their diet.

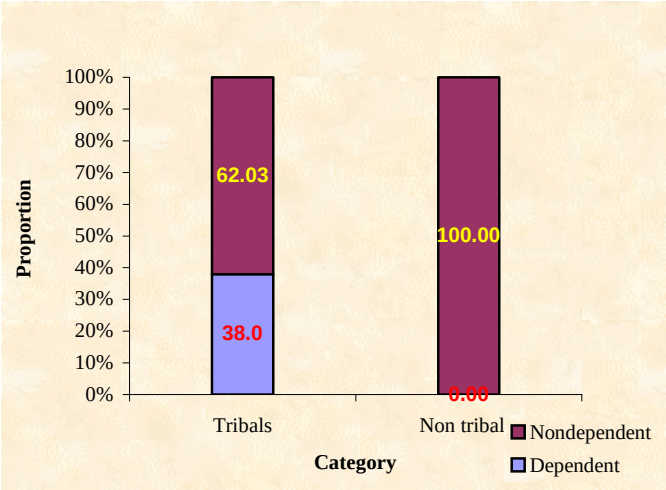


Figure 2.6: Dependence of the local communities on the PAs for food

The low percentage of dependence among tribes is mainly due to the modernisation and the accessibility to the food market through subsidised means; also, the low availability of food products in the forests has reduced the importance of forest food products. More over, the improvement in the social entitlements and increase in the opportunity cost of gathering foods from forests, rather than purchasing them, made dependence on forest for food unattractive. There is also a decline in the use of forest food because of the depleting knowledge base and a lack of interest especially among the younger generation, who spend more time in school than in the fields.

2.3.3.2 Poles : Construction of houses in the PAs and annual maintenance of these is an important activity among the local communities, which has involved the use of forest products like thatches and poles. Poles are used as banana props and also to build houses. Extraction of poles during monsoon season was a common feature in the study area in the past. However, after imposing restrictions, pole extraction rate has come down. Where it is available in plenty, bamboo is preferred as poles and if not available the branches or

saplings of Teak (*Tectona grandis*), Chadachi (*Grewia tiliaefolia*), Irul (*Xylia xylocarpa*), Maruthu (*Terminalia paniculata*), etc. are collected.

Among the local communities 16.2 per cent are depending on the protected areas for poles (Fig. 2.7). The dependence among tribes on forest for poles was observed to be high (24.8 %), compared to non-tribes (10.2 %), accessibility and affordability being two main factors in the case of tribal communities. The government-initiated housing development programmes in the tribal areas may be the reason for reduced dependence of the tribes on forest for poles, at least to this extent.

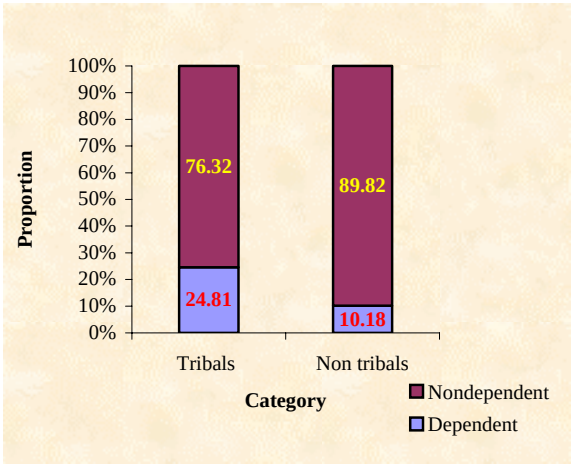


Figure 2.7: Dependence of the local communities on the PAs for poles

2.3.3.3 Fuelwood: Fuel utilisation is an important indicator of people's dependence on the forest. Though the contribution of biomass sources in the overall energy scenario is gradually decreasing, it still contributes majority of the energy supply in the PAs. The local communities depend heavily on the forest for fuelwood to cater to both subsistence as well as market needs. Approximately 74.3 per cent of local communities directly depend on the forests for fuel wood (Fig. 2.8).

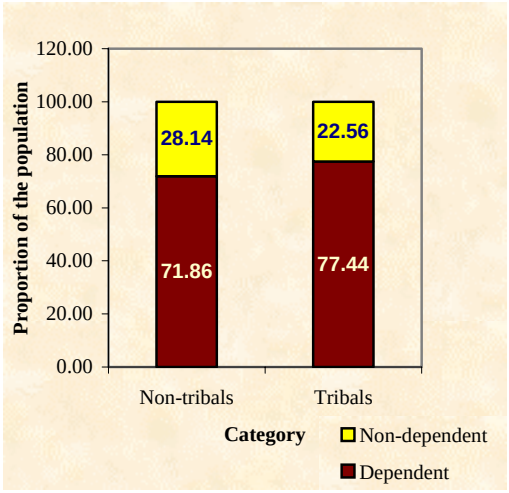


Figure 2.8:Fuel wood dependency of the local communities

2.3.3.4 Fodder: The local communities living in the periphery of the forest which own cattle depend on the forest for fodder due to absence of community pasture land and other

fodder sources. About 38 per cent of the local communities own cattle among which 21 per cent depend directly on the PAs for fodder. The proportion of dependents among tribes and non-tribes is 23.3 per cent and 19.1 per cent (Fig. 2.9) respectively. Factors like shortage of community land for grazing, PA being an open access area and the non-co-operation of the local communities to keep cattle out have made the control over grazing and lopping of fodder trees an arduous task. The grazing pressure is comparatively higher in Chimmoni (Plate 1) , though the population pressure in the PA is low compared to that of Peechi-Vazhani. Many of the tribes of Echippara tribal settlement, the settlement which lies in the immediate periphery of Chimmoni Wildlife Sanctuary, and the nearby non-tribal families own numerous cattle and goats which are grazed in the PA itself. However, in Peechi-Vazhani, grazing takes another dimension where the system of leaving large number of cattle in the sanctuary for months together was also observed. It has been understood that the unaccounted cattle belong to people staying elsewhere and not to the immediate local community.

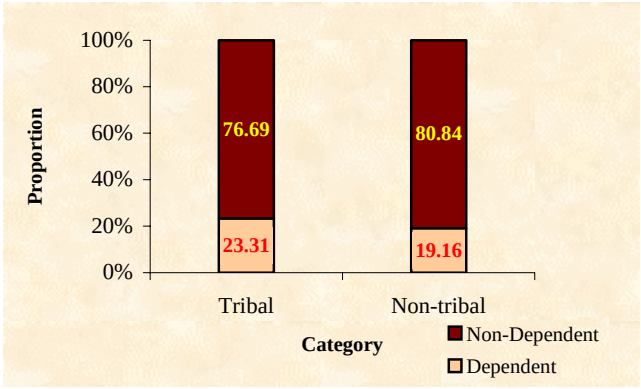


Figure 2.9: Dependence of local communities on the PAs for fodder

Plate 1.1: Grazing in Chimmoni WLS

2.3.3.5 Green Manure : The agricultural communities living in the periphery of the forests are dependent on the forests for bio-fertilizer i.e., green manure. Among the local communities, about 12.7 per cent (Fig. 2.10) were depending on the PAs for green manure. The extraction of green manure was done by the farmers themselves or by employing labourers. It is also collected by tribes who sell the same to farmers for monetary returns, particularly in the monsoon season when the NTFP collection is very low. The dependence among tribes hence is a little high, though, the collection is not done for subsistence (13.2 %) than the non-tribes (12.2 %). The low dependency level among the stakeholders is mainly due to the less number of large holders among the local communities. The main areas where green manure collection was observed are Vazhani, Kolathassery, Velladi,Melillam, Kattilapoovam, Kompazha, Vallor, Karadikund, Chakolatharissu and Maillattumpara. The species commonly collected by the stakeholders for green manure are Maruthu (*Terminalia paniculata*), Irul (*Xylia xylocarpa*), Konna (*Gliricidia* sp.), Chadachi (*Grewia tiliaefolia*) and Edampiri (*Helicteres isora*).

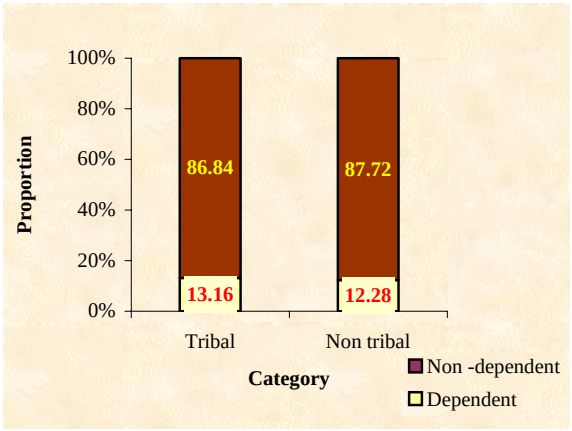


Figure 2.10: Dependence of the local communities on the PAs for green manure

2.3.3.6 NTFPs

There is a 30.5 per cent dependence on NTFPs in the PAs. A higher level of dependency was observed for the tribes (Fig. 2.11). This forms a primary source of income among the tribal community, though seasonal. As collection is demand-driven, they sell their product either to GSCS or

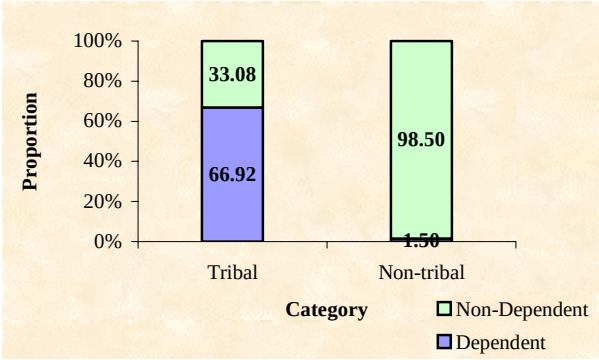


Figure 2.11: Dependence of the local communites on the PAs for NTFPs

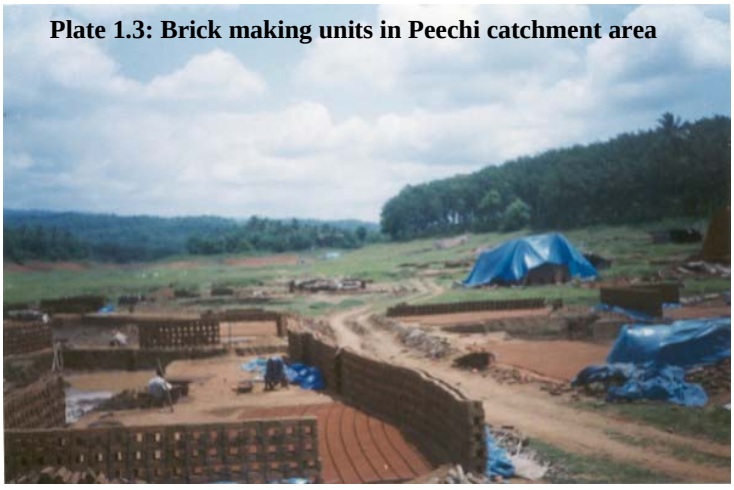
the private traders (more details on NTFPs in the next chapter).

2.3.3.7 Cultivation : Another form of dependency is the land use practices of the local communities within the PAs. This form of dependency is found prominent in the forest lands and catchment areas of the Peechi reservoir. The clearing of forest lands for cultivation was observed in *Thamaravellachal* and *Maniyankinar*. They (Malayans) undertake mixed cropping, mainly vegetables. In the catchment areas of Peechi reservoir (Plate 2) particularly in the areas of Maniyankinar, Kompazha, Adukkalappara, Aanavari, cultivation of rice and vegetables in the reservoir bed is in full swing during the dry season by the local communities. Among the people living near the reservoir 41.2 per cent depend on the seasonally dry reservoir bed for cultivation.

Plate 1.2: Rice cultivation in Peechi catchment area

2.3.3.8 Brick making : Another form of economic dependence of the local people (in the catchment area of Peechi reservoir) is the mud / clay from the catchment area for brick making. Each year, for four months (December-March) there are six brick making units (Plate 3) functioning in the catchment area. Each unit produces about 15 lakh bricks and hence makes a turnover of about Rs.16 lakhs per year. About 60 families living near the areas are depending on these brick making units for their livelihood.

Plate 1.3: Brick making units in Peechi catchment area



Recently there is a ban imposed by the Forest Department on this activity, although there is resistance against this.

2.3.3.9 Fishing : There are two Scheduled Caste Schedule Tribe Reservoir Fisheries Co-Operative Societies at Peechi and Vazhani. Commercial fishing in Chimmoni is restricted. The tribes are permitted to fish in Chimmoni purely for subsistence needs only. About 8 per cent of the local communities of the study areas are depending upon the PAs for fish. The fishing details of Peechi and Vazhani reservoirs were collected in order to understand the quantity of fish collected from each reservoir and the revenue obtained from the sales. The quantity of fish collected and the revenue obtained from Peechi reservoir from 1991-92 to 1998-99 show a declining trend over the years though there was a slight increase in the year 1998-99 (Fig. 2.12). This falling trend in the collection of fish from Peechi reservoir may be attributed to the unsustainable land use practices adopted by the local residents of the catchment area particularly the use of highly toxic insecticides and also to the poor aquaculture management strategies adopted by the fisheries co-operative society.

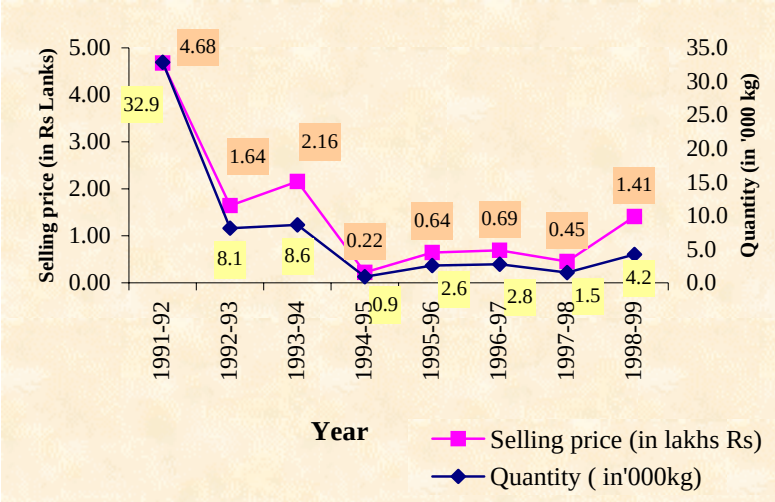


Figure 2.12:Fishing details of Peechi Reservoir

The quantity of fish collected from Vazhani reservoir for the period 1992-2001 shows an increasing trend (Fig. 2.13). The fisheries co-operative society is doing a good management of the aquaculture by putting new fish species in the reservoir and conserving and managing the same effectively. This, together with no disturbances in the

catchment area, may be the reason for the increasing trend in the quantity of fish collected from Vazhani reservoir.

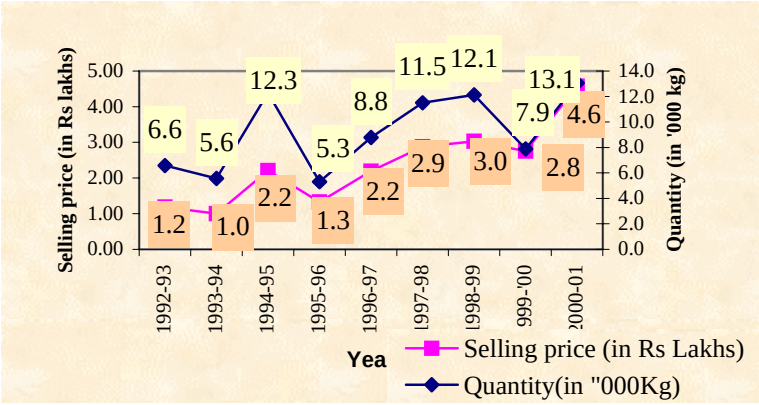


Figure 2.13:Fishing Details of Vazhani Reservoir

2.4. Forest Dependence Matrix (FDM)

The dependence of the local communities on the WLSs varies significantly between the two social groups, tribes and non-tribes. The dependence on each forest produce or services has been further classified into four based on their intensity levels, viz., high, medium, low and a no-dependence level, to analyse the degree of dependence of each social group in varying intensities. Majority among the social groups come under the no-dependence level, 52.9% and 86.7% respectively (Table 2.9). Of the remaining, a large share of the tribes (24.7%) comes in the high dependence category whereas among the non-tribes 5.6 per cent indicate medium dependence. Thus, it is evident that among the social groups, intensity of dependence of the tribes is significantly high when compared to the non-tribes.

Table 2.9: Forest Dependence Matrix (Peechi -Vazhani and Chimmoni WLSs)

Sl. No	Dependence level / Parameter	No dependence		Low dependence (0 - 30 %)		Medium dependence (30 - 60%)		High dependence (60 - 100 % inclusive)		Total	
		T*	NT**	T	NT	T	NT	T	NT	T	NT
A.	**Social dependence**										
1	Cultural / Religious	40.0	100.0	10.0	0.0	20.0	0.0	30.0	0.0	60.0	0.0
2	Medicinal	50.0	100.0	15.0	0.0	28.0	0.0	12.0	0.0	50.0	0.0
B.	**Economic dependence**										
3	Food	62.0	100.0	12.0	0.0	16.0	0.0	10	0.0	38	0.0
4	Poles	75.2	89.8	6.4	6.0	8.2	2.2	10.2	2.0	24.8	10.1
5	Fuel wood	22.6	28.1	8.0	21.3	18	35.6	51.4	15.0	77.4	71.9
6	Fodder	76.7	80.8	5.0	8.0	6.0	7.6	12.3	4.0	23.3	19.2
7	Manure	86.8	87.7	2.0	5.2	6.1	4.1	5.1	3.0	13.2	12.3
8	NTFPs	33.1	98.5	2.0	0.5	12.3	0.0	52.6	1.0	66.9	1.5
9	Income	30.1	95.1	11.7	3.4	19.9	0.9	38.3	0.6	69.9	4.9
Total		**52.9**	**86.6**	**8.0**	**4.3**	**14.9**	**5.6**	**24.7**	**2.8**	**47.1**	**13.3**

Source : Primary data estimates
* - Tribes, ** - Non-tribes

2.5. Forest Dependence Index (FDI)

The FDI was calculated in order to measure the socioeconomic dependency level of local communities on the WLSs. The FDI highlights a 30.4 per cent (Table 2.10) dependence of the local communities on the study areas for various purposes. The dependency level is high among tribals (47%) while it was estimated low among the non-tribals. The dependence index was found high in the case of fuelwood and low for green manure.

Table 2.10: Forest Dependence Index of the local communities (Peechi-Vazhani and Chimmoni WLSs)

Sl. No	Dependence/ Community / Parameter	Dependency Ratio -α (d / 100) d= Dependency level		
		Tribal (α_t)	Non Tribal (α_n)	Total β_1 (Average)
A.	**Social dependence**			
1	Cultural / Religious	0.6	0.0	0.3
2	Medicinal	0.5	0.0	0.25
B.	**Economic dependence**			
3	Food	0.38	0.0	0.19
4	Poles	0.25	0.10	0.18
5	Fuel wood	0.77	0.72	0.75
6	Fodder	0.23	0.19	0.21
7	Manure	0.13	0.12	0.13
8	NTFPs	0.67	0.02	0.35
9	Income	0.7	0.05	0.38
Total -β_2 (Average)		0.470	0.133	0.304
Forest Dependence Index ***(β_2*100)***		**47.0**	**13.3**	**30.4**
χ^2 value		**82.940**		

Primary data estimates

Calculated value of the chi-square indicates the existence of a significant association between the social group and forest dependencies. It implies that dependence on forests of the individual depends on the social group.

2.6. Forest and livelihoods

Forests thus provide a range of benefits in the form of goods and services that arise from direct and indirect use. Availability of various livelihood inputs (such as subsistence goods, income, employment, etc.) from the PAs helps in bridging seasonal gaps and determines the standard of living of the dependent communities. This can also reduce

vulnerability by means of providing a reserve that can be used for subsistence and income generation in times of hardships or to meet special needs like school fees, festivities, etc. Ease of access and proximity to widely dispersed rural markets enable very large number of people to generate some income from forest produce. Income from forest produce seldom appears to account for a large share of households' total income. With awareness of present day techniques of farming, market situation and government assistance, the local communities are in a better position to harvest sufficient returns from their land, in spite of the small size holding and in certain cases, tenurial insecurity. These activities can, therefore, be very important to the poor in situations in which they are unable to obtain income, or sufficient income, from agriculture or wage employment or few other options exist. Their health status is not very distressing as it reflects the Kerala average. The occupational structure indicates a dominance of the primary sector, indicative of a basically agrarian economy. Shift from traditional crops (subsistence crops to cash crops) is suggestive of advancement in their social and economic outlook.

2.7. Potential for participatory mode of management

The socioeconomic attributes of the sample population are very much similar to any area in the State with a heterogeneous community features and purely agrarian economy. This in itself presents complexities as the needs and aspirations of different communities vary across the landscape. The socioeconomic status highlights a heavy dependence in the primary sector. Given the complexities of a heterogeneous population, it does not rule out the possibility of management and development of resources through the participatory mode of management.

The presence of a livestock population increases people's dependency on forest for fodder, particularly for grasses. The present cropping patterns, the economic conditions in the site and accessibility do not favour the development of any alternate source of fodder. With this scenario it is essential to improve the quality of cattle, introduce stall feeding, and strict vigilance on the part of the sanctuary managers, in order to reduce pressure on forests.

The literacy rates (81.7 %) and prevalent livelihood patterns (reflecting the quality of life) indicates dependence on forests mainly for fuelwood, fodder and NTFPs. Wood constitutes almost 75 per cent of the fuel consumed in the WLSs. This factor can help promote forest enhancement schemes such as participatory mode of management.

3. NON-TIMBER FOREST PRODUCTS

3.1. Background

Forests bestow a variety of products, which are useful to human beings. Traditionally, the forest products have been classified as minor (medicinal plants, rattan, bamboo) and major products (timber and firewood). This division is primarily based on revenue contributed to the Forest Department; i.e., the major product like timber contributed more revenue than minor forest products. Consequently in traditional forest management, the major products, particularly timber received high importance, while minor products were given less significance. In India, there are about 3000 plant species that provide minor products, having some use, and of these species only a few are considered commercially important (Mahapatra and Mitchel, 1997).

The term minor forest products gave an erroneous impression that these products are of less importance. The income and employment potentials of the minor forest products were recognized and attempts were made to rename the term into Non-Wood Forest Products (NWFPs) or Non-Timber Forest Products (NTFPs) during the 1990's (Shiva, 1993). Non-Wood Forest Products include all goods of biological origin as well as services derived from forests or land under similar use and exclude wood in all its forms (Chandrasekharan, 1995). Later this definition has been modified excluding services (FAO, 2000). NTFPs refer to all biological materials extracted from forests except timber for human use (Beer and McDermot, 1989). It is also defined as all the biological materials (other than industrial round wood and derived sawn timber, wood chips, wood based panels) that may be extracted from natural ecosystem, managed plantations, etc. (Wickens, 1991). The main difference between NWFPs and NTFPs is that the former excludes fuelwood from its purview, while the other includes it. In this study the term NTFP has been used as it includes fuelwood also.

This part of the study covered the following objectives: (i) to quantify and classify NTFPs collected from the study areas, (ii) to suggest scientific methods for the collection of various NTFPs and methods for their value addition based on review of earlier studies

and discussion with experts, and (iii) to conduct / develop a training programme for the local people on sustainable collection and value addition.

3.2. Classification of NTFPs

Because of the inadequate emphasis given to NTFPs development in traditional forest management, these did not attract much research attention in the past. Consequently, there is no proper database on NTFPs in Kerala. This was further complicated by the fact that these products are collected by the tribal communities in an unorganised manner and also there is unauthorised collection by non-tribal people (Muraleedharan *et al*., 1997).

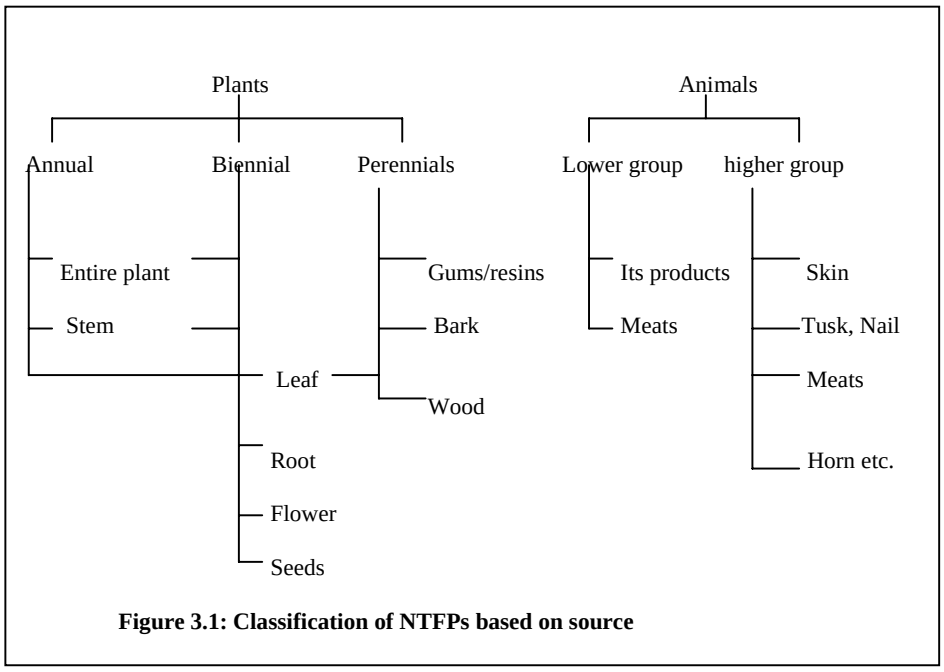


Figure 3.1: Classification of NTFPs based on source

NTFPs are derived from a variety of sources: trees, shrubs, herbs, grasses, palms, insects, birds, reptiles and a range of others (Shanker, 1999). Primarily they can be classified based on the sources (Fig. 3.1), both plant and animal. Plants can be further grouped into annual, biennial and perennial. The animals can be categorized into the lower and higher groups. Once they are broadly classified as per their source, they can now be classified based on their uses, i.e., edible products, toiletries, medicinal plants, tans and dyes, gums and resin, rattan, bamboo and animal products. About 250 species providing medicinal plants are found in Kerala forests (Nambiar *et al*., 1985). Among the NTFPs, 120 items are listed as commercially important. In the study area, about 83 NTFP species (Appendix 3.1) have been identified of which the tribal communities largely or regularly collect 29 items (Table 3.1). Of the commercially important products,

medicinal plants and edible products account for 62 and 14 per cent respectively, followed by toiletries (10.3%), resins (6.9%), tans and dyes (3.4%) and animal products (3.4%).

Table 3.1: Commercially important NTFPs extracted from Peechi-Vazhani and Chimmoni WLSs

Sl.No.	Item	*Scientific name*	Use	Part used
1	Adapathiyan	*Holostemma ada-kodien*	Medicinal	Rhizome
2	Amalpori	*Rauvolfia serpentina*	Medicinal	Root
3	Cheenikkai	*Acacia concinna*	Toileteries	Fruit
4	Cherutheck	*Clerodendrum serratum*	Medicinal	Root
5	Cheruthein (karinthein)	*Apies* species	Edible/ Medicinal	Honey comb
6	Elakkaya (cardamom)	*Eletaria cardamomum*	Edible/Medicinal	Fruit
7	Incha (pattincha)	*Acacia instia*	Toileteries	Bark
8	Kakkumkaya	*Entada rheedii*	Medicinal	Seed
9	Karimkurinji	*Strobilanthes ciliatus*	Medicinal	Root & stem
10	Kasthoorimanjal	*Curcuma aromatica*	Medicinal	Rhizome
11	Kolincha	*Acacia instia*	Toileteries	Bark
12	Koppuvella	*Vateria indica*	Varnish or paint	Resin
13	Kurumthotti	*Sida rhombifolia*	Medicinal	Root & leaves
14	Madhurakurinji	*Strobilanthes sp.*	Medicinal	Root & stem
15	Manjakoova	*Curcuma angustifolia*	Medicinal	Rhizome
16	Maramanjakkol	*Coscinium fenestratum*	Medicinal	Stem
17	Marottikuru	*Hydnocarpus pentandra*	Medicinal	Seed
18	Mezhuku	*Apies* species.	Animal product	Honey comb
19	Moovila	*Pseudarthria viscida*	Medicinal	Root
20	Nannari	*Hemidesmus indicus*	Edible	Root
21	Oorila	*Desmodium velutinum*	Medicinal	Root
22	Padakizhangu	*Cyclia peltata*	Medicinal	Root
23	Palmuthukku	*Ipomea mauritiana*	Medicinal	Root
24	Pathiripoovu	*Myristica dactyloides*	Spices, medicinal	Seed aril
25	Sathavari	*Asparagus racemosus*	Medicinal	Root
26	Thein	*Apies* species	Edible/ Medicinal	Honey comb
27	Thelli	*Vateria indica*	Varnish or paint	Resin
28	Thippali	*Piper longum*	Medicinal	Fruit & stem
29	Urinjikaya	*Sapindus laurifolius*	Toiletries	Fruit & seed

Source : primary data estimates

3.3. Quantification of NTFPs: Institutional arrangement for collection

The institutional arrangements for the collection and marketing of NTFPs are more or less uniform in the State. The right to collection of NTFPs in the State is vested with the Federation, the apex body of SC/ST Co-operative societies in the State. There are 35 Tribal Service Co-operative Societies (TSCS), which are engaged in the collection of NTFPs. One of the objectives of establishment of these organizations is to free the tribes from the clutches of the private traders and to arrange proper marketing of the products effectively, by eliminating middlemen from the chain. Based on a contract signed by the Branch Managers of the Federation and the Divisional Forest Officers, different ranges in a Division are allotted to different societies working within the Forest Division. Then the societies engage their members for the collection. Generally, each society has its own jurisdiction of collection to which the members of other societies may not enter for collection.

There are two TSCS covering the two sanctuaries, viz. Palapilly Girijan Service Co-operative Society and Thalappilly Girijan Service Co-operative Society of which the latter has been defunct during the course of the project period due to various reasons. The Palapilly Girijan Service Co-operative Society (PGSCS) is one of the earliest societies in the State, which was established during 1978. As the Thalappilly Service Co-operative Society has not been working for last so many years, the collectors coming under this society sell their products to the private traders and are thus vulnerable to exploitation.

3.3.1. Quantity collected, collection charge and sale value

Figure 3.2 depicts the trend in the quantity collected, collection charge paid and sale value of Palapilly Tribal Service Society during the period of 1983-2000 along with compound growth rates. The analysis highlights a positive growth rate of 8.2 per cent for the quantity collected over the 18 years. The collection charge earned by the gatherers also showed a positive growth rate of 23.0 per cent and the sale value realised by the PGSCS also showed a significant growth rate of 23 per cent. The compound growth rate of sale value and collection charge are uniform. This indicates that the Society is giving

adequate or proportionate or reasonable collection charge. This could be associated to an increased demand leading to long collection periods (eg. medicinal plants collected soon after the monsoons) and also the attractive collection charge paid by the Society. Then there is also the main factor of lack of alternative sources of employment (low agricultural work, building works, etc.). And, finally there is over-exploitation by the younger generation, which may be attributed to either misguidance or their level of awareness which could be either conservation-oriented or destructive in nature.

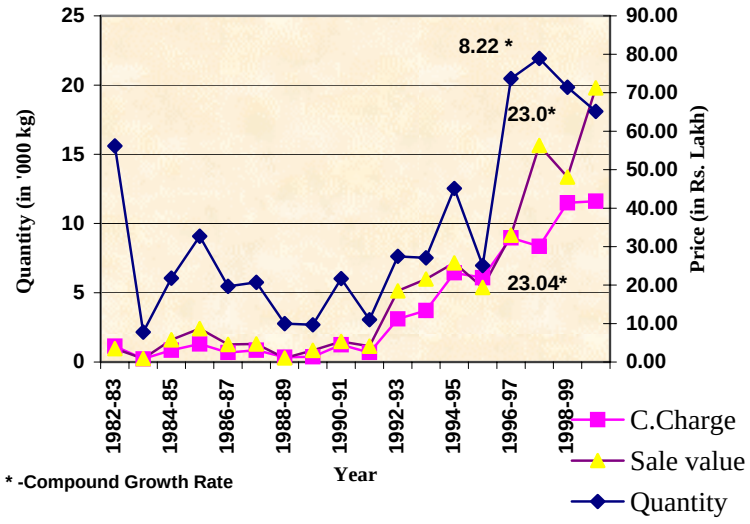


Figure 3.2: Quantity, Collection charge and Sale value of NTFPs (Palappilly TCS 1983-2000)

Broadly, over a period of time all the three variables, showed an increase with annual variations, which are more prominent in the case of quantity collected. After the 1990s, a common tendency of high fluctuations in the quantity collected in the alternate years is observed. This particular fluctuating trend may be due to (i) high intensity of harvest in the previous year, over exploitation and unsustainable extraction (eg. gooseberry); (ii) restricted collection (proposed by the Department) of certain items in the alternate years (eg. *Rauvolfia,* etc.); (iii) Product not in demand due to previous year's excess stock. A steep rise since the year 1996-97 is attributed to a change in the board of administration of the society in which very able and committed members came into power, who could raise adequate fund allocation from the departments concerned and started collecting more products. But due to the existing marketing inefficiencies, the desired target level in

sales could not be achieved, which explains the gradual decline in the quantity collected in the subsequent years.

As mentioned earlier, due to the non-functional Thalappilly GSCS, there is paucity of information on the quantity collected, collection charge paid and the sales realised by the society in Peechi-Vazhani sanctuary. Under such circumstances, we had to rely exclusively on primary data, generated from among the actual foragers. This indicated an annual collection of 137000 kg per year, which basically goes to the open market (private traders). Table 3.2 depicts the quantity of major NTFPs collected from the study areas.

Table 3.2: Quantity of major NTFPs collected from Peechi-Vazhani and Chimmoni WLSs (Authorised and unauthorised)

Sl.No.	Common name	Scientific name	Quantity Collected / year (in kg)	
			Peechi-Vazhani * (Private)	Chimmoni ** (Society)
1	Adapathiyan	*Holostemma ada-kodien*	80	150
2	Amalpori	*Rauvolfia serpentina*	320	70
3	Cheenikkai	*Acacia concinna*	13000	16106
4	Cherutheck	*Clerodendrum serratum*	2500	2097
5	Cheruthein	*Apies sp.*	100	360
6	Elakkaya	*Eltteria cardamamum*	190	1365
7	Incha	*Acacia instia*	38000	16526
8	Kakkumkaya	*Entada rheedii*	550	205
9	Karimkurinji	*Strobilanthes ciliatus*	1500	5711
10	Kasthoorimanjal	*Curcuma aromatica*	4000	1018
11	Kolincha	*Acacia instia*	500	1802
12	Koppuvella	*Vateria indica*	1500	1214
13	Kurumthotti	*Sida rhombifolia ssp.retusa*	19000	76
14	Madhurakurinji	*Strobilanthes sp*	750	0
15	Manjakoova	*Curcuma angustifolia*	500	500
16	Maramanjakkol	*Coscinium fenestratum*	60	557
17	Marottikuru	*Hydnocarpus pentandra*	300	542
18	Mezhuku	*Apies sp.*	1700	237
19	Moovila	*Pseudarthria viscida*	4000	463
20	Nannari	*Hemidesmus indicus*	10500	65

Contd.

21	Oorila	*Desmodium velutinum*	19500	3349
22	Padakizhangu	*Cyclia peltata*	150	3
23	Palmuthukku	*Ipomea mauritiana*	600	1425
24	Pathiripoovu	*Stereospermum colais*	2700	566
25	Sathavari	*Asparagus racemosus*	1300	2246
26	Thein	*Apies sp.*	3500	4931
27	Thelli	*Vateria indica*	1800	1151
28	Thippali	*Piper longum*	8000	851
29	Urinjikaya	*Sapindus laurifolius*	400	6
Total			**137000**	**63593**

* Approximated based on primary information
** Tabulated from Sales registers of Palappilly GSCS

3.4. Price Differences (Authorised Vs Unauthorised))

As mentioned earlier, the dominance of private traders in Peechi-Vazhani is very prominent due to non-functional status of the Thalappilly Girijan Service Society. One of the advantages of the working of efficient institutions like PGSCS is that they provide adequate or reasonable collection charge announced by the Federation (Table 3.3). In their area of operation, the number of private traders is less as they are forced to fix a price as high as society's price in order to gather the products. On the contrary, where the societies are not functioning properly, the collectors are at the mercy of the private traders and the prices paid by them

Table 3.3: Collection charge of major NTFPs (Society and Private Traders)

Sl.No.	Item	Collection Charge (in Rs/ kg)	
		Society *	Private **
1	Adapathiyan	250	155
2	Amalpori	125	65
3	Cheenikkai	20	12
4	Incha	15	10
5	Karimkurinji	12	3
6	Kasthoorimanjal	45	25
7	Kolincha	15	10
8	Kurumthotti	12.5	6
9	Moovila	16.5	7
10	Nannari	50	26
11	Oorila	15	8
12	Pathiripoovu	200	105
13	Thein	80	50
14	Thelli	47.5	35
15	Thippali	15	8

Source : SCST Federation primary data estimates
* - Price list given by SCST Federation and society
** -Price list collected from various private traders centered

quite often are less than that of the society. Thus, the existing system does not have adequate technological and management backup. As is evident there is a significant difference in the prices paid by these two agencies; the price paid by the society is much higher than that of private traders. This is suggestive of the vulnerability of the collectors, who have no other choice in the absence of an efficiently functioning society. Hence, the key issues of concern here are (i) benefits to the primary collectors, and (ii) the gap between the prices given by the society and private traders.

3.5. Income from NTFPs

The collection of NTFPs is one of the main sources of livelihood of the tribes in Kerala. A few case studies show that a significant proportion of the tribals in the State still depend on income from collection of NTFPs. For instance, the collection of NTFPs is the main occupation of more than 68 per cent of the tribals in four districts of Kerala such as Palakkad, Thrissur, Wayanad and Kannur (Shanker, 1999). Thomas (1996) estimated that NTFP trade provides 58 per cent of the total income of the tribes in Kerala. NTFPs contribute to household income, but this contribution varies geographically. Average annual income of a forager household in the study areas was estimated to be Rs. 18,320 and income from NTFPs amounted to Rs.10,277 accounting for 57 per cent.

Total family income of the forager households in the PAs constitutes income from NTFP collection (57%), wages (35%) and income from agriculture (8%) (Fig. 3.3). Among the selected samples total family income of the four households was estimated to be less than Rs. 5,000, which is

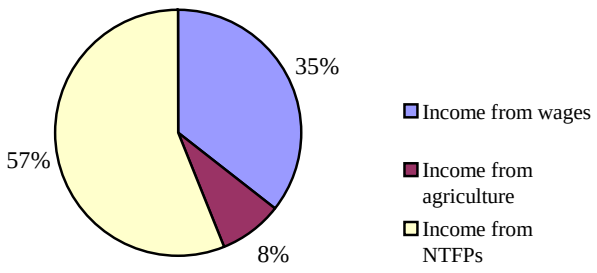


Figure 3.3 :Classification of family income of an average forager family

exclusively from NTFPs, indicating their total dependence on these resources for their livelihood (Table 3.4). About 30 per cent of the households falling in an income category of Rs.5, 000-10,000 received less than Rs. 5,000 from NTFPs.

Table 3.4: Distribution of forager households based on Total family income

Family income (in Rs)	Income from NTFPs (in Rs)				Total
	> 5000	5000 - 10000	10000 - 25000	25000 - 50000	
Below 5000	**4** (100.0)* (10.81)**	**0**	**0**	**0**	**4** (100.0) (2.19)
5000 - 10000	**11** (34.38) (29.73)	**21** (65.62) (32.81)	**0**	**0**	**32** (100.0) (17.49)
10000 - 25000	**18** (15.79) (48.65)	**40** (35.09) (62.5)	**56** (49.12) (80.0)	**0**	**114** (100.0) (62.3)
25000 - 50000	**4** (14.81) (10.81)	**3** (11.11) (4.69)	**13** (48.15) (18.57)	**7** (25.93) (58.33)	**27** (100.0) (14.75)
50000 - 100000	**0**	**0**	**1** (16.67) (1.43)	**5** (83.33) (41.67)	**6** (100.0) (3.28)
Total	**37** (20.22) (100.0)	**64** (34.97) (100.0)	**70** (38.25) (100.0)	**12** (6.56) (100.0)	**183** (100.0) (100.0)

Source: Primary data estimates
* - Percentage of horizontal total ** - Percentage of vertical total

Sixty two per cent of the total NTFP forager households, i.e., 114 households, received a family income in the range of Rs.10, 000-25,000 of which 16 per cent households received less than Rs.5, 000, 35 per cent between Rs. 5,000 and 10,000 and 49 per cent between Rs.10, 000 and Rs. 25,000. Six households received a family income between Rs. 50,000 and 10,0000 of which one household received an income between Rs.10, 000 and 25,000 and 5 households in the range between Rs. 25, 000 and 50,000 from NTFPs. Only 24 per cent of the sample has exclusive dependence on NTFPs for their livelihood (Fig. 3.4). 15 per cent of the forager households depend less than 25 per cent on NTFPs for their livelihood. This indicates that NTFP collectors depend heavily on the collection of these items for their livelihood.

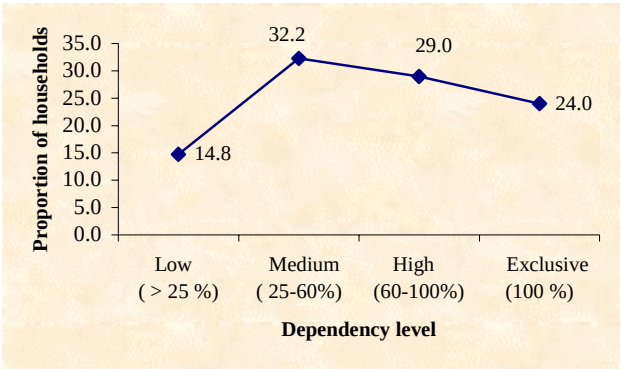


Figure 3.4: Dependency level of forager households on NTFPs for income

3.5.1. Relationship of NTFPs to other socioeconomic indicators

In order to assess the relationship between income from NTFPs and other socioeconomic parameters, a Linear Multiple Regression Analysis was carried out, where income from NTFPs is taken as the dependent variable and the family size, age of the head of the family, income from wage labour, income from agriculture, asset value, distance travelled for collection, number of adult members, number of educated adults, education of the head of the family and experience in foraging are the independent variables. The selection of independent variables was based on some *a priori* assumptions regarding the possible relationship existing between dependent and independent variables. For example, as family size, or age of the head of the family increases, there would be an increase of income from NTFPs. Similar *a priori* assumptions are made in the case of other variables too. Total number of forager households are grouped into two: (i) those which receive less than 50 per cent of the income from NTFPs and (ii) more than 50 per cent of the income from NTFPs. Finally, a multiple regression equation was fitted using pooled data (combining groups 1 and 2).

Table 3.5 : Results of multiple regression analysis

Data group	Results
The group having the income from NTFPs is Less than 50 per cent	$Y= -6359.3148 + 0.41464\ x_7 + 0.00744\ x_8 + 448.7026\ x_9$ (2049.13588) (0.16138) (0.00274) (174.19765) (Adjusted $R^2 = 0.4876$)
The group having the income from NTFPs , higher than 50 per cent	$Y = - 8732.44276 + 1731.78588\ x_9$ (1235.37145) (132.86479) (Adjusted $R^2 = 0.70111$)
Two groups pooled together	$Y = -8174.12594 + 1736.83864\ x_9$ (1185.77893) (106.0338) (Adjusted $R^2 = 0.5949$)

Figures in parenthesis are standard errors
Y = HH income from NTFPs (Rs / Y)
x_7 = Income from wage lab
x_8 = Total asset value

In group-I, household income from NTFPs depends to some extent on parameters such as income from wage labour, total asset value and distance travelled for collection (Table 3.5). Of these three, the only parameter found to have a direct and positive influence on the income from NTFPs was X9, i.e., the distance travelled. In group II and the combined analysis also,

there exists a positive relationship between income from NTFPs and distance travelled. In the pooled group about 60 per cent of the variations in income from NTFPs is contributed by distance travelled, indicative of dwindling resources, and the remaining 40 per cent by factors that were not considered in the model. This has much implication on the depletion of NTFP resources in the PAs, which will be discussed later.

3.6 Fuelwood collection

Fuelwood collection is one of the major activities of the local communities, particularly the scheduled tribe and scheduled caste people living nearby the sanctuary. It was estimated that about 74 per cent of the selected households collect firewood from the forests. The main areas of collection are: Mula, Vazhani, Manalithara, Kattilapoovam, Pullankandam, Melillam, Kolathassery, Kalappara, Thanikundu, Elanad, Thirumani, Olakara, Kompazha, Thamaravellachal, Perumthumpa, Vaniampara, Chanothukunnu, Valloor, and Mayilattumppara.

The collectors collect all species of firewood but preference is given to collect Chadachi(*Grewia tiliaefolia*), Irul (*Xylia xylocarpa*), Maruthu (*Terminalia paniculata*), Thek (*Tectona grandis*), Venthek (*Lagerstroemia microcarpa*) due to high demand in the market.

It was estimated that about 1,400 tonnes of firewood is collected annually of which 560 tonnes are for sale and 840 tonnes for self-consumption. The sale price of one bundle of firewood (20 to 35 kg) at the market varies between Rs. 35/- and 70/-, depending upon area, season, demand, etc. However, firewood collection, which is a source of income and livelihood of the local communities, is one of the reasons which adds to the depletion pace in the study areas.

3.7 Harvesting

Harvesting, as a process in the production and utilisation chain links resource management with resource utilisation and has an impact on both (FAO, 1993 (b)). This is particularly a feeble link in the utilisation of NTFPs due to the variety of tools, techniques and situations involved.

Table 3.6: Classification of Commercially important NTFPs based on their useful parts

Useful part	No. of Products	% to total
Root	8	27.59
Root and other parts	3	10.34
Stem	1	3.45
Stem and other parts	1	3.45
Bark	2	6.90
Rhizome	3	10.34
Resin	2	6.90
Leaves	0	0.00
Flower	0	0.00
Fruit	2	6.90
Fruit and seed	1	3.45
Seeds	2	6.90
Seed aril	1	3.45
Others	3	10.34
Total	**29**	100.00

In the study area 69 per cent of the collection (classified based on use) is for roots, stem, bark, resin and whole plant (Table 3.6). The commercial importance of the products can lead to degenerative extraction practices of the natural resource, if utmost care is not adhered to. The collection of seeds, flower, leaves, fruits, etc. accounts for 31 per cent. Collection of these is not considered as destructive as the group of items coming under 69 per cent harvest (Fig. 3.4).

3.7.1 Unsustainable harvesting and depletion of NTFP resources : Some Indications

Sustainable collection is one which gives more or less a steady supply of resources over a period of time. A large number of factors affect the sustainability of NTFPs among which sustainable harvest is the most important. Because of variety of ecological, social and economic factors, there has been unsustainable

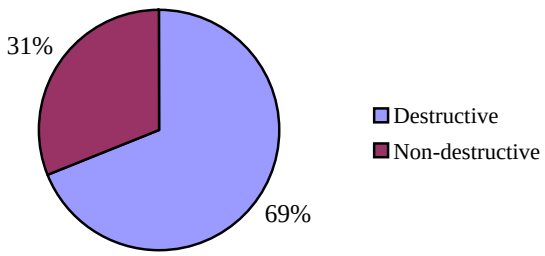


Figure 3.5 : Destructive and non-destructive harvesting percentages

collection of at least some selected NTFPs, in most of the tropical countries (Godoy and Bawa 1993; Ganesan, 1993; Perez,1995) which results in fluctuations in the quantity collected and scarcity of these products. The scarcity is manifested in an increase in the collection charge over the years which has affected, at least in the case of certain products, in the study areas. For instance, for honey and Pathiripoovu (*Myristica dactyloides),* there was an increase from Rs17.05 / kg. and Rs. 29.9 / kg. in 1990 -91 to Rs. 48.25 / kg. and Rs. 110 / kg in 1999-00 respectively. The distance travelled by the tribals for collection is one of the indicators of depletion or scarcity of these products. When distance travelled is more, the proportion of NTFPs collected is also more. For instance, within a radius of less than 3 km, a collector is able to collect only 10 per cent of the total collection /day and a collector has to travel at least about 10 km a day for one day's collections (Table 3.7). The results of the regression analysis carried out earlier also indicated that there is a positive relationship between increase of income and distance covered, which substantiates the depletion of NTFP resources in the study areas. This is also an indication that the collection of NTFPs is increasingly becoming laborious and is highly time-consuming due to their scarcity. Besides this, there is also a noticeable reduction in the size of the product extracted, another important indicator of over harvest.

Table 3.7: Proportion of NTFPs collected in different foraging distances

Distance covered	Proportion of NTFP collection
1km to 3 km	10%
3km to 7 km	30%
7km to 10 km	60%
10 km	100%

Source: primary data estimates

3.7.2 Economic extinction of NTFPs

For understanding the real returns from NTFP related activities, it is necessary to take into account the costs involved in the collection / extraction of NTFPs. An analysis that accounts for relative costs in addition to relative benefits can substantially alter the economic picture for specific NTFPs (Neumann and Hirsch, 2000). The cost of collection and harvesting appears to vary widely, from negligible to prohibitive. NTFP collection may be physically arduous, require special collection tools, require a great deal of skill or experience, or require the collector to search further a field as resources get depleted (Siebert and Belsky, 1985; Thomas and Bai, 1993; Nilkamhaeng; 1995; Neumann and Hirsch, 2000). Though these costs cannot be estimated in monetary terms

they can be assessed as opportunity cost, that is the benefits foregone. Moreover, it is also necessary to include transportation cost in the cost of NTFP extraction, which is very relevant in Peechi-Vazhani WLS where the GSCS is defunct and the foragers have to travel a long distance to market their product. Further, as the marketing of NTFPs in the open market is considered as unauthorised, the risk involved also increases. It is difficult to assess the depletion state of a NTFP using the supply and demand functions. The situation, demand outstrips supply gives an indication of depletion of the resource, because in economic terms supply of a product is not the stock of the product available, but the quantity that the producers are willing to supply at a given price level. As forest products are having comparatively inelastic supply, it is not possible to assess how the resource base will change over time as prices of the product change. But if the marginal costs of collection of certain NTFPs are rising steeply, then there will be definitely reaction against the extraction of such product even before their depletion or extinction. So, there will be economic extinction of non-premium products, when costs of collection outweigh benefits (Olsen, 1997). This situation precludes botanical extinction

Murali *et al*. (1996) noted that most common species are harvested more intensively than less abundant species. Among a total of 83 NTFP species available in the study area, 56 items are included among the 120 commercially important items listed by the State MFP committee. Of these, only 52 per cent are collected on a regular basis, this mainly being market-driven. The remaining 48 per cent are not collected regularly. Though these products are offered a fair price by the society, the main cause for the non-collection of these items is the relative low benefits accrued to the foragers. This is so, due to the high relative costs (visible and invisible) outweighing the low relative income. This situation is termed as 'economic extinction' of a resource. The costs of collection of these NTFPs are high because of several intra- and inter-sectoral factors.

3.7.3. Intra- and inter-sectoral factors

The relative availability of the NTFPs facing economic extinction, the relative income generated from these NTFPs, the relative costs involved (visible and invisible) in the collection are the major intra-sectoral factors within the NTFP sector. The major inter sectoral factors, i.e., factors contributing to the economic extinction of NTFPs outside the NTFP sector, are, availability of employment other than NTFP collection (like forestry labour or other wage labour) and the wage rate existing in the local labour market.

In this context, it is interesting to note Homma's model of economic dynamics of extractivism (Homma, 1992) in which four developmental phases have been identified for NTFPs. In the expansion phase, there is a clear growth of extraction. Prices begin to rise in the stabilisation phase, after supply and demand have reached equilibrium. The decline phase, caused by shrinkage base and increased cost of harvest leads to gradual failure of extraction. In this model, four main factors contribute to the decline of forest products extraction: (i) the inelastic supply of forest products;(ii) harvest rates that exceed regeneration rates;(iii) the domestication of the forest product; and (iv) the development of industrial substitutes for the product. Although the model in its real form is not applicable in the study area, some observations in the model are applicable here also particularly the third phase, i.e., the decline phase. The depletion of the resources starts in its expansion stage when the prices of certain products increase due to rush to cash in and continues in the decline stage when foragers over harvest in order to maintain their living standards. The over extraction of NTFPs due to a fall in the purchase price in order to meet the daily requirement observed in the study area is contradictory to the Homma's model. This phenomenon is found particularly in Peechi-Vazhani where the GSCS is defunct and the foragers are selling the product in the open market and thus face exploitation by the private traders in the form of low prices and adulteration in the measurement of quantity. Thus, the imperfections in the market can also influence the economic extinction of certain products. So, it is not possible to make a general model of interaction of prices and NTFP extraction due to the imperfections in the market. Considering the factors such as variations in the availability over a period of time and

scarcity of NTFP resources and increased cost of harvest, it may be indicated that the NTFP resources are at the depletion stage which can be arrested further only through sustainable NTFP management through the adoption of sustainable harvesting practices and enrichment planting.

3.7.4. Sustainable harvesting methods of NTFPs

Continued collection of and/or over harvesting of NTFPs may lead to depletion of population of target species (Nepstad *et al*., 1992; Peters, 1992), which may lead to an overall reduction in quantities of NTFPs, due to lack of regeneration (Boot and Gullison, 1995). Over harvesting is therefore presumed to alter population size, growth rates and reproductive capacity of the harvested species (Hall and Bawa, 1993; Mohankumar *et al*., 2001). Further, there are many examples of depletion of population because of over exploitation. For instance, over harvesting of *Acacia catechu* and S*antalum album* has almost wiped out these species from the Orissa forests (Mahapatra and Mitchell,1997). Felling trees and/or lopping twigs and branches also creates openings in the canopy which in turn increase light penetration, alter microhabitat on the forest floor and alter regeneration dynamics (Mohankumar, *et al*., 2001). A study in three areas of Kerala (Wayanad, Attappady and Nilambur) also pointed out that there is a gap between the proposed and actual harvesting of NTFPs, indicating unsustainable extraction of NTFPs in the study areas (Muraleedharan, 1997). Although no attempt was made to assess the level of extraction scientifically in most of the studies, our experience with tribal extraction methods indicates that their practices are unsustainable. For instance, branches of fruit trees are lopped (*Phyllanthus emblica, Myristica dactyloides, Mangifera indica* and *Hydnocarpus pentandra*), bark is cut into small pieces (*Ficus beddomei* and *Ficus racemosa*) and removed, cuts are made in the bark and hardened resin is collected (*Canarium strictum*) and fire is lit at the base of the tree to stimulate resin flow. Other problems, which result in depletion, are the repeated annual collection of premium items that have high demand in the market, lured by price increase, and the collection of certain specific items ending up in over harvesting of these items. Thus, for sustainable management of the products, scientific extraction methods are to be followed.

Although this is one of the important aspects in the management of NTFPs, only a very few studies dealt with this topic in India (Daniels *et al*., 1995; Umashankar and Murali, 1998). Even these studies documented only the impact of NTFP extraction on forest structure and composition, and they have not mentioned scientific practices to be followed in the extraction of NTFPs for biodiversity conservation and sustainable use.

3.8. Training programmes on NTFPs

As part of the project work, three training programmes for NTFP collectors- two at Peechi and one at Vazhani were organized with the help of the Forest Department Officers. The programmes, which focused on availability of NTFP species in the sanctuary, methods of sustainable harvesting and semi-processing and value addition, were practical-oriented with suitable demonstration and they were well attended. Experts in the field handled the classes and the participants were allowed to interact with them. Some of the sustainable extraction methods proposed in Table 4.8 and selected simple value addition methods were discussed and demonstrated in the workshops. Further, field training on identification and sustainable collection of NTFPs was also organised as part of the training programme.

Based on review of literature and discussions with tribals and some experts, some guiding principles for collection of various NTFPs have been developed. This was based on their useful part (as the harvesting method of homogenous parts for different NTFPs are more or less the same) considering their depletion potential (Refer Table 3.1 and Table 3.6). These are summarized below (Table 3.8). Based on this, the training programme was developed and imparted to the foragers.

Table 3.8: Existing and proposed extraction of selected NTFPs from Peechi Vazhani and Chimmoni WLS

Sl.No.	Part used	Present method of harvesting / Semi-processing	Sustainable extracting method
A. NTFPs with high potential for depletion			
1	**Rhizome and Root**	The tubers / roots are dug out or pulled out along with the stem and separate the roots and tubers. While collecting species like Sida robust plants are uprooted and dried along with 15 -25 cms long stem portions. Roots of Rauvolfia are cut into 5 - 7 cms long pieces and dried under sun before selling to society or private traders.	Care should be taken while collecting the roots from trees because the plant will face immediate destruction if the entire root is removed. For sustainable use remove only 50 per cent of the roots preferably from one side of the plant in order to ensure that the plant will survive as new roots sprout. For sustainability of herbs and shrubs a minimum per cent of the part extracted should be retained. Post–monsoon season is the preferable time for tuber extraction because of the easiness to collect. The collection should preferably be only once a year.
2	**Fruits and Seeds**	The fruits are collected by shaking the branches of the plant using a rod or manually. But for getting more fruits with less effort the branches bearing the fruits (eg.*Emblica officinalis*) are cut down or the base of the woody climber is cut off (eg.*Acacia concinna*) to avoid the effort of climbing to collect maximum quantity with less effort. The fruits are dried for two to four days and then given to the society or the private traders.	While collecting fruits, it is desirable to see that the plant is subjected to least injury. Fruits can be plucked with due care to avoid injury to the plants. Shaking the branches or using billhooks could easily do this either. About 2-5 percentages of fruits may be kept for the production of viable seeds.

contd.

3	***Bark***	Bark is collected in a destructive manner by removing as much quantity as the gatherers can remove. Bark of certain species is difficult to remove completely from the wood. In the case of *Acacia instia* the stem of the plant is cut first . Then an iron rod or stick is used to beat the stem and separate the bark. The separated bark is dried before giving to the society or the private trader	For sustainable harvesting of bark, the uppermost layer and the sub-epidermal region alone should be harvested. This is mainly because if the interior region is damaged the plant will lose its ability to regenerate the bark. Care should be given to extract only one third of the circumference of the tree in linear strips and that too from an interval of two to three years. The preferable season for collection is the post-monsoon period.
4	**Resin**	For extracting resins cuts are made in the bark and the hardened resin is collected later. Sometimes fire is lit at the base of the trees to promote speedy exudation of resins.	Care should be taken when extracting the resin so that the plant is not destroyed. The cuts in the bark may be small and sufficient for normal exudation of the resin. The exudation of resin should not be forced with fire which will destroy the entire plant.
5	**Stem**	The stem of the plant are cut or removed. Then the removed stem is cut into pieces of 3 cms length and dried before selling. Generally maximum quantity of stems/branches are cut which can lead to destruction of the plant.	In the case of collection of wood/stem, care should be given to fell only a few mature branches rather than from the main trunk so that the plant can produce new branches. If possible, *Bordaux* paste can be applied at the cut ends in order to avoid fungal infection.

contd.

B. NTFPs with Low potential for depletion			
6	**Leaves**	The leaves of the plant are plucked directly from the plant, often by cutting down branches. The collected leaves are given to the society or the private trader with or without drying.	It is desirable to harvest the leaves when the plant begins to flower, as they are usually rich in metabolites. Tender branches devoid of flower could be collected in the case of plants like *Indigofera tinctoria.* While defoliating or cutting of branches, care should be taken to see that the stem of the plant is not injured. Collection of leaves may be restricted to 2 to 3 times in a year.
7	**Flowers**	The flowers are plucked from the plant as much quantity as possible often by lopping branches of trees and give to the society or the private traders	While collecting flowers or inflorescence it is desirable to retain at least 10 per cent of the flowers on the plant to facilitate fruit/seed formation. Shaking the branches for collecting flowers is better option.

Source: Primary data estimates, literature, discussions.

3.9. Value addition

Although collection of NTFPs is one of the important sources of income of the tribes, the bulk of the profit is shared between middlemen and private traders and collector continues to be exploited (Hiremath, 1997; Muraleedharan *et al*., 1997). One of the possible solutions to this is to undertake value addition through semi-processing at the village/household level. This will facilitate better marketing and satisfy customers demand **(**FAO, 1996). Further studies indicate that value addition at primary collector's level could significantly enhance the return from the sale of same amount of NTFPs (Mahapatra and Sinha, 1997; Prasad *et al*., 1999).

In a sense, processing and value addition are also a part of marketing, aiming to enhance the value of the product and the profit of the producers/collectors. Because of the variety

of NTFPs, the market for them shows corresponding variations (Chandrasekharan, 1993) and type and quality of the products demanded by the users also vary. For instance, the Ayurvedic Manufacturing Industry in Kerala largely uses NTFPs and the type and quality of products demanded are different for different units; some units prefer fresh plants, while others demand dried and graded products. One of the reasons for the preference for processed items by the manufacturers/users is that they can avoid these processes in their factories and reduce number of workers. Thus, proper semi-processing/value addition of some of the products can generate employment and additional income at the collectors level.

3.9.1. Value addition through semi-processing of NTFPs : Some possibilities

It is difficult to undertake semi-processing/value addition for all the NTFPs because of numerous products and users. Thus, an assessment of market potentials and possible users of important NTFPs is essential. Similarly, identification of species for which demand is expected to rise substantially in future, on a sustainable basis, is also needed for the selection of items for semi-processing/ value addition (Nair, 1994). Semi-processing/value addition may be simple or mechanical depending upon the type of technique used (Box. 3.1).

Box 3.1: Simple semi-processing / value addition methods for different NTFPs

- **Honey (*Apies* Sp.) -** Heating, filtering, grinding, etc. for removing foreign bodies.
- **Gums (Resin):** Removal of impurities like bark and wood pieces, small stones, etc.
- **Fruits:** crushing of fruits like Tribala to remove its covering. Separation of seeds from fruits like gooseberry and *Terminalia bellirica* (Thannikka).
- **Roots and bark:** proper cutting, sizing to smaller size by chopping, washing and sun/air drying and bundling of root according to the needs of the users.
- **Flowers:** Proper collection, drying, packing in a polythene bag and storage properly.

3.9.2. Problems relating to value addition/semi-processing

Some of the problems of value addition/semi-processing are given below:

1. Most of the NTFPs are perishable and cannot be stored for a long time. It also requires sufficient space for proper storage, which is not generally available in the tribal hamlets.
2. NTFPs need to be dried, graded and packed properly in order to enhance their quality and get maximum price. This requires investment, which is lacking in the study areas.
3. Training for undertaking proper processing activities is necessary to increase the quality and value of the products. At present, no agency is imparting technical know-how to the collectors.

3.10. Conclusions

NTFP collection plays an important role in the livelihood of the local communities particularly, those of tribes in the study areas. This is evident from the fact that the collection provides majority of their income (56%). Further, the products such as medicinal plants, firewood etc. are used extensively for self-consumption. NTFPs are being depleted, which are manifested in variations in the availability of the resources, reduction in the quantity of the product, more distance traveled for collection of these products and economic extinction of non-premium items. Destructive harvesting is rather common and regeneration of some of the products appears to be low, resulting in loss of biodiversity. This has serious implications in the future management of NTFPs in the study areas. Sustainable management of these products is the one of the important options for future management, which requires adoption of new set of strategies and action oriented programmes.

Appropriate institutional support for better collection, processing and marketing is another important component of the sustainable management of these resources in the study areas. Of the two societies, one is defunct and many private traders, who offer low prices for the products, are operating in their areas. Revival and strengthening of the existing institutions is one the viable options for better management of these resources. Alternatively, the local communities may be encouraged to participate in the forest management, particularly the conservation and enrichment of NTFPs. *In situ* and *ex situ* conservation of these resources are also required for conservation of biodiversity and sustainable utilization.

4. HUMAN-RELATED CONSTRAINTS IN PA MANAGEMENT

4.1. Nature of conflicts in PAs

4.1.1 Background

The most critical areas of conflict in the natural resource management are the forest lands in and around which there is a dependent populace. Conflicts over the appropriation, control and use of forest resources are an inherent condition of forest-dependent communities, whether such conflicts are acknowledged or not. One dimension to be emphasised above others is the linkage between the complex resource and social systems and the range and diversity of these linkages. Of particular impact are the links between forestry and the basic needs of forest-dependent communities.

Problems in conservation are created on access and use of natural resources by forest-dependent communities and others wanting the same scarce resources. Those who depend on a particular resource and are unable to partake in the planning or monitoring of its uses get marginalized (Chambers, 1997). A conflict also surfaces when local traditional practices are no longer viewed legitimate or consistent with the national policies, or when entities external to a community are able to pursue their interest, while ignoring the needs and imperatives of local people (Anderson *et.al.* 1996; Claude and Michelle, 1997).

Many global factors contribute to the emergence of human-related constraints in conservation at the local level which often have a determining influence on the nature of conflicts that arise. These include: population dynamics, the degrading physical environment, the historical inheritance, the cultural ethnic and religious diversity, warfare and the displacement of population (refugee camps), the policy, legal and institutional context, economic factors and communications having a significant positive or negative impact (Micheal, 2000).

Conflicts occur both at the micro and macro levels, that is, among and/or between local communities and others like government, private organization, etc. These types of conflicts that arise in natural resource management are '*inter*' or '*intra*' micro-macro level conflicts having both long-term and short-term adverse impacts in management (Michael, 2000). These can vary from a provisional reduction in the competence of resource management regimes, to a complete collapse of initiatives of the government and others, and in extreme cases conflicts over natural resource management can escalate into physical violence. Examples of types of conflicts that arise in natural resource management are listed in Box 4.1.

BOX 4.1. Types of conflicts arising in Natural Resources Management

Intra micro-micro conflicts

- Disputes over land and resource ownerships
- Latent family and relationship disputes
- Disputes due to natural resources projects being captured by elites and /or those who happen to own resources of higher quality; and
- Breaking of Common Property Resources rules

Inter micro-micro conflicts

- Conflicts between indigenous Common Property Resources groups and more recent settlers
- Dispute generated by jealousy related to growing wealth disparities; and
- Internal land ownership disputes ignited by the speculation activities of commercial companies.

Micro-Macro conflicts

- Contradictory Natural Resource needs and values, eg. between Wildlife habitat protection and local livelihood security;
- Disputes caused by political influence;
- Disputes arising from differences between the aspirations of community groups and expectations of NGOs or commercial companies; and
- Off-site environmental impacts affecting unintended third parties.

Source : Michael, 2000.

The underlying cause of conflict over natural resources, both among and between local communities and PA managers, is the combination of demographic change and the limits to sustainable extraction of renewable natural resources. However, these pressures are complicated by development process. These include a growing awareness among the local communities of the existence and commercial value of the natural capital, increasing importance of market economy and consumerist lifestyles of the local communities, lack of incentives to avoid producing adverse social and environmental

impacts and various new conservation policies. Besides, there are various structural causes too; for example, the inequalities inherent in legal definitions of land ownership, local and regional economic and political inequalities and cultural differences (Anderson *et.al.* 1996). The State fuels local deforestation by providing infrastructure (roads) which reduces the net costs of agricultural expansion, or when markets are imperfect and local behaviour is determined by survival needs (Arild, 2001). All the above consequently result in creating conflicting situations.

4.1.2. Types of conflicts identified in the PAs

Against the backdrop of the different types of human-related constraints in conservation leading to a conflicting situation, the types of conflicts found in the PAs specially in Peechi-Vazhani are discussed below. Conflicts identified here are basically (i) *for land* (change in boundaries, wanting social security); (ii) *for produce / resource*, either for self-consumption or for sale (either legitimate – eg. cheenikka, or illegitimate –eg. rose wood, deer meat); and (iii) *for political dominance*, exhibiting extremist behaviour / attitude. These are found on outer boundaries (eg.Thirumani, Kalappara, etc.), along inner boundaries (eg. Maniyankinar, Thamaravellachal, Olakara, etc.) and between social groups (tribes, m*alayans, kaders*; non-tribes *kavaras, pulyas, vettuvas* and *parayas*; and others; also between Forest Department and local communities). Existence of human enclaves within the WLS (eg. Maniyankinar, Thamaravellachal, Mundipadam) is a potential threat in the long run. They tend to expand at the cost of the sanctuary. There are a wide range of conflicts and disputes adversely influencing PA management of the study areas. Some of these recorded are summarised in Box 4.2.

BOX 4.2. Conflicts identified as human-related constraints in effective and sustainable PA management (Peechi-Vazhani and Chimmoni WLSs)

General

- Land ownership conflicts - creating land disputes with no expedient legal method to clarify ownership;
- Tensions from rapid socio-economic changes due to shift from subsistence to market economy;
- Political and religious tensions creating family and community divisions;
- Growing pressures to find alternative income or subsistence where resources are depleted;
- Tensions caused by breakdown of traditional leadership structures and systems; and
- Tensions between tribes and settlers over the use of natural resources.

Local Community Vs Forestry

- Dominance of commercial interests over fodder and fuel wood needs of women, exclusion of local people from access to forest resources;
- Lack of involvement of local interested parties in management and defining strategic livelihood objectives within PAs;
- Social tensions consequent with creation of VSS;
- Tensions between communities unaware of forestry practices and downstream stakeholders; and
- Contradictory natural resources management objectives of the wildlife managers and the basic livelihood issues.

Primary data estimates (PRA)

Here, an attempt has been made to put the historical information in an analytical framework to elucidate the genesis of human-related constraints in management followed by an explanation of the dependency factor that has resulted in 'actual commercial threats' to the PAs. The causative factors of human-related constraints in management, their manifestations and attempts to manage are also explained. This is followed by an assessment of the level of conservation awareness among the local communities and the management options. Finally, an integrated landscape livelihood approach is proposed as the most appropriate management option.

4.1.3. The genesis of the human-related constraints

All forestry interventions deal with a historical interface between people and the landscape, which is often considered less significant in any management plan. Most of the development programmes, project appraisals and documents focus on the current scenario or situation. An understanding of the historical background can help compile a picture of people in their landscape, and mutual influences between them, which is referred as *'cultural landscape'* by cultural geographers (Anderson, 1990). The temporal

scale in this analysis starts from the intervention of the feudal chieftains in the late 1700s followed by the British intervention in the study sites from the late 1800s to the present day State Forest Department Management.

The past history of forest management in the Division has been very varied. Between 1760 and 1780 major parts of the forests of the Division were under the ownership and possession of the erstwhile Cochin State, under the *Naduvazhies* (local Chiefs). It was during this period that the Portuguese and Dutch traders extracted large quantities of teak and exported them to their countries (Development Report, 1996). Naturally, social side of forestry was totally neglected. This was the beginning of the process of exploitation and degradation of the natural wealth.

Interest in forests as a commercial resource started way back with the British rule. The British used the forest resources to meet their timber and other forest products needs back home and this led to a large-scale exploitation of our natural resources. The reservation of forests under the British colonial government is widely recognised as a turning point in the management of the PAs (Gadgil, 1991). The reservation process altered the access rights of the local residents to the forests and forest products, and imposed new objectives and imperatives in forest management such as timber extraction and establishment of plantation. To this end, the community-based systems of restrained use and consumption had to be scuttled. The bulk of state-owned lands were converted into reserve-forest lands. A fraction of about 25 per cent was set aside as minor forest lands for meeting the subsistence needs of the local people (Gadgil, 1991). But, these forest lands came to be treated as *open-access resources* and have resulted in escalating degradation as predicted in the *tragedy of the commons* scenario.

Areas around the sanctuaries have also undergone drastic change. The sanctuaries saw the growth of commercial plantations and leases starting from the mid-1800s. The expansion of agricultural lands sustained food crops as well as commercial crops like rubber and pepper (Logan, 1887). With mounting commercial pressures also grew the subsistence demand of the rural population after the World War II; which continued to be

met from the open-access public land. This led to an erosion of traditional practices of sustained harvests from natural areas, resulting in highly wasteful pattern of natural resources use.

Two major events that adversely affected the management of forests of this area were the cyclone of 1940 and the clearance of forest for the 'Grow more food' campaign and 'Hill paddy scheme'. In 1940s, leasing out forest land for `grow more food` programme and other plantation purposes without proper survey and demarcation gave a golden opportunity to the encroachers to extend their possession surreptitiously into the adjoining forests. Absence of proper records helped the leasers to expand their holdings. There was no scientific management, often throwing open large tracts for food production. Their continued existence coupled with encroachment caused destruction of large areas of the forests. All management plans were set aside during the two World wars, permitting totally unregulated harvesting from reserve forests.

The transformation during the last two centuries was facilitated or accelerated by three factors of development, viz. (i) Economic integration of the provinces that made up Kerala to the world market; (ii) Development of communications infrastructure; (iii) Control of Malaria and political changes that favoured large scale migration of farmers from the plains to forests (Chundamannil, 1993).

Prior to the formation of the sanctuary, the Reserve Forests were virtually a paradise for encroachers and settlers (Mohanan, 2000). The people in and around had a lot of rights and concession. After the declaration of the sanctuary, all their rights ceased. The areas around what now constitutes the WLS have gradually increased in population density and the conversion of forest for agriculture continues today. Many of the neighbouring villages were established only in the last few decades. The construction of Peechi and Vazhani dams in the southern and northern portions of the Division respectively, during the 1950s and 1960s, has directly accelerated the encroachment rate in these areas. Most of the workers who participated in the construction later became encroachers, doubling the rate in the second half of the century. Repeated plantation failures and subsequent

encroachments are the major problems in this area. Many lands recorded as plantations are now under encroachment (Narayanankutty, 1990).

After independence, in enthusiasm to gain self-sufficiency and provide food, shelter and employment to the people, the Government's forest policy resulted in large scale clearing of forests for irrigation and power projects. The policy of managing forest resources was also mainly to raise plantations to meet the industrial demands. In fact many rich natural forests were converted into plantations to meet the requirements of timber and soft wood. In the wake of development, the cultivators/settlers have been poorly compensated and often forced to encroach on forest land to eke out a living.

It is in the 1970s and 1980s that the emphasis shifted from exploitation to conservation. The Forest Conservation Act of 1980 stopped clearfelling and selection felling in natural forests. But, by the time the ideology and practice of conservation of forests gained momentum, much of destruction of natural forests had already taken place. Coupled with this loss of forests were the problems of a growing population and their social and economic dependencies on the forests. This was especially true for the poor, living adjoining to the forests who were dependent for food, fodder, fuelwood, housing material, etc. on the natural wealth. The consequences of the population pressure, increased cattle population and increased consumerist lifestyle of the people on the forests were manifold. The forest got exploited in the most unsustainable manner resulting in its degradation. The forest laws ensured that the forests were kept inaccessible to the people. People saw these as restrictions on their livelihood. It was none of the people's concern if the forests got degraded or even destroyed. Whatever be the amount of policing done by the Forest Department, the people always found a way to enter the forest to meet their livelihood needs. They also left their cattle to graze due to lack of common grazing land or caused fires for several reasons, which further accelerated the process of degradation. To counter this loss of forest the forest officials book or charge cases for violation of forest laws against the people and very often the poor get punished. This led to a feeling of fear, discontentment and hostility on the part of the people towards the PA managers and a general feeling of mistrust developed between

the two. Now, there exists a strained relationship. Their hostility has been and is being manifested in several ways that poses a constraint in the management of the PA. The resultant scenario is that neither are the people's needs satisfied nor is the forest protected and conserved. This only aggravates the already strained relationship between the PA managers and the local communities.

4.1.4 Implications of reservation

The conflicts, as a result of constraints in management, between the local communities and PA managers are based amongst other things, on differing agendas and perceptions. Thus, arises a natural question of relevance, ‘what were the implications of such reservation on the relationship between the landscape and the local communities living in and around it?’ The two important social groups today in this regard are the settled non-tribal farmers, and the indigenous people (tribal community).

The initial reservation process involved settlement of rights for farmers, allowing them rights of passage through the forest, and limited rights to graze and water cattle. Strains on the relationship between Forest Department and villagers stemming from these changes are noted in the Malabar Gazetter / Manuals.

The forests of Peechi-Vazhani and Chimmoni today are an outcome of a long history of interaction amongst people, and between people and place, which is an ongoing process. The transition from reserve forest to a WLS in 1958 and 1984 respectively placed further restrictions on activities like hunting. These restrictions were again strengthened with the enactment of the Wildlife Protection Act 1972, which also makes the existence of tribal settlements within the WLS unauthorised. This has been the basis for resettlement of tribes to neighbouring farmlands, and is a bone of contention in PA management today.

Table 4.1 briefly depicts the chronological progression of human related constraints in the Peechi-Vazhani WLS since 1980s when the issue of encroachment assumed serious proportions and posed repeated threats in management. In 1980s began the process of

eviction of the encroachers who vehemently opposed the same. The process is still on and to date no solution has been brought about in spite of political and judicial interventions.

Table 4.1. Chronological progression of important human related conflicts in Peechi-Vazhani WLS since 1980s

Place and date	Conflicts	Consequences
Thamaravellachal (Peechi sanctuary) 16-5-1980	Encroachment of forest land - eviction from the forest land	Offence booked against the encroachers and evicted from the encroached land. But they came back with force and re-encroached
19-5-1980	Re-encroachement of the forest land by the former encroachers who were evicted on 16th May 1980. The encroachers were the tribes of the adjoining settlements	Evicted from the area with the help of police
12-12-1980	Evicted the encroachers who encroached the land on 19th May 1980 with the help of Police force	Encroachers re-encroached with the support of the local politicians
(Thamaravellachal) 1-9-1981	Attempt to evict the encroachers	Eviction unsuccessful (political backup)
(Thamaravellachal) 11-1-1982	Attempt to evict the encroachers	- do -
(Thamaravellachal) 21-5-1983	Attempt to evict the encroachers	Eviction failed again due to political backup
8-7-1983	- do -	Proposal for settlement of the encroachers at *Thekkumpadam* was prepared
(Thamaravellachal) 8-8-84	Resettlement proposal as per Government letter No: 50252/FGI/83/AD dated.8-8-84 for the occupants of *Thamaravellachal* forest area was discussed. The proposal envisages to provide each family 50 cents of land at a place called *Thekkumpadam*, a failed plantation area. The proposal was opposed by the occupants on the argument that the area proposed for the resettlement is a rocky area where there is dearth of water and hence not suited for cultivation	An alternative proposal was given by the then district Collector to translocate the occupants to *Pampatty* near *Pattikad* by allotting 2 acres of land in the second rotation teak regeneration area. The Chief Conservator of Forest turned down the proposal and asked the Conservator of Forest of Thrissur Circle to examine the possibility of allowing the occupants in *Thamaravellacha*l itself and the CF agreed to this proposal. But no Government Order was made in line with this proposal.

(Maniyankinar) 17-3-1998	Tribes of Maniyankinar tribal settlement instigated by 'Adivasi Samithy' demolished 51 permanent cairns erected during 1985 to consolidate the boundary around Maniyankinar tribal hamlet	Offence booked against 19 tribes of the settlement. A picket station was erected in the vicinity of the settlement to prevent any further attempt to encroachment.
(Maniyankinar) 21-3-1998	Tribes physically obstructed and kept the Assistant Wildlife Warden and staff hostage who went there for patrolling. Police intervention was sought to free the forest department officials	Police booked case against 63 tribes for preventing Government officials from discharging their duties
(Maniyankinar) 1999	Using the grant for house construction allotted by the District Panchayat, tribes tried to construct basement in the forest land lying outside the demolished cairns, which was prevented by FD officials	Booked case against the tribes concerned
(Olakara) 2001	Tribes held the forest officials of Olakara forest station and took charge of the forest station. This was to express their displeasure on certain false cases booked on them.	Officials freed after police intervention
(Thirumani) 20-10-2001	Forceful encroachment under the leadership of the District Adivasi Samithi with the aim of retaining the alienated tribal land and some areas of Eucalyptus plantation by tribes of *Thirumani* tribal settlement	Temporary withdrawal from the encroached land after discussions between the tribal leaders and the DFO
(Kalappara) 25-10-2001	Demolition of cairns and encroachment of forest land under the leadership of the District Adivasi Samithi by the tribes of *Kalappara* tribal settlement together with the tribes of *Maniyankinar, Elanad, Olakara*	Temporary withdrawal from the encroached land after discussions between the tribal leaders and the DFO
(Thirumani) 4-12-2001	Taking over of the *Elanad* Forest Station by the tribes of *Thirumani* Tribal settlement under the leadership of Dalit Adivasi Samithi demanding increase in wages paid for them for forestry labour	Group dispersed itself after discussion with the Deputy Ranger ensuring a discussion between the leaders and the higher officials on the matter concerned on 7th December 2001.

*Source: Narayanankutty.1999; Mohanan.2000; The Hindu 2000-2001; The Malayala Manorama 2000-2001; Primary data estimates.

Besides these, there is the dependency factor and also various commercial interests being pursued within the Peechi-Vazhani sanctuary that is also a causative factor in bringing about human related constraints in conservation and management of the PAs.

The situation in Chimmoni WLS is not as stormy as in Peechi excepting for the issue related to the resettlement of Kallichitra tribal settlement after the inception of Chimmoni Dam. Initially, the Malayans of Kallichitra resided within the sanctuary. The decision to relocate them came up in 1990, when the dam was to be constructed and the reservoir would inundate their settlement. There was a chain of negotiations with the tribes by the district revenue authorities headed by the district collector. But, the tribes rejected the initial offers of resettlement and demanded more land area and compensation. Finally, they have been resettled at Nadampadam in November 1992 by giving Rs. 25,000/- per family for house construction and by allotting 65 cents of land each on which they have started rubber cultivation.

4.2 The dependency factor

Peechi-Vazhani and Chimmoni WLSs do face an anthropogenic threat from the dependence on the local and easily available resources. The local communities not only depend on the sanctuaries for their sustenance needs, but also relate to them in various cultural ways. Unfortunately, Wildlife Conservation policies and programmes have till recently ignored these dependencies, rights and relations. When access to natural resources is restricted and ownership rights are not clear, this natural capital becomes an *open access resource*. Thus, denial of their primary source of livelihood, the discontentment and dissatisfaction resulting in constraints being posed in management, lead to conflicts. Ultimately, this also threatens conservation goals with an already understaffed Department at the field level working in hostile conditions with very little public support. There are also unauthorised operations of wood theft, poaching, urban growth and encroachment for various commercial purposes, which along with others are the actual commercial threats that the PA faces, especially in Peechi-Vazhani (Box 4.3).

In the study areas collection of NTFPs is undertaken both by the local communities and the tribes for commercial purposes and also for their subsistence. It is more often to supplement their family income. For instance, 62 per cent of the extraction is for the roots, bark or the whole plant, where if caution is not borne in mind, can lead to

destruction of the resource itself. Poor harvesting methods have resulted in product wastages and resource damages. Important constraint faced from the conservation point of view is the over harvest in response to market-driven demand. Commercial extraction has led to degenerative or destructive extraction practices. The non-functional status of Thalappilly TSCS has made NTFPs in this area an *open access resource*, which is being harvested by almost anybody in need. The linkages to a chain of middlemen and private traders are not conducive to sustaining the resource base, where again market driven commercial exploitation is in practice, and the actual primary collectors are not given a fair price. Plants with medicinal properties are also being extracted for both domestic as well as commercial purposes. The older generation with the indigenous knowledge of identifying a suitable herb for particular ailments, both for cattle and humans, feel strongly that these herbs are fast dwindling in the forest causing an escalation in the prices while more and more people are going in for allopathic medicines (Primary data estimates).

Box 4.3. Actual commercial threats to the PAs

- ✓ *Open access area*
- ✓ Indigenous Farming / cultivation - specially in catchment
- ✓ Commercial Fishing
- ✓ Uncontrolled extraction of medicinal plants & other NTFPs from within and adjoining areas
- ✓ Commercial extraction of fuel wood
- ✓ Large number of entry paths
- ✓ Brick making units in the catchment areas
- ✓ Sand mining
- ✓ Rock mining
- ✓ Encroachment
- ✓ Poaching
- ✓ Unauthorised wood felling
- ✓ Unauthorised Brewing

Source : Primary data estimates

Forest land is also used for grazing mainly because of the scarcity of common grazing lands and the high cost of fodder. This was found to be more common in the plantation areas where there is grass undergrowth than in the thick forests where canopy is thick for grazing. Grazing to a large extent needs to be controlled as it can have an extreme influence on the regeneration. The grazing pressure in the study areas is recognised as approximately 25 livestock/km^2, which is significantly high. The total grazing impact zone is 125 km^2 (Peechi - 75 km^2 and Chimmoni - 50km^2). The grazing pressure in

Peechi-Vazhani is significant and is closely correlated to forest degradation quality–wise (Jayanararyanan, 2000). The socio-economic conditions of the local communities, non-implementation of laws checking grazing in public and private lands and the non-implementation of the cattle pound system allow local communities to overstock, thus promoting overgrazing and habitat destruction and can in the long run result in habitat modification and loss of species within PA. The following examples are some of the effects of grazing by domestic stock on five ecological processes (Table 4.2).

Table 4.2: Some effects of grazing by domestic stock on five ecological processes

Ecological process	Effects
Natural succession	✓ Modification of natural succession by treading and selective grazing leading to dominance of unpalatable species ✓ Invasion of weeds and exotics species ✓ Reduction of palatable tree, shrub and perennial species and expansion of grassland particularly of annual species ✓ Disturbance of native animal species by domestic grazing
Organic production and decomposition	✓ Primary production diverted to ground level with loss of trees and shrubs ✓ Reduction in total biomass and possibly energy capture ✓ Decrease in biomass of native animals ✓ Natural decomposition process circumvented by grazing animal cycle ✓ More of primary production diverted to large herbivores ✓ Increased herbage intake leading to less litter and lower rates of decomposition
Nutrient circulation	✓ Reduction in nutrient pool with fewer nutrients in vegetation ✓ Local and uneven re-allocation of nutrients according to distribution of feacas and urine ✓ Increased rate of nutrient circulation ✓ Replacement of slow cycling through soil organisms by more rapid, plant animal cycling pools ✓ Initial stages of decomposition in rumen and gut of grazing animals ✓ Loss of nutrient capital with removal in animal products (meat, milk, hides)
Water circulation	✓ Increased surface run-off ✓ Reduction in interception and transpiration ✓ Soil surface layers drier ✓ Increase in evaporation from soil surface with loss of vegetation cover ✓ Increased soil compaction due to treading

Source: Ovington, 1984

People living within and adjoining Peechi reservoir, mainly to supplement their family income undertake cultivation in the catchment area, hence affecting river flows. The effect of land use on hydrological characteristics of water catchment has been studied in a number of countries (Box 4.4). The river Manalipuzha; which originates from the forests, is already threatened from agriculture and human settlement expansions, hence experiencing conflict between the different stakeholders. The cultivation practice adopted by the local communities is highly unsustainable, particularly with the regular application

of dangerous pesticides like *Phorate*, which is highly poisonous and known for its '*bio-magnifier effect'*. It is hazardous to humans, cattle and wildlife and environmentally threatens the sustainability of the environment, forest, wildlife, water and water catchment area as a whole (CPP, 1986). This product is toxic to fish, shrimp, crab, birds and other wildlife. The local communities are not aware of the negative impact of the pesticide. This is a very serious matter, needing immediate attention. The danger lies in the contamination of the reservoir when it fills with water immediately after the cultivation period, as it is the source of drinking water to Thrissur town and nearby panchayaths.

Box 4.4 Effects of land use on hydrological characteristics of water catchment- some findings

- ✓ change of land use from forestry to clearfelled land has resulted in increased run off between 15 and 30 per cent
- ✓ uncontrollable loss of forest cover, thus increases forest surface flow, and a decrease in dry season flow.
- ✓ would trigger the most significant changes on downstream systems reliant on regular stream flow
  - Downstream flow would increase in total with less regulated flow
  - Water table replenishment would decrease.
  - Water supplies would become less dependable
  - Farming systems relying on dry season flow are at an increased risk
  - Irrigation based stream extraction would be less viable.
- ✓ Biodiversity decreases through loss of habitat

Source : Omosa, 1998.

Distinct varieties of crops have been produced using naturally available natural manure. In an age of growing crop, resistant to pesticides and human diseases that have failed to come under control, conversationalists caution the use of such hazardous pesticides and advocate biofertilizers. Though, these practices have been stopped in the current year, there is a lot of local resistance to the same. In the Vazhani and Chimmoni catchment areas of the reservoirs no cultivation is observed.

There is a rich fish fauna in Peechi-Vazhani and Chimmoni WLSs, with a total of 37 species, belonging to 15 families (Thomas, *et.al*, 2000). It is evident that the quantity of fish collected and the sales from Peechi reservoir is decreasing over the years (Fig. 2.12). But, the quantity of fish collected from Vazhani reservoir and its sales has indicated an increasing trend over the years (Fig. 2.13). This may be attributed to the unsustainable

land use practices undertaken in the Peechi reservoir catchment area and the less disturbed catchment area of Vazhani reservoir.

Fuelwood collection is also rampant, although is a restricted activity in a PA to meet the subsistence needs, this is permitted to a large extent. Now, the situation is such that it has become a commercial activity and has led to head loads being removed from the forest area whereby, preferred species are becoming scarce and the local people are resorting to inferior species. In the past, this may have been attributed to the *laissze faire* attitude of the officials, considering their social and economic conditions, which led to large-scale extraction and present state of affairs. Now, strictness has brought about tensions between local communities and the PA managers. Charcoal preparation was very rampant in the 1950s and 1960s. Strict vigilance on the part of the Department Officials has definitely decreased this activity although this is still rampant in certain pockets.

Unauthorised activities such as encroachment especially for the purpose of cultivation, hunting and unauthorised grazing, also take their toll on the PAs. Majority of the encroachment took place in the early 1950s when scarcity of food materials after the second World War, the hill paddy scheme of the then Government, comparatively low land value, languid attitude of the Officials, made conditions ideal for encroachment. The issue of encroachment is highly complex and often seemingly irresolvable, ranging from situations where traditional settlements have been termed 'encroachments' to those in which land mafia use poor people as fronts to grab forest land. There is also this problem of local communities enticed or driven to desperation, becoming conduits for unauthorised trade in the wildlife products or an accomplish in timber felling. Changes in traditional modes of resource use have also tended to reduce the conservation-orientation that they once had.

Other commercial interests like sand mining, brick making units, and poaching (unauthorised) are also being pursued here in the catchment, but for the current curb on the same. Poaching, although an unauthorised activity, is found only in certain areas (eg. Karadippara, Chakkolatharissu, Pullankandam, etc.) again for self-consumption and

often traded. This contributes to the degradation process. In the study area, poaching has indicated a decrease in the population of the deer, wild boar, rabbits, in between 1970s and the 1980s (Jayanarayanan, 2000).

Rock mining is another activity being undertaken in the PA exercising immense pressure on the PA and indirectly polluting (noise as well as material waste) the atmosphere. In Pattikkad range alone, the demand for rock as boulder, metal, etc. for house construction put immense pressure and the number of quarries increased from one to eight by 1998 (Table 4.3). This is attributable to the socio-economic conditions of the local communities, lack of alternative job opportunities, negligence on the part of Department officials and the political support to labour unions.

Table 4.3 : Number of quarries and quarry workers

Particulars	1967	1970s	1980s	1990s	1998
Number of quarries	1	1	2	5	8
Number of workers	6	15	32	90	64
Rock mined (loads)	2	6	14	0	45
Gate pass (in Rs.)	-	10	30	90	170
Daily wage (in Rs.)	9	15	40	60	130

Source: Jayanarayanan, 2000.

The local communities also find employment in the routine forestry operations of the Department. Here again, though there has been an understanding that the tribal people will be utilized for this purpose, it is very unfortunate that in certain areas (eg. Thirumani, Pattikkad, etc.) they are kept out and there seems to be a preference for local people(non-tribals) in employment. This has brought about discontentment among the Malayans and they have protested by means of picketing the Department office, cutting down tress and setting fire to the forest (Primary data estimates).

4.3. Causatives of forest-related conflicts

There are a number of factors that have contributed to the natural resources based conflicts in Peechi-Vazhani sanctuary. Some of the causes are the attempts to evict the encroachers / forest dwellers, land allocation, changing socio-economic needs, lack of community awareness, breakdown of traditional institutions that governed resource

conservation and use, political interference and the growing population and dwindling resources. Most of the causes of conflicts are the result of constraints within and between local communities and the State over the resource ownership and access versus protection. Some take advantage of such a situation and end up causing more conflicts. Some such resultant conflicts are so serious that they have turned political. Some of the causative factors (Fig. 4.1) of human-related constraints in the study area, most of which are more prominent in Peechi-Vazhani than in Chimmoni, are discussed here.

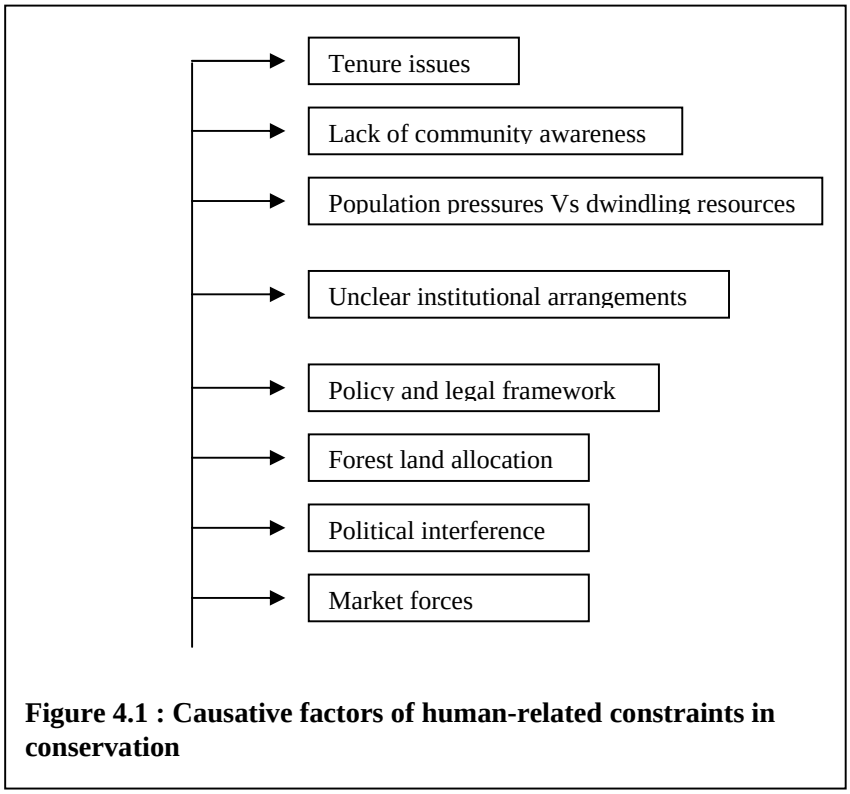


Figure 4.1 : Causative factors of human-related constraints in conservation

(1) Tenure issues : Property rights are not well defined or enforced; indeed, many frontier areas are still *de facto* open access areas. Conflicts arise over land ownership, allocation of land, lack of access roads, and sometimes the land use practices. There is also over-exploitation without due consideration for sustainability and inappropriate land use practice which leads to soil degradation. Undefined tenure issues lead to exploitation of natural capital (*open access resources*), good examples are the events at Thamarvellachal and Maniyankinare Malayan settlement within the sanctuary area.

(2) Lack of community awareness : Most of the people living next to or inside the forests do not know the provision of the laws as to their rights and responsibilities to forest conservation. When forests are being denotified or put to different use, the communities are never consulted and yet they are the first ones to immediately feel the impact. Sometimes they even participate in destruction. They also know very little about their rights of access to forests and forest products. They are, in most cases, denied access to by the Department staff even when it is permissible to collect firewood and grass. Sometimes the communities living next to the forest do not understand the need to conserve the forests since they do not obtain any benefits from them. They, therefore, strive to use the forest in an unauthorised manner and do not take sustainability into account.

(3) Population pressures Vs dwindling resources : The latest decadal population growth rate of over 8.7 per cent means that pressure on land will continue. This will lead to a progressive reduction of forest cover. Estimates show that large number of people live in the areas adjacent to PAs and directly depend on the natural capital for their livelihood and survival . Population increase implies that the number of users and uses have grown competing with the available scarce resources. For example, in Thamaravellachal (human enclave) initially (early 1980's) there were less than 15 households, comprising of mainly Malayans. Now, this number has grown to about 75 households with high proportion of scheduled castes. Available research reports show that deforestation is a big threat to the WLSs and economic development. During the period from 1960 to 1984 the deforstation rate almost doubled by 50 per cent (Menon, 1984).

(4) Unclear institutional arrangements: Unclear institutional arrangements end up confusing the resource-dependent communities. The following institutions like KFD, Water Authority, Irrigation Department, Girijan Service Co-operative Society, Public Works Department, etc. have responsibility in managing or have a stake on the study area in question. There is a lack of coordination among these various institutions. A clear delineation of the responsibilities and accountability is severely lacking, i.e., lack of an integrated approach to the management of the same resource.

(5) Policy and legal framework **:** The policy and legal framework are not in line with the changing demands of local communities. For instance, although research has shown the importance of people's participation in sustainable resource management, the policies have so far been against involving people. Conservation efforts create conflicts among local communities and between local communities and the enforcing authorities. Local communities see these efforts as government-imposed restrictions on their socioeconomic systems. This results in uncontrolled exploitation of the resource by forest adjacent communities whose livelihood depends on the forests.

(6) Forest land allocation: Forest land is being allotted to people who end up putting it to different uses that may have a negative impact on environment. In most cases, the land is developed for agriculture or commercial use that defeats the purpose. Influx of cultivators from neighbouring districts has led to an increase crop production and thus clearing of forests (eg. Thamaravellchal and Maniyankinar). Reduced wildlife habitat and forest habitat fragmentation have exacerbated the human-wildlife situation. Mechanisms that ensure that local people benefit from forest and wildlife conservation are yet to be developed.

(7) Political interference : Political intervention also led to irregular forest land allocation with sustainability of the resulting settlements not guaranteed. This is not backed by any impact assessment or legislation resulting in conflict and irregularities in the implementation of laws governing the use of forests. The area around the PAs (Peechi) has had a good share of tribal conflict eruption since the onset of the multi-party era. Conflicts are caused by ethnic diversity common in this area.

(8) Market forces : As a result of the ‘globalisation’ process the local resources are exposed to the outside market due to internal and external demands. This implies competition over limited resources. Local communities who cannot afford to compete in a liberalized market, yet depend on natural resources for basic needs, have no other option but to over-exploit resources.

4.4 Manifestations and attempts to manage the conflicts

The human-related constraints in PA management leading to a conflictual situation have been realized in many and different forms in the study areas (Box 4.5). These are manifestations of their resentment to the restriction clamped upon them which they see as restrictions on their basic livelihood issues, which have consequently resulted in a strained relationship between the two.

Box 4.5: Human-related constraints in the PA management - manifestations

- ✓ non co-operation (refusing to help put out forest fires, refusing to keep out cattle)
- ✓ deliberate destruction (unauthorised timber cutting, starting forest fires)
- ✓ violence against officials (against Wildlife Warden and associated staff)
- ✓ bypassing the law by gaining political patronage
- ✓ illicit liquor brewing and ganja cultivation
- ✓ passive resistance (tree felling etc.)

Source: Primary data estimates

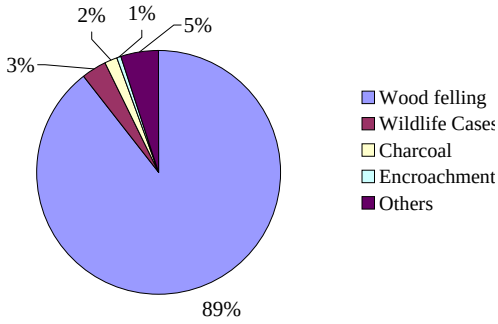


Figure 4.2: Nature of forest cases (Peechi-Vazhani WLS)

Attempts are also made by the Forest Department to manage these conflicts. Cases are booked and charged in the court. Offences are booked under 2 different categories, viz. (i) Wildlife offences (WL) (such as, poaching etc.), booked under the Wildlife Protection Act 1972; and (ii) Forest Offences (FR) (such as, wood felling, etc.) booked under the Kerala Forest Act 1961 and other Acts. As far as the nature of forest cases in Peechi - Vazhani is concerned 89 per cent reported are wood felling cases (Fig. 4.2), and in Chimmoni 94 per cent constitute forest cases other than wildlife cases like unauthorised wood felling (Fig. 4.3).

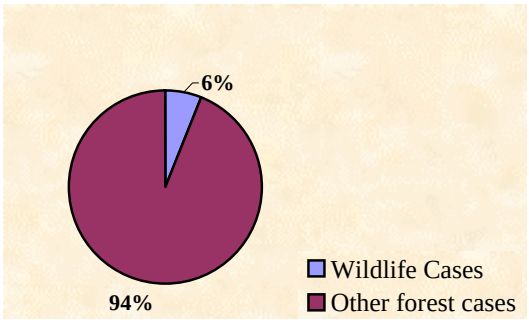


Figure 4.3: Nature of forest cases (Chimmoni WLS)

Number of forest cases reported from Peechi-Vazhani WLS during the last decade (1992-2001) showed a declining trend (Fig. 4.4) although inter-year fluctuations are observed in both WL and FR cases. . Decadal (1992-2001) record of forest cases reported from Chimmoni WLS, also depicts a declining trend though fluctuations are observed in the initial years (Fig. 4.5).The declining trend of FR and WL cases indicates reasonably good level of law enforcement even though there are stray cases which go unregistered. Case details of both sanctuaries are listed (Appendix 4.1 and 4.2).

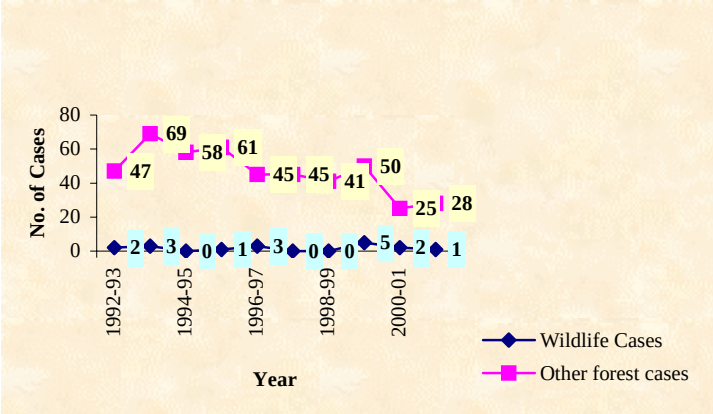


Figure 4.4: No. of forest cases (Peechi-Vazhani WLS 1992-2001)

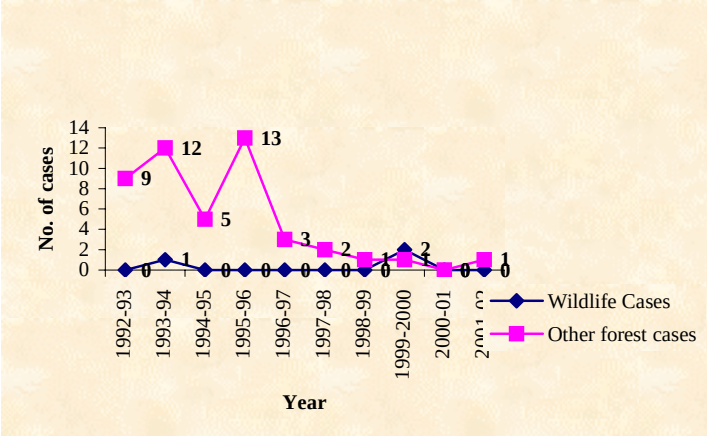


Figure 4.5: No. of forest cases (Chimmoni WLS-1992-2001)

The excise cases registered in Peechi-Vazhani wildlife sanctuary show fluctuating trend over the years (Fig. 4.6). The low number of cases reported may be due to the fact that these sorts of unauthorised activities (illicit

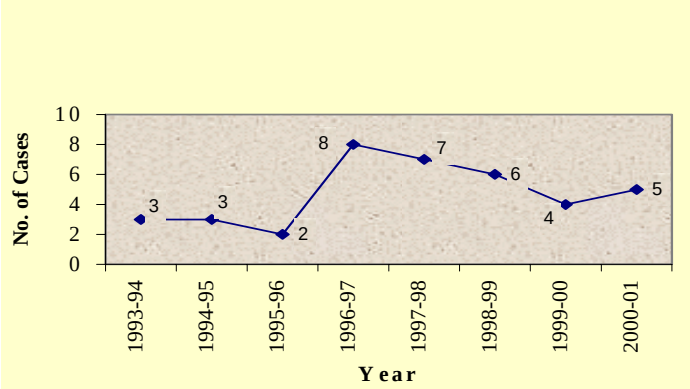


Figure 4.6: No. of excise cases (Peechi-Vazhani WLS- 1993-2001)

brewing) take place in certain pockets which are not easily accessible for the authority concerned to act on a timely basis. This justifies the fact that many cases go unrecorded. In Chimmoni, although on occasional raids the officials come across the materials that were used for brewing, no excise cases have been registered mainly because of the absence of the involved persons on the spot.

4.5 Conservation awareness : the cultural capital

The conservation awareness of the local communities or the indigenous knowledge used to refer to that knowledge which is generated and transmitted by communities, over time in an effort to cope with their own ecological and socio-economic environments. This knowledge is generated and transformed through a systematic process of observing local conditions, experimenting with solutions to modified environmental, socio-economic and technological situations (Gadgil, 1992). This accumulation of experience, knowledge, and belief in dealing with the natural environment may be termed as `cultural capital' and like any capital, it is also productive if it is properly utilized.

As several studies point out, indigenous knowledge or traditional ecological knowledge is of significance from a conservation perspective and an attribute of societies with continuity in resource use practices. Local people with traditional knowledge play a very important role in the conservation of natural areas. In particular, long-term trends or fluctuations in abundance and distribution of wild species, past influences and changes, values and usefulness for human purposes can be assessed most easily from local people. This type of knowledge includes : protection of individual plants and animals considered to be sacred, eg. trees of the genus Ficus or monkeys such as Hanuman langur and bonnet macaque, protection of specific life history stages, such as birds breeding at heronaries, protection of animals from over-hunting through devices such as ban on hunting of fruit bats at the roosting sites but not outside the sites, protection of entire biological communities in the sacred groves and sacred ponds (Gadgil, 1991). Thus, traditional knowledge of the local communities complements modern scientific knowledge in conservation and sustainable use of natural resources. Documentation of such traditional

knowledge is of great significance and it will help formulate better conservation strategies.

People living proximate to the WLS have a significant impact on it. Rich traditions of nature conservation exist among the local communities. They have a unique indigenous knowledge, based on their long-term, local experience. Such knowledge may be related to the ecosystem of the forest and features animals and their behaviour, plants and their management, availability and uses of various forest products, techniques for extracting and processing forest products, conservation problems faced in the forest, etc. Recognition of the value of local knowledge and its use are powerful tools for enhancing communication and co-operation between local people and the forest managers and for ensuring better sustainability and management of the forest. Conservation awareness among the local communities in the study area was assessed using three environment quality attributes, viz., ecological environment (covering the landscape features), environment health (biotic / abiotic) and social environment (Table 4.4). Scaling

Table 4.4: Conservation awareness level of local communities based on environmental quality attributes

Sl.No	Quality features	Attributes (as perceived by the local community)			
		Low	Medium	High	No opinion / not aware of
1	**Ecological environment (Landscape features)**				
1.1.1	Habitat diversity	*	***		
1.1.2	Fragmentation		*	**	*
1.1.3	Proximity to PA			****	
1.1.4	Aesthetics	*	*		**
2	**Ecosystem health (Biotic / A biotic)**				
2.1.1	Floristic diversity	*	**		*
2.1.2	Faunal diversity	**	*		*
2.1.3	Habitat utility	*	**	*	
2.1.4	Regeneration potential	*	**		*
2.2.1	Forest fire		*	**	*
2.2.2	Weed infestation	*	*		**
2.2.3	Stream diversity	*	*		**
2.2.4	Water quality		*		***
2.2.5	Soil erosion		*	**	*
3	**Social Environment**				
3.1	Ethnic groups	*	**	*	
3.2	Forest dependence	*	*	**	
3.3	Forest products	*	*	**	
3.4	Employment opportunities	**	*		*

Primary data estimates
*= 25%

techniques were employed to assess the subjective responses on the level of conservation awareness. This was ranked in three categories from 0-3 (low level of awareness), 4-7 (medium level of awareness) and 8-10 (high level of awareness). Among the local stakeholders 75 per cent fall in the ranking scale of 6-10, indicating a reasonable level of conservation awareness. Among the environmental attributes, 67 per cent conservation awareness was recorded for ecosystem health, whereas, 94 per cent of the stakeholders showed a high level of awareness regarding the social environment.

It is thus evident that a large proportion of the local community possess reasonable level of conservation awareness, which should be enhanced and incorporated in the conservation and management plans of the PAs. It is also indicative of good potential for the application of participatory management tools in the study area. Consultation with these people is essential to gain important knowledge for both conservation and the avoidance of conflict.

4.6 Management options

There is an urgent need for decision-makers to participate in debates and contribute to issues on how to counter conflicts by doing away with issues pertaining to natural resource management. An assessment of the attitude of the local communities towards working jointly with the Forest Department, 73 per cent indicated their willingness (Fig. 4.7). Coming to the local communities' attitude towards participatory management, it is interesting to note that although willingness to work jointly with FD is there, 83 per cent (Fig. 4.8) expressed an indifference, which on further

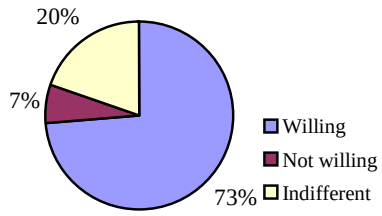


Figure 4.7: Willingness of the local communities to work jointly with FD for the conservation of the PAs

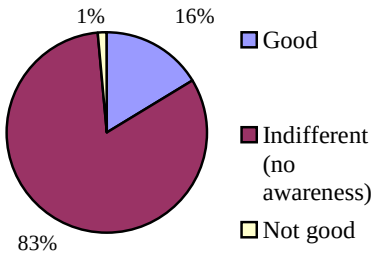


Figure 4.8: Attitude of the local communities towards participatory management

investigation indicated low awareness as far as participatory approach to management is concerned.

There is enough evidence that, if forestry is to play a key role in sustainable development, forest-dependent communities must be fully involved in both the decision-making process concerning land and resources they inhabit and use. An enabling environment is fast emerging in terms of participatory approach to management, as is the case in *Modavara* in Thrissur Division, where the Vana Samrakshan Samithi formed in 1996 has shown some positive results. Here, the local communities are well organised and committed to the need to conserve. These circumstances offer the local communities and others stakeholders an opportunity to influence decision on natural resource management. The most recent common Joint Policy Statement on conflict from the OECD (1998) supports this approach, asserting that a society's capacity to manage conflict without violence is a foundation for sustainable development.

4.6.1 A landscape-livelihood approach to PA management

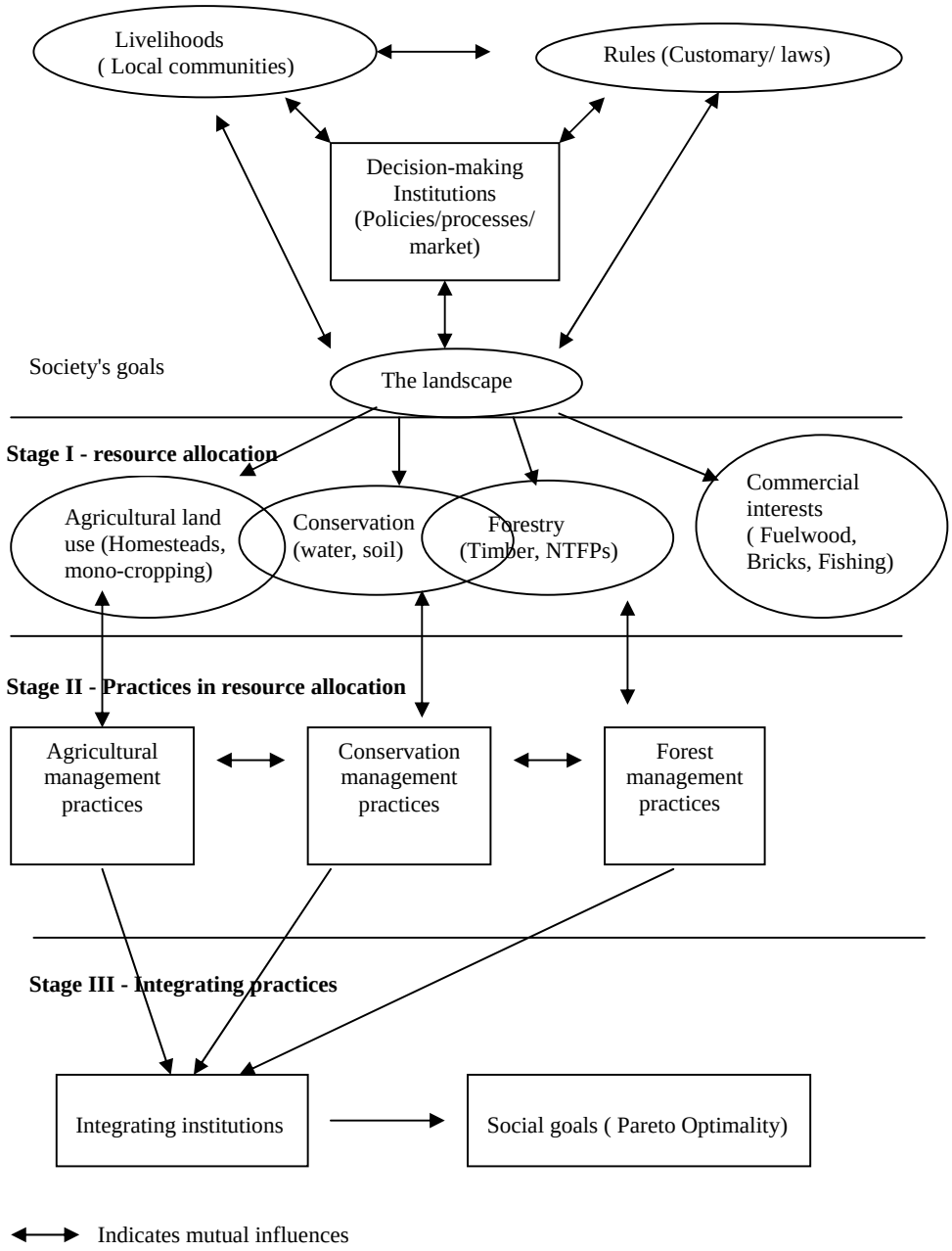
Given that a conflict cannot operate outside social context, it is necessary to adopt a management strategy where along with the PA objectives, sustainable livelihood issues are also addressed. In other words, it is essential to adopt an integrated landscape-livelihood approach to PA management. In a landscape there are several elements like the forests, degraded forest, plantations, village ecosystems, human activity, etc. which have inter-linkages and interactions within and also with those across the landscape. The changes that happen now and potential changes can be understood and managed only when the human interactions are studied. A change in any landscape is inevitable. However, changes due to management decisions and human interactions are quicker and there is a need to manage such changes in a way that does not compromise the long-term sustainability of the resource base and the options available. A sustainable livelihood approach is removing constraints and exploiting opportunities to realize positive livelihood outcomes at the community level. In other words, a livelihoods approach is thus, putting people at the center of the development, thereby increasing the standard of living (eliminating poverty) and sustaining the landscape at large.

An increase in pressure / dependence on natural resources should be equated with necessary and equivalent changes in formal planning. Such an integrated approach will encompass all the landscape elements (forests, degraded forest, plantations, village ecosystems, human activity, etc.) rather than neo-classical economic approach to resource allocation and use. A conceptual land use planning model explains how actors' views, needs and wants influence and are influenced by rules, envisaging two decision-making levels in forestry management (Tacconi, 2000). But, here, a modified version taking a new landscape livelihood approach is proposed.

The first stage of planning (Fig. 4.9) in a landscape is the resource allocation stage where extreme caution is to be borne in mind. As is evident from the foregone discussion, the WLSs are being put to different uses, viz., agriculture, conservation (protection), forestry and other uses (commercial interests). There is an interrelation between the first three forms of uses, for instance, sustainable agricultural practices conserve soil. This interrelation is incomplete, for land use within the WLS (especially the catchment areas), result in biodiversity loss on the one hand and, on the other, current forestry practices are not in par with the depletion pace.

The second stage would concern itself with the practices adopted in the three different use spheres of agriculture, conservation and forestry. This again holds significance because of resource allocation at a given point of time, for example, an improvement in forest management practices may increase the biodiversity by habitat improvement. This in turn would bring about a positive change in the local communities, views on resource allocation and the need to bear caution in all their land use practices, thereby not engaging in any hazardous or destructive practices. Integrating the different practices in conformity to society's goals forms the third stage of planning. Good governance is characterised by accountability, transparency and representation. Adherence of these would result in an effective and efficient forest management.

Figure 4.9 A landscape-livelihoods approach to PA management



Such an approach will go a long way in conserving WLSs and also catering to the basic livelihood requirements of the dependent local communities (including tribes).

4.7 Conclusion

In comparison to Chimmoni WLS the survival of the Peechi-Vazhani WLS (which is already fragmented) is threatened from its role as an important catchment area for many rivers, source of drinking water, food and other forest products for the local and forest dwelling communities and a habitat for biodiversity. Thus, as is evident from the above, human-related constraints in management have led to a conflictual atmosphere in Peechi–Vazhani. These mainly relate to an insufficient attention to (i) the approach of involving local communities and others who care about the PA in the planning, management and decision-making for the area, (ii) the social and economic dependencies of the local communities, (eg. for grazing land, firewood, building material, fodder, medicinal plants, etc.) that conflict with the objectives of the PAs, and (iii) actual commercial threats facing the PAs. A deeper analysis of the area shows that the conflicts are fuelled by scramble for land in the newly and politically created settlement schemes (Thirumani, Olakara), political pressure, and unequal distribution of resources. This has affected the land use and investment on land as insecurity ranges, resulting in deliberate destruction of the natural capital like tree felling, etc. An integrated landscape-livelihood approach is considered most appropriate in PA management.

This part of the study has only enumerated the human-related constraints by highlighting the types of conflicts in the study area and the causative factors. A much more detailed conflict analysis study needs to be undertaken in order to understand the complexities involved and to formulate suitable strategies for PA management.

5. CONCLUSIONS AND RECOMMENDATIONS

The multiplicity of forest products and their uses, the conflicts they may cause and the various other commercial interests make forestry planning at the sector level highly complex. The current scenario existing in the study areas highlights a situation where the local communities have little say over the management and policy matters pertaining to conservation. This coupled with lack of transparency on the part of the sanctuary managers and insufficient capacity at the local level makes people's participation in natural resource management an uphill task. The following are the major conclusions of the study.

- ✓ Resource constraints and poor socioeconomic conditions coupled with easy accessibility to the WLSs explain the anthropogenic dependence/pressure on the study areas. This is further complicated with the skewed distribution of resource endowments. The poverty rate prevalent in the area shows a high incidence of poverty among tribals. This coupled with their relative high degree of dependence on the WLSs is indicative of the threat of further degradation.

- ✓ Human consumptive use of resources and human land use practices are incompatible with conserving biological diversity.

- ✓ The socioeconomic attributes of the PAs with a heterogeneous community feature and prevalent livelihood patterns signify the potential for promotion of participatory management.

- ✓ The high cattle density in the WLSs accelerates the degradation process.

- ✓ The existing harvesting systems do not have adequate technological and management backup. Its linkages to a chain of middlemen and traders are not conducive to sustainable resource use.

- ✓ There are fluctuations in the collection of NTFP resources over a period of time. This is partly due to unsustainable harvesting and lack of scientific management.

The complexity is further added up by the major indicators, viz., variations in the availability of resources, reduction in the quantity of the product, longer distances covered for collection and economic extinction of non-premium products.

- ✓ Unplanned harvest of NTFPs without adequate knowledge of their resource base, appropriate method (tools and techniques) to be used and the local subsistence demands, may result in further depletion of the resources.

- ✓ Actual commercial threats facing the WLSs are: open access area; indigenous cultivation in the catchment area; commercial fishing; uncontrolled extraction of medicinal plants and other NTFPs; commercial extraction of fuelwood; large number of entry points; brick making units in the catchment area; sand and rock mining; encroachment; poaching; unauthorised wood felling and unauthorised brewing.

- ✓ Causative factors of human-related constraints in conservation are, tenure issues, lack of community awareness, population pressures versus dwindling resources, unclear institutional arrangements, policy and legal framework, forest land allocation, political interference and market forces.

- ✓ The existence of enclave settlements, which tend to expand at the cost of the sanctuary is a potential threat in the long-run.

- ✓ There is a lack of tenurial security among the tribals. The decreasing income potential from forest-based activities has forced them to look upon non-forest based activities, specially cultivation, which has led to land-based conflicts. Conflicts are fuelled by scramble for land in the newly and politically created settlement schemes, political pressure and unequal distribution of resources.

- ✓ Reasonable level of conservation awareness was assessed among the local communities (75%) based on the environmental quality attributes.

Recommendations:

- ✓ Catchment area conservation: The catchment area of Peechi reservoir is being subjected to unsustainable land use practices by means of clay mining and cultivation and associated use of pesticides. This may result in irreversible damage to the ecosystem and must be checked. The local communities need to be educated and convinced of the ill effects of unsustainable practices on the ecosystem.

- ✓ The practice of leaving cattle for grazing in the WLSs for months together should be prohibited. Also, restrictions need to be imposed on grazing by the local populace.

- ✓ The tenurial complexities in the sanctuaries need to be addressed in order to resolve the land-based conflicts.

- ✓ Firm control needs to be imposed in order to check further expansion of human enclaves within Peechi-Vazhani WLS. Road access to and from the enclaves must be limited to traditional routes (i.e., no new trails or roads) and no clearing along the sides of the roads must be allowed.

- ✓ NTFP management: A common recommendation for both WLSs pertains to NTFP resources. Sustainable management of NTFPs in the study areas can be achieved through a combined attempt of strengthening appropriate institutions with adequate management backup, participatory management involving the actual foragers, judicious use of products, adoption of scientific methods of extraction and value addition and practices of *in situ* and *ex situ* conservation.

- ✓ Integrated landscape-livelihood approach: Adopt landscape livelihood approach as a management strategy where along with the PA objectives sustainable livelihood issues are also addressed in a participatory mode of management.

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APPENDIX

Appendix 1.1 Tribal settlements in Peechi-Vazhani and Chimmoni WLSs

Sl No	Settlement	Households	Population		
			Male	Female	Total
Peechi Vazhani WLS					
1	Kalappara	21	36	36	72
2	Payyanam	32	65	67	132
3	Urulakunnu	4	8	9	17
4	Valloor	14	27	25	52
5	Marotichal	26	64	62	126
6	Vazhani	10	13	24	37
7	Nadampadam	14	31	26	57
8	Vilangannoor	4	6	13	19
9	Perumthumpa	6	8	15	23
10	Olakara	21	39	46	85
11	Thamaravellachal	23	35	42	77
12	Kompazha	5	8	9	17
13	Poovanchira	32	67	76	143
14	Maniyankinar	57	79	126	205
15	Karadikundu	4	10	7	17
16	Pottimada	7	12	18	30
17	Payakandam	6	11	10	21
18	Adukkalappara	5	12	15	27
19	Aanavari	4	10	12	22
20	Thirumani	36	68	68	136
21	Mattinmugal	16	24	30	54
Chimmoni WLS					
22	Kallichithra	28	38	45	83
23	Echippara	32	48	56	104
24	Aanapandham	59	79	126	205
25	Karinkayam	5	9	12	21
Total		471	807	975	1782

Source : Primary data estimates

Appendix 3.1 Important NTFPs available in Peechi-Vazhani WLS

No.	Botanical name	Common name
	Trees and woody climbers	
1	*Acacia caesia*	Incha
2	*Acacia concinna*	Cheevakkai
3	*Acacia pennata*	Kattincha
4	*Acacia torta*	Kattincha
5	*Ailanthus triphysa*	Matty, Pongaliyam
6	*Alangium salvifolium*	Ankolam
7	*Alstonia scholaris*	Ezhilam pala
8	*Anamirta cocculus*	Polla,Karantakam
9	*Aporusa lindleyana*	Vetti
10	*Bauhinia malabarica*	Malamandram
11	*Bauhinia recemosa*	Mandram
12	*Butea monosperma*	Plasu
13	*Cassia fistula*	Kanikonna
14	*Celastrus paniculatus*	Kilitheeni Panji
15	*Cinnamomum spp.*	Karuva
16	*Cinnamomum zeylanicum*	Karuva
17	*Dillenia pentagyna*	Malampunna
18	*Dysoxylum malabaricum*	Akil
19	*Emblica officinalis*	Nelli
20	*Entada rheedei*	Kakkumkai
21	*Ficus racemosa*	Athi
22	*Gmelina arborea*	Kumbil
23	*Holoptelea integrifolia*	Aval
24	*Hydnocarpus pentandra*	Marotti
25	*Lagerstroemia reginae*	Manimaruthu

26	*Mesua ferrea*	Nangu, Churula
27	*Myristica dactyloides*	Pathiripoo
28	*Oroxylum indicum*	Palapayani
29	*Palaquium ellipticum*	Pali
30	*Persea macrantha*	Kulamavu
31	*Phyllanthus emblica*	Nelli
32	*Pongamia pinnata*	Ungu
33	*Pseudarthria viscida*	Moovila
34	*Salacia oblonga*	Ponkoranti
35	*Sapindus trifoliata*	Pasakkotta
36	*Sarcostigma kleinii*	Vellodal
37	*Schleichera oleosa*	Poovam
38	*Semecarpus anacardium*	Alakkucheru
39	*Spondias pinnata*	Ambazham
40	*Stereospermum colais*	Pathiri
41	*Strychnos nux-vomica*	Kanjiram
42	*Terminalia bellirica*	Thanni
43	*Wrightia tinctoria*	Dhanthapala
	Shrubs	
44	*Clerodendrum serratum*	Cheruthekku
45	*Holarrhena antidysenterica*	Kodakappala
	Herbs	
46	*Adenia hondala*	Muthakku
47	*Aerva lanata*	Cherula
48	*Aristolochia indica*	Garudakodi

49	*Asparagus racemosa*	Sathavari
50	*Balanophora indica*	Athithippali
51	*Baliospermum montanum*	Nagadanthi
52	*Barleria prattensis*	Madurakuringi
53	*Biophytum sp.*	Mukkutti
54	*Caesalpinia bonduc*	Kazanchi
55	*Centrosema pubescens*	Kattupayar
56	*Cyathula prostrata*	Cherukadaladi
57	*Cyclea peltata*	Padakizhangu
58	*Desmodium gangeticum*	Orila
59	*Desmodium gyrans*	Thozukanni
60	*Desmodium laxiflorum*	Moovila
61	*Desmodium velutinum*	Orila
62	*Elephantopus scaber*	Anachuvadi
63	*Evolvulus alsinoides*	Krishnakranthi
64	*Gloriosa superba*	Menthonni
65	*Hemidesmus indicus*	Nannari
66	*Holostemma ada-kodien*	Adapathiyan
67	*Ichnocarpus frutescens*	Pal velli
68	*Indigofera tinctoria*	Neela amari
69	*Mucuna pruriens*	Naikorana
70	*Naravelia zeylanica*	Vathakodi
71	*Naregamia alata*	Nilanarakam
72	*Nervilia aragoana*	Orilathamara

73	*Ocimum gratissimum*	Kattuthuttavu
74	*Phyllanthus amarus*	Keezharnelli
75	*Piper longum*	Thippali
76	*Rauvolfia serpentina*	Sarpagandhi
77	*Rubia cordifolia*	Manjatti
78	*Sida rhombifolia ssp. retusa*	Kurunthotti
79	*Solanum torvum*	Chunda
80	*Tinospora cordifolia*	Amruthu
81	*Tragia involucrata*	Kodithuva
82	*Uraria hamosa*	Moovila
83	*Zingiber zerumbet*	Kattinchi

Source : N. Sasidharan *et al* (forthcoming)

Appendix 4.1 Type of forest cases during 1992-2001(Peechi-Vazhani WLS)

Sl.No.	Type of Case	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
1	Wood felling	46	63	53	56	37	44	38	47	25	28	437
2	Wildlife Cases	2	3	0	1	3	0	0	5	2	1	17
3	Charcoal	0	2	3	2	0	0	0	0	0	0	7
4	Illegal Fishing	0	2	0	0	0	0	0	0	0	0	2
5	Encroachments	1	0	0	0	0	0	1	1	0	0	3
6	Others	0	2	2	3	8	1	2	2	0	0	20
Total		**49**	**72**	**58**	**62**	**48**	**45**	**41**	**55**	**27**	**29**	486

Source: Peechi Wildlife Division Office, Kerala Forest Department

Appendix 4.2 Type of forest cases during 1992-2001(Chimmoni WLS)

Type of Case	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	Total
Wildlife Cases	0	1	0	0	0	0	0	2	0	3
Other forest cases	9	12	5	13	3	2	1	1	0	46
Total	9	13	5	13	3	2	1	3	0	49

Source: Peechi Wildlife Division Office, Kerala Forest Department