Kerala Research Programme on Local Level Development

Constraints in Sustainable Development:
A case study of inter-sectoral allocation of bamboo & reed resources in Kerala

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Abbreviations

ADMT Air-dry metric tonnes

CCF Chief Conservator of Forests

CFC Common Fund for Commodities

CIFOR Centre for International Forestry Research

CSE Centre for Science and Environment

DFO District Forest Officer

FAO Food and Agriculture Organisation

FRI Forest Research Institute

FSC Forest Stewardship Council

GIL Grasim Industries Ltd.

HNL Hindustan Newsprints Ltd.

IDC Industrial Design Centre

IISD International Institute for Sustainable Development

IIT Indian Institute of Technology

INBAR International Network on Bamboo and Rattan

JFM Joint Forest Management

JFM Joint Forest Management

KFRI Kerala Forest Research Institute

KSBC Kerala State Bamboo Corporation

LDC Least Developed Countries

LSGI Local Self-Government Institution

LTA Long Term Agreement

MP Madhya Pradesh

NMBTTD National Mission on Bamboo Technology and Trade Development

NGO Non-Governmental Organisation

NID National Institute of Design

NTFP Non-timber Forest Produce

NWFP Non-Wood forest Produce

OPM Orient Paper Mill

PCS Production-to-Consumption System

PFM Participatory Forest Management

PPM Punalur Paper Mills

SC Scheduled Caste

ST Scheduled Tribe

TPIL Travancore Plywood Industries Ltd.

WBC World Bamboo Congress

WP Working Plans

Introduction

Bamboos[1] are plants that are recognised to have a close association with human life and civilisations from ancient times onwards. Bamboo has been eulogised, sung about, drawn and ascribed distinct spiritual powers in several Asiatic civilizations. Many ancient and medieval classical texts including the *Yajurveda* and the *Arthasastra* of India as well as *I Ching* of China abound in references to the spiritual and the material values of bamboo. Bamboo has enjoyed more positive epithets in several cultures and during several ages than the common description of it as the "poor man's timber" in modernist India. Bamboo was the 'Friend of the People,' a 'Gentleman' and one of the 'Four Noble Plants' to the Chinese and 'Brother' to the Vietnamese (Farelly1984). More recently, bamboo has been called the "wonder plant" (INBAR 2004), the "miracle-grass" (ETI PROSEA 2001) and the "raw material of the 21st century" (Sastry 2002). The cultural and material links between bamboo and human societies suggested in these soubriquets appear to remain in tact to this day in several regions of the world, going by the intense, intimate and diverse uses to which the plant is put to.

The stature of bamboo in the plant kingdom with regard to diversity of taxa, habitat, distribution and uses is perhaps unrivalled. Bamboo grows more rapidly than many 'fast-growing species ' of plants on earth, clocking 'as fast as 47.6 inches in a 24-hour period' (Farelly1984) and is regarded as one of the best renewable resources on earth that can mitigate many environmental and economic problems of the modern age. While this astonishing vitality, the versatility, the lightweight strength, the ease in growing it as well as working it with the simplest of tools and the elegant beauty of the plant in its natural and finished states are features that have endeared bamboo to human beings across different spans of time and space, the multiple environmental functions of bamboo in its natural settings (ranging from soil and water conservation and biomass generation to carbon sequestration) underline the indispensable value of the plant in a non-homocentric, biological regime. Bamboo provides not only economic security to several human societies; it also provides environmental security to the biological systems without which the former would be unsustainable.

[1] The term 'bamboos' or even 'bamboo' is used in this report mostly in a collective sense to include a large number of reed-bamboo species falling under the genus *Ochlandra.*

Bamboo as raw material

Apart from the ease in being made into a variety of tools for processing other materials, bamboo is in itself amenable to various techniques of processing for value-addition employing technologies/tools ranging from the simplest knives of aboriginal hill men to the sophisticated machinery of the modern pulp or mat board industry. While bamboo often meets the basic necessities of food and shelter of neglected human and animal populations within forests and forest-fringe villages (where very often there is virtually no other alternative), it also forms the raw material for the flamboyant clothes, the exquisite dishes and the elegant décor preferred by the rich and the elite in the metro cities in the world.

Bamboo is an important commodity at many different levels of global economy, right from the bottom of sheer subsistence use by forest-dwellers in several countries to being chosen by the global Common Fund for Commodities (CFC) for a grant of USD 2 million aimed at improvement of resource base, quality, durability and market opportunities in two least developed countries (LDCs) (CFC 2004). As a non-timber forest produce (NTFP) and as a subsistence crop, bamboo is a source of income to resource extractors and farming community people who often have very limited opportunities to earn other cash incomes.

As a raw material for a wide range of small and medium-scale enterprises, bamboo serves as a basis for employment and income generation. At the same time, several products made from bamboo find international demand and are able to generate foreign exchange earnings. The contribution of bamboo to the economy of the earth and the life of its peoples is assessed to be enormous. Over 2.5 billion people live in association with bamboo and its annual usage worldwide is equivalent to US $2.7 billion (WBC 2003). The current level of global and national trade in bamboo and bamboo products put together is estimated at over $ 4.5 billion.

Competing demands

This versatility of bamboo often lends the plant highly prone to competing demands and, despite its vitality and "invasive[2]" nature, to over-exploitation. Scholars have probed the rather abrupt transformation in the stocking of bamboo in several forest regions in India, depicting stark images of "bamboo famine" and the associated

[2] The term 'invasion', in a botanical sense, means the penetration and colonization of a host or a new territory by an organism, *Forestry Compendium*, CAB International, 2000.

relegation of vast sections of ecosystem people dependent primarily on bamboo to "ecological refugees (Gadgil and Guha 1995)."

The causative factors behind the decimation of the bamboo resource base and the consequent destruction of the livelihood of millions of people associated with bamboo have been many and interrelated. Bamboo being primarily a forest plant, all human interventions, whether organised or not, on forest land-use have affected the stock and flow of bamboo from the forests. Commercial extraction by corporations, business concerns, individual entrepreneurs and the governments aimed at reaping financial profits from the forests has been a prime cause of forest denudation and degradation all over the world. Developmental activities by agencies or institutions of governments such as construction of dams form a second set of activities that have harmed forest wealth and forest people. Subsistence activities by local people aimed at meeting their basic survival needs for biomass, water, food and raw materials for value addition also have been regarded as inflicting harmful impacts on the forests, though the extent of damage caused by them remains debatable. Religious and cultural activities including pilgrimages, fairs and ritual hunting too have caused drastic decline in forest biodiversity.

Bamboo and the forest policy

Bamboo being primarily a forest resource, and as forests are mostly owned by national and state governments in many parts of the world where colonial heritage prevails, extraction and processing of bamboo is governed by an elaborate set of policy instruments. These regulations, interventions and policies were ostensibly aimed at (1) protection of the forest wealth and (2) judicious use of forest wealth for creating income and growth in forest-based industrial sector. The basic components of the forest policies until recently have been state ownership and concessional leases and preferential access rights, leases on forest land and subsidised supply of raw materials to select industries. While state-owned forests constituted 77.20 percentage of the total forest area in India in 1949-50, it went up to 92.30 per cent in 1967-68 and 95.20 per cent in 1973. "Nationalisation of forests didn't improve forest wealth as such as the mean annual increment (MAI) of the country's forests remained 0.5 m^3 against 2.6 m^3 in Asia, 2.5 m^3 in Europe and 2.1 m^3 for the world as a whole" (Government of India 1982). On the other hand, the state interventions in the forest-based industry sector in India were "pervasive" and, until the formulation of the National Forest Policy 1988, had taken the form of "public ownership of key

industries, long-term concessional raw material supplies to industry, price controls and quotas for finished goods, restriction on movement, sale and harvesting of trees from private sources, distortionary industrial credit and licensing policies as well as setting up of tariff and non-tariff barriers" (Bajaj 1997). Apart from the dead weight of a colonial policy burden, the ineffectiveness of the new policy framework has also been a subject for critical evaluations.

The stranglehold of forest policies have also been extensive: even when allowed to grow or grown in areas outside the forest boundaries, whether in common property lands or private farms, the extraction, transportation and processing of bamboo have been controlled by laws and regulations. In Kerala, for instance, farm bamboo was governed by transit rules applicable to forest timber despite the fact that homestead bamboo contributed 63 per cent of the total supply in 1993 (Krishnankutty 1998). Thus bamboo remains deeply enmeshed in the long history of laws and policies of governments, the economic and political compulsions behind these and the perceptions and ideologies of the policy makers and the general public that strongly influence the formation of laws and policies. Availability/lack of common sense knowledge and scientific data often play a crucial role in changing the status of natural resources as well as the people who depend on them and bamboo is a typical example: bamboo is only slowly recovering from the neglect heaped on it by colonial science as a 'weed' to regain its popular recognition as 'green gold'.

Bamboo institutions

A huge edifice of formal institutions set up to implement the policies of the governments as well as informal institutions and customary systems the people have evolved over centuries have governed bamboo in the country. The hierarchical structure and the bureaucratic functioning of the forest department are generally regarded as exerting adverse influences on the maintenance and augmentation of forest resources. On the contrary, local systems for co-management or community management of forests have been regarded as institutions that could improve the upkeep and equitable distribution of resources. Under the socialistic leanings of the polity and the governments in the early years of Indian independence, several initiatives had been made to set up cooperative institutions to manage processing and/ trade of resources including non-timber forest produce (NTFP) such as bamboo. The success or the failure of such institutions has also played a crucial role in shaping the fortunes of bamboo.

In this context, taking bamboo resources as a specific group, studies have attempted to delineate the entire production to consumption system (PCS) of bamboo in several countries, in the process identifying the constraints and opportunities in developing the resource in a 'sustainable' manner (INBAR Working Papers). More specifically, case studies have highlighted the impact of the resource extraction practices (and the policies that govern them) of one particular sector of forest industry viz., the pulp and paper industry (PPI) on the bamboo resources in the country (Savur 2003, Gadgil and Guha 1995).

Objectives of the study

At one level, the present study follows this particular trail by looking at the methods and impacts of extraction (from the forests as well as the homesteads) of bamboo and reed by two major industrial pulp and paper units (the Grasim Industries Ltd. and the Hindustan Newsprints Ltd.) on the availability of the resources to the other user groups as well as common property uses in the state of Kerala, South India.

In the process the report has tried to (1) identify and prioritise the different stakeholders in the bamboo and reed sector; (2) estimate the demands on the stock of resources from the different user-groups/uses; (3) compile data on the quantum of stock available under various stock assessment surveys carried out at different periods in time; (4) compare the quantum of resources supplied/made available to various segments of uses or users; (5) describe and briefly analyse the systems though which the resources were made available to the various users; (5) describe the modes in which the gaps in demand and supply were sought to be filled by the various user groups themselves; (6) assess the social, economic, political and ecological impacts of these gaps and (7) discuss the implications of these impacts on the overall development of the state of Kerala from the perspective of sustainable development.

The question of sustainability:

Maintaining an adequate stock of the natural resources so that their vital biological or ecological functions and, *inter alia*, the functions extended to human societies are not undermined has by now become a major challenge before the world. A host of global institutions, national and state governments, policy makers and scholars as well several resource dependent communities themselves have been forced to address this challenge of 'sustainable development'. The realisation that resources on the earth are finite and non-renewable or have become so as a result of the dynamics of global

development is at the root of making the concept of 'sustainable development' an explicit goal.

Interpretations of the evolving concept of 'sustainable development' range from those that give utmost primacy to conservation of environment and ecology and to "limits set by Nature on economy" (Shiva 1997) to those that view sustainable development as "economic development that can continue indefinitely… because it is based on the exploitation of renewable resources and causes insufficient (sic) environmental damage for this to pose and eventual limit" (Allaby 1988).

Within the range of these extreme views, however, a broad consensus does exist that 'sustainable development' should accommodate economic, ecological and social development. But even here there are differing emphases between interpretations of the concept prevalent in the developed nations and that in the developing nations. In the former view, the emphasis is by and large on inter-generational equity: "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (WCED 1987). But the immediate requirements of the developing nations, such as poverty alleviation of the majority of population, tend to broaden the concept still further. "Sustainable development involves a process of deep and profound change in the political, social, economic, institutional, and technological order, including redefinition of relations between developing and developed nations" (Strong 1992).

Gro Harlem Bruntland of the World Commission on Environment and Development had outlined some of these issues succinctly: "There are many dimensions to sustainability. First, it requires the elimination of poverty and deprivation. Second, it requires the conservation and enhancement of the resource base, which alone can ensure that the elimination of poverty is permanent. Third, it requires a broadening of the concept of development so that it covers not only economic growth, but also social and cultural development. Fourth, and most important, it requires unification of economics and ecology in decision-making at all levels" (Bruntland 1986).

'Criteria and Indicators'

Attempts to translate the concept of sustainable development into practice have led scholars and development practitioners to evolve several indicators that help in recognizing and assessing sustainability or threats to sustainability. Ever since the 1992 Earth Summit recognized the important role that indicators can help countries to make informed decisions concerning sustainable development, work on evolving sets

of indicators of sustainable development have been taken up several organizations of the UN system, intergovernmental and non-governmental organizations and the secretariat of the Convention on Sustainable Development (CSD). Different sets of principles, criteria, indicators and verifiers (PCIV) of sustainable development applicable for systems small and big (for e.g., ranging from criteria and indicators (C&I) for assessing and certifying micro-level forest management units (FMU) or the harvest of Brazil nuts in Bolivia to the development of a C&I for a whole nation such as New Zealand) have thus been evolved by scientists and policy planners. The literature and practices of applying C&I in actual contexts are gaining strength, promising to be a norm and not just a positive concept in the days to come.

The present study has borrowed ideas from the emerging system of the PCIV matrix, especially the one evolved by the Forest Stewardship Council (FSC). The study hasn't, however, made an attempt to test or apply any particular set of criteria and indicators for bamboo in the context of Kerala. Though highly desirable, this should be left to a more focussed and specialised research.

Constraints and opportunities: The subject matter of the study has under gone much transformation between the period it was initially proposed and finally completed. The major industrial consumer of bamboo in Kerala, the Grasim Industries Ltd., closed down its rayon grade pulp factory at Mavoor in Kozhikode in 1999, thus releasing a substantial quantity of the resource from the government's supply commitments. Discussions on reopening another PPI unit, the Punalur Paper Mills, made some progress, one of the conditions put forth by the company being regular supply of raw materials at subsidised prices. Under pressure of donor agencies, the state government had to modify its policy on subsidised supply of forest resources to industries. Policy changes at the national level resulted in the formation of a National Mission on Bamboo Technology and Trade Development and the Government allocating Rs 2, 600 crores in the Tenth Plan for the promotion of bamboo. Taking the cue from these developments, the Government of Kerala has also formed a State Bamboo Mission to carry out a comprehensive action plan for integrated development of the bamboo sector in the state. Such recent changes have to some extent altered the thrust of the study from identifying the constraints to pinpointing the gaps between the potential and the reality of bamboo in the state.

Methods

As the study involved both quantitative (assessments of the inter-sectoral allocation of bamboo/reed resources) and qualitative aspects (assessment of the constraints in the system of resource management, distribution and utilisation from the perspective of sustainable development), a mix of methods was adopted.

Literature survey:

Importance was given to a review of secondary literature on the subject. The literature reviewed was broadly from the following fields of knowledge:

1. **Forestry:** The Administrative Reports for the period 1960-2000 and the various Working Plans of the of the Kerala Forest Department from the 1950s onwards were perused for data on geographic distribution, volume of stock, quantity of extraction and supply of bamboo and reed from the forests of Kerala. Various forest survey reports prepared during the period were perused to assess the changes in the resource base. Studies on the yield from different species of bamboos were looked at for comparing the data with the (scanty) information available on the productivity and yield of bamboo in the forests and homesteads in Kerala. Forest laws of Government of India and the state of Kerala as well as regulations/ guidelines of the Ministry of Environment and Forests regarding resource use and rights over forests, especially those related to (1) non-timber forest produce (NTFP) and (2) tribal communities were looked into. Case studies on NTFP extraction from various states of India related to bamboo done by independent agencies were scanned. Reports from the bamboo databases of Kerala Forestry Research Institute (KFRI), the *Indian Forester* journal and the Centre for Science and Environment (CSE) were made use of.
2. Specific studies on the production to consumption system (PCS) of bamboo forming part of the Working Paper series of INBAR provided much insight into the subject.
3. In an effort to strengthen the conceptual base and to refine the methods of the study, reports from several agencies including CIFOR, FSC, IISD and FAO on the concepts and practices of 'sustainable development' were looked into.

4. The *Vikasana Rekhas* (Plan Reports) of *gram panchayats* (local self-government institutions (LSGIs) were referred to in order to assess the strength and status of bamboo/reed weaving craft in rural Kerala.

5. Different journal reports on the *adivasi* (Indigenous People) situation and struggles across India were surveyed, with particular focus on the rights of *adivasis* over forest produce including bamboo.

6. Annual reports, press releases as well as official websites of Grasim Industries Ltd. (GIL) and Hindustan Newsprint Ltd. (HNL) as well as media reports on the two companies were perused. Records submitted by Grasim Industries Ltd. before the Government of Kerala such as the 'Request for permission of closure' was scrutinized for information on the quantity of raw materials procured by the company, the profile of GIL workers and the crisis faced by the unit.

7. Studies, newspaper/magazine reports and Internet content on the pulp and paper industry were referred to.

Baseline data:

Some baseline data on the geographical distribution, numerical strength and the thriving/threatened status of the bamboo and reed weaving communities in Kerala were gleaned from the *Vikasana Rekha* (Development Reports) of the *grama panchayats*, municipalities and the corporations in Kerala.

A preliminary baseline survey was carried out in the Thrikkaipetta village in Meppadi Panchayat of Wayanad district in order to identify (1) the different stakeholders and (2) the linkages in the bamboo/reed sector in the village.

The district of Wayanad was chosen for the survey for the following reasons. According to recent studies, the district had the second largest reserves of forest bamboo in the state (Nair *et al* (2001). The forests in the district had contributed a very large proportion of the supplies of bamboo to the main industrial unit in the present study, the Grasim Industries Ltd. So it was presumed that the impacts of extraction of bamboo from the forests could have been most directly evident on the non-industrial, rural uses and users of bamboo as well as on the ecosystem in Wayanad.

The non-industrial/rural bamboo user groups in Wayanad were *prima facie* the least 'developed.' Many developmental support measures (such as raw material distribution depots of the Kerala State Bamboo Corporation (KSBC), various welfare measures enjoyed by the weavers and the resource extractors coming under the fold of the corporation elsewhere etc.) were absent in the district.

The village of Thrikkaipetta was chosen for the survey, partly on account of the high number of the Scheduled Caste population in the area.[3] The choice was also partly guided by convenience of carrying out the survey among a varied cross section of bamboo user groups as the village had a concentration of artisans (belonging to SC, ST and general community), extractors (tribal and non-tribal) and farmers associated with the bamboo production centre run by the NGO Uravu in the village.

Sample survey I: A sample survey for (a) identifying the various rural uses of bamboo and (b) the source of raw materials for meeting these requirements as well as (c) understanding the system of procurement of raw materials and (d) the costs involved was conducted among 54 households in Meppadi Panchayat and 10 households in the neighbouring Muttil panchayat in Wayanad district.

Sample survey II: A sample survey was conducted among a total of 32 families in Kakkathodu Ooru (tribal hamlet) and Pulithookki Ooru in Noolpuzha panchayat, Sulthan Bathery taluk, Wayanad district, in order to assess the bamboo resource extraction volumes, utilisation and the forest rights/access system among the tribal communities.

Sample survey III: A sample survey was conducted among the bamboo artisans in the village of Thrikkaipetta in order to assess the raw material requirement of bamboo artisans, the volume of handicraft production and the income earned in the process. The thrust of the survey was on understanding the constraints in resource availability.

Reeds:

Data on reeds regarding resource base, extraction/procurement, distribution, processing and income generation in the organised (under KSBC) and unorganised

[3] Meppadi Panchayat had the highest concentration of SC population in Wayanad district, according to the Development Report of the Wayanad District Panchayat, 1998.

(traditional sector outside the KSBC fold) sectors were gathered from official reports and records of the Kerala Forest Department, KSBC and previous studies.

Data on captive cultivation and farm forestry programmes of HNL was gathered through site visits and interviews with officials of the company as well as participant farmers.

Bamboo in a Kerala village

Bamboo in Wayanad

According to a recent study (Nair *et al.* 2001), the forests in Wayanad division including the Wayanad North and Wayanad Wild Life Sanctuary were the richest in bamboo resources in the State, containing an approximate quantity of 5,65,450 tonnes or 21.50 percentage of the growing stock of bamboo in the state (Ibid). There was also a high degree of species diversity of bamboo in Wayanad district (State of Forest Report 1999), the predominant species being *Bambusa bambos*.

Bamboo species in Wayanad district

Bambusa bambos (L.)Voss

Ochlandra beddomei Gamble

Ochlandra scriptoria (Dennst.)C.E.C. Fisch.

Ochlandra setigera Gamble

Ochlandra travancorica Benth.

Pseudoxytenanthera monadelpha (Thw.) Soderstr. & Ellis

Pseudoxytenanthera stocksii (Munro) Naithani

Schizostachyum beddomei (Fischer) Majumdar

Sinarundinaria wightiana (Nees) Chao & Renv.

Through a baseline survey, an attempt was made to identify the stakeholders and understand the functioning of the bamboo sector in a common village in the district. The village chosen, Thrikkaipetta in Meppadi Panchayat of Wayanad district, had an average presence of bamboo clumps in the plains that could be found in any village in the hilly Wayanad district. The village also had nearly 100 acres (42 ha) of forested hilly terrain where reeds were available in plenty. The village also had an average concentration of Scheduled Tribe (tribal) population and a high proportion of Schedules Castes, both social groups believed to be historically associated with reeds and bamboo processing.

The survey sought to identify the different stakeholders in the bamboo sector in the village and assess their socio-economic status to some extent. It tried to understand the

organisation of the bamboo economy in the village by looking at the means and volumes of raw material extraction/procurement, the manufacture of marketed and non-marketed products out of bamboo/reed and the marketing of these products. An effort was also made to assess the levels of technology/tool adaptation in the processing of bamboo and reed in the village.

From the Development Report (*Vikasana Rekha*) of the Meppadi Panchayat, data on the number of families engaged in bamboo/reed processing in Thrikkaipetta was gathered. Based on this data and inputs from knowledgeable local sources, the households that were engaged in the occupation of bamboo/reed processing were located. The bamboo related activities these families engaged in were identified using questionnaire-based household-level interviews. An attempt was also made to collect details regarding products and applications of bamboo/reed that were common in the village within homes, homestead gardens and agricultural fields.

Village profile

Administratively, Thrikkaipetta village formed Ward I area of the Meppadi Grama Panchayat. It is a small village situated on the foothills of the Manikkunnu mala (*mala* is the local name for hill/mountain), 12 km away from the district headquarters Kalpetta. According to the 1991 census, there were 1,390 male and 1,346 female (total: 2,736) members in the village. The village came under the limits of the Meppadi Forest Range, the foothill of the Manikkunnumala being the administrative boundary between with the forests and the village. The hill proper has been classified as a 'vested forest.[4]'

Land use pattern

Most of the land in the village was used as agricultural land. Pepper and coffee were the major cash crops. Ginger, tapioca and arecanut were cultivated at a modest level. Till recent times, the wetlands in the village were used mostly for rice cultivation. However, large extents of paddy fields in the village were now being used for cultivating banana, ginger etc. Until the 1950's crops like maize, *ragi*, sugarcane and tobacco were cultivated in the area. According to local elders, the village was once very rich in bamboo and reed. During the 1940s, migrants from various part of the

[4] Tracts of forestland that were vested to the Kerala government from private owners through the Kerala Private Forest (Vesting and Assignment) Act, 1971.

state had started settling in this village and in the process bamboo and reeds were cleared for cultivation of other crops.

Cultural celebrations and occasions of the local people still used bamboo in many ways. The major festival of the village was *Thira* (a ritual dance form), celebrated in various parts of the village. Bamboo and reed were widely used in making the costumes used by the dancers who took part in this ritual. The *Mudi* of the Thira dancer, which was a symbol of god, used to be made out of bamboo and coconut leaves.

Out of a total of 789 households in the village, 77 were found to be associated with bamboo handicrafts. These households belonged to three broad groups: the Scheduled Tribes, the Scheduled Castes and a general/mixed group of people comprising of members of different castes and religions associated with the bamboo production unit in the village run by the local NGO Uravu Indigenous Science and Technology Study Centre.

Traditional bamboo extractors: A large number of families which continued to have close association with bamboo either through its extraction from the forests or through production of items needed for the village were settled on the Manikkunnumala on the fringes of the village. These families were mostly of two tribal groups, Kattunaikka and Thachanadan. They lived inside the forest boundary in small houses having mostly mud walls (50%), bamboo roof structures and grass thatch. The families owned the huts and the small plots on which they stood. All the members on the tribal hamlets possessed 'possession certificates' on the land but no title deeds as these forestlands belonged to the Government.

All families possessed ration cards and voters identity cards. Only male members of the hamlet were involved in bamboo/reed and other MFP collection. A few younger males of the hamlet who were involved in MFP collection had registered themselves as members of a tribal cooperative society. But they enjoyed no other social or job security supports such as memberships in trade unions, welfare funds, life insurance protection, health care etc.

Out of the households located on the Manikkunnumala, seventy-five percentage of the respondents used firewood and kerosene as cooking fuel. Nearly 25 per cent of the households also used bamboo as firewood. There was no supply of electricity in the

hamlet but for a solar streetlight at Vengachola that was found to be in working condition.

Employment availability to the people in the hamlet was highly seasonal and included, agricultural works in the fields, MFP collection from the forests, basket weaving in response to local orders and casual work in the forests. The wages earned were also highly unstable. When jobs were available, male members earned around Rs. 100 per person per day though MFP collection. On an average, a person got 12 days of work in the fields in a month, fetching Rs. 80 per day. This accounted for the largest share of monthly earning and thus the primary source of livelihood income. Only a few members of the hamlet obtained forest management jobs for about three months in a year, (or on an average 7.5 days per month) which, when available, fetched Rs. 50 per day as wages.

The MFP the people collected through the legal channel of the tribal cooperative society included mostly the roots of 'kurunthotti' (*Sida cordifolia*), honey, 'aanachunda' roots and a few other tubers of medicinal importance. There was considerable local demand for MFP in the markets in Wayanad.

Demand for bamboo and reed came mostly from farmhouses that required both raw bamboo poles and woven products such as baskets and mats. Single-pole ladders made of bamboo were used by every coconut-plucker and almost in all farming households and these fetched a price of Rs. 75-80 per pole of bamboo. Such ladders were in heavy demand during the pepper-harvesting season in Wayanad.

Five members of the hamlet worked on extracting reed (*Ochlandra travancorica*) and Oda (*Ochlandra scriptoria*) for around 10 days a month, except during the rainy season of June-August. This was to feed the bamboo-based craft production centre of the village run by Uravu. It took a full day labour for a person to extract a bundle of 20-25 numbers of reeds and deliver the same at the village down the hill. The local bamboo craft unit purchased a bundle of reed collected from the Manikkunnumala at the rate of Rs. 150-180 per bundle.

At the present level of demand, the average yearly removal of reeds from 100 acres of forest area and private estates on the Manikkunnumala for meeting rural needs and feeding the local craft centre would come to 5 (persons) X 10 (days) X 9 (months) X 22.5 (numbers) = 10,125 numbers of reeds equivalent to approximately 14 tonnes (@720 reeds=1 tonne.0

As part of the survey, an attempt was made to understand the perception of the bamboo/reed extractors in the village on the status of these resources in the forests and the reasons for the change in the resource status. A set of seven choices was given to the extractor-respondents in order to pinpoint the important factors that affected the availability of resources in the forests. All respondents opined that the availability of both bamboo and reeds had declined within the forest area they were familiar with.

Table 1 Perceived causes for change in bamboo resource availability

Perceived causes for change in bamboo resource availability		
Sl. No.	***Causes***	***% of respondents***
1	Changes in extraction intensity	23
2	Climatic changes	85
3	Forest fires	95
4	Changes in forest area	11
5	Impact /neglect of protective laws	6
6	Changes in management practices	85
7	Changes in biotic pressures	5

They identified the most important factors responsible for the decline as (1) forest fires, (2) poor management practices such as failure in taking out fire-lines in the forests and (3) the general change in climate. Twenty three per cent of the respondents thought the intensity of extraction had a significant impact on the decline in resource stock.

It is significant that the extractors found forest fires to be the major cause of depletion of the bamboo and reed resources in the area and that they linked this with poor management practices adopted by the forest department. This shows that even in areas not yet opened up for large-scale industrial exploitation, forest fires have become an important threat to the forest resources. The perception of the extractor-respondents indicates that even in areas with low levels of extraction, the depletion of resource base is faster than natural regeneration. Their observations also suggest the imperative of adopting assisted natural regeneration measures for improving the resource base.

Bamboo–based production

In the village, bamboo poles were commonly used for ladders, constructing cattle stays, fences, platforms and traps for catching wild pigs, rats etc. Apart from the general household and rural applications of bamboo, there were three distinct groups

of people engaged in bamboo/reed-based production of goods either for own consumption or for the markets.

1. Tribal communities.
2. The Scheduled Caste communities: Mainly members of the Paraya caste, who are traditional bamboo weavers.
3. The relatively new group of bamboo workers belonging to different tribal, caste and religious communities who have obtained training in bamboo processing from Uravu, a local NGO.

Except for the third group of artisans working under the NGO, bamboo-based economic activity was a subsidiary activity carried out for earning supplementary income. Bamboo craft was carried out to meet seasonal demand for products and when other farm or non-farm jobs were not available.

Tribal user groups:

Kurichya, Kuruma, Paniya, Kattunayakka and Chetty were the tribes who lived in the village. Within the Kurumas, there were two groups, the Oorali kurumas and Mullu Kurumas. These communities made several bamboo products such as baskets, winnows, mats, cradles etc. They also made animal and fish traps with bamboo and reed. The Kurichya community also made bows and arrows out of bamboo. Bamboo shoots used to be a food item of the Kurichyas during the monsoon season. Kurichyas were also known to be skilled in constructing houses with bamboo and mud.

The tribal community considered water stored inside bamboo culms as a remedy against several stomach disorders and worms. They also used bamboo for construction of houses, cattle sheds etc. The very first school of the village was built with bamboo. For the tribal communities, production of bamboo/reed items was mainly for meeting their own needs. Very few products – a few mats or cradles – were supplied on specific demand to households in the village.

The SC community bamboo artisans :

The Paraya (Sambhava) community was a migrant backward community to settle at Thrikkaipetta. They were traditional bamboo weavers and had migrated from south Kerala. Until recent times, they had continued to produce bamboo/reed items for selling in the local towns and for direct house-to-house sales. The production season,

schedule, volume etc. were very much irregular, depending on various factors like the seasonal market demand, availability of raw material and availability/lack of other jobs in the area.

Interviews with SC community artisans revealed that the average earning realised by a traditional community weaver from bamboo/reed products was around Rs. 70 per day during the good production season. This compared well with the wages for unskilled farm jobs, which were in the range of Rs. 60 for female labour and Rs.80 for male labour for an 8-hour day. However, the number of days on which bamboo craftwork was done was on an average not more than 10 days in a month. The total number of hours spent on bamboo work within a single day also varied considerably.

Local knowledge on bamboo:

For many centuries, bamboo had been a readily available resource that met various requirements of the economically weaker sections of the society. In the course of this long association, people in general and the indigenous people (tribal communities) in particular had evolved specialised knowledge related to preservation and use of bamboo. For instance, certain adivasi communities considered water stored inside bamboo culms as a remedy against several stomach disorders and worms.

To prevent borer attack on bamboos, traditional communities used to follow the lunar calendar in bamboo harvesting. Although traditional preservation methods such as soaking bamboo/reed in water were know to the local people, of late, they were not being practiced. Except the third group of artisans trained by the local NGO, the artisans were generally unaware of modern chemical treatment methods for increasing the life of bamboo products. Boiling bamboo slivers in turmeric water, a traditional practice for preservation and colouring, was known to some of the artisans belonging to the SC community. But, of late, this method was also not being practiced.

Tools:

The tools used by the local people for cutting bamboo and reeds and making slivers out of them were a long knife (machete) known locally as *vettukathi* (blade 6.5 cm width, 16 cm length; handle - 15 cm length) and a small knife known as *chooral kathi* (width 2.4 cm, 10.5 cm blade and 10 cm handle).

Designs:

The local communities have been making the same type of bamboo/reed products for a long time. No significant effort had so far been made by the artisans themselves or any government agency to upgrade the weaving patterns and adopt new product designs.

Production by the tribal (ST) communities

Production of bamboo/reed items by the indigenous (ST) communities was mainly for their own use. One of the items produced by this group was a type of basket traditionally used for carrying fish. A very large basket (about 5 ft. in diameter) was being made for storing grains. A woven bamboo/reed mat (locally called *Panambu*) of different sizes was another product made by them. The *panambu* was used for drying paddy, pepper etc. The production of bamboo items by the tribal communities was erratic and seasonal despite the fact that some of the products, for instance the cradle that the Kurichyas made with 15-20 reeds and 1-1.5 days' labour, fetched a price of Rs. 140 in the village itself and a mat, which required around 200 reeds and part-time work of a week, fetched Rs. 500.

Table 2 Production details: Kurichya (ST) community

Product	***Length/ Diameter***	***Width***	***Height***	***Sliver Width***	***Time Taken***	***Raw material Required***	***End-use***	***Price in Rs.***
Basket (large)	53 cm	NA	30 cm	2 cm	1.5 days	6 - 10 Reeds	Agriculture	Own use
Cradle	82 cm	41 cm	30cm	3cm	1-1.5 days	15 - 20 Reeds	House hold	140.00
Basket	42 cm	48 cm	26 cm	2 cm	1 day	4 Reeds	Agricultural	Own use
Flattened Reed Mat (*Panambu*)	NA	NA	NA	NA	7 days	200 Reeds	Drying farm products, making walls	500.00
Thoppikkuda (hat)	NA	NA	NA	NA	1-1.5 days	1 Reed	Guarding against sun, rain	Own use
Bow & arrow	120 cm	NA	NA	NA	2-3 days	NA	Hunting	Own use
Winnower	NA	NA	NA	NA	1.5 days	7 Reeds	Agricultural	50.00

The winnower (*muram*) was another major product made of bamboo. There were two basic designs in this -- one-cornered and two-cornered winnowers. The size of slivers used for this was also seen to differ. Winnowers were used for separating husk from paddy and dust from pepper. The *Chada* was a different type of winnower used for cleaning grains before cooking. These products were in demand in the village and the nearby towns, but the demand was highly seasonal.

Korambakkuda and Marakkuda, two types of umbrellas made out of bamboo leaves and reeds, were also used traditionally by the tribal communities while working on the fields to protect the body from sunlight and rains. However, of late, plastic sheets have largely replaced the use of the *Korambakkuda*. The tribal communities also made cradles out of bamboo mostly for own consumption and sometimes for local sale. Spoons made in different sizes by the local artisans were a combination of bamboo and coconut shell.

Table 3 Production details: Kattunaikka (ST) community

Product	***Length/ Diametre***	***Height***	***Sliver Width***	***Time taken/ product***	***Raw material***	***Usage***	***Price (in Rs.)***
Basket	30 cm	20 cm	0.5 cm	1 hour	2 Reed	Agricultural	15.00
Basket	30 cm	8 cm	0.4 cm	1 hour	1 Reed	Agricultural	8.00
Basket large	39 cm	25 cm	0.4 cm	2 hours	2.5 Reed	Agricultural	30.00

Table 4 Production details: Paniya (ST) community

Product	***Length/ Diameter***	***Height***	***Sliver Width***	***Time Taken***	***Raw material Required***	***Usage***	***Price (in Rs.)***
Field Umbrella	NA	105-120 cm	0.5 cm	2 Days	15 Reeds	Field work	100.00
Chada (Sieve)	NA	NA	NA	2 Days	25 Reeds	For filtering boiled rice	100.00
Fish Trap	NA	NA	NA	NA	Reed	Trapping fish	Own use

Table 5 Production details: Paraya (SC) Community

Product	*Length/ Dia.*	*Height*	*Sliver Width*	*Time Taken*	*Raw material*	*Usage*	*Price in Rs.*
Basket	36 cm	28 cm	1cm	NA	NA	Agriculture	NA
Korukotta	NA	NA	NA	Half day	5 Reeds	Agriculture	70.00
Winnower	55	NA	2 cm	4 Hours	3 Reeds	Agriculture	50.00

The Paraya community members in the village who were earlier weaving mats have almost stopped doing this due to difficulties in getting adequate quantity and quality of reeds and the penetration of cheaper mats from Angamaly and Perumbavoor into the local markets.

Local markets for bamboo/reed products:

Artisans belonging to the Paraya community in the village often took their products to far away townships such as Mananthavady, nearly 40 km from Thrikkaipetta. They also sold their products directly to households taking them door-to-door. But by and large the products of the bamboo artisans of Thrikkaipetta were being sold in nearby markets such as Sulthan Bathery, Meenangadi and Kalpetta, within 5-30 km from the village. Baskets, winnowers, spoons etc. from other regions of the district including Panamaram and Chethalayam also reached these markets. Bamboo products from far away places in South Kerala such as Perumbavoor in Ernakulam district also reached these markets. The products coming from each area varied in quality and size.

Table 6 Price of bamboo/reed products in the Meenangadi market

Product	**Raw Material**	**Price in Rs.**
Basket – Big	Bamboo	65.00
Basket - Small	Reed	25.00
Basket – (*korukotta*)	Bamboo	75.00
Winnower (1-corner type)	Bamboo /Reed	12.00
Winnower (2- Corner)	Bamboo / Reed	15.00
Spoon	Bamboo & Coconut shell	3.00
Perumbavoor Basket	Bamboo	40.00- 50.00
Fish Basket	Bamboo	12.00

The sales volume of bamboo and reed products in these markets was high during January to May. The volumes were lower during September to December. Large-sized baskets that are mostly used in marriage halls etc. for carrying cooked rice received better demand during February-March-April. The selling price differed for the same type of product in different shops. The traders complained that there was no stability in the prices demanded by the artisans.

Production at the local bamboo craft centre

The bamboo training and production centre of the NGO has been functioning in the village from 1996 onwards. The areas of operation of the centre run by Uravu, a registered non-profit charitable trust, include enhancement of raw material base through participatory bamboo/reed planting programmes, providing training in upgradation of skills for bamboo-based production, marketing of bamboo products through exhibitions, eco-shops and craft emporia. The training cum production unit of Uravu provides training-cum-employment to over 40 local people, over 60 per cent of them women.

Table 7 Bamboo production at Uravu bamboo craft centre

Month	***Mandays created/month***			***Earnings distributed/month (in Rs.)***		
	Male	*Female*	*Total*	*Male*	*Female*	*Total*
Mar-03	75	377	452	6,900	13,263	20,163
Apr-03	135	345	479	12,988	12,058	25,045
May-03	130	434	564	13,428	15,523	28,950
Jun-03	128	366	494	15,350	13,285	28,635
Jul-03	126	495	621	15,340	18,110	33,450
Aug-03	61	536	597	9,280	20,035	29,315
Sep-03	45	384	428	8,500	14,368	22,868
Oct-03	77	555	632	11,060	19,963	31,023
Nov-03	46	381	427	8,760	13,505	22,265
Dec-03	72	400	472	11,310	14,470	25,780
Average	**89**	**427**	**516**	**11,292**	**15,458**	**26,749**

On a monthly average, the centre created 516 mandays of work in bamboo processing alone (89 mandays of work for men and 427 mandays of work for women) in the period between March and December 2003. The activity fetched, on an average, Rs. 26,749 per month to the village as earnings from bamboo processing at the centre. The monthly expenditure of the unit on procuring raw materials ranged from Rs. 5,000 to Rs. 7,000 for bamboo and, Rs. 1000 to Rs. 2,000 for reeds. The average price

paid for bamboo fetched from local farmers was Rs. 130 per pole (inclusive of transportation costs), which worked out to Rs. 2,080 per tonne. The price paid for getting reeds from private estates, common lands and forests on the Manikkunnumala was Rs. 160-180 per bundle of 24 numbers (or approximately Rs. 5,250 per tonne)[5]. Thus the average monthly raw material consumption of the unit was around 46 poles of bamboo (equivalent to 2.88 tonnes) and 8.82 bundles (or 211 numbers equivalent to 0.29 tonnes) of reeds. Thus, using around 3.17 tonnes of raw material, worth around Rs. 7,500, the unit generated nearly Rs 26,749 every month as earnings for the local people, mostly women. The value addition involved in the process was around 356 %.

As per these calculations, the annual consumption of bamboo and reed of the unit would be around 35 tonnes of bamboo and 3.5 tonnes of reed. It is not clear how much of the raw materials come from the forests.

[5] At the conversion rate of 16 bamboo poles = 1 tonne and 720 reeds = 1 tonne.

Rural demand and utilisation of bamboo

As part of the study, a questionnaire-based survey was carried out among 64 households (54 in Meppadi panchayat and 10 in Muttil panchayat) in Wayanad district in order to identify (1) the household-level uses of bamboo, (2) an approximate quantity of bamboo required for the various uses and (3) the sources of bamboo for meeting these requirements.

The Wayanad district was chosen for the survey based on the assumptions that (a) the district possessed one of the largest reserves of bamboo in the State and hence (b) its utilisation as well as the impact of any decline or improvement in the resource base could be most evident in the district.

Within Wayanad, the Meppadi panchayat was chosen for the survey as the panchayat had the highest population of Scheduled Caste communities (17 per cent) in the district who are traditionally associated with bamboo-based occupations. The households selected formed a convenient sample belonging to workers and trainees associated with the bamboo-craft training centre at Thrikkaipetta village in Meppadi panchayat.

Method:

The representatives of the selected households were instructed to list out all the uses of bamboo and reeds (1) within the house in the kitchen, drawing/bed room etc.; in the construction of the house (roof structures, walls etc.), (2) in the home-garden adjoining the house (propos for plants, sheds for cattle, firewood etc.) and (3) in the fields or cultivated plots the household was in possession of. The respondents were also asked to estimate an approximate number/quantity of bamboo/reed used in each such application. The respondents were instructed to note down only the existing uses of bamboo and reed while enlisting them.

They were also asked to make a list of bamboo/reed items purchased and used by the household and an approximate number of each item purchased/replaced in a year.

Results: The survey covered a total of 64 houses in the two panchayats and identified 28 common uses/applications of bamboo within the household, within the adjoining home-gardens and the agricultural fields that belonged to the households.

Table 8 Common rural uses of bamboo in the households, homegardens and agricutlural fields

	Uses	*No. of user families*	*As percentage of total households surveyed*
Within the house	Decorative items	15	23.44
	Winnows	48	75.00
	Basket	44	68.75
	Kitchen utensils	31	48.44
	Roofing/ceiling	15	23.44
	Stands/shelves	8	12.50
	Woven mat	22	34.38
	Furniture	6	9.38
	Firewood	1	1.56
In home garden	Ladder	48	75.00
	Fences	23	35.94
	Chicken pen	13	20.31
	Cattle shed	21	32.81
	Firewood shed	5	7.81
	Fruit Pluckers	3	4.69
	Dog house	1	1.56
	Rabbit house	3	4.69
	Electric post	1	1.56
	Prop in banana cultivation	19	29.69
In the fields	Vegetable *pandal*	16	25.00
	General purpose *pandals*	3	4.69
	Bunds	2	3.13
	Plough	1	1.56
	Water channels	2	3.13
	Threshing rod (Okkal kol)	4	6.25
	Fishing basket	3	4.69
	Bow and arrow	3	4.69
	Foot-bridges	1	1.56

The most prevalent household uses of bamboo were as winnowers, ladders, baskets and kitchen utensils such as spoons. Another traditional, common use of bamboo was in construction of fences for which the thorny bamboo (*Illi mula*) *Bambusa bambos* available locally came handy. Mats woven with bamboos as well as reeds used for drying paddy and other agricultural produce such as pepper, coffee etc. was also in use in the village.

Table 9 Most prevalent rural uses of bamboo & reed

Uses	***Percentage of user families in the sample***
Winnowers	75.00
Ladder	75.00
Baskets	68.75
Kitchen utensils	48.44
Fences	35.94
Woven mat	34.38
Cattle shed	32.81
Prop in banana cultivation	29.69
Vegetable trainers (*pandal)*	25.00
Decorative items	23.44
Roofing/ceiling	23.44
Chicken pen	20.31

Through the survey data on an approximate quantity of bamboo required for meeting some of the above needs was also collected.

Table 10 Household utilisation of bamboo

Uses	***Average No. of bamboo poles used/ household/year***
Fences	14
Ladder	1
Vegetable trailing	7
Prop for banana plant etc.	17
Fruit- plucker	1
Firewood shed	6
Chicken pen	9
Cattle shed	8
Total	**63**

The survey on consumption of bamboo in the rural households showed that, on an average, a household used 63 bamboo poles per year, which worked out to nearly 4 tonnes (at the official conversion rate of 16 bamboo poles making a tonne).

The use of bamboo as props for banana plants (and other garden vines such as pepper) consumed, on an average, 14 bamboo poles per household per year (0.86 tonnes). (The data pertains only to banana cultivation in the relatively small-sized home-gardens; the use of bamboo as props in banana cultivation in the converted paddy fields that has of late spread greatly in Wayanad district was not estimated in the present survey).

Construction of fences required 14 bamboo poles (0.86 tonnes) per household per year. An average of seven bamboo poles (0.44 tonnes) were used for making plant trainers (*pandal*) in vegetable cultivation in the home-gardens. Making chicken pens required 9 bamboo poles (0.56 tonnes), cattle sheds were made of 8 poles (0.50 tonnes) and firewood sheds with 6 bamboos (0.36 tonnes) per household per year. Garden ladder (*aeni*) and the fruit-plucker (*thotti*) each required one pole of bamboo per year per household.

Out of the 64 houses surveyed from the Meppadi and Muttil panchayat, data regarding utilisation of bamboo in construction of dwellings was available from 54 households. Among them, 11 houses (making up 20.37 percentage) used bamboo as the roof support structure. On an average, such 'kucha' houses used 26 poles (1.63 tonnes) of bamboo per house for construction of the roof-structure. As the bamboo roof structures lasted several years and did not require annual maintenance, construction of roof structures did not involve annual extraction of bamboo.

In addition to these uses of raw bamboo, the rural households surveyed purchased, on an average, two bamboo baskets, one winnower and a bamboo mat (*panambu*) per year. The average price of a standard basket varied from Rs. 30-60, that of a winnower from Rs. 40-50 and that of a mat from Rs. 125-150.

Less than 20 per cent of the sample of households were found to be using bamboo in the following products or application: stands/shelves, furniture, firewood shed, threshing rods (*Okkal kol*), rabbit house, fishing basket, bow and arrow, construction

of bunds in fields or water channels, water pipes, firewood, electric posts, ploughs and small foot-bridges across culverts, streams etc.

Sources of bamboo for meeting rural needs:

Table 11 Sources of bamboo and reed resources for household utilisation

Method and source of collection	***Percentage of households***
Collection from common property lands	1.85
Own cultivation	3.70
Purchase from local farmers	38.89
Purchase from open market	1.85
Extraction from forests	
a) Collected using forest passes	3.70
b) Collected through local extractors	50.00
Multiple sources	23.43

Nearly 23.43 percentage of the households in the survey depended on multiple sources for getting their bamboo resources. This included collections from the local farmers as well as extraction from the forests. The quantities of bamboo/reed collected from each source varied depending on several factors such as price, distance of the source from the area of use, mode and cost of transport available, the vigil of the forest watchers and other officials. In the absence of clear record or memory among the respondents on the quantity collected and the source on each occasion, it has been assumed that roughly half the collection of those who used multiple sources came from the forests and the remaining half from the home-gardens of local farmers.

It was found that a half of the households (50 per cent) in the sample used the neighbouring forests as a source of their bamboo/reed resources at one time or the other. They obtained their resources from the forests, paying a price to the authorised or unauthorised bamboo/reed extractors in the locality who supplied the material at the doorsteps. As even those bamboo/reed cutters who collected the materials using the passes were not supposed to sell what they collected for their own *bona fide* use, it can be said that forests provided a convenient though not legal source of bamboo and reed for nearly half the sample of population in the village.

This need not, however, mean that 50 per cent of the bamboo used by the rural households were from the forests, as a significant proportion of the households (23.43 per cent) depended on multiple sources for getting the resources they needed, depending on a variety of local and temporal factors including the price and the proximity of the source.

Only 3.70 percentage of the households surveyed bothered to collect *bona fide* users' passes from the forest department for meeting their requirements. The difficulty in getting a pass sanctioned by the forest department official and the amount of time and money that had to be spent on collecting the pass were pointed out to be the major hindrances in adopting the lawful means of procuring the resources.

Around 39 per cent of the households surveyed purchased bamboo from local farmers paying a price, which ranged from Rs. 100-120 per pole depending on the length, strength and the species of bamboo. Despite the fact that the price charged by the farmers for a pole of bamboo was marginally lower than the average of Rs. 150 charged by the extractors for fetching a bamboo pole from the forests, the local people depended more on forest bamboo than on farm bamboo. A major deterrent in promoting bamboo users' dependence on local farmers, which would have created a mutually beneficial financial and social linkage between the rural households and the farmers as well as enriched the village ecologically, seems to be the restrictions on transporting bamboo even when extracted from homegardens.

Permission in the form of a transit pass issued by the Forest Department is required for cutting and transporting bamboo from the homegardens as bamboo is regarded as a "forest produce" under the Kerala Forest Act (*For a detailed discussion on this, see chapter on Distribution of bamboo from Forests in Kerala*). Even though the fees for obtaining a transit pass was negligible, the informal expenses and the time delay in obtaining it were substantial.

Only a very small percentage of the rural households (3.70 percentage) grew a bamboo clump or two on their garden lands for meeting own requirements. The small size of landholding among the majority of the households (28.13 percentage of the households in the sample possessed 20-50 cents of land and 26.56 percentage of households possessed just 5-10 cents of land) was the major factor that prevented the people from cultivating bamboo. Bamboo is generally regarded as a plant that

occupied a large amount of space and an invasive one. Non-availability of planting materials of more appropriate species (that consumed less space and were easily manageable such as many of the monopodial Muli bamboo found in abundance in the North-eastern State), lack of a steady market for farm grown bamboo, lack of awareness on cultivation and management practices, absence of technical and financial support measures from the government and other institutions and doubts regarding the financial prospects of growing bamboo as a crop were the other factors that prevented rural households from growing bamboo.

Discussion:

A few important aspects of the rural uses of bamboo have come out of the study:

(1) Bamboo was mostly used in its natural, raw form in the households, without virtually any value-addition. Structural properties of bamboo poles such as strength, length, light-weight and the ease in processing with simple tools are the important characteristics of bamboo that were put to use in these household applications.

(2) No effort has gone into supply of raw bamboo in standardised length or diameter whereby wastage at the end-use could be minimised.

(3) Even the use of bamboo in product forms was mostly confined to a few traditional items such as kitchen accessories and baskets, woven mats, winnowers etc. used within the households and in agricultural operations. These were products being made in the same designs, sizes, quality and finishes for over centuries and adaptations of them to suit new uses were rare. Most of these products now had their cheaper substitutes in plastic and other material and, as such, represented a vanishing breed. Products utilising the structural possibilities of bamboo poles such as kitchen shelves, household and office furniture etc. too were not in use. The bamboo board 'Bambooply', a modern industrial product manufactured by the KSBC within the state itself, has not penetrated into rural households in any significant way.

(4) New types of products of bamboo handicraft made at the local bamboo craft centre too have not entered into the households in any major way despite the respondents themselves being engaged in the production of such items. Only around 23 per cent of the respondents in the sample used a few decorative

products, desktop utilities or fruit baskets made at the centre. And, perhaps, this lack of appreciation for the 'modern products' made of bamboo also reflected the need for re-orienting bamboo craft as it was practiced in the area today to go in for the production of more utilitarian and less expensive products for the domestic market.

(5) The common property environmental uses of bamboo (for soil conservation, water preservation etc.) as well as utilisation of bamboo in the construction of small footbridges across water streams and in irrigation and fishing appear to be dying out.

Uses of bamboo in house construction – a comparison:

A comparison of consumption of bamboo in rural households in the Kerala village with that in Assam, one of the bamboo-rich areas in the country, would be interesting. A study carried out in the Jorhat district in Assam by scientists from the Institute of Rain and Moist Deciduous Forest Research (now Rainforest Research Institute) (Anup Chandra *et. al*. 2002) had found that in the Titabar block in the district the average consumption of bamboo was of 145.37 numbers per household per year. This is more than double the average household consumption of bamboo in Kerala.

The predominant form of use of bamboo in Assam varied considerably from that in Kerala, with house construction consuming the major share in the former (23 per cent or 32.95 numbers out of 145.37 numbers of bamboo used per household per year) and construction of new fences accounting for another 16 per cent. Annual repair of houses utilised another 7.5 per cent and repair of fences took up 7 per cent more of the household consumption of bamboo in Assam. Thus, more than a half of the household utilisation of bamboo in Assam was in construction and related applications.

Because of its fast growth, short rotation age, annually renewing growth, local availability, ease in transportation and workability with simple tools and, above all, its high mechanical strength in comparison with wood and steel, bamboo has been used in several forms of permanent as well as temporary constructions for centuries, mostly in Asian countries. Quoting Banik (1996), UNDP has reported that in Philippines 80 per cent of bamboo supplies were used for housing. In other Asian countries too considerable proportion of the bamboo supplies was used in rural constructions –

Bangladesh 50%, Indonesia 16%, Japan 24%, Myanmar 30%, Nepal 50% and Thailand 33%. In contrast, India used only 6 per cent of bamboo for rural construction (against 66 per cent in pulp production until recently). However, it has also been noted that this all-India average figure may not reflect the regional diversities in the country, especially in the case of the Northeastern states (UNDP 1997:3).

Other studies have found that the use of bamboo in construction of dwellings had been a feature of several Indian villages in the Western Ghat region too. From a study in the Alur village in Haliyal taluk of Uttar Kannada district in Karnataka state conducted in 1979, Prasad and Gadgil (1984) had found that the tradition was strong in the Western Ghat region. "The most important use of bamboo in the farming villages was in house construction," the study had observed. Out of the 46 huts sampled in the village, only five used no bamboo at all and these houses belonged to the richer farmers who preferred timber. Of the remaining 41, 21 houses used bamboo very extensively. The other 20, which did not use bamboo so extensively, were smaller and apparently temporary dwellings. Thus the vast majority of permanent houses of the farmers were constructed largely out of bamboo in the Karnataka village (Ibid: 131).

Grasses, leaves, reeds, bamboo, thatch and mud had remained the predominant roofing material of 74.1 per cent of all residential houses in Kerala (76.9 per cent of rural houses and even 56.7 per cent of urban houses) until 1960s (Harilal and Andrews 2002). According to this study, the dropping of bamboo and other locally available construction material from the builders' portfolio in Kerala took place mainly after 1960s and quite intensely in the period 1971-1981. By 1991, traditional roofing materials such as bamboo and grasses found a place only in 25.20 per cent of houses (28.10 per cent rural houses and 16.90 per cent urban houses). The proportion of census houses that used bamboo, reed, mud or un-burnt bricks as *wall material* also declined from 637 out of 1000 houses in 1961 to just 354 by 1991 (Ibid).

Presently, among the 65.95 lakh households in Kerala, members of 44.94 lakh households (68 per cent) lived in permanent houses and 14.24 lakh (21.6 per cent) in semi-permanent houses (Economic Review 2003). Nevertheless, there was still a numerical shortage of 63,000 houses in Kerala in addition to the requirement of reconstructing dilapidated houses numbering 5.33 lakhs and repairing at least 2.3 lakh 'livable' houses (10 per cent of the total number of 'livable' houses in the state).

Needless to say, most of the 'dilapidated' and the 'livable' houses that need replacements would belong to the poorest of the poor in the state, i.e., the adivasis and *dalit* communities living largely in the forest-fringe villages and the coastal belt. (Until the terminology was revised in the 2001 Census, houses were categorised as 'pucca', 'semi-pucca' and 'kucha' corresponding to the latest 'permanent', 'livable' and 'dilapidated' houses).

Based on a sample survey carried out by in Wayanad, Thiruvananthapuram and Thrissur district in late 1990s, KFRI scientists Muraleedharan and Anitha (2000:23) had found that out of an average of 1.2-1.6 lakh houses built in Kerala every year, 20 per cent, i.e., 24,000-32,000 houses were 'kucha' houses and, out of these 'kucha' houses, 40 per cent numbering 9,600-12,800 used bamboo in their roof structure.

As stated earlier, our field observations have shown that the construction of roof structure of an average house in Kerala required 26 bamboo poles. Thus if 40 per cent of the kucha houses in Kerala (9,600-12,800 houses) were to use bamboo for roof structures again (at the rate of 26 poles or 1.63 tonnes of bamboo per house) the requirement would be 15,648 to 20,864 tonnes of bamboo per year.

The flooding of Kerala market with the timber ruthlessly cut down from the private forests in the interregnum of promulgation and actual implementation of the Kerala Private Forest Vesting and Assignment Act 1971, had played a crucial role in enticing the entire Kerala society to use wood in place for bamboo in the construction of houses. If cutting down most of the trees in the private forests had been a knee-jerk, anti-social reaction on the part of the owners of these forests who wanted to salvage whatever money possible before the government usurped the forests, changing over totally to the use of wood, a costlier and virtually non-renewable material, in the construction of houses only helped to perpetuate this drain on the forest resources.

Looking at the rapid changes in the construction sector in Kerala from the point of the present study, it is important to note that the period of this transformation also coincided with (1) the intensification of industrial extraction and utilisation of bamboo and the consequent experience of scarcity of these materials within the Government forests and (2) migration of workers from traditional occupations such as bamboo weaving to jobs in the construction sector. Also, this was the period when the

rural bamboo, the bamboo in the home gardens, began to make way for the cash crops that have by now ceased to be cash crops.

It is worth mentioning here that the study by Harilal and Andrews had raised doubts whether the changes that took place in Kerala's housing sector were entirely rational or cost-effective. The study had also pointed out a significant social impact of the changes in construction practices and materials: " The introduction of materials and techniques alien to handicraft production has contributed, to a significant extent, to the breakdown of the practice of artisanal production of buildings on the one hand and to the penetration of capital into the building industry on the other" (Harilal and Andrews 2002: 40).

Sensitive architects too have highlighted the dependency factor involved in altogether replacing 'traditional' building materials and methods with the 'modern' ones. For instance, according to Ritu Varuni, an architect-designer trained at the National Institute of Design, "when bamboo and cane were replaced with imported materials like brick and concrete, new skills were required for which old systems were ill prepared. Imported materials required imported labour and the traditional practices disappeared. High transportation cost made the use of these new materials impractical and unviable to the large majority of the population. It also meant the loss of self-sufficiency and the beginning of dependence for a very basic need that could easily be met within the community and the area" (Varuni 2002).

In his seminal work on bamboo, *The Book of Bamboo*, Farrelly (1984) states: "sheltering people should not mean implementing housing projects, but rather, making resources available, re-awakening traditional skills and playing midwife to new forms of old solutions, so that people can resume responsibility for self-shelter."

The potential for application of bamboo as a construction material not only within India but also across the globe has been emphasised by others. According to Vinoo Kaley, the visionary ''Bamboo Man of India'', bamboo "could lay a fair claim as the single most important roofing material that has potential to truly and squarely meet our housing needs, and those of the Third World" (Kaley 1989).

The world population reached six billion in 1999 and will be seven billion after 2010. At least 600 million urban dwellers in Africa, Asia and Latin America lived in "life and health threatening homes," according to a UNDP report. Presently, one billion

people on earth lived in bamboo houses and in countries such as Bangladesh 73 per cent of the population live in houses that used bamboo for pillars, walls, window frames, rafters, room separators, ceilings and roofs.

In addition to its length, rigidity, easy workability and good stiffness/weight ratio, Kaley had emphasised the low-energy costs involved in the production, transportation and use of bamboo, an important factor in the "modern times where energy crisis looked like a sure visitor in the near future." Studies have shown that energy required for processing bamboo to create a building material was only 1/8th of concrete and 1/3rd of wood. In comparison to steel, bamboo needed only 1/50 the amount of energy for processing.

Against this backdrop of the vast, global potential of bamboo as a structural material and the "wood of the 21st Century" (Sastri 2002), use of bamboo in constructions in Kerala remained sadly limited. It has been relegated to a few firewood sheds, chicken pens and livestock sheds in the backyard of the homesteads.

Source of bamboo for rural uses: Homegardens or forests?

Krishnankutty (1990) and Krishnankutty, Blowfield and Boa (1995) had assessed the demand and supply of bamboo in Kerala to draw the conclusion that home-gardens contributed 63 per cent (and the forests, only 37 per cent) of the total supply of bamboo in the state. These researchers had also argued that the entire bamboo requirement of households (which included uses such as supports for scaffolds and concreting) was met from the homesteads. It was acknowledged by these authors that the "estimate of the quantity of bamboo used in the household sector did not include the quantity of bamboo illicitly collected from the forests and used by households" (Krishnankutty *et. al.* 1995:5). This inability to account for the 'leakage' of the resource from the forests remains a lacuna of the study.

Again, as pointed out by Mathew (1998), the above study had not included data on the resource position and extraction of reeds, which formed the "mainstay of bamboo activity in the State". The two studies by Krishnankutty were conducted focusing on trading depots and homegardens mostly in Palakkad and Thrissur districts and to some extent on the low-levels of supply to Palakkad from Kannur and Kasaragod districts. Thus the studies had not touched upon the bamboo availability and supply scenario in Wayanad district where the present survey was carried out.

Whether the homegardens did really meet the needs of the households has been subjected to enquiry by other KFRI scientists. In a later study (Chandrasekara *et al.* 1997:41) carried out in the Pallam village in the same Palakkad district, the researchers had found that the home-gardens in Pallam and its neighbouring villages did not meet even the requirement of bamboo branches for constructing fences. Thirty-seven per cent of the farmers in the village were found to be obtaining their supplies of bamboo branches through traders. Only 17 per cent of the farmers could depend on the homegardens in the nearby places. Again, only 7 per cent of the farmers were self-sufficient in obtaining bamboo branches from their own clumps (Ibid). Moreover, they found that due to decrease in supply, the price of the bamboo branches had increased from around Rs. 20-25 per bundle to Rs. 50-55 per bundle in the period 1995-1997.

The present study based in Wayanad district has found that one cannot really generalise upon the notion of self-sufficiency of the bamboo homegardens in Kerala. The dependence of bamboo users on neighbouring forests appears to be quite high, at least in certain pockets of Wayanad. The study has shown that nearly 50 per cent of the rural population in the sample from the Meppadi and Muttil panchayat do depend on the forests, however partially, for meeting even their bare minimum and rapidly diminishing requirements of bamboo and reeds. The pressures such encroachments on forests would be inflicting on the already depleted resource base would be critical, especially because they are mostly clandestine, totally unmonitored and even unacknowledged fly-by-night extraction.

Looking once again at the bamboo construction scene in the area, it becomes clear that even when people in the forest-fringe areas are legally permitted to extract a certain number of bamboo poles for repair of houses and sheds using a pass from the FD, there have been very few to take to this legal route. This is mainly because the quantity the Kerala Forest Department generously allots for construction or repair of houses is just five bamboo poles per family per year.

It has been shown that while the requirement of bamboo for building the majority of bamboo houses in the state as a whole are being met almost equally from homegardens (33%), private depots (33%) and forestlands (34%), there are considerable variations in this between districts (Muraleedharan *et. al.* 2000:14-16). In Wayanad district, where no private bamboo depots operated, the dependence on

forest bamboo for construction of thatched bamboo houses was as high as 70 per cent compared to 20 per cent in Thiruvananthapuram and none in Thrissur.

The ground reality in Wayanad remains that not only individual rural households but also groups of village artisans and even some of the organised bamboo-craft production centres depend quite a lot on bamboo and reed from the forests. Their current volume of extraction would be relatively low only because bamboo craft was just beginning to be recognised as a viable non-farm occupation for employment and income generation in the rural areas. With government and non-government agencies and local self-government institutions taking up more bamboo processing schemes in the area, the extraction of bamboo and reed could reach harmful levels unless effective immediate measures are adopted to augment the resource base both within and outside the forest areas.

Utilisation of forest bamboo by tribal communities

The tribal communities of India largely occupied forested regions where for a long period in their history they have lived in isolation but in harmony with nature. The deep-rooted, multifarious links between tribal communities and forests have been explained by several authors as well as official reports. "The forests not only provide them (the tribals) with food, material to build houses, fuel for cooking, light and warmth, fodder for their cattle, but also satisfy the deep rooted sentiments….In times of distress like famine, forests are their last succour. Even in areas where forests do not exist, the tribals still visit the distant forests periodically and try to get their traditional requirements from there, however insignificant they may appear to others" (Government of India, 1982).

The *adivasis* in Kerala numbering around 3.2 lakhs lived in miserable conditions. The prime cause of this was landlessness, alienation from forestlands and the consequent denial of rights and access over basic resources. "Out of the adivasis in Kerala, 90 per cent comprising of over 53,472 families remained landless. At least 80,590 ha of tribal land had been alienated in the state by 1996 (Adivasi Gothra Maha Sabha 2003).

Twenty-three percent of Kerala's *adivasi* (Indigenous People / tribe/ Scheduled Tribe) population, approximately 73,000 people belonging to more than 30 different tribes, lived inside forest reserves. Although the adivasis made up only 1.1% of the State's population, they were the majority population group living inside forest reserves. As a result, "they remained highly dependent on the forests for subsistence goods, collection of NWFPs for trade and forest wage labour" (World Bank 1998).

The importance of MFP including bamboo in the lives of tribal communities, especially of those who have limited or no access to cultivable lands, has been highlighted by several studies from different regions of the country and abroad.

In this context, the present study conducted a sample survey among members of 32 families in Kakkathodu *Ooru* (Ooru = tribal hamlet) and Pulithookki *Ooru* in Noolpuzha panchayat, Sulthan Bathery taluk, Wayanad district, in order to assess (1) the volume of bamboo resource extraction, (2) the nature and volume of utilisation of bamboo and (3) the rights/access system pertaining to forest produce existing among the tribal communities.

Survey location:

Wayanad district had a total geographical area of 2,131 sq. km. of which 884.27 sq. km. was forests, according KFD records. The actual forest area reported by the Kerala Forest Research Institute was lower at 791.86 sq. km. Forests formed 37.16 per cent of the land area of the district. Nearly 64 per cent of these forests had become degraded due to various pressures.

An important feature of the district was the large *adivasi* (Indigenous People / tribe/ Scheduled Tribe) population, consisting mainly of Paniyas, Adiyas, Kattunaykka, Kurichiya and Kuruma tribes. Around 36 per cent of the adivasi population in the state lived in Wayanad, according to the 1991 Census. Roughly a century ago, 90 per cent of the population in the area were indigenous people. However, due to large-scale inward migration of people from other districts coupled with the alienation and dispersion of the adivasis from their original habitats in the forests over the last century under colonial and post-colonial government control over the forests, the adivasis now formed only a minority 17 per cent of the population in the district.

The Noolpuzha panchayat was the most thinly populated panchayat in the district with a population density of just 95 persons per sq. km. against the average population density of 749 persons per sq. km. in the state. The total land area of the panchayat was 242.97 sq. (Panchayat Level Statistics 2001). Tribal communities formed a sizeable proportion (38.58 per cent) of the population in the panchayat. The members of the two selected hamlets were the Paniyas, one of the most impoverished tribal groups in Kerala. The workforce of the panchayat comprised mostly of agricultural labourers. Out of a total of 7,013 houses in the panchayat area, 50.69 per cent were thatched houses, reflecting the natural resource dependency as well as the poor socio-economic status of the residents. Nearly 25,357 ha area of the panchayat has been classified as protected forests coming under the Muthanga Forest Range within the Wayanad Wild Life Sanctuary.

The Pulithookky hamlet comprising of a single congested cluster of around 13 huts ('dilapidated' houses!) made of mud walls, mud basement, bamboo rafters and grass-thatch was situated on the fringes of forest. All the houses were put up on a total of 30 cents of land. Other than this commonly held *Ooru* land, none of the members of the hamlet possessed any land where they could grow food. The paddy fields that

extended beyond the 30-cent plot belonged to others and provided only occasional employment to the members of the tribal community.

Because of the drastic fall in the prices of coffee and ginger, many local farmers had stopped hiring labour, thus denying jobs to the adivasi labourers. A couple of years ago the Pulithookki Colony had hit newspaper headlines when three adivasis died in an outbreak of cholera. The 'colony' often made news because of the chronic unemployment and poverty among its members that made starvation deaths almost an annual incident in the hamlet (Janu and Geethanandan 2003). There were 17 families in the hamlet making up a total population of 61 members including 19 men, 25 women and 17 children living a crammed life in just 13 huts provide d by the government.

Table 12 Population in tribal colonies

Hamlet	***No. of families***	***Adult Population***		
		Male	Female	Total
Kakathodu	15	18	17	35
Pulithookky	17	19	25	44
Total	**32**	**37**	**42**	**79**

Until 1998, a few men in the hamlet used to find employment in extracting bamboo for the pulp industry unit in Kozhikode, viz., Grasim Industries. However, since the closure of the factory in 1999, even this source of income has disappeared. Though experts in extracting bamboo, these tribal men had not learned the craft of making products out of bamboo. Only one member each in the two hamlets knew the craft. None of the women in the hamlets knew the craft of bamboo weaving.

Table 13 Percentage distribution of bamboo artisans in the sample

Name of hamlet	*Persons engaged in bamboo-based production*	*As percentage of total adult population in the hamlet*
Kakkathodu	1	2.86
Pulithookky	1	2.27
Total for the 2 hamlets	**2**	**2.53**

In the Kakkathodu hamlet, only a single house was found to have been built entirely with bamboo. All the other huts were made of mud walls, mud basement and bamboo rafters as roof structure. As the houses in the two 'colonies' were all built with government assistance, the people looked upon the government to provide assistance also for repairing them. So the repairs were not carried out unless and until the government provided such doles under some scheme or the other.

Table 14 Extraction of forest bamboo by tribal households in Pulithookky and Kakkathodu hamlets in Wayanad

Families	*Monthly extraction of bamboo (in Numbers)*	*Estimated yearly extraction (in tonne) @ 16 bamboo = 1 tonne*
Average extraction per family	**1.78 numbers per month**	**1.34 tonne/ year**

The survey showed that the extraction of bamboo from the forests by the households in the two tribal hamlets came to an average of 1.78 numbers per household per month. This worked out to 1.34 tonnes per household per year. Bamboo was used in these two tribal hamlets totally for internal consumption in uses such as cooking, repair of houses and making winnowers, baskets and fish-traps. Very rarely were these products sold to the general community members.

The volume of utilisation of bamboo in the tribal hamlets was much less than that in an average rural household (approximately 4 tonnes per household per year) as found in the sample survey in Meppadi and Muttil panchayats in the district. This is despite the fact that these tribal hamlets were situated just on the periphery of forestlands rich in bamboo wealth.

There appears to be a considerable decline in the variety of use of bamboo in the tribal households in the district. Uses of bamboo in agricultural applications have not been reported from the two hamlets because none of the members of the two hamlets possessed cultivable lands.

Again, the use of bamboo in construction of various sheds usually found attached to the rural houses were absent in the tribal hamlets because of the scantiness of land in the possession of the hamlet and the virtual absence of farm animals. Bamboo was

used for repair of constructed houses only when government allotted money for the purpose.

Thus it appears that even the tribal people in Kerala have ceased to look upon bamboo as a resource that can fetch employment and income. Though in reply to questions some women members of the Pulithookky hamlet showed interest in getting trained in bamboo craft, they were doubtful about the prospects of making bamboo craft a profession. They did not have any information on the sources of technical and financial supports available for such a career and were not confident of acquiring the minimum skills needed. They were also doubtful about the market prospects of bamboo products.

A large number of respondents in the survey also opined that availability of bamboo in the neighbouring forests had declined considerably over the years, though they were not able to pinpoint the causes.

Access to bamboo resources:

None of the members of the two hamlets possessed bamboo extraction passes issued to *bona fide* forest users by the forest department. The difficulties in obtaining the pass were many. A pass would be issued only on demand and payment of seigniorage rates. The current level of seigniorage rate that stood at over Rs. 1,100 per tonne of bamboo was unaffordable for any tribal family. Then, the applicant had to go in search of the concerned forest official or wait for him for several hours at the office. Usually this entailed three or four visits to the local forest office. The pass, when issued, was valid only for a limited time of 24 hours by which the extraction and the transportation of the felled bamboo culms had to be completed.

The maximum number of bamboo culms allotted to a *bona fide* user remained fixed at 15 bamboo poles per family/person per year. The officials of KFD were authorised to monitor and certify the correctness of the extraction.

Many such restrictions prevented the adivasi from abiding by the rules and strictly conducting extraction on the basis of passes obtained. Often the rules existed only in the records of the KFD and the Government and the forest officials waived these conditions, partly out of sympathy for the plight of the adivasis and partly out of their own convenience. Nevertheless, the law, whether applied or not, remained a potent weapon that the Forest Department could use against the adivasi any time. Such a system, which treated an adivasi *legally* as a thief if he collected more than five

bamboo poles at a time, even if it was for meeting the fundamental need of constructing a shelter that the government had failed to meet, remained inimical to the interests of the adivasis as well as that of conservation of forests.

Bamboo and Reed in Kerala: The Resource Base

Bamboo Surveys: The cart before the horse:

Hitherto there have been hardly any comprehensive effort to survey the bamboo and reed resources of the country including that of Kerala from the point of view of assessing the multiple ecological and social associations as well as functions of these resources, prioritising the demands and apportioning the resources according to sustainable priorities. The surveys that had been conducted were most often prompted by the predetermined objective of identifying and earmarking resources required by the large industry, under overarching 'national policies'.

Even in 1870s when commercial wood pulp was just emerging from the experimental to the commercial manufacturing stage in the European continent, the suitability of bamboo for pulping had been discussed. From 1905 onwards, experiments were carried out in British India (which then included Burma) to use bamboo for pulp manufacture.

The first surveys to identify the dominant species, habitat and growth, yield, suitable cutting rotation and cost of transportation of bamboo in the country were prompted by the success of technical research on the suitability of bamboo for pulping carried out at the Imperial Forest Research Institute (FRI) at Dehra Dun in as early as in 1920s. The clinching result of the research works at the Forest Research Institute was that "it was possible to deliver pulp at British ports at £ 2-3 per ton less than the corresponding imported wood pulp from Sweden and other counties" provided bamboo was used (Indian Forester 1927). The experiments at FRI also indicated that bamboo pulp was equally suited for the manufacture of artificial silk for textiles.

"Extensive bamboo forests, running into thousands of square miles and capability of yielding several million tons of pulp per annum were awaiting exploitation in India and Burma," announced FRI scientists, calling upon "enterprising capitalists to translate the results of the studies into commercial ventures." The assumption was that the exploitation could be *in perpetuum* because "bamboo was annually reproductive and, therefore there was no risk in the depletion of the economically exploitable areas at any time" (Ibid).

Colonial interests had been the source of inspiration for assessment of bamboo resources in Kerala too. Even as early as in 1914, M/s Thomas Nelson & Sons, an

Edinburgh-based publishing firm had shown interest in getting bamboo for manufacturing paper and the imperial forest managers had looked into the possibility of supplying at least 20,000 tonnes of air dry bamboo annually to the firm, according Mr. Bourne's Working Plan Report of 1940, quoted in the Working Plan for Nilambur Forest Division for the period 1967-68 to 1976-77.

Early accounts

Bourdillon (1892) has recorded one of the earliest accounts of the status of forests in Kerala. During his travels through the forests of Travancore, Bourdillon observed reeds, mainly *Ochlandra travancorica*, as forming the undergrowth of forests over very large areas in different parts of the country. Near the crest of hills it occupied the whole ground covering the slopes with dense and almost impenetrable thickets. He had also noted that the lands cleared for cultivation were covered with heavy moist forests containing chiefly *Ochlandra travancorica, O. beddomei* and *O. scriptoria*.

The Working Plan for Wayanad Forest Division for the decade 1950-51 to 1959-60 mentions early attempts to cultivate *Dendrocalamus longispathus* in the Konoth Reserve in 1886-91. But these bamboos all flowered and died in 1937. Bamboo from the reserve was extensively used as floats for carrying heavy timber to the coasts. There was no other reported use for bamboo during those days.

The same Working Plan quotes forester Coode's description of bamboo forests in the region in 1925: "Bamboo forests are found in the moister southernmost parts of the Sulthan Bathery Range and in the central Padri Reserve." Bamboo was found in considerable amount in all better reserves but were rare in drier forests. But all along, the Wayanad forests were regarded as one of the 12 first class forests under the Madras presidency, following the classification introduced by Capt. Beddome in 1863.

Bamboo resource assessments in Kerala

One of earliest bamboo surveys, *A Survey of Bamboo Resources of Nilambur Valley Forests,* was conducted by A.M.T. Devar, Assistant Conservator of Forests, V.Madhava Menon, ACF (Private Forests) and M.Sivarjan, ACF (Govt. Forests) in 1956. Details about the survey could not be gathered during the present study.

By then the proposal for setting up a rayon grade pulp unit near Nilambur-Beypore was under active consideration of the State Government. Later the Government

ordered a detailed survey of the forests in the Nilambur valley, Wayanad and Attappady areas (vide GO MS No.361 dated 30/03/1959 and further clarifications issued on 29/03/1959). The 75-day survey -- *A Report on the Survey of Bamboo Resources of the Forests of Kozhikode Circle (1959),* was conducted by a team of Forest Department officials led by M. Sivarajan, Assistant Conservator of Forests and N.G. Paulose. The officers of the Birlas were part of the team.

The report of the survey recorded that the Nilambur Valley Forests alone would not meet the requirements of the proposed rayon grade plant. "Supplies from neighboring forest divisions will have to be earmarked for the proposed rayon grade pulp plant," the report observed. The conclusion of the report, however, was that "the Government forests of erstwhile Malabar district alone had more than enough bamboo resources to meet the present industrial demand."

The demand of the proposed plant was estimated as 400 tonnes of bamboo per day or 1,25,000 tonnes of air dry bamboo per annum (tpa) for a production of 100 tonnes of rayon grade pulp per day.

The 1959 Survey:

As the survey of bamboo resources carried out in 1959 is of much importance from the point of view of the subject of the present study, it is pertinent to look at this particular survey in detail. Even before the commencement of the survey, the Kerala Government had committed itself on providing 1,60,000 tonnes of bamboo (and 3.2 lakhs tonnes when the company chose to double its capacity) annually to M/s Gwalior Rayons Silk Manufacturing and Weaving Company by signing the Principal Agreement on 3rd May 1958. The company had not started production at the time the survey was conducted. However, by this agreement the government had already assigned to the company exclusive rights for 20 years for felling and removing bamboo from "all the government forests within the Ernad Taluk, Kozhikode district, as well as 16 un-surveyed forests in the same taluk that belonged to private parties" (Principal Agreement 1958).

Such largesse shown to the industry was unfounded scientifically and legally because, on the one hand there was no scientific resource data to support the contract and, on the other, the government did not have, at that time, legal control over the private forests it sought to lease out wantonly to the company.

The manner in which the terms of the contract were fixed has made many observers doubt the real forces that were at work behind the Birlas setting up the pulp industry in Kerala. For instance, Manorama Savur (2003) has argued that the harsh and demanding terms and tone of the contracts signed between the Government of Kerala and the Gwalior Rayons as well as the fact that the agreements were signed by the Governor of Kerala (the representative of the Centre) are indicators of a possible intercession or imposition of the PPI on Kerala by the Central Government.

The methods adopted by the survey team were detailed field investigations and sample surveys for making a complete enumeration of all culms in all clumps in the sample plots. The survey had initially planned to cover the forests owned by the government; the private forests in Nilambur, Wayanad, Kozhikode and Palghat forest divisions, the Thekadi leased forests, the Kollengode Raja's forests and the Nellikalidam as well as Puzhakkilidam forests in the Nenmara Range. But actually the survey did not cover the forests in Kasaragod, Kanhangad, Thaliparamba ranges in the Wayanad Forest Division and the Thamarassery and Kuttiadi forests in the Kozhikode division.

The survey found that "only a few bamboo areas in the Nilambur valley forests could compare with the growth of bamboo in Mancheri in North Amarambalam reserve of Karulayi Range" (Sivarajan 1959). The bamboos in the range were endowed with better height, growth and weight. However, from a point of view of regeneration, the forests were found lacking as the bamboos had "fewer number of *andans*[6] per acre" in the area compared to many weaker bamboo forests. Observing that the private forests of the Nilambur Kovilakam and the Manjeri Kovilakam were already over-exploited for timber rafting and indiscriminate destruction of newborn shoots, the survey recommended that a long period of rest and judicious management were needed for these forests.

Sporadic flowering, dying of clumps and regeneration from seedlings were already taking place in Cherupuza, Mudayanthodu and gregarious flowering was occurring in Ammankavu, Karimpuzha, Puzhathuthi, Chakkikkuzi and Pothnugal forests in the Nilambur division at the time when the survey was conducted.

[6] *Andans* are less than one-year-old monoshoots put forth by the bamboo clumps.

Within the Wayanad forest Division, the survey found good bamboo forests in Mananthavady Range, Begur Reserve Forests, Kadrikode Range and in Alathur, Oliot, Kartikulam, Edakodu and Shanamangalam reserves. As the Kannoth and Kuthuparamba forests in the division were not found to be good for the purpose of meeting the supplies of the proposed industry, it was suggested that "these forests could be reserved for meeting the local needs. Nevertheless there was a catch here: "in times of an emergency, such as gregarious flowering, bamboo from even these forests could be diverted to industrial use."

Bamboo flowering was occurring in the Wayanad forest Division too at the time of the survey.

Similarly, in the Kozhikode Division, the Padiri and Kuppadi forests were found to have good bamboo resources. But bamboo was on the verge of turning from sporadic to gregarious flowering in Neminad, Nulpuzha, Kuppady forests and in portions of Mavinahalla forests. Incidentally, the government forests in Padiri range and the Muthanga forest range showed one of the highest yields of bamboo in Kerala touching 3.50 and 3.30 tonnes per acre per year respectively, within the whole area surveyed.

Within the Palghat Forest Division, there were plenty of bamboo in the Silent Valley forests and the Chenat Nair Reserve with culms of "girth of 20 inches at the first internode" and very high number of (around 60) *andans* per acre, with a potential to yield 5-6.5 tonnes of bamboo per acre. The private forests of Attappady were found to have been heavily exploited.

The largest stock of bamboo in the survey area was found to be in the Nenmara Forest Division and the forests that came under the Thekadi leased reserve as well as the Nellikkalidam and Puzhakkilidam forests. Though there wee good stocks of bamboo in the Parambikulam area, they were expected to be submerged under irrigation dams slated to come up in the area.

Yield assessment:

The yield assessment in the survey was based on certain assumptions. On hindsight, one could say there was too much of the spirit of positivist science in the exercise of the survey that it failed to see several important imperfections in the forest management system as it existed in the day.

The survey calculated the annual yield as a multiple of the average number of shoots produced per acre per year in the sample and the bamboo acreage. The number of shoots produced in a clump had exhibited considerable variation even in the limited area surveyed, being high in the Palghat division and low in the Karulai Range in Nilambur. The rate of production of new shoots was in inverse proportion to the growth of individual culms as growing individual culms created congestion in the clump and, naturally, reduced shoot production.

The survey assumed the "safe average" of shoot production to be 10 per cent of the number of culms in a clump. The survey report (Sivarajan 1959: Para 64) went on to assume that "with systematic working" (i.e., scientific management of the forests keeping to silvicultural principles and harvesting prescriptions), over a period of five years the average production of shoots could be increased to 33 per cent or one-third of the number of culms.

According to the study, the average annual productivity of bamboo in the forests surveyed was 4.44 tonnes per ha per year.

The survey estimated that apart from the areas from where sustained annual yield of bamboo was expected for the next decade, other forest areas such as Kurichiat North, Kuppadi Reserve Forest and Neminad RF areas accounting for an additional bamboo area of around 5,400 acres would be available for extraction.

Table 15 Bamboo Survey 1959: *(Area in acres; yield in air dry metric tonnes)*

Forest division	Bamboo Area A	Yield B	Flowered area C	Yield in flowered area D	Re-growth area E	Yield in regrowth area F	Total bamboo area A+C+E	Total yield B+D+F	Area excluded from industrial supplies G	Yield excluded H	Total area earmarked for industry (A+C+E)-G
Wayanad	18667	38247	0	0	566	1164	19233	39411	2177	2425	17056
Palghat	5989	14240	0	0	0	0	5989	14240	5267	4011	722
Kozhikode	34798	93870	2450	5341	3913	8773	41161	107984	0	0	41161
Nilambur (Govt.)	18865	46334	775	814	480	393	20120	47541	1343	1869	18777
Nilambur (Pvt.)	20988	24013	6481	9527	6670	6304	34139	39844	1499	368	32640
Nenmara	32260	99415	0	0	0	0	32260	99415	0	0	32260
Total	**131567**	**316119**	**9706**	**15682**	**11629**	**16634**	**152902**	**348435**	**10286**	**8673**	**142616**

Source: Compiled from Sivarajan et al 1959

Table 16 Forest areas and estimated quantum of bamboo available for supply to Gwalior Rayons as per the 1959 Survey.

Forests	***Area in acres***	***Annual yield (air dry tonnes)***
Govt. forests in Nilambur valley	20,120	47,531
Private Forests in Nilambur division	33,539	39,587
Govt. Forests in Sulthan Bathery range	8,333	20,856
Kurichiat, Chedleth reserves in Wayanad	3,934	8,277
Pvt. Forests (Pambra, Pulpally)- Wayanad	16,735	36,887
Total	**82,661**	**1,53,138**

Bamboo flowering and clear-felling:

Bamboo was already flowering in many forests and this provided a possibility of clearfelling and totally utilizing the bamboo stock in the course of a few years. As bamboo flowering was spread over 3-5 years and it took nearly 10 years for bamboo in an entire region to flower and die off, it was suggested that coupes should be so divided as to be worked in 5-10 years through clearfelling. Again, in the true spirit of scientific forestry, restrictions were suggested even for clearfelling. A few culms, preferably at the rate of 5 ft lengthwise spread of the mother clump had to be retained to assist seed dispersal. Measures such as debris removal should have been taken in order to avoid chances of forest fire. Clumps with young culms left in them even after flowering should have been spared from clearfelling. It was calculated that clearfelling flowered areas would provide 25 air-dried tonnes of bamboo per acre. The report said, "since flowering has started and was spreading fast, all flowered and flowering areas need to be clear felled in the next 5-10 years." The extent of area suggested for clearfelling was huge - nearly 49,000 acres spread over 18,000 acres in the Mananthavady Range, 15,000 acres of forests in Padiri, Mavinahalla, Edatorai, Muthanga, Alathur and Kallur coming under the in Kozhikode division, and 16,000 acres in the Nilambur Forest Division (Karulai range, New Amarambalam Range and Karimpuzha Range). By the observations contained in the same survey report, these were the most highly bamboo-rich forests in the state. Clearfelling 49,000 acres of

bamboo were expected to yield 12,25,000 tonnes of bamboo, equivalent to the entire requirement of the pulp unit for the next 8-9 years.

So once bamboo had started flowering and clearfelling was permitted, what was the need for practicing selection felling? That appears to be exactly what the Gwalior Rayons thought and practiced.

Table 17 Areas initially marked for clearfelling -1959 Survey

Forests	***Bamboo area prescribed for clearfelling (in acres)***
Mananthavady	18,000
Kozhikode division	15,000
Nilambur division	16,000
Total	**49,000**

Accommodating local demands

A significant aspect of the 1959 survey was that, for the first time, it paid some attention to the local users and uses of bamboo and tried to accommodate them, however biased (with dominant notions of development and positivist science) the attempt had been. Interestingly, the survey report sought to separate local demands from commercial uses, giving sympathetic attention to the former and ignoring the latter as doomed to fade into oblivion in the course of the incessant march of development being heralded in the country under the guidance of science and technology. The survey found a flourishing small-scale industry in Nilambur using bamboo to make umbrella sticks, but did not pay any further attention to its resource requirements or the real or potential in such small scale industries in providing employment and income to the local people. Instead, it paid some attention to the local uses of bamboo as the 'poor man's wood', largely in construction of houses (roof frame, walling, parquet, windows and doors) and sheds made of bamboo for cattle which were "invariable items of every household" (Sivarajan 1959:Para 49). In and around bamboo growing areas, bamboo was found to be used for "all possible needs," but this was expected to be "curtailed voluntarily without harm" when a better market developed for the resource with the setting up of the 'modern' industry. "Though the requirements to meet all these demands may count in hundreds of

bamboo pieces, the tonnage would be very small and an insignificant percentage of the total stock."

The use of bamboo in rafting down timber was acknowledged but was expected to be replaced with the increasingly popular motor transport. A possible understanding with the industrial unit could still leave out some quantity of bamboo for the local people for use in rafting, it was hoped. The export of bamboo from Kerala to other states was noted but left without volume estimation. It was expected that the private forests would continue to provide for local needs. The possibility of local non-forest cultivation of bamboo was hinted at by saying that "bamboo may even be made available to any industrial unit on a small scale if attractive prices were offered to local people."

Nevertheless, in actual terms, the survey provided the Birlas what they would have been looking for: (1) further expansion of catchments and (2) virtual reservation of all nearby sources of bamboo raw material for the future.

Table 18 Percentage share of Grasim in the total bamboo forests in Kozhikode circle as per 1959 survey

Forest division	***Bamboo area (in acres)***	***Area marked for supplies to Grasim (in acres)***	***Catchment area of industry (as % of total area)***
Wayanad	19233	17056	88.68
Palakkad	5989	722	12.06
Kozhikode	41161	41161	100.00
Nilambur (Govt.)	20120	18777	93.33
Nilambur (Pvt.)	34139	32640	95.61
Nenmara	32260	32260	100.00
Total	**1,52,902**	**1,42,616**	**93.27**

Source: Compiled from Sivarajan et al 1959

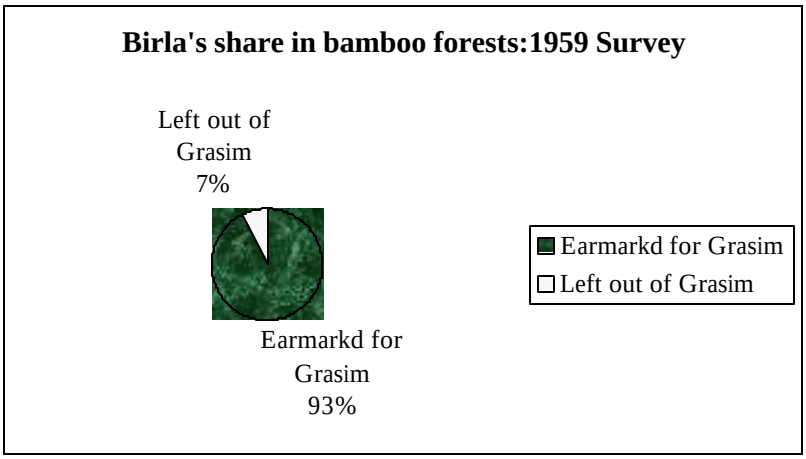
From the survey results, it can be seen that only an insignificant portion of the total bamboo area in the survey area were in fact set aside for uses other than that of the proposed industrial unit. As we have found earlier, the survey had assumed that the quantum of bamboo required for "local uses" would be insignificant in terms of tonnage. Such an approach foreclosed the option of upgrading the bamboo sector from mere 'local uses' to 'industrial' value-addition (whether tiny, small, medium or big in size) for which tremendous possibilities existed. Much before Gwalior Rayons

came up with its proposal for starting a pulp unit, bamboo and reed weaving had become "one of the most important cottage industries in the state providing employment to a few lakhs of persons," as the Kerala Industries Directory would later report in 1964. "The cottage industry had a very high concentration among the Harijans for whom it was not only a source of employment but also the main means of livelihood," the directory would rightly note a little later (Sridhar 2000).

Even if they had failed in realizing that other and better options existed for utilizing bamboo in a productive manner, the surveyors who claimed to go by the principles of scientific forestry should not have failed to see the destructive possibilities that lurked in opening up such a vast area of bamboo forests for industrial extraction.

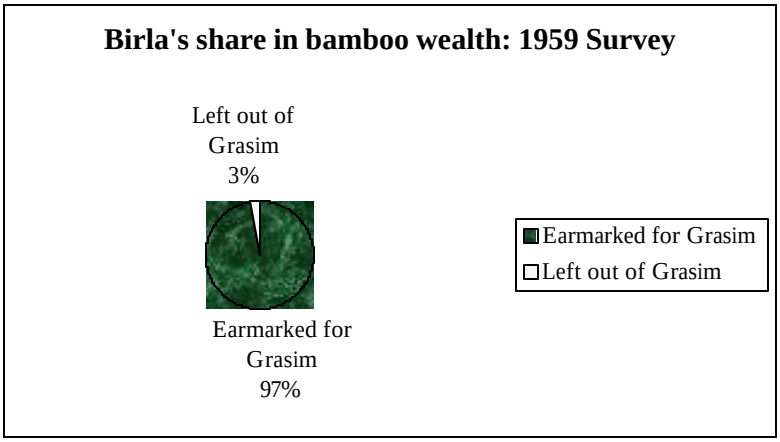
Out of a total bamboo area of 1,52,902 acres of bamboo area identified in the survey (inclusive of areas where bamboo had flowered and areas where bamboo was regenerating), the lion's share amounting to 1,42,616 acres (93.27 %) were earmarked for supplies for the proposed industry.

Figure 1 1959 Survey: Birlas' control over Bamboo forests



In terms of the bamboo yield in the survey area, the reservation for the Birlas' amounted to 97.51 per cent of the total stock in the surveyed area: an absolute monopoly.

Figure 2 1959 Survey: Birlas' share over bamboo wealth



Such a myopic prioritisation of the 'modern' industry in the survey report in allocating resources seems to have been built up on several assumptions: The essential premise of the sustained yield assessment and the recommendations of the 1959 survey was 'scientific management' of the bamboo forests, which, in reality, simply did not exist and was hard to achieve in the given administrative system. Neither the Forest Department nor the Pulp and Paper Industry in the country had given an iota of importance to scientific management of bamboo in the country. Neither had any efficient systems in place for practicing it. Even the ruling assumptions regarding the availability and characteristics of bamboo within forestry literature were negative, ranging from the FRI's early observations that set the pace of bamboo based pulp production in the country that "bamboo would be available *in perpetuum"* to the notion that bamboo was a "noxious weed" like lantana and fit to be classified under "injurious plants."

It was based on this non-existent premise of scientific management and an exaggerated regeneration rate of 33 percent achievable through it in five years that the survey prescribed an annual cut of 6.5 per cent of the total stock every year for five years after which the yield was expected to stabilize at a higher rate. The felling prescriptions were also based on these calculations and assumptions.

Prescriptions on felling: The main prescription that a bamboo extractor was expected to follow was that the number of bamboo extracted should be no more than the number of new shoots produced in the year plus an equal number of mature (i.e.,

more than three year old) culms. Strict adherence to this formula for selection felling and allotting the coupe in such a manner that no extraction was carried out during June, July and August were expected to ensure sustainable yield. Another assumption that formed the basis for the allocation of bamboo to GIL was that the local users would voluntarily sacrifice their demands, some uses getting totally replaced by modern technologies. Yet another was that PPI corporate would willingly part with some of its quota of resources. The private forests in Kerala were thought to remain in tact and provide for public needs. It was also expected that farmers would take to bamboo cultivation on the basis of attractive prices.

The survey was built on the assumption that needs of the non-industrial users were "local" whereas that of the 'modern industry' was universal, both in a temporal and spatial sense.

Another set of assumptions that obliterated even the empirical observations from the field was, as mentioned above, related to scientific forestry. The finding that the forests of Nilambur valley alone would not be sufficient to meet the requirements of the industrial unit and thus the commitment that the government had already made was bound to fail was not highlighted. Instead, the survey went on to identify and allocate greater areas for sustaining the huge volume of extraction by a single industry. The threat of bamboo flowering and bamboo death that loomed large over most part of the surveyed area was ignored under the assumption of normal natural regeneration. No adverse impacts were expected from human interference in such a massive scale on the forest's biological and ecological systems.

Pre-investment Survey (1967-68) or the FAO survey:

The next survey of the bamboo resources of Kerala was the Pre-Investment (P-I) Survey of Forest Resources of India carried out under a FAO-Government of India joint project in 1967-68. The survey, for the first time, used aerial photographs to assess the extent and quantum of forest resources in the state. The survey covered the following forests fully: Thenmala, Punalur, Konni, Ranni, Kottayam, Malayattur, Chalakudy, Periyar Wild Life Sanctuary. It covered the following forests partly: Thiruvananthapuram, Munnar, Trichur and Nenmara. The survey did not cover the forests of Wayanad, Kozhikode, Nilambur and Palakkad.

During 1971-72, the Forest Resources Survey division of the Kerala Forest Department covered the portions left out of the P-I survey. However, the survey did not cover the vested forests running into 1500 sq. km in the erstwhile Malabar region and another 380 sq. km in the rest of Kerala. This survey especially looked at reeds and bamboo.

The very fact that an international organization such as FAO came forward to sponsor a study of the forest resources of India shows that forests and forest products have larger stakeholders and wider interest groups who decide forest policies. From the point of view of political economy of forests, several researchers have elaborately probed the involvement of FAO (and the World Bank) in the development of the forest-based industries as well as the growth of eucalyptus plantations in India. For instance, Manorama Savur (2003:II, 502) has said: "FAO's mandate went much beyond managing forests to develop pulp and paper industry as well as agriculture."

Table 19 Growing stock of bamboo and reed in Kerala forests : 1973

Forest Divisions	***Growing Stock of bamboo***	***Growing stock of reeds***
	In '000 ADMT	*In '000 ADMT*
Trivandrum	163	398
Thenmala	184	370
Punalur	117	12
Konni	180	42
Ranni	90	986
Kottayam	38	28
Periyar WLS	46	240
Munnar	36	980
Malayattur	37	1012
Chalakudy	72	406
Trichur	20	8
Nenmara	46	22
Palakkad	83	28
Nilambur	96	12
Kozhikode	168	-
Wayanad	64	16
Total	**1440**	**4560**

Based on Pre-Investment Survey 1967-68 and Forest Resources Survey 1971.

The FAO study and the FRS division's study that followed aimed at an appraisal of the growing stock of wood by the different forest divisions in the state, by the forest types as well as species and by size categories. The survey FRS report observed that as bamboo flowering in Kerala had been widespread during 1959-66 and the

surveyors could observe old and new stock, the "estimated growing stock did not indicate a stable situation and had to be taken with caution" (FRS division report 1971).

Based on the two surveys, the FRS division estimated a total growing stock of 1.4 million air-dried tonnes of bamboo and 4.6 million air-dried tonnes of reeds in the Kerala forests in the government-owned forests of Kerala. The growing stock of bamboo in the vested forest of Kerala was guesstimated to be 4,00,000 air-dried tonnes.

As bamboo from the Periyar Wild Life Sanctuary (Periyar Tiger Reserve) was not utilizable for industrial use, the net growing stocks of bamboo and reed were estimated to be 13,94,000 tonnes of bamboo and 43,20,000 tonnes of reeds.

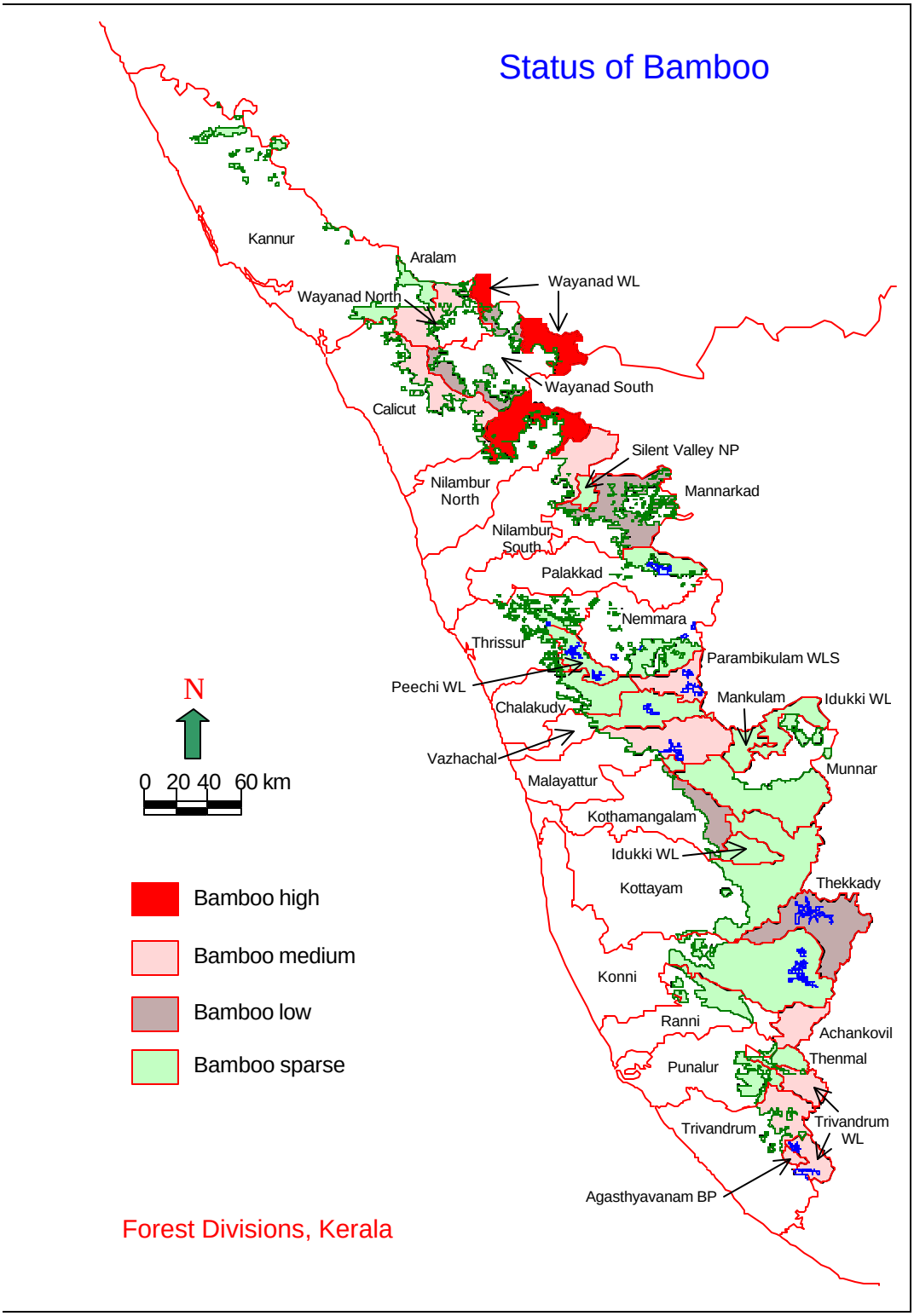
KFRI's assessment 2001:

The most recent survey to assess the strength of the bamboo and reed stock in the Kerala forests was conducted by KFRI scientists Nair P.V, Menon A.R.R and Krishnankutty C.N, who used remote sensing techniques and field visits. According to the report (Nair *et al* 2001), multi-spectral images from IRS 1C provided sufficient spatial resolution to identify entire plant communities in the study area. Bamboo was classified into three density categories high, medium and low. The area of bamboo in each of these density categories was determined through analysis of satellite images. The area was converted into quantity through factors established by field sampling.

The study found the maximum quantity of bamboo in the Olavakkode region (34 per cent) out of the five regions in the state. Most of the bamboo in this region was in Nilambur North and Nilambur South Forest Divisions and the Parambikulam Wildlife Sanctuary.

This was followed by the Northern region (30.70 per cent) that comprised of the Northern Circle and the Wayanad Wildlife Sanctuary. The Southern region came third with 21.70 percent of the growing stock of bamboo. In the southern region, the Trivandrum Wildlife Division, Trivandrum and Achenkovil Forest Divisions contributed the maximum. The Central region and the High Range region contained 8.9 per cent and 4.66 per cent of the bamboo stock in the state respectively. In these cases also the Wildlife Sanctuaries/National Parks of the region were included.

Figure 3 Status and distribution of bamboo in Kerala forests as per 2001 study



Source: KFRI

The study calculated the total bamboo stock in the state to be 2.63 million tonnes. This was much higher than what was reported to be available in 1973 (1.4 million tonnes).

The major conclusion that can be arrived at from the KFRI study that there has been a near doubling of bamboo stock in the forests of Kerala between 1970s and 2000, could naturally raise many eyebrows. Several field reports in the interregnum have mentioned widespread destruction of bamboo across the state. The pulp industry, mainly Grasim Industries, has time and again raised complaints regarding non-availability of bamboo from its catchments.

Table 20 Estimation of distribution and stock of bamboo in Kerala forests: 1973 and 2001

Forest regions	***Forest Divisions***	***As % of total stock estimated in 2001***	***Approximate quantity of stock (in tonnes)***	**Estimation of stock in 1973 (in tonnes)**	**Difference between estimates in 1973 and 2001(in tonnes)**
Olavakkode			**7,02,210**	**2,25,000**	**4,77,210**
	Nilambur north	15	3,94,500		
	Nilambur south	5.7	1,49,910		
	Parambikkulam WLS	6	1,57,800		
Northern Region			**5,65.450**	**2,32,000**	**3,33,450**
	Wayanad North	5.3	1,39,390		
	Wayanad WLS	16.2	4,26,060		
Southern Region			**3,51,894**	**7,34,000**	**(-) 3,82,106**
	Trivandrum WL division	2.68	70,484		
	Trivandrum	2.8	73,640		
	Achenkoil	7.9	2,07,770		
Central		8.9	**2,34,070**	**1,29,000**	**1,05,070**
High Range		4.66	**1,22,558**	**1,20,000**	**2,558**
	Other scattered forest divisions	24.86	**6,53,818**		
Total		**100**	**26,30,000**	**14,40,000**	**11,90,000**

Source: Recalculated from percentage figures given in the KFRI study and Report of Forest Resources Survey 1971-72, KFD.

Supplies from the KFD to the industrial users of bamboo had shrunk considerably over the three decades. The KFD itself, in its Project Implementation Plan document of its prestigious (because it is World-Bank funded) Kerala Forestry Project, July 1998, had observes that "quantities of bamboo and reed annually harvested (from the forests in Kerala) had a level of 40-50,000 tonnes for bamboo and 80-1,00,000 tonnes for reeds." Even these levels were "likely to lead to depletion because sound silvicultural and management practices were not strictly applied," the document had admitted. Then, how come such a drastic increase in the stock in the KFRI study?

This paradox remains unexplained. One plausible argument, often put forth by forest department officials, is that the stock of forests have increased following the adoption of forest conservation measures in the wake of the Forest Conservation Act 1980. But there is little data or any field report to substantiate an improvement in the management of the bamboo forests in Kerala.

Another explanation could be that the study mapped a situation following the stoppage of extraction of bamboo by Grasim Industries, the monopoly consumer and the major destroyer of bamboo in the Kerala forests. Data on raw material procurement by the Mavoor unit provided by Grasim in its closure notice in August 1999 shows that throughout the 90s (except for the three years 1992-93, 1994-95 and 1997-98) it had consumed more eucalyptus than bamboo (Grasim 1999:Annexure IV, Page 2). And during the period 1994-95 to 1997-98, the company had not collected the total quantity of raw materials allotted, as reported by CCF (Protection), KFD, to the Government Secretary, Labour and Rehabilitation Department, who rejected the company's petition for closure (Dept. of Labour 1999). "Bamboos go into hibernation and revive to their old glory once over-felling ceases," claims Savur (2003:I:215), pointing out that this has happened in East Bengal after the partition of Bengal (which left all the mills in the West Bengal and the bamboo, in the East) and in Karnataka after the state government imposed a ban on bamboo felling by the pulp industry in 1992.

Another equally valid explanation could be that the tools adopted for the study might not have been perfected to give accurate results. The authors of the study were in fact working for some time on evaluating the potentiality of remote sensing data in the estimation of natural resources and land cover mapping of natural forests of tropical belt. "The remote sensing data in the form of large-scale aerial photographs were used on an *experimental basis* (emphasis added) to stratify the bamboo area in the natural forests of Western Ghats region, aiming at the identification and stratification of bamboo area with respect to density and height classes," Menon, the co-author of the study, had explained in an earlier paper describing the research project when it was in an initial state (Menon 1991).

The present study, a sequel of the project mentioned in Menon (1991), could very much have remained *experimental* in nature. In such a situation, the application and the efficacy of the method could have been more important than the accuracy of data generated or results arrived at. In a computer based GIS, geographic data are represented as points, lines and areas or as attributes of grids. The data may be stored at a high level of detail and then plotted at a more general level and at a different scale. The locations are recorded in terms of a coordinate system like the latitude/longitude. Here, "some data may be accurate within meters while other data may be accurate to 100 meters," according to Nair PV, the principle author of the study. This explanation could probably give an indication of the problem of accuracy in the use of satellite imagery for assessing natural resources. Some scholars have even gone to the extent of doubting the efficacy of using satellite imagery to map bamboo in a forest because bamboo grows mostly as an under-story plant. The still unsettled controversy regarding the wide disparities in the different assessments of the forest cover in Kerala, which had partly to do with the methods and technologies used for the assessments, is a similar case worth mentioning here.

Bamboo in the homesteads:

A KFRI study (Krishnankutty 1990) had projected a stocking of 39 million culms equivalent to 2.5 million tonnes of bamboo as the availability from the homesteads in Kerala. Through a sample survey, conducted with its samples chosen from 30 villages in central Kerala, the study had gathered information on the extent of area occupied

by bamboo in the homesteads, its stocking, density and availability as well as the quantity of bamboo used for construction and other purposes by the households. The results of the survey indicated that bamboo occupied an area of 581 ha with 39 million culms in the homesteads. The harvest during the year 1987-88 was estimated to be 9.1 percent of the growing stock. It also revealed that the quantity of bamboo used during 1987-88 was around 3.2 million culms mainly for house construction and as a support for the banana crop.

In the homesteads in Kerala, bamboo is either found mixed with a large number of other species of trees or purely in patches. The most common species of bamboo found in the homesteads of Kerala were *Bambusa arundinacea*, which was widely distributed and frequently cultivated. *B. vulgaris* and *Dendrocalamus strictus* were also found in homesteads.

Reeds: the resource base

The FAO sponsored Pre-Investment Survey report of 1968 had assessed that there were 10,000 sq. km of reed forests in the State with an annual availability of 5,00,000 metric tonnes of air-dry reeds (Asari, 1978). This was later found to be a wrong assessment as the total area under forest was only 9,400 km^2 during 1973 and this included plantations, high elevation forests, dry forests and grasslands which did not support reed growth.

Subsequently the Forest Resources Survey conducted by Chandrasekharan (1973) estimated the total reed area in the state as 185 km^2, with a growing stock of 45,60,000 tonnes. The allowable annual cut was prescribed as 2.45 % of the growing stock i.e., 1,12,000 tonnes (air dry) (Chandrasekharan, 1973).

On the basis of another survey, the reed areas were reassessed as 869 sq. km (Asari, 1978). Detailed survey was conducted in the reed catchments earmarked for Kerala News Print Project in 1977-78. This survey revealed 717 km^2 of reed areas falling under three categories, viz. scattered distribution 351.45 sq. km, dense occurrence 325.875 sq. km and pure reed areas 39.6 sq. km. The yield estimated from the above was 1,89,000 tonnes of green reeds per annum. Taking into consideration

all these previous surveys and the existing field conditions, the Department of Forests assessed the availability of reeds in Kerala as 3,50,000 tpa (air dry).

At this point it is also to be mentioned that the total forest area lost between 1940 and 1970 amounted to 3,450 sq. km (Chandrasekharan, 1973). Subsequent rough estimates collected by the Hindustan Newsprint Ltd. reveal that from 1970 to 1990 the total reed area lost permanently was 55 sq. km. Around 50 km^2 was found to be degraded due to poor regeneration as a result of gregarious flowering 1980's (in Malayattoor and Vazhachal Divisions). About 100 sq. km area fell within the Wildlife Sanctuaries and National Parks, with the result the extraction of green reeds had to be stopped in order to conserve fodder for wild elephants which otherwise very often caused crop damages.

The total requirement of reeds for the large-scale industries was estimated to be 2,74,000 tpa while the requirement for the traditional sector under the Bamboo Corporation was thought to be 30,000 tpa. The direct use for traditional workers near forest areas, clandestine collection, collection for household purposes etc. was estimated to be approximately 10,000 tonnes (Basha 1991). As against the total requirement of 3,14,000 tpa the actual collection always remained much less. Pointing out that "in spite of the intensive collection made by different agencies, it was difficult to attain even 50 per cent of the requirement," Basha has said that "the reed resource was not rich enough to yield even 3,04,000 tonnes per annum not to speak of 3,50,000 tonnes as assessed by the Department" (Ibid).

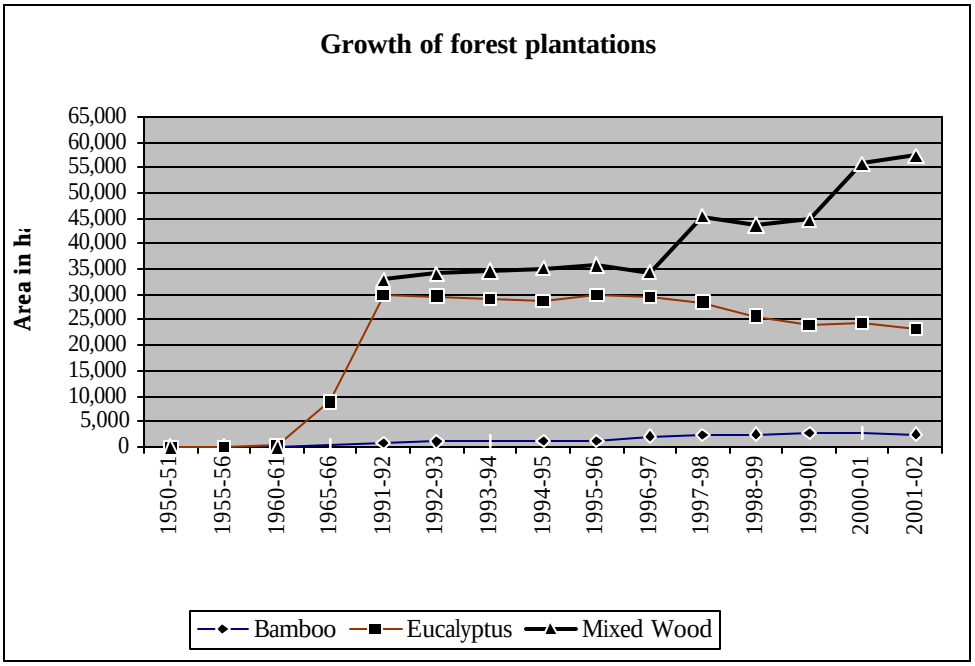
Resource augmentation

Large-scale industrial utilisation of bamboo had started in the country on the assumption that bamboo would be available *"in perpetuum"*. "Bamboo is annually reproductive and, therefore, there is no risk of depletion of the economically exploitable areas at any time," an article on the "National and Imperial Importance of the Bamboo Pulp Industry' published in the *Indian Forester* in 1927 had claimed. It only took a few decades to realise that unless concerted measures were taken to protect the bamboo forests against overexploitation of resources as well as adverse impacts such as fire hazard inadvertently introduced along with human interference in the natural bamboo stands the resource base could neither be protected nor expected to provide sustained yield.

Basically there are two methods for augmenting forest resources, either through natural or assisted regeneration in the natural stands or through setting up plantations of the required species. Foresters have by and large preferred the latter. The preference for plantations have several reasons such as lower infrastructure and supervision costs as well as amenability to advance planning and the centralised system of forest administration. In contrast, natural regeneration calls for constant vigil and tending as well as more decentralised interventions informed with knowledge of local ecological conditions and hence entails more outlay on labour and supervisory staff (Chundamannil 1986). Forest Working Plans show that efforts for artificial planting of bamboo in forestlands in Kerala had begun as early as in 1886 when *Dendrocalamus longispathus* and *Ochlandra brandisii* were planted in Konoth Reserve in British Malabar. But these bamboo forests flowered and died leaving just six ha of bamboo plantation in 1930 (Chandrasekharan 1973). Since then there appears to have been no concerted effort to grow bamboo until 1960s when, in the five years between 1960 and 1965, 180 ha of bamboo plantations were raised.

Bamboo plantations: The track record of KFD in setting up plantations of bamboo to

Figure 4 Growth of forest plantations in Kerala



augment the dwindling resource base in the natural stands has been poor, especially when compared to other species of forest plantations and also the potential in bamboo. The actual addition of bamboo area pales into irrelevance compared to the

fascinations for eucalyptus, the area under the latter shooting up from 275 ha in 1960 to 8,895 ha in 1965. The area under bamboo plantations grew only at an annual average of 181 ha between 1991-92 and 2001-02. In fact the bamboo plantation area dropped by 221 ha in 2001-02 compared to the previous year.

The 1959 bamboo survey, which provided the 'scientific' basis for setting up the Grasim Industries unit at Mavoor, had banked much on the hope improving the annual natural regeneration rate and consequently the yield of bamboo through scientific management. The foresters who conducted the survey expected the annual regeneration in bamboo forests to go up to 33 per cent of the growing stock against the actual regeneration of 8-10 per cent of the growing stock observed in the Nilambur forests. While there have not been any serious attempt to assess the regeneration of stock in the natural bamboo stands in the Kerala forests since then, the ground reality has been that large tracts of bamboo forests were wiped out immediately after extraction began, either by gregarious flowering or by forest fires or by both, leaving very little regeneration.

There are no conclusive data on the productivity of bamboo in the forests or the plantations in Kerala. The Kerala Forestry Project Appraisal Report states the average productivity of bamboo culmns in Kerala to be around 2 tonnes per ha per year. This could be just one-tenth of the potential yield in bamboo. According to Hunter and Junqi (2000) various studies had found quite a varied range of *total* biomass productivity in different species of bamboo: 114.8 tonnes/ ha for *Sasa kurilensis*; 143 tonnes/ha for *Bambusa blumeana*; 146.8 tonnes/ha for *Gigantochloa levis* and 136.8 tonnes/ha for *Phyllostachys bambusoides*, 100 tonnes/ha for *Arundinaria alpina*, 43.2 tonnes/ha for *Phyllostachys pubescens* in Taiwan. One of the highest total biomass production figure per ha was that claimed by Shanmughavel and Francis (1996) -- 122 tonnes per ha (at 4 years age), 225 tonnes per ha (at 6 years) and 287 tonnes per ha (at 8 years) for *Bambusa bambos* in India.

Comparing such results of bamboo productivity studies from different countries for different species of bamboo, Hunter and Junqi have suggested that bamboo could produce "between 10 and 20 tonnes /ha/year of biomass from the *culms*." According to the two scholars, growth rates between 10 and 30 tonnes per ha were not exceptional amongst woody biomass species.

Where bamboo scored over several other species of forest trees was on the fact that the total biomass generated by bamboo from its leaves, branches, stems (culms), coarse roots (rhizomes) and fine roots – all of which could be put to one use or other, was considerably higher.

Failure of Eucalyptus plantations:

Quoting Kulkarni and Seth (1968), Chandrasekharan (1973) had claimed that the forests in Kerala ranked above other states in the country on the Paterson's Index or the Potential Productivity Index. The potential for wood production in Kerala was put at 10.76-11.98 cubic metres per ha for natural species against 7.70-8.35 in Uttar Pradesh (UP) and 8.35-9.37 cum/ha in Assam. In the case of exotic species, the productivity potential was estimated to be 23 cum/ha in Kerala in comparison with 17 cum/ha in Assam and 15 cum/ha in UP. Technical improvements and adoption of proper exotic species of wide adaptability was expected to bring productivity range four times that indicated by Paterson's Index.

The planting of the exotic, so-called 'fast-growing' species including eucalyptus had begun in Kerala during the Second Five year Plan (1956-1961) based on FAO expert J. Von Monroy's "reckless advice" (Savur, 2003:II: 691) to Government of India to clear-fell one per cent of the most productive forests in the country or 1,50,000 acres (62,500 ha) every year for 10 years to be planted with eucalyptus so as to ensure 4.5 million tonnes of industrial raw material from 1975 onwards. Even before Monroy's prescriptions were swallowed by GOI, i.e., as early as in 1955, yet another FAO expert, Sukam Thirawat, had raised the alarm bell against eucalyptus in India, points out Savur (Ibid: I: 24).

Most of the assumptions behind the FAO-GOI sponsored eucalyptus plantations in India would be proven wrong later and even FAO would turn full circle to acknowledge the multiple virtues of bamboo (against just the pulp-making quality of bamboo which impressed FAO in 1953). But, any way, during the Third Five Year Plan (1961-66) and the subsequent three annual plans the KFD had uncritically gone about expanding eucalyptus plantations in Kerala, putting as much as 55 per cent of the total investment in plantations on eucalyptus. During the same period, only less than one per cent of the total annual expenditure (or less than one per cent of the total

revenue from forest timber) was allocated for natural regeneration in felled forests (Chundamannil 1986).

How unrealistic, unscientific and costly the projections and hopes related to scientific forestry were have been exposed by studies on the growth of eucalyptus in Kerala. According to Krishnankutty and Chundamannil (1986) the average mean annual increment (MAI) achieve d by eucalyptus plantations in Kerala was in the range of "3.3-6.3 cum per ha, falling far short of the minimum MAI required (10 cum/ha) for a fast growing species." Only two plantations in Munnar out of 70 studied by the authors could achieve a MAI of more than 20 cum per ha as predicted by Kulkarni and Seth. "Although the Paterson's Index is cited in several forest planning documents, we are at a loss to understand where exactly this index is applicable," the KFRI researchers had wondered.

Partly due to the failure of the eucalyptus plantations to achieve the target yield and partly on account of the changes in the forest policy since 1980s, area expansion under eucalypts was stopped, providing greater importance to plantations of mixed wood species.

Resource augmentation in natural stands: Nair (1984) has pointed out that although regeneration operations formed an essential component of any silvicultural system and were introduced in the working plans as early as in 1923, it got only scant attention under the selection felling system practiced in Kerala. He found the assumption that gaps created by felling of mature trees would be closed naturally by regeneration during the interval between two successive fellings to be unfounded because of absence of efforts to plant new seedlings and saplings, heavy damage during felling operations to poles as well as saplings and even unmarked mature trees and high degree of competition from coloniser species which come up in the forest openings. The area treated under 'intensification of management' was limited to a small fraction of the area subjected to felling. For instance, between 1975-76 and 1980-81 a total of 4,925 ha area of forests were felled in the Ranni Forest Division and only 90 ha were regenerated. In the Thenmala Division, the average area taken up annually for regeneration was about 50 ha while selective felling was carried out in 400-500 ha in a year (Ibid: 99).

The forests in the Muthanga Wild Life Sanctuary in Wayanad district provides an illustrative example of the folly of first converting rich bamboo forests into monoculture plantations of eucalyptus and then trying to regenerate a natural forest. The bamboo survey conducted in 1959 had found that the forests under the Muthanga, Padiri reserve and Kuppady ranges in Wayanad were very good in bamboo stocking. The bamboo in the 202 acres (84 ha) of bamboo area in the Muthanga Reserve Forest exhibited one of the highest yields of around 3.30 tonnes per acre (nearly 8 tonnes per ha). But these stocks of bamboo were soon wiped out due to heavy industrial extraction of bamboo (at the rate of an average of 40,000 tonnes per year from Wayanad forests which included wild life sanctuary areas) and extensive flowering in 1962-1967 and 1990-94. Between 1950 and 1982, the forest cover in Wayanad decreased by 1086 km^2 and the plantation area increased by 468.82 km^2 (Easa 1999). As the total forest area rapidly shrunk, the pressure on the remaining forests from the people and their domestic animals increased as also the conflict between the people in the forest settlements and the wildlife, especially the elephants, increased.

In the two decades 1960-1980 large tracts of deciduous forests in Wayanad including the areas cleared of bamboo were planted with eucalyptus. The total extent of eucalyptus plantations within the Wayanad Wildlife Division amounted to 1444 ha. "The floral diversity in the standing eucalyptus blocks was almost nil," admitted the Wayanad Wild Life Division Working Plan for 2002-2012. Under pressure from local environmental groups as well the compulsions of Forest Conservation Act 1980, the KFD later made some attempts to reconvert 1097.920 ha of eucalyptus plantations into natural forests through enrichment planting of natural tree species including *Dendrocalamus strictus, Terminallia bellerica, Pongamia pinnata and Emblica officinalis.* But due to several reasons including "heavy weed infestation in the open patches and recurrent wild animal damage," the re-forestation effort failed miserably.

The ecological and social disasters that accompanied the destruction of the natural forests in Muthanga need mention. "The most ecologically disastrous single act in (the history of) Kerala was the conversion of natural forests into eucalyptus plantations," according to Wayanad Prakriti Samrakshana Samithi (1988). "Setting up eucalyptus plantations destroyed over 10,000 acres of wet paddy lands within and around the forests in Wayanad, adversely affecting the livelihood sustenance of over a lakh local people including adivasis and also the survival of wild animals" (Ibid: 7).

After the conversion of natural forests into plantations, "there were no natural forests left in the forests in Karadimunda (1304.93 ha), Maragatha (2055 hectares), Thottamoola (1961.68 hectares) and Noolpuzha (2017 hectares) within the Muthanga Forest Range and nearly 3,000 ha of forestland remained completely barren," according to C.K. Janu and M. Geethanandan, the leaders of the Muthanga adivasi uprising in February 2003.

Converting natural forests into eucalyptus plantations had also caused eviction and displacement of large number of adivasis from Muthanga forests. The recent adivasi struggle in Kerala which sought to re-occupy the forests within the Muthanga Wildlife Sanctuary demanding "social justice, rights over resources and right to self-rule" for the adivasis had also prepared tentative plans to revive the dead streams and the barren forestlands through collective action (Janu and Geethanandan 2003). But the agitation was brutally suppressed by the state government.

Forest fires:

A major reason for the decline in bamboo yield from the forests, according to foresters, is the recurrent damage to the stock caused by forest fires. KFD's administrative report for 1963-64 had recorded "14 wild fires in Kozhikode division where 2083 acres of teak, 105 acres of softwood plantations and 7.8 lakhs of bamboos collected by Gwalior Rayons were burnt away." In another incident of fire that burned down 10,000 acres of forests in Wayanad, around 3,000 tonnes of bamboo extracted by Gwalior Rayons was lost. Researchers as well as foresters have associated such unprecedented forest fires with the harmful extraction practices adopted by Grasim. "The year in which these forest fires occurred was the year following the starting of production in the (Grasim) factory," Sridhar (2000:18) had noted, suggesting that the company caused the forest fires by negligence of felling prescriptions and even by deliberate design. "Raw material shortages in the allotted area as well as frequent losses of collected material due to fire were some of the many reasons why Grasim was always given more areas" (Ibid). "Adverse interference in the stock of bamboo was a foul game that Grasim played to get eucalyptus," according to C.K Karunakaran, retired Chief Conservator of Forests, who was in charge of the Kozhikode forest division during the 1960s (Karunakaran 1999).

Debate over bamboo flowering

That bamboo flowered extensively in India during the 1950s and 1960s is a fact borne out by several reports. For instance, it has been reported that nearly 55 per cent of the total productive bamboo forests of Madhya Pradesh, in comprising an approximate area of 8,595 km ^{2} died out after gregarious flowering (ICFRE and INBAR 1998). Again, there have been a number of reports on bamboo regenerating in forests after stoppage of intensive extraction by the PPI. Nevertheless, it is a matter of debate whether the PPI was just reaping the windfall of bamboo flowering or was, in fact, the *agent provocateur* of flowering in the bamboo forests in India. Concluding her extensive study of bamboo forests and the utilization of bamboo by the PPI in nine states in the country, Savur has put forth the hypothesis that a combination of overfelling and wrong felling practices caused gregarious flowering and death of bamboo, a defensive reaction by the plant to propagate the species (2003:II: 688). The author has argued that mutilations of the culm, overfelling, wrong felling and introduction of the unnaturally short felling cycle of three or four years all constituted abiotic "stress beyond its tolerance point," similar to biotic stresses caused, for instance, by drought. Such stresses have been known to cause gregarious flowering, according to the author.

Forest fires also can provoke bamboo to flower. While "the bamboo forests usually had a greater tolerance to fires than other forests, …efforts should be made to prevent fires, because burning would stimulate bamboo flowering," says a Chinese report (Zhu Zhaohua 2001). The forest managers and scientists consider bamboo flowering as a botanical enigma. "Several theories exist concerning the causes of flowering but all are without any experimental proof or any other evidence," remarks Sharma (1991). Nevertheless, reports indicate that traditional knowledge of people who have had a long history of association with bamboo has sometimes succeeded in controlling bamboo flowering. A case study of bamboo in Anji County in China reports that gregarious flowering in moso (*Phyllostachys pubescens*) bamboo has not been reported in the county since 1601 (Belcher 1999).

Distribution of bamboo and reeds from Kerala forests

The value of bamboo as a commercial crop seems to have been recognised in Kerala as early as in 1840s when bamboo was sold from the forests in Travancore for a price of Rs. 0.50 for 100 numbers (Karunakaran 1985: I: 80). In 1890 the rate was raised to Rs. 1.25 per 100 bamboos. According to Chundamannil (1988), another early instance of applying a price on bamboo was when the Travancore Princely State introduced the Puduval Rules in 1932 for assigning forestlands for cultivation and sold off mature bamboo in the forests for a price of Rs. 3 for every 100 culms.

Nevertheless, the forest laws allowed certain concessions and privileges on forestlands and forest produce to certain user-groups. The Administrative Reports (ARs) of the Kerala Forest Department distinguish between four types of users of bamboo and reeds, viz., 'Government Agencies', 'private purchasers', 'Free-grant Holders' and 'Rights Holders'. Forest resources made available to these different categories of users used to be shown in the annual ARs. It was customary for each AR to mention that "the *bona fide* uses of agriculturalists and other consumers were met by collections made on the strength of seigniorage passes." However, in reality, very few entries have been recorded in the ARs against supply of bamboo and reeds to either 'free grantees' or the 'right holders'. For instance, in the 15 years between 1963-64 and 1977-78, the Government had recorded supply of bamboo to the 'right holders' only in three years. In 1963-64, a quantity of 54,500 numbers (or 3406.25 tonnes, assuming that the supplies were of full bamboo and 16 bamboos weighed one tonne) valued at Rs. 47,624 was supplied to right holders. In 1964-65, a quantity of 57,200 numbers (or 3,575 tonnes) valued at Rs. 78,276 and in 1969-70, small bamboo numbering 10,000 that fetched only Rs. 108.15 as revenue were similarly given to right-holders. (Administrative Reports, various years, Kerala Forest Department). Thus the total supply to 'right-holders' for these 15 years would not have been more than 7,606 tonnes or an average of 507 tonnes per year amounting to 0.01 percentage of the total outturn of bamboo for the period.

Even though the system of seigniorage passes and supplies to the 'right-holders' were retained in principle, it was not rigorously implemented. A senior forest official has admitted so much that "the system was discontinued in the early sixties …to meet the commitment of supply to Gwalior Rayons and HNL" (Surendranathan Asari,

Principle Chief Conservator of Forests, Government of Kerala, in *Status of Bamboo Resources in Kerala* , seminar paper, KFRI, date unknown).

Interestingly, detailed charts on bamboo sold in different size classes (e.g. 30 ft., 20-30 ft. etc.) and classified according to the portion of the bamboo (top, bottom, branches or leaves) as well the price realised for each category used to be recorded meticulously in the ARs from the days of the British rule. For instance, the AR of the forest department under the then Travancore-Cochin Government for the year 1948-49 shows a supply of 774 numbers of 'complete' bamboo, 24,670 numbers of 20 ft. basal portion of bamboo, 400 pieces of *kambayeni* (ladder) bamboo, 123 pieces of *vazhathandu* (banana prop), 500 pieces of lathi bamboo (policeman's stick/baton), 2125 numbers of '*chillies*' (branches) and 1,152 head-loads of bamboo thorns. This shows that such varied uses of bamboo were acknowledged initially and supplies were allocated from the government forests in order to meet them. It was only much later, i.e., after the volume and nature of consumption of bamboo changed drastically with the arrival of the prime industrial consumer, the Pulp and Paper Industry (PPI) that this accounting system seems to have been dropped. The size, part or age of bamboo, properties that are of great importance to several types of uses and categories of users became immaterial since then because the industry cared only for the tonnage of the pulping material and not for the intrinsic qualities of bamboo or its varied rural applications.

Systems for supply/extraction of bamboos and reeds:

Bamboos and reeds being plants primarily growing in forest areas, their management has hitherto been a component of the forest management systems that prevailed during different times throughout India. The early commercial and industrial orientation of forestry operations, forest laws and forest policies in colonial and independent India has been highlighted by several studies (for instance, Shiva et al. 1991:17). Many authors have also scrutinized the nature, scope and extent of various concessions and privileges on forestland and forest produce granted to different groups of users. Nevertheless, it remains a matter of debate whether the demands of the rural population or the demands of the industry influenced the pattern of utilization and, consequently, the management of forest resources to a greater degree. Representatives of the industry have argued that the growing rural population and their demands for forestland and forest produce as well as the governments' demand

for settling landless people in the forest areas have had a greater impact on forest management priorities rather than meeting the timber needs of the forest-based industries (MOEF, 1999).

Despite forests initially being in the 'state list' and the states enjoying some amount of freedom to govern the forests coming under their territorial jurisdiction, the policies and strategies for managing forests in general and bamboo resources in particular have remained tied to larger 'national' goals and developmental strategies. Again, despite the Ministry of Agriculture holding charge over the forests for a long time after Indian independence, there have been no effort to look at bamboo as a highly renewable crop that can yield rich, multiple dividends.

Until demand arose from the organized industrial units and a market was thus established for bamboo, there were several different systems in place in Kerala for supplying forest timber including bamboo to the varied user groups. These included the permit system, the contract system, the depot system, the departmental system, the quota system, leasing out of extraction areas, auctioning of coupes, the head-load pass system and so on. The forest laws and the prescriptions of the Working Plans (WP) for each forest division governed the adoption of these modes of resource supply.

Working systems: With regard to the actual mode of 'working' the forests (felling and removal of trees being its core components and protection and regeneration being supplementary) many options had been tried during the colonial days in order to make maximum commercial gains from the forests. Giving permits to individuals or companies to remove fixed quantities of trees and other forest produce earmarked for annual extraction was one such system. Often the forest and/ revenue departments had carried out felling using hired labour. Under the quota system, forest areas were often assigned to private sector companies for carrying out extraction and removal of fixed quantum of raw materials and supply of the excess quantities, when available, to the government.

Apart from these systems applied in the case of industrial consumers of bamboo, *bona fide* local users and traditional artisans have been permitted to draw a fixed quantity of bamboo every year using head-load passes. Despite a history of trying out such

different systems, the dominant one in Kerala till 1958 seems to have been auctioning of whole coupes to the highest bidders. The relative merits or demerits of different options do no appear to have been weighed properly before entering into long-term contracts with the pulp and paper industry.

Under the permit system, the consumers had to apply in advance, specifying the quantity required, paying a fixed sum of money as seigniorage rate, and get a permit from the conservator of forests. This was in practice in the Travancore state quite early where the seigniorage rate was fixed initially on the basis of the number of the trees extracted. In 1840, bamboo had been sold from the forests in Travancore for a price of Rs. 0.50 for 100 numbers (Karunakaran 1985: I: 80). In 1890 the rate was raised to Rs. 1.25 per 100 bamboos.

Forest-based industries in Kerala:

Forests and forest-based industries had played an important role in the economy of Kerala ever since the colonial period. Apart from the cash crop plantations established within forest areas providing huge revenues to the colonial coffers, timber from Kerala forests, especially teak, had met the needs of British Navy and the Railways. The *Raja*s of the times too had nurtured the forests as a source of revenue. Out of the total revenue of Rs. 225.40 lakhs earned by the Travancore princely state in 1931, the timber industry's contribution was the second highest at Rs. 43.90 lakhs, after Rs. 78.20 lakhs contributed by textiles (Namboodiripad 1948:245). Forest-based industries were encouraged in Travancore quite early and the first law enacted in Travancore for setting up joint stock companies in 1887-88 was to facilitate the establishment of the Punalur Paper Mills (Ibid: 231). The *Travancore State Manual* reported that the objective of establishing PPM was to "utilise the large volume of raw material that was being wasted."

Beginning with the Standard Furniture Company established in 1920 (it started production in 1937), a large number of plywood manufacturing companies including the Government-owned Travancore Plywood Industries at Punalur had also set up units in Kerala (Chundamannil 1993: 68-69).

Despite these early forays, the forest industries sector in Kerala remained dominated by primary processing units and poor technology upgradation. There was a "preponderance of small-scale units, especially in the matchwood, plywood and saw

mill industries," according to Nair (1984). There were also many forest-based industries manufacturing furniture and fixtures, pencil, bobbin, wooden toys, handicrafts etc. Most of these were in the household sector.

Until the formation of the Kerala state in 1956 the forest-based factories in the erstwhile Malabar region used to obtain their raw materials from the private forests and those in Travancore-Cochin states were supplied resources from the reserve forests. Later, supply quotas were fixed for the plywood industry and long-term agreements signed with the PPI units.

Plywood Industries

Kerala's share in the plywood production in the country had been substantial, amounting to 19.20 per cent in 1973-74, though this declined to 17.2 percentage in the next two years (Nair 1977:8). According to the study, wood availability, a major factor contributing to the growth of the plywood industry, had not received the attention it deserved. The system of supplies through annual quotas was saddled with problems such as delay in allotment, inadequate and uncertain supply due to inaccurate estimate of availability of resources. The plywood unit in Kerala, especially the smaller ones, had often expressed concern at being discriminated against (in comparison with the pulp and paper industries) with regard to raw material supplies.

Table 21 Timber supply to plywood units in Kerala *(In tonnes)*

Year	*Quantity allotted*	*Quantity actually obtained*
1973-74	62359	46403
1974-75	59042	45699
1975-76	47952	37892

Source: Nair (1977)

The government monopoly over forests, especially after the implementation of the Kerala Private Forest (Vesting and Assignment) Act 1971 had forced many plywood units in Kerala, especially the smaller ones in the erstwhile Malabar region which had depended solely on wood from private forests, to close down for want of raw materials.

Pulp and Paper Industries:

Punalur Paper Mills

The Punalur Paper Mills (PPM) consuming mostly reeds (*Ochlandra travancorica* and *Ochlandra rhedii*) was set up at Punalur by the Travancore Paper Mill Company in 1890, soon after the first mechanised pulp mill of the country, the Bally Paper Mills, Hooghly, Bengal, began production in 1870 using the imported Fourdinaire machine. The PPM plant, situated on the banks of the Kallada River had an installed capacity of 50,000 tpa and initially consumed only reeds collected from the government forests on the basis of a long-term agreement (LTA) with the princely state of Travancore and later with the Government of Kerala.

In 1968, the mill was bought over by Dalmia, one of the six Indian big businessmen who penetrated into the British monopoly over the pulp and paper industry (PPI) in the country during the 1930s. Initially, the "mill's annual consumption used to be 750 tonnes which it extracted by clearfelling reeds, totally disregarding the need for either rotation or selection felling," records Savur (2003:Vol.III: 529). According to the author, the extraction of reeds by PPM damaged the forests of Punalur, Thiruvananthapuram and Thenmala "beyond repair". The area for reed extraction was then shifted to Adimali and Pooyamkutty as the mill's raw material requirement rose considerably. Recurrent addition of capacity, diversion of reed-bearing areas for other uses and growth of other reed using industries enhanced the gap between demand and supply of raw materials. Non-availability of reeds led to increasing substitution of reeds with eucalyptus.

As per the 10-year LTA signed on October 17, 1941, the government had to supply PPM with 2,500 tonnes of reed in the first two years and 3,500 tonnes each in the subsequent eight years (Karunakaran 1985). The Shendurni forests were reserved for meeting this supply. The seigniorage rate for reeds payable by PPM was then Rs. 2.75 per tonne. The total raw material requirement of PPM rose to 33,000 tpa in 1972 to 50,000 tpa in 1975 and still further to 85,000 tpa in 1982. As per the 10-year LTA signed in 1982, the Government had to give the company 85,000 tonnes of reeds and 40,000 tonnes of eucalyptus. The royalty charges to be paid by the company were in accordance with the Kerala Forest Produce (Fixing of Selling Price) Act. "In the pulp and paper industry, installed capacity has been increased without due consideration of

sustained availability of raw material leading to demand-supply imbalance" (Nair, Chundamannil and Muhammed 1984:24). By the time PPM was permanently closed down in 1986 on the orders of the Bombay High court after the company defaulted on payment of dues to the financial institutions, the government's annual raw material commitment (as per LTA signed on 20-4-1982) to the company had gone up to 40,000 tonnes of eucalyptus and 85,000 tonnes of reeds.

Grasim Industries Ltd

Grasim Industries, earlier Gwalior Rayons Silk Manufacturing and Weaving Company, is the flagship firm of the Aditya Birla group, one of the largest and richest business groups in the country. Even before India became independent, the business group had gained much clout with the colonial government and the Indian National Congress that ruled the country after Independence. While the imperial FRI had discovered bamboo as a cheap raw material for pulp making, the Birlas claimed the credit for succeeding in using bamboo for the first time in the production of rayon grade pulp.

Soon after FRI's discovery, and feeling the threat of external competition, the British rulers had passed the Bamboo Paper Industry Protection Act. The Act worked as a double-edged sword making entry into the PPI sector difficult, but once the Indian bourgeoisie stood up to the challenge, the protective Act became a boon, according to Savur (2003:I: 77). Birla was one of the pioneers to take on the British monopoly, shrewdly choosing even to leave the group's base in Bengal to set up the Orient Paper Mill (OPM) in Orissa in 1936 where the forests were rich in bamboo and the Indian National Congress had much popular clout. Before 1950, the group set up two PPI units (OPM and Sirpur Paper Mills) and in the next two decades, three more units (in Kerala, Karnataka and Madhya Pradesh).

Long Term Agreements:

In order to assure continued supply of raw materials to the factories, the route adopted by the PPI was to sign long-term agreements with the state governments. In Kerala the first such agreement was signed between the Gwalior Rayons and the State government in 1958.

The Principal Agreement dated 3rd May 1958:

- The agreement provided the company with exclusive rights and license valid for 20 years to fell and remove bamboo from specific Contract Areas (CAs) in the Nilambur Valley so as to receive a supply of 1,60,000 tonnes of the raw material annually.
- It was further agreed that if the CAs in the Nilambur Valley assigned by the government were not sufficient for fetching a quantity of 1,60,000 tonnes of bamboo, the government would permit the company Additional Contract Areas (ACAs).
- Within the contract period, the government would provide separate leases for felling bamboo in excess of 1,60,000 tonnes in order to assist the company double its capacity, when required.
- The CAs and ACAs would be exclusively reserved for the use of the company. No other leases or concessions would be granted to any other person or company over any forest area in the Nilambur Valley (even outside the CAs and ACAs) for a period of three years after the Gwalior Rayons started operations in order to enable the company decide on going in for capacity addition. Even after these three years, any grant or concession in these forests would be granted to any other person or company only after the same has been offered to the Gwalior Rayons.
- In the CAs and the ACAs, the government retained rights over mines and minerals, trees other than bamboo, removal of bamboo for silvicultural purposes from a maximum area of 100 acres per year, extraction of bamboo for departmental works upto a maximum of 1000 tonnes per year and acquisition of land for developmental schemes such as dams etc. (the acquisition of which would be equally compensated in other areas).
- The company would be obliged to supply a maximum of 1,000 tonnes of bamboo per year to the existing local users at prices, which could be fixed by the company in consultation with the District Forest Officer (DFO).

- The company shall abide by the felling rules for bamboo. The felling rules shall be subject to modification by the CCF in consultation and in agreement with the company.
- The government shall provide the company other sites for erection of sheds, depots, storehouses, bungalows, staff offices etc. and such sites shall be rent-free.
- There shall be no rent payable for the CAs and the ACAs.
- The seigniorage payable for the bamboo extracted would be Re. 1/ tonne.

The contract was unscientific because, it was not based on any solid ground-level data on availability of bamboo resources in the contract area As we have seen earlier in the present report, the quantity of bamboo available in the entire Nilambur Valley forests at the time of signing the LTA was far short of the 1,60,000 committed. Nevertheless, the government promised to provide not just 1.6 lakh tonnes but actually double that quantity if the company chose to go in for capacity expansion.

The LTA was legally unsound because many of the forests proposed to be leased out to the company for extracting bamboo were not in the possession of the government but belonged to private owners.

The LTA not only reserved the CAs and the ACAs for the Gwalior Rayons; it also kept all the bamboo forests in Nilambur division virtually out of bounds for any other users and uses for the subsequent three years. Thus 4,615 ha of bamboo forests in Nilambur was exclusively reserved for a single unit producing 100 tonnes per day of rayon grade pulp.

The company was granted vital powers to modify the felling rules, the only system at the disposal of the government to prevent overfelling and ensure the renewal of the resource.

The LTA granted the company deciding powers over fixing the price for supply of bamboo to local users.

Apart from the CAs and ACAs, the company was provided further rent-free lands for setting up stores, sheds, depots, factories, bungalows etc.

The seigniorage rate fixed for the supply of bamboo was virtually a sell-out and amounted to just a token price fixed to overcome the legality which prevented the government from giving off the raw materials free of cost. Birla is said to have bargained much with the Kerala government for reducing the price of bamboo from Rs. 2 per tonne initially proposed by the Kerala government and bring it down to Re. 1 per tonne (Sridhar 2000:53). Needless to say, the rate was "one-to-two thousandth of the market price of bamboo" (Chundamannil 1993:48 quoting Gadgil [1991]), which then stood around Rs. 2000 per tonne. It was even less than Rs. 5 per tonne of bamboo that the British rulers had collected a century ago from the basket weavers during the days of Hugh Cleghorn, Conservator of Forests in Madras during 1850s.

The First Supplemental Agreement dated 6th August 1962:

- Extended the Additional Contract Areas to cover the Government Reserve Forests in the Forest Divisions of Wayanad, Palghat, Kozhikode and Nenmara.
- The quantity of bamboos allowed to be extracted was raised to 2,00,000 tonnes per annum in order to enable the company expand capacity.
- The 16 private forests in the Nilambur area earlier included illegally under the CAs were deleted.
- Government promised to permit the company to extract and remove further quantities of bamboo if available in the CAs and the ACAs for further expansion of capacity upto 200 tonnes per day of pulp.

The second supplementary agreement was the direct offshoot of the bamboo resource survey conducted jointly by the KFD and the company in 1959. The survey had found the resource base of Nilambur forests inadequate to feed the industry and hence suggested a larger catchment area. The agreement earmarked 2,00,000 tonnes of bamboo for Grasim out of 3,48, 435 tonnes of annual yield estimated by the survey to be obtained from the forests of the Kozhikode Circle.

Agreement on purchase of private forests dated 14th July 1965:

By this agreement, the government of Kerala permitted Grasim Industries to purchase 30,000 acres of private forests from the Nilambur Kovilakam for utilising the bamboo thereon and raising captive plantation of species suitable for the rayon grade pulp plant and such other factories the company may start in Kozhikode district in the

future. Signing the agreement with the government was to ensure that that latter would not take back the land for a minimum period of 60 years. (However, despite agreeing to the condition, the government went on to vest these lands following the enforcement of the Kerala Private Forests [Vesting and Assignment] Act, 1971).

The agreement also stipulated that the quantity of raw material collected or raised from the land would be reduced from the supplies provided by the government.

Purchasing 30,000 acres of forestland from Nilambur Kovilakam was the only measure that the Grasim Industries had taken all through the history of its operations in Kerala to establish its own captive source of raw material. Buying the land for a total price of Rs. 75 lakhs in fact gave the company more money in return through the sale of teak, rosewood and all other valuable trees, according to Godavarman Thirumulpad (personal communication), the custodian of the Nilambur Kovilakam lands. However, with the government nationalizing the private forests in 1971, the company suffered a blow: "all our efforts at being self-sufficient were rendered futile," lamented Grasim in its Closure Notice in 1999.

Grasim had succeeded in challenging and getting the Vesting and Assignment Act quashed in the Kerala High Court (on 21-06-1972), but later the Supreme Court of India upheld the Act on 18-09-1973.

The Second Supplemental Agreement dated 10th July 1974:

The agreement was meant for settling disputes that had arisen between Gwalior Rayons and the Government of Kerala. Meanwhile the company had represented to the Government that the factory required 3.60 lakh tonnes of raw materials annually for operating the plant at full capacity. The agreement, signed when a review of the Principle Agreement (which was valid only to May 1978) was due, also revised the prices of the raw material marginally.

- The Government agreed to ensure supply of 2 lakh tonnes of raw material annually.
- The company was ensured exclusive rights and licence to extract and remove the entire quantity of bamboo in the CAs, estimated at 40,000 tpa at specified rates, the volume being calculated on the basis of specific formula mutually agreed upon.

- The company was ensured supply of eucalyptus to make good the deficit in the committed quantum of supply of raw material at specified rates and, in case of reduction in the quantity of eucalyptus too (with the government meeting its commitment to the proposed newsprint factory of Hindustan Newsprints Ltd), supply of reeds, bombax or other wood.
- The company was accorded permission to extract bamboo from outside the contract areas if 40,000 tonnes were not available or accessible from the CAs so as to make available a total quantity of 60,000 tonnes of bamboo annually.
- Even though the Government's expressed commitment on raw material supply was restricted to 2 lakh tpa, the Government declared its willingness to take measures to enhance the supply when required.
- Government committed itself to replant bamboo areas destroyed for silvicultural needs with pulpwood species.

Table 22 Grasim: Revised Seigniorage rates in 1974 (in Rs. per tonne)

Raw material	*If measured before 30th day of felling*	*If measured between 30-75 days of felling*	*If measured after 75 days of felling*
Bamboo & reeds from the contract areas	1.67	2.78	3.34
Bamboo & reeds from outside the CAs.	18	30	36
Other 7 species (with bark)	15	15	15
Revised seigniorage rate for eucalyptus	Rs. 22.50 tonnes		

Source: Long-term Agreements between Grasim and Govt. of Kerala

The Second Supplemental Agreement admitted that the availability of the bamboo in the Contract Areas was only around 40,000 tonnes per year against the unrealistic commitment of 2 lakh tonnes. And using this as a pretext the agreement virtually opened up the bamboo catchment area of Grasim to include any forest "as far as possible" contiguous with the CAs and ACAs. By this agreement, the Government also expressed its willingness to supply more than the contracted amount of raw

materials. The agreement also introduced an unspecific commitment on supply of eucalyptus and other pulpwood.

The Third Supplemental Agreement dated 20th November 1976:

The Agreement sought to make the earlier agreements effective by filling gaps in rules and regulations regarding the collection and removal of raw materials from the forests. The rules and regulations specified were related to allotment of areas; permissions and passes; felling practices; collection and removal of raw materials; measurement and recording of weights and values etc. by forest officials; monitoring and verification of extraction; removal of extraction workers and contractors found to have violated the rules; sales tax payable by the company; recovery of dues and compensation payments; the appellate authority of the State government on disputes between KFD and Grasim and ensuring fire protection in the forest coupes etc.

It is an irony that it was after 14 years of virtually unmonitored and uncontrolled extraction of resources from the forests of Kerala by the company that these rules were found to be necessary. And despite introducing clauses that gave the government right to claim compensation for violation of felling rules, the Third Supplemental Agreement allowed Grasim to forgo the basic ecological precaution of stopping extraction of bamboo during the period of closure (the regeneration period when new shoots appeared on bamboo). The agreement allowed Grasim to commence working the bamboo coupes every July 10. This was an "amazing concession, a gross transgression of all silvicultural felling rules of bamboo which forbid anthropogenic interference from June to September," according to Savur (2003:II: 531).

The Fourth Supplemental Agreement dated 27th October 1988:

After the signing of the Third Supplemental Agreement and the consequent tightening of extraction system, the company had begun to feel constrained in its operations. The commissioning of production at the reed, eucalyptus and bamboo based newsprint plant of Hindustan Newsprints Ltd (HNL) at Velloor in 1982 made Grasim further threatened in relation to availability of raw materials. Further, in 1978 the Kerala Government passed the Kerala Forest Produce (Fixation of Selling Price) Act that sought to stop all subsidies on forest-based raw material and impose taxes on raw material supplies to industries in the form of a Forest Development tax. Aggrieved by the Act, Gwalior Rayons management approached the High Court and got this order

quashed and its subsidies reinstated. However, the Supreme Court of India finally ratified the Act in a case filed by HNL.

Gwalior Rayons and the Government of Kerala had by then got engaged in a number of disputes which were pending before a tribunal. Around the same time the anti-pollution struggles against the company reached a peak, leading to the High Court of Kerala pronouncing sharp criticism against the company. ("*The banks of Chaliyar, once a health resort, have virtually become a hell on earth," observed Justice K.K Narendran* in 1982) An on-the-spot investigation by a Rajya Sabha enquiry committee and an order from the Government of Kerala asking the factory to reduce production in order to reduce pollution (Chaliyar Action Committee 1999) added to Grasim's woes. Probably as a result of all these pressures and ostensibly on account of a labour struggle that had begun in the factory, Grasim Industries stopped production at its pulp and fibre plant at Mavoor on July 7 1985. The company remained closed till October 1988. The long period of closure resulted in a people's struggle to reopen the factory. People including those who had earlier fought against pollution caused by the factory, now demanded it's reopening. This provided an advantageous situation for the Birla group to extort further concessions from the government. This was the context of the Fourth Supplemental agreement.

The agreement was a part of a larger but yet undisclosed package deal between the Government of Kerala and the Grasim management involving the trade unions at the Mavoor factory.

- The agreement renewed the government's commitment to supply 2 lakh tonnes of raw material (40,000 tonnes of bamboo from CAs, ACAs or elsewhere; 1 lakh tonnes of eucalyptus and the rest other species such as Bombax).
- The Company shall be allotted raw material at a concessional rate of Rs. 250 per tonne inclusive of additional price, forest development tax, sales tax, and additional sales tax for a period of 5 years.
- Reiteration of the clauses on mutual liability, i.e., payment of compensation to the company in case of shortfall in supply and compensation to the Government in case of failure in removing the allotted quantity of raw material.

- The government and the company mutually agreed to withdraw all pending disputes and litigation.

  The disputes that were compromised included an Original Petition filed by the company against the Kerala Forest Produce (Fixation of Selling Price) Act; the forest department's claim that the company had violated several provisions in the LTAs, the government's claim over balance of payment in respect of bamboo and reed supplied between 1978-79 and 1980-81 and the company's claim of compensation from the government for shortfall in raw material supply.

This agreement made in order to facilitate the reopening of the factory amounted to a sell-out of Kerala's larger interests in the name of protecting the job of a few thousand industrial workers. The package of settlement of between the government, the trade unions and the Birlas included a promise on the part of the trade unions to desist from labour strikes for five years, according to A. Vasu (personal communication), trade unionist and leader of Gwalior Rayons Workers' Organisation (GROW) whose prolonged hunger strike had forced the government to negotiate with the Birlas and reopen the Mavoor plant.

The deal also involved commitments on the part of the government to reduce the raw material prices and even to amend the Forest Produce (Fixation of Selling Price) Act in order to exempt Grasim from its provisions. The clause 6 of the Act, which exempted sale of raw materials to State or Central Government companies from the provisions of the Act, was made applicable to Grasim, a private sector company, through an amendment inserted in the Act. The new clauses introduced for this purpose specified that sections 5 and 5A of the Act (restricting sale of forest produce prices below the selling price) would not be applicable to "sale of forest produce to certain industrial establishments" where (a) "the total quantity of supply exceeded 50,000 tonnes" and (b) "the number of persons employed in or under such industrial establishment was not less than 1000 workers." These clauses came into force on 24-10-1988 and put Grasim on par with HNL and Kerala State Bamboo Corporation (KSBC), both government sector companies, with regard to concessional payment of seigniorage.

Draft Fifth Supplemental Agreement 1993:

The details of the agreement, which was to take effect from 1993, are not available because this was not officially signed.

Hindustan Newsprints Ltd.

Hindustan Newsprint Limited (HNL), a Government of India enterprise under the administrative jurisdiction of the Department of Heavy Industry, Ministry of Heavy Industries and Public Enterprises, was incorporated as a wholly owned subsidiary of the Hindustan Paper Corporation limited (HPC) on June 07, 1983. The Government of India had established HPC on May 29, 1970 for developing indigenous capacity in production of paper and newsprint with a view to reduce dependence on imports. HPC launched the Kerala Newsprint Project (KNP) in 1976.The mill was designed to manufacture newsprint using a combination of chemi-mechanical pulp (CMP) produced from eucalyptus wood and chemical pulp (CP) made from bamboo/reed in the proportion of 70:30. Proximate availability of raw material was the prime factor that determined the choic e of the mill site (Savur 2003:II: 508). The mill rolled out the first newsprint reel on February 26, 1982 and went into commercial production on November 1, 1982. HNL took over the business of the Kerala Newsprint Project with effect from October 1, 1983.

In the initial years HNL also met a major portion of its requirement for raw materials from forest sources. The company signed a long-term agreement with the Government of Kerala in 1974 for the supply of eucalyptus wood and reed from state forests. Under the 30-year LTA, the government agreed to provide 1,89,000 tonnes of reed (at 50 per cent moisture content) and 1,50,000 tonnes of eucalyptus (1 lakh tonnes of *E. grandis* the rest *E. tereticornis*). It was also agreed that in case of destruction of reed forests due to gregarious flowering in the areas allotted to HNL, suitable long-fibre pulpwood from other areas would be supplied, as far as possible.

The seigniorage rate fixed for the company was Rs. 12 per tonne of reed. The royalty rate for eucalyptus was initially Rs. 11 per tonne. Under the contract, there was a provision for revising the price of eucalyptus after 5 years. Interestingly, the increase was to be in proportion to the price of the product of the company, a condition that the government had not applied to any other PPI unit in the state. Thus the price of eucalyptus was revised to Rs. 325 per tonne in 1993.

"The concessions given to HNL did not in any sense measure upto those bestowed on Birla, or rather those grabbed by Gwalior Rayons" (Savur, 2003 II: 533). The basic cost of bamboo for HNL was 12 times higher than that set for Grasim. After the promulgation of the Forest Produce (Fixing of Selling Price) Act, HNL also had to pay forest regeneration charge of Rs. 25 per tonne, 10 per cent forest development tax and additional sales tax whereas these were waived for Grasim in the 1988 agreement.

In the LTA with HNL, a clause for paying penalty for causing fire in the forest coupes was introduced; a condition that was not introduced in the supplemental agreement signed with Grasim around the same time.

Kerala State Bamboo Corporation (KSBC)

The Kerala State Bamboo Corporation (KSBC) was set up on 13 March 1971 with the objective of supporting the traditional bamboo and reed weavers in Kerala and getting rid of the middlemen in the sector who exploited the weavers.

Ensuring cheap and adequate supply of raw material to the weavers was one of the prime objectives of setting up KSBC. To this end, an agreement was signed between the corporation and the Government in 1977.

Under the agreement, KSBC was annually allotted exclusive rights over collection of 5,000 tonnes of reeds from specified forest coupes. Initially these were forests in the Trichur and Kollam forest circles. The quantity allowed to be extracted was raised to 20,000 tonnes in 1978-79 and the catchment area expanded to include industrial plantations and forests in the Perumbavoor circle.

In 1983, the Government further raised the quota to 25,000 tonnes per year and, "considering the welfare orientation that guided its mandate," exempted KSBC from royalty payment through a government order (GO (Ms) 310/Fin/dated 12-10-1983).

The government also allowed the corporation to extract reeds from the Mankulam forests and the forests in the erstwhile Malabar region.

Table 23 Kerala Government's raw material commitments to bamboo/reed industries.

Company	*Year of agreement*	*Raw material*	*Quantity (in tonnes)*	*Basic Royalty rate (In Rs./tonne)*
Grasim	1958	Bamboo	1,60,000	1.00
	1962	Bamboo	2,00,000	1.00
	1974	Bamboo	60,000	(Average) 15.00
		Eucalyptus + wood	1,40,000	22.00
	1988	Bamboo	40,000	250.00
		Eucalyptus & wood	1,60,000	250.00
HNL	1974	Eucalyptus	1,50,000	11.00
		Reed	1,89,000	12.00
	1993	Eucalyptus	1,50,000	325.00
		Reed	1,89,000	12.00
PPM	1941	Reed	2,500	2.75
	1944	Reed	3,500	2.75
	1982	Reed	85,000	NA
	1982	Eucalyptus	45,000	NA.
KSBC	1977	Reeds	5,000	18.00
	1978	Reeds	15,000	18.00
	1982	Reeds	20,000	18.00
	1983	Reeds	25,000	0
	1987-88	Reeds	30,000	0

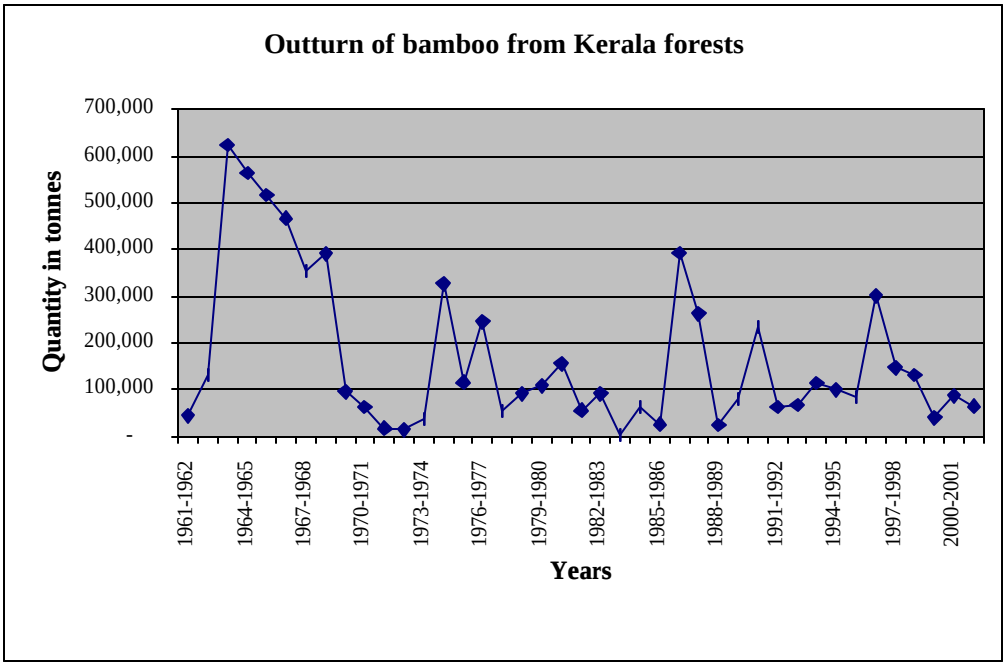
Since 1980, KSBC's annual reports repeatedly complained of raw material shortage due to the "starting of HNL and flowering of reeds." In this period, the corporation also submitted several demands for exclusive reservation of specific reed forests. In 1987-88, the allotment for the corporation was further enhanced to 30,000 tonnes per year but no decision was taken on reserving forest areas exclusively for the use of the corporation.

As we have seen, the Administrative Reports of the KFD used to record the total outturn of bamboo and reeds from all the forests in the state, classified into purchases by 'government agencies' as well as 'private parties', supplies in the form of 'free grants' and supplies to 'right holders'. However, until the industrial supplies began to be clearly estimated against each industrial unit, the outturn figures for purchases by government agencies and private agencies appear to be not clearly distinguished. This

means that government agency purchases have often ended up as supplies to the private sector industrial unit, i.e., Grasim Industries, the supplies being made on the strength of the long-term agreements.

In the ARs, the bamboo outturn is recorded under both forest produce and minor forest produce (MFP). But the ARs show that only in a few years have the supplies under MFP been marked as given to 'right holders'. Thus even the outturn of bamboo under MFP, which should have gone to the 'rights holders,' could have been diverted to industries including Grasim. This was so because the supply to the 'right holders' did not really entail any legal rights for the rural or forest-fringe people and was at best only a concession granted by the government whereas the agreements on supplies to the industries were legally enforceable and proved to be *fait accompli* for the government.

Figure 5 Outturn of Bamboo from Kerala forests



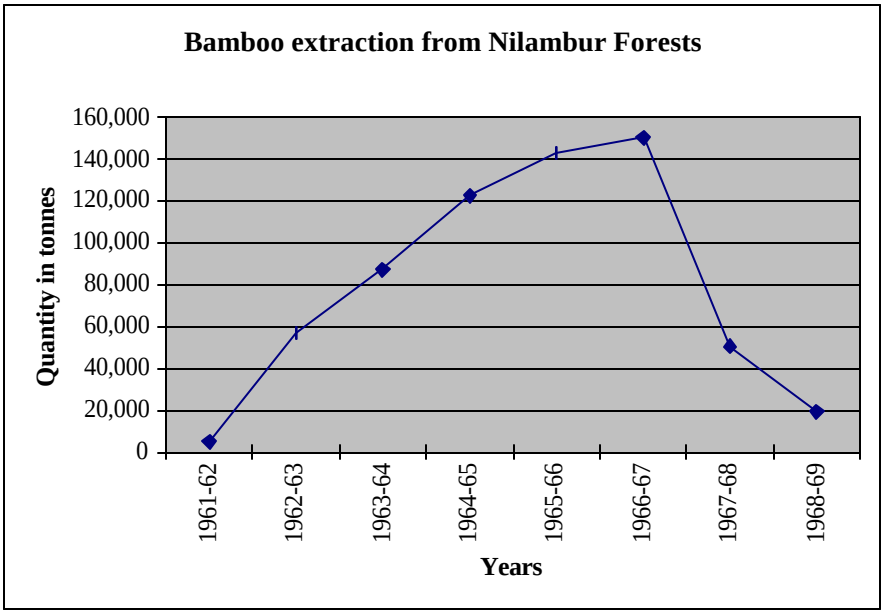
Decline in bamboo outturn

Grasim Industries, the first major PPI unit in the state to be fed exclusively on bamboo, had started collecting the resource in 1961.The figures for bamboo outturn in the ARs show that within the 10 years from 1962-63 to 1972-73 there has been a drastic decline in the total outturn of bamboo from the forests in Kerala.

Immediately after Grasim began to collect bamboo from the forests, the total bamboo outturn from the forests shot up from a low 6,94,783 numbers (equivalent to 43,424 tonnes) in 1961-62, to 20,90,522 numbers (1,30,657 tonnes) in 1962-63 and further to 99,66,168 numbers (6,22,885 tonnes) in 1963-64 (various Administrative Reports). This shows that the resource extraction had been highly intensive and much beyond the prescribed annual extraction volume.

The change in the outturn of bamboo from the Nilambur forests, the catchment area originally expected to be sufficient to feed Grasim Industries, gives a close-up view of the decline of bamboo availability within the first decade of beginning industrial extraction. In 1961-62, the year in which extraction activities were started, Grasim collected only 81,925 numbers of bamboos (5,120.31 tonnes) from the Nilambur forest division. But in the next year the extraction went up more than 10 times to mark 9,10,641 numbers (56,915 tonnes). It reached a peak of 24,06,997 numbers (1,50,437 tonnes) in 1966-67 and then dropped to 8,10,919 numbers (50,682 tonnes) in 1967-68 and further down to 3,10,921 numbers (19,433 tonnes) in 1968-69.

Figure 6 Bamboo extraction by Grasim from Nilambur Forests: 1960s



Source: Working Plan for Nilambur Forest Division 1967-68 to 1976-77, KFD

KFD's Working Plans for the Nilambur Forest Division have given two explanations for this drastic decline in bamboo resource availability in the area. The first

explanation was that extensive bamboo flowering caused the damage. As we have found earlier, moist deciduous forests and semi-evergreen forests in Nilambur valley were rich in bamboo. "In the region *B. arundinacea* attained gigantic sizes upto 100 cm in girth and 30-35 meters in height" (Nilambur Working Plan 1967: 130). The number of clumps in pure bamboo areas in the region was found to be a high 100-120 per ha and the number of culms per clump was 100 to even150. But by 1962, sporadic flowering had set in. This, as KFD claimed in the Working Plan, made it obligatory to stop felling in un-flowered areas and salvages the dead and dying bamboo from the flowered areas. "The company (i.e., Grasim) stepped in at the right moment and salvaged almost everything that could be made use of," said the Working Plan.

Apparently, KFD had no clue to management of bamboo flowering and considered the arrival of the PPI unit as a godsend. The first Working Plan for the Kozhikode Forest Division also recorded that "almost all bamboos in the division had flowered and were dying" and hence "no detailed (bamboo management) plan was required for the next 10 years" except that the dead and dying bamboo should be extracted and utilized by the company "to avoid loss of revenue to the Government."

From the KFD records it appears that the extent of bamboo flowering in the 1950s and 60s in Kerala had been vast, especially in the Nilambur forests. In 1959 when the KFD and Grasim jointly carried out the bamboo resource survey, bamboo flowering had been noted in 775 acres (323 ha) of government forests in the Nilambur Forest Division. Later, the 1967 Working Plan for the division said extensive flowering in 1950s and 60s "affected the bamboo stock in all but 715 ha out of a total of 4,615 ha of bamboo forests in Nilambur." Thus nearly 85 per cent of the bamboo forests in Nilambur were affected by gregarious flowering.

As a result, the Working Plan said, the estimation of available yield had to be drastically reduced (from 46,334 tonnes per year estimated to be available annually from the government forests in Nilambur by the 1959 survey) to a total quantity of bamboo that could be salvaged from around 40,500 tonnes of dead and dying stock and the bamboo that was available from 49,700 tonnes of live stock in the un-flowered bamboo forests. So, once the dead and dying stock of 40,500 tonnes too would have been removed though clearfelling, the annual yield from un-flowered bamboo forests in Nilambur would have got reduced to around a paltry 3,230 tonnes

per year (assuming 6.5 per cent of the total stock to be the optimum sustained annual yield as recommended by the 1959 survey).

Table 24 Bamboo extraction by Grasim from Nilambur Forest Division: 1970s

Year	*Extraction (in tonnes)*
1973-74	224
1974-75	186
1975-76	3412
1976-77	3389
1977-78	3000
1978-79	2717
1979-80	1757
1980-81	2438
Average	**2140**

Source: Working Plans of Nilambur Forest Division

The very low extraction level of bamboo from the Nilambur forests in the 70s (an average extraction of 2,140 tonnes per year between 1973-74 and 1980-81) supports the above observation.

A subsequent Working Plan addressed the question whether the extraction practices of the PPI unit had contributed to the decline of bamboo wealth in Nilambur. The Working Plan for the period 1982-83 to 1991-92 indicated that Grasim's extraction practices too could have contributed to reduction in yield. During an inspection of the coupes worked previously by Grasim Industries, forest department officials found that "only the easiest and most lucrative methods of extraction were practiced. Complete collection of all silviculturally available bamboos was not done," the working plan report said, suggesting that the impacts of uncollected material could be both reduction in yield and spread of forest fires (Nilambur Working Plan 1982:139). The report said Grasim used to leave the basal portions of bamboo unremoved and top portions hanging on the clumps. This made the remaining forests vulnerable to forest fires. Rules to retain immature culms and the prescription of working a clump from ends opposite to immature culmns needed to be followed more scrupulously, the 1982 Working Plan said.

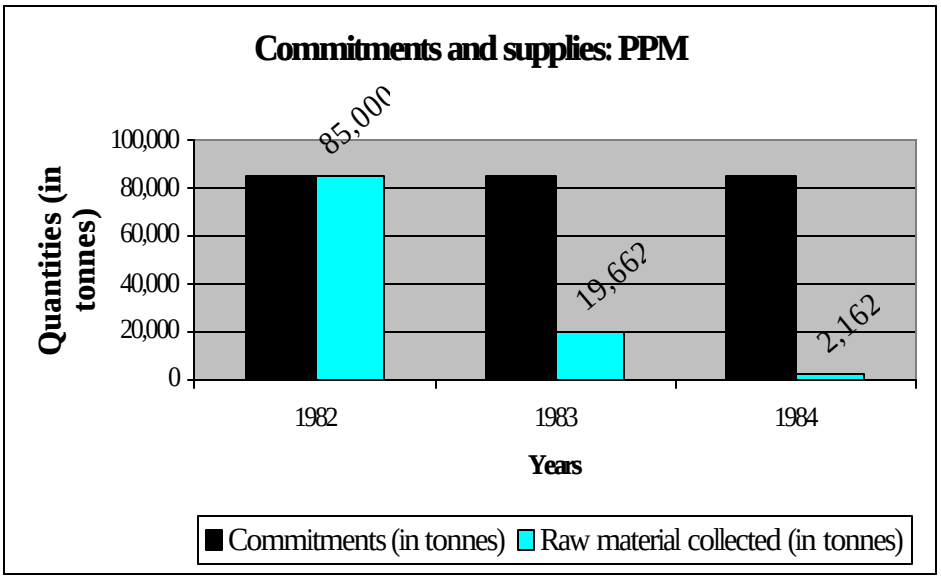
Commitments, resource allocation and actual supplies

All forest-based industries in Kerala have at one time or other felt shortage of raw material because often the government had not been able to keep its commitments. This has happened either throughout the period of long-term agreements or at various points of time within the period for different industries. This was despite the fact that the commitments to supply raw materials were legally binding on the government and there were provisions within the agreements that could have forced the government to pay compensations to the companies.

Punalur Paper Mills (PPM)

PPM, the first paper mill in the state was started at a time when there were no other industrial consumers for bamboo and reed. As we have already seen, the production capacity of the plant was raised considerably over the years and hence the raw material requirement too had to be enhanced from 750 tonnes of reeds per year initially to 85,000 tonnes per annum by 1980s.

Figure 7 Commitments and supplies: Punalur Paper Mill



After the 1982 revision of the LTA, the government's commitment to PPM stood at the supply of 85,000 tonnes of reeds and 40,000 tonnes of eucalyptus. Though the

government could meet the demand in 1983, the next year the company could collect only 19,662 tonnes of reeds. The steep fall in the subsequent year seems to be more a result of the company's financial problems on account of which PPM shut down the plant in 1986.

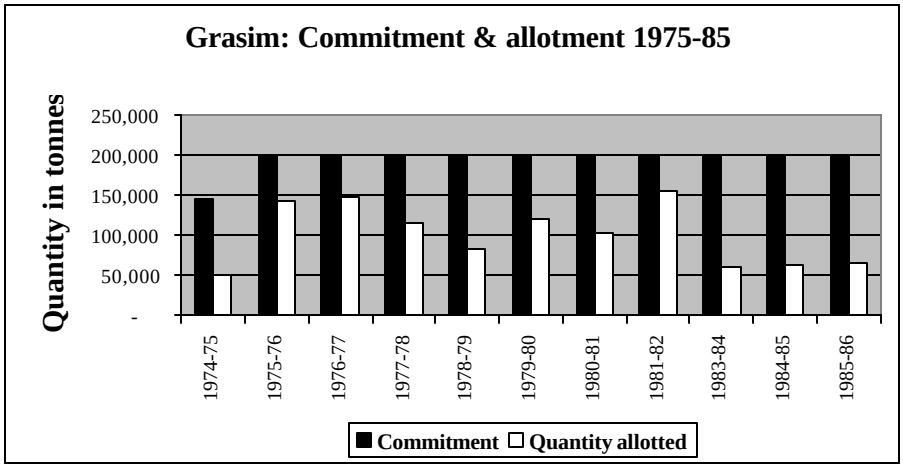
Grasim Industries

While the Administrative Reports of KFD have on many years recorded in minute detail the number of bamboo poles allocated to Grasim Industries from each forest division, there are no clear records on how much bamboo Grasim could actually collect from each coupe allotted. Thus, between the records of KFD and Grasim, there are huge disparities in the annual allotment figures and the actual collection figures.

Forest department records very often show high volume of purchase of bamboo by private purchasers. Grasim could have carried out much of such purchases. Again, apart from the bamboo collected from allotted forest coupes, Grasim Industries was also supplied with bamboo extracted from (1) industrial plantation division outside the Kozhikode circle and (2) forestlands submerged under irrigation/hydroelectric reservoirs. Considering all these, the total availability of bamboo for Grasim should have been very high in the years immediately after the inception of the factory at Mavoor. We have already found that the collection of bamboo from the Nilambur division had reached a peek amount of over 1.5 lakh tonnes in the 60s and then it had dropped to rock bottom levels of just a few thousand tonnes in the 70s.

Nevertheless, what is important here is to note that in the 70's the Government's commitment was for supplying a whopping1,60,000 tonnes of bamboo per year, a

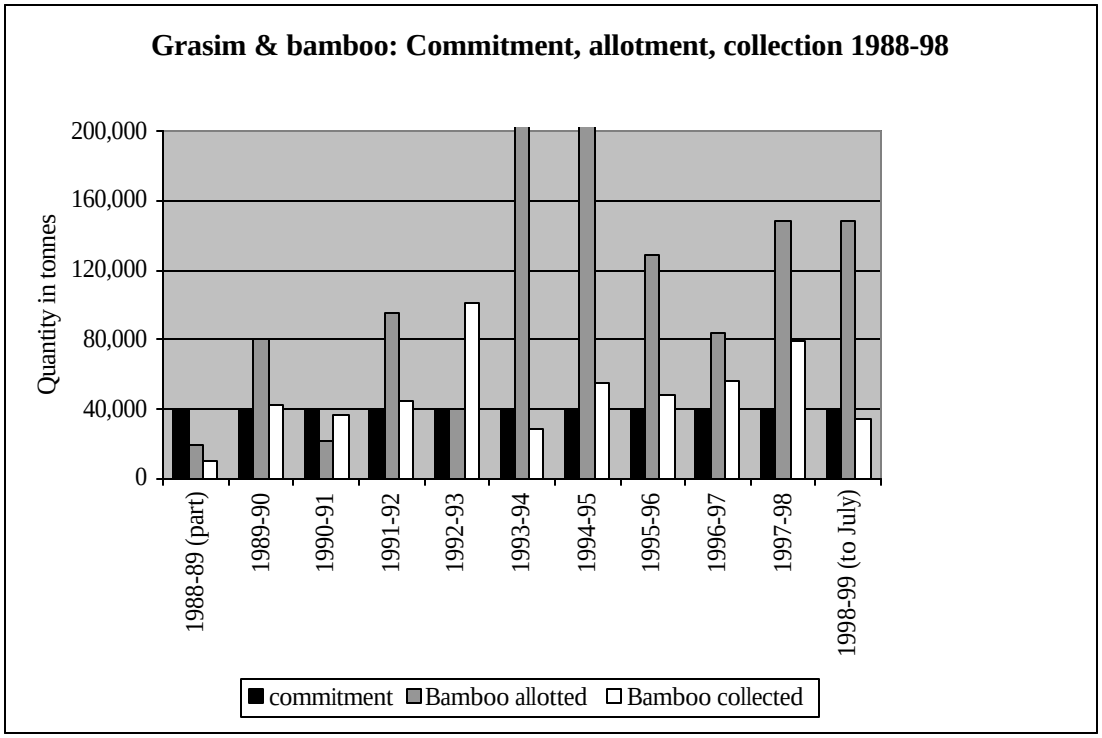
Figure 8 Grasim: Commitment & allocation of total raw materials 1975-85



quantity non-existent in the contract areas earmarked for the company. Still in 1974 the Government went on to sign the new long-term agreement which hiked the total commitment on the part of the government to 2,00,000 tonnes of raw materials (60,000 tonnes of bamboo and the rest eucalyptus, bombax and other wood). But the government could not fulfill its commitment throughout the next decade.

However, since the Fourth Supplemental agreement signed in 1988 in order to reopen the factory at Mavoor, Government's allotment of bamboo to Grasim improved considerably. In fact, succumbing to pressures from the Birlas, the trade unions and the civil society, the government appears to have allotted more than the committed quota (40,000 tpa) of bamboo to Grasim in seven out of the 11 years between 1988-89 and 1998-99. The bamboo allotted touched an all-time high figure of 11,38,171 tonnes in the year 1994-95. There was a shortfall in the allotment of bamboo only in the year 1990-91. The total allotment of bamboo during the 10 years stood at 19,78,845 tonnes and the average for 10 years was 1,97,885 tonnes against an annual commitment of 40,000 tonnes.

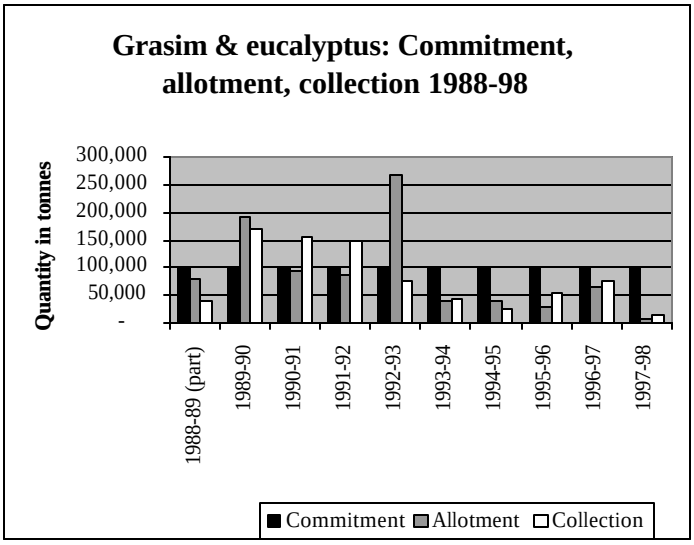
Figure 9 Grasim & Bamboo: Commitment, allotment and collection 1988-98



In contrast to the improvement in the allotment of bamboo, the allotment of eucalyptus from the government forests became threatened in the 1980s and dropped considerably in the 1990s.

By now Grasim had changed its production systems in such a manner that it required more eucalyptus than bamboo and claimed that eucalyptus alone "was the proper raw material for manufacture of rayon grade pulp" (Grasim 1999).

Figure 10 Grasim and Eucalyptus: Commitment, allotment and collection



Source: KFD records and Grasim (1999).

In the decade 1988-98, the government's commitment was to provide at least 40,000 tonnes of bamboo and 1,00,000 tonnes of eucalyptus and make up the remaining quantity of 60,000 tonnes with acacia or such other soft/hard wood. The allotment of eucalyptus remained highly erratic, touching a peak volume of 2,70,213 tonnes in 1992-93 and dropping to 39,797 tonnes in the very next year. Nevertheless, for the 10 years as a whole, the average quantity of eucalyptus allotted by government worked out to 90,297 tonnes, roughly 10 per cent short of the commitment.

When we look at the total picture of raw material commitment and allotment, (Table 25) it becomes clear that the allotment of all raw materials put together was above the commitment during the decade.

Table 25 Grasim Commitment & allotment 1988-98

Year	Commitment	*Total allotment*
1988-89 (part)	100,000	1,00,389
1989-90	200,000	2,71,664
1990-91	200,000	1,17,381
1991-92	200,000	1,81,594
1992-93	200,000	3,10,294
1993-94	200,000	2,61,666
1994-95	200,000	11,76,975
1995-96	200,000	1,64,726
1996-97	200,000	1,59,896
1997-98	200,000	2,16,609
Total	**19,00,000**	**29,61,194**

Thus it appears that the Government had fulfilled its moral and political obligation to the major pulp and paper industry in the state during the 1990s. However, there is a catch here. Government had only allotte d the raw materials; the real collection of raw materials by the user company had fallen short of the allotment in most of the years of the decade. For the decade as a whole, actual collection of raw materials had only been around 47.41 per cent of the total allotment and 73.89 per cent of the commitment.

Figure 11 Total commitment, allotment and collection 1988-98

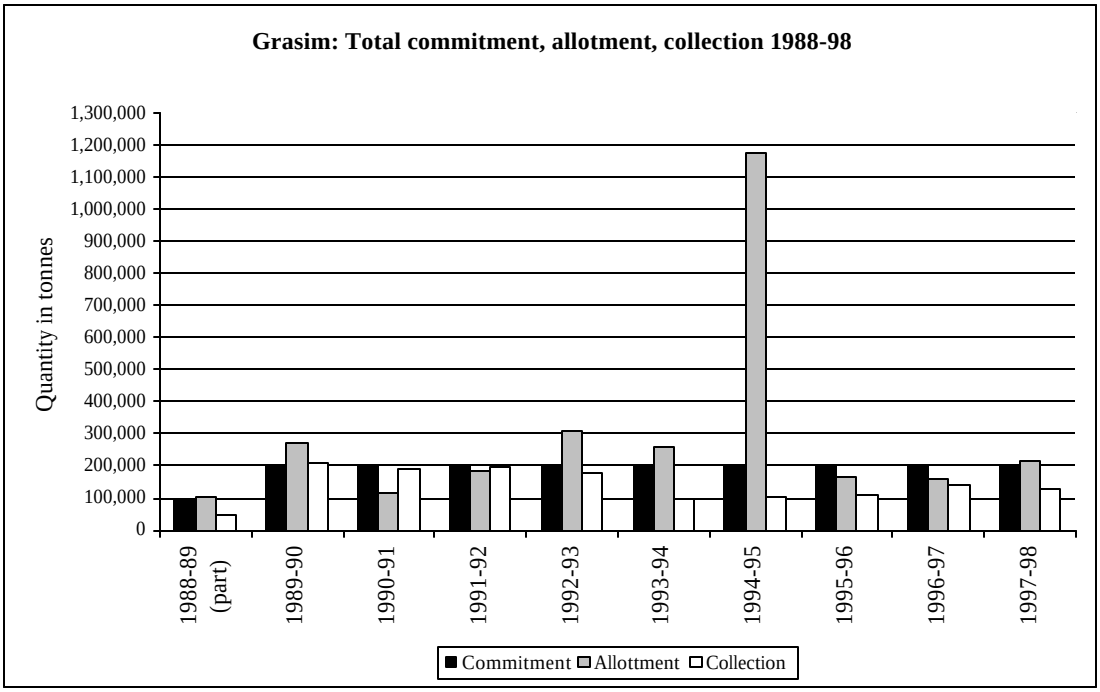


Table 26 Grasim: Commitment, allotment and collection 1988-98

Year	*Commitment*	*Allotment by Govt. and collection by Grasim*						*Total allotment*	*Total Collection*
		Bamboo allotted (A)	Bamboo collected (B)	Eucalyptus allotted (c)	Eucalyptus collected (D)	Reed+ hardwood allotted (E)	Reed + hardwood Collected (F)	(A+C+E)	(B+D+F)
1988-89 (part)	1,00,000	20,000	10,248	80,000	39,052	389		100,389	49,300
1989-90	2,00,000	80,064	42,203	191600	169556			271,664	211,759
1990-91	2,00,000	21,725	37,179	93,956	156,188	1,700		117,381	193,367
1991-92	2,00,000	94,907	44,814	86,687	149,623			181,594	194,437
1992-93	2,00,000	40,078	101,622	2,70,216	76396			310,294	178,018
1993-94	2,00,000	221,869	29185	39,797	42,066	26554	26554	261,666	97,805
1994-95	2,00,000	1,138,171	54840	38,804	23,379	18,106	24243	1,176,975	102,462
1995-96	2,00,000	128,970	48271	29,028	52,830	6,728	6,535	164,726	107,636
1996-97	2,00,000	84,187	55788	65,526	73,347	10,183	11,647	159,896	140,782
1997-98	2,00,000	148,874	78,770	7,360	14,979	2,209	34,543	216,609	128,292
1998-99 (to July)	2,00,000	148,874	34115		65,716		11,282	1,58,443	111,113
Total	**20,00,000**	**2,127,719**	**537,035**	**7,74,848**	**863,132**	**65,869**	**114,804**	**2,961,194**	**1,514,971**

It would be politically convenient to blame Grasim Industries for failing to collect the quantity of raw materials it was allotted by the government. However, the glaring nature of this growing gap between allotment and actual collection warrants a closer look at the raw material distribution system.

Supplies to Grasim from Kerala Forest Development Corporation: An important change in the forest produce distribution system brought in during the decade was that the Kerala Forest Development Corporation was asked by the Government to supply eucalyptus to Grasim. Thus from 1989-90, to 1998-99, KFDC supplied part of the eucalyptus requirement of Grasim Industries. The supplies were to be at subsidised rates fixed by the Government despite the fact that the Kerala Forest Produce

(Fixation of Selling Price) Act (in short, SP Act) had stipulated that no forest produce should be sold by any forest officer at a price below the selling price of that produce. The Accountant General of the State and the Law Department too had clarified that the provisions of the above Act would apply to KFDC too. Nevertheless, the Government fixed the rate to be realised from Grasim at Rs. 250 per metric tonne, inclusive of tax, for the next five years (GO (MS) 87/88/F&WLD dated 27.10.1988]. Following this, supplies made to Grasim during 1989-90 to 1992-93 were all invoiced by KFDC at the rate of Rs. 224.09 per tonne (setting off taxes). This was at a time when the selling price of eucalyptus as per the SP Act was Rs. 518.50 (including additional price at Rs. 25/MT, Forest Development Tax @ 5% and Sales Tax @5 %) per stacked tonne and KFDC had ready-to-pay buyers at a net price (after deducting extraction, de-barking and transportation costs) of Rs. 600 per stacked tonne (Agriculture Production Commissioner 1989).

As a result, the loss KFDC had to suffer in supplying 27,340 tonnes of eucalyptus to Grasim in 1998-99 alone amounted to Rs. 58.500 lakhs. No wonder then that the corporation felt aggrieved on account of being forced to subsidise Grasim heavily at a time when "due to non-payment of wages there was starvation among the (KFDC) workers" (Ibid).

To make matters worse, there had been three different formulae for calculating the weight of eucalyptus in a stacked tonne. In the LTA with Grasim, Government of Kerala had assumed the volume/weight ratio for eucalyptus without bark as 2 cum = 1.1 metric tonne. Later in 1984 (as per GO (MS) 330/84 AD dated 15.11.84) the government fixed the volume/weight ratio for eucalyptus at 2 cum = 1.8 metric tonne. In certain other orders the government, the specified the ratio was 2 cum = 1 stacked tonne. That these different ratios alone made significant price difference could be seen from the fact that the supplies to Grasim from KFDC in 1994-95 amounted to 18,000.108 MT or 11,000.066 MT or 10,000.060 MT under the three different formulae. And, as could be expected, Grasim and KFDC had to wrangle much over the application of these ratios, the former often withholding payment and the latter retaliating by withholding supplies, as was the case in 1997.

The net result of KFDC's involvement in supplying eucalyptus to Grasim Industries was that it left the corporation in financial trouble and many of its officials so

embittered as to indirectly (through a local NGO, the Thiruvankulam Nature Lovers' Movement) approach the High Court of Kerala with a public interest petition exposing these anomalies.

Subsidies: As per KFDC records, the total amount due from Grasim Industries to the corporation over eucalyptus supplies for the period 1989-90 to 1997-98 stood at Rs. 1,50,78,714. For the same period, the total amount due to KFDC from the Government of Kerala as compensation/subsidy amounted to Rs.9,77,25,069.

The above assessment of loss due to subsidies in supplying eucalyptus to Grasim Industries pertains only to supplies by KFDC and only the amount the corporation demanded the Government to compensate after deducting the payments obtained from Grasim. Again, this calculation was based on the difference between the prices under the KFPF (SP) Act and the special price allowed to Grasim and not the difference between the market price of eucalyptus and the price paid by Grasim.

Taking into consideration the actual levels of productivity of forest plantations, the costs of production at 12 per cent discounting with a land rent of Rs. 2500/ha/year, forest economist Mammen Chundamannil (2001:26) had calculated that the minimum price of eucalyptus should have been Rs. 2000/tonne, that of acacia Rs. 3000/tonne and wattle wood Rs. Rs. 2925/tonne. If these values were applied the subsidies enjoyed by Grasim Industries would have been much higher.

According to the World Bank's assessment, the subsidies meted out to the two PPI units in Kerala (Grasim and HNL) were to the tune of 33 per cent of the market prices, amounting to approximately Rs. 175 million in 1997/98 (World Bank 1998). "The above subsidy estimates have been calculated conservatively and the actual amount may be higher," the World Bank report had cautioned, adding that such subsidies acted as deterrents to raising productivity from forest plantations, private investment in production of forest produce, investments in high-yield plantation technology and meeting production commitments. The subsidies also promoted over-cutting and unsustainable harvesting practices in reeds and bamboo.

Coming back to the issue of the gap between allotment and procurement of forest raw materials, it can be said that such imperfections in the system of supply often caused delays and shortfalls.

Another cause of the shortfall in collection of raw materials by Grasim from the allotment by the Forest Department was the delay in getting the Working Plans approved by the Ministry of Environment and Forests (MoEF). According to Mr. K. Mohanachandran, Principal Secretary, Forests, Government of Kerala (as reported from the official meeting on 28.1.1998 presided over by the Chief Minister), 1,38,000 tonnes of eucalyptus could not be supplied to Grasim because MoEF did not sanction the working plans under which the allocation had been included. As per norm, the cutting of the plantations could be permitted only after the working plans were approved by the Govt. of India (Govt. of Kerala 1998).

But the most important reason for the shortfall between allotment and actual collection of forest resources could have been the absence of realistic assessments of the quantity of resources available in the areas allotted by the KFD. The department allotted forest coupes to the company based on the Working Plan estimate of available resources. Often Working Plan reports themselves have expressed doubts about the correctness of data on growing stock and regeneration of resources, as we have found in the case of bamboo in the Nilambur forests. Periodic field verifications to determine growing stock, sustainable extraction limits and viable quantities available for extraction based on the costs involved have not been carried out.

According to Grasim's assessment, eucalyptus plantations of the Kerala Government had almost exhausted their stock and the third and last rotations were being extracted in 1998. Hence the company expected a supply of only 30,000 tonnes per year from the forest plantations. To keep the plant running, the company would be forced to procure raw material from private sources in other states such as Tamil Nadu, Karnataka, Andhra Pradesh, Uttar Pradesh etc. by incurring high cost of transportation or forced to use heterogeneous wood which would result in quality deterioration of pulp and fibre, Grasim argued (Grasim 1999:7). Non-availability of required quantity and quality was the prime reason cited by Grasim in its application to the Government seeking permission to close down the pulp and fibre units at Mavoor.

Grasim's charges on the resource management system of KFD worth mention here because they reflect the charges PPI units across India have voiced against state governments and state-monopoly forest management. According to the company, the Government had sabotaged its effort to produce its own raw materials by nationalising

30,000 acres of forestland purchased for setting up captive plantations of eucalyptus. The government's decision was discriminatory because it later on provided 5,600 ha of forestland to HNL for raising eucalyptus. The government had not taken any serious measure to augment the resource base. Under the influence of the Forest Conservation Act 1980, the state government also converted industrial plantations into wildlife sanctuaries/other miscellaneous plantations/natural forests.

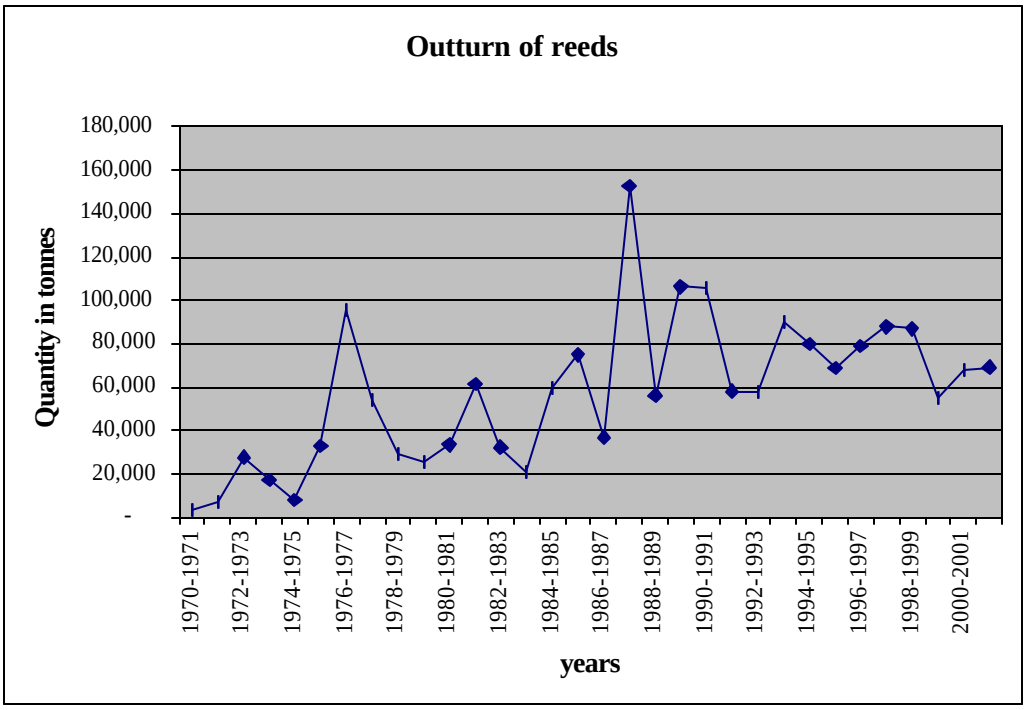
Hindustan Newsprint Ltd.

The gaps between raw material commitment and allocation as well as allotment and actual collection are more evident in the case of Hindustan Newsprint Ltd. The government's raw material commitment to HNL, an "extremely modern, highly automated, public sector unit manufacturing socially important newsprint" (Savur 2003:II: 34) in contrast to special grade industrial quality paper and rayon grade pulp for expensive clothing was to supply 1,89,000 metric tonnes of reed at 50 per cent moisture content (or 1.05 lakh tonnes at 10 per cent moisture content) and 1,50,000 tonnes of eucalyptus.

The quota of reeds for HNL was fixed on the basis of the results of the pre-investment survey (1967-68) sponsored by FAO and the Forest Resources Survey 1971-72. The two surveys had found the total growing stock of reeds in the Kerala forests to be 4.6 million air-dry metric tonnes (ADMT) and the annual sustained yield to be 1,12,700 tonnes (Chandrasekharan 1973). The sustained yield expected was thus lesser than the commitment already made to HNL.

Apparently, this anomaly continued because based on these two surveys and its own (poor?) judgement of the field conditions, the Forest Department had gone on to project an annual availability of 3,50,000 tonnes of reed. It took several years for the government to correct this exaggerated figures for the growing stock and sustained yield of reeds. It was only much later, i.e., in 1998. That the Industry Oriented Reed Management Plan survey assessed the total growing stock of reed to be only around 6,66,087 tonnes and the available annual yield to be around 1,33,217 tonnes.

Figure 12 Outturn of reeds from Kerala Forests



Source Administrative Reports, KFD

Kerala Forest Department's figures for the total outturn of reeds from the forests are closer to the above lower estimates of growing stock and sustained yield estimated in the Industry Oriented Reed Management Plan, 1998. According to the ARs, the highest outturn of reeds was 1,52,496 tonnes achieved in 1987-88, which was much lower than the commitment to HNL alone.

HNL's records show that throughout its existence, the company had experienced considerable shortfalls in the quantity of reeds actually collected from the forest coupes in relation to the quantities allotted by the government. The highest quantity of reeds collected by HNL in any year since its inception was 1,00,674 ADMT in 1990-91.

Figure 13 HNL: Quantity of reeds committed, allotted and collected

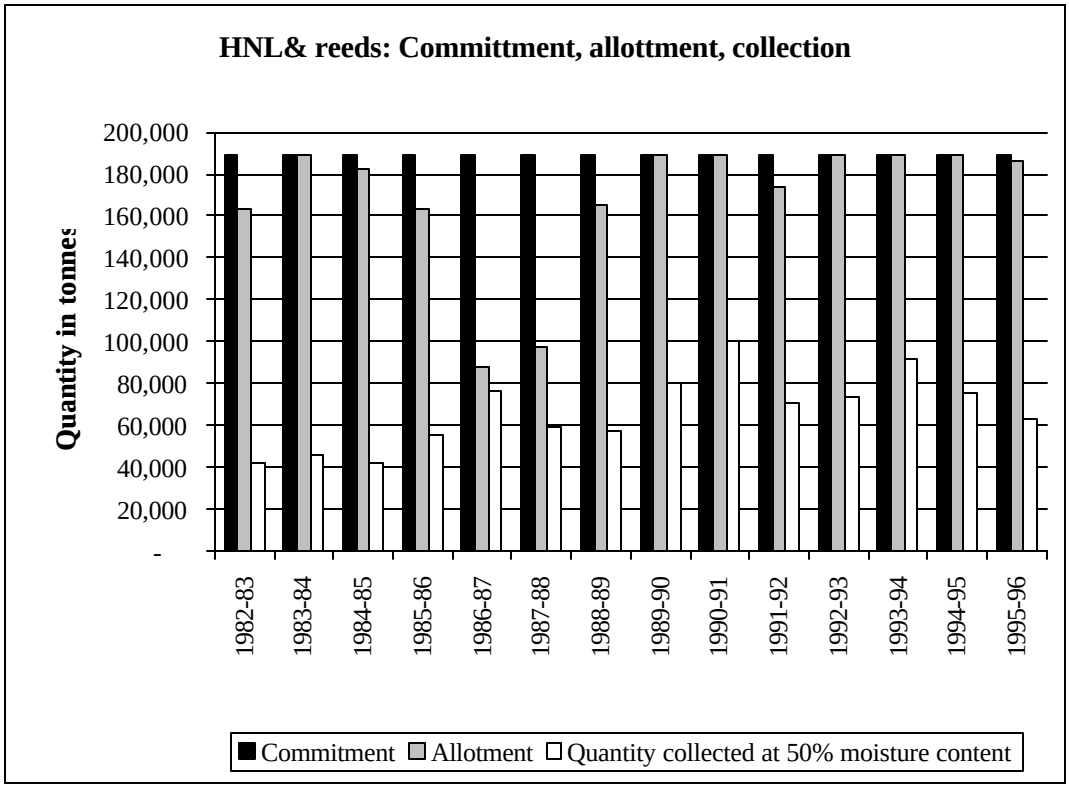


Table 27 Govt.'s commitment, allocation and actual collection of reed by HNL

Years	*Commitment*	*Allotment*	*Quantity collected*	*Collection as % of commitment*	*Collection as % of allotment*
1982-83	189,000	163,000	42,422	22.45	26.03
1983-84	189,000	189,000	46,385	24.54	24.54
1984-85	189,000	182,200	42,098	22.27	23.11
1985-86	189,000	163,400	55,284	29.25	33.83
1986-87	189,000	88,140	76,217	40.33	86.47
1987-88	189,000	97,300	59,576	31.52	61.23
1988-89	189,000	165,700	57,086	30.20	34.45
1989-90	189,000	189,000	80,123	42.39	42.39
1990-91	189,000	189,000	100,674	53.27	53.27
1991-92	189,000	173,500	70,893	37.51	40.86
1992-93	189,000	189,000	73,406	38.84	38.84
1993-94	189,000	189,000	91,619	48.48	48.48
1994-95	189,000	189,000	75,720	40.06	40.06
1995-96	189,000	186,500	62,995	33.33	33.78
Total	**2,646,000**	**2,353,740**	**934,497**		
Average				**35.32**	**39.70**

Thus, for the 14 years between 1982-83 and 1995-96, the total collection of reeds by HNL was only 9,34,497 tonnes against a total commitment of 26,46,000 tonnes and a total allocation of 23,53,740 tonnes. In other words, the actual collection over the period was only 35.32 % of the total commitment on reeds and 39.70 percentage of total quantity allotted.

The official estimate of actual collection of allotted raw materials is around 45 % in the case of reeds. The Industry Oriented Management Plan report on reeds has given the following reasons for the shortfall in availability of reeds to the various users:

- Inaccessibility of the coupes allotte d for extraction.
- Destruction of reed forests through fire and consequent poor regeneration.
- Exclusion of wildlife areas from industrial exploitation, as necessitated by FCA, 1980.
- Destruction of the resource base as a result of simultaneous working by HNL and KSBC.
- Growth of weeds due to degradation of forests
- Damage done to the resource base on account of the contractors concentrating on easily accessible areas
- Absence of special efforts for regeneration.

We have already mentioned that out of 2,88,230 ha of original reed area allotted to HNL, 65,675 ha had to be eliminated as wildlife protection area and land to be submerged under reservoirs etc. Out of this vast area earmarked, the reed users could work only 45,100 ha, the rest being inaccessible. This necessitated further expansion of industrial catchment areas across the state resulting in several adverse impacts including an expansion of the environmental foothold of the reed-based industry and the consequent ecological damage and an increase in costs incurred by all user-groups towards extraction and transportation of raw materials to the processing unit.

The following table gives the costs HNL had to incur in procuring raw material from far away catchments spread out across the state.

Table 28 HNL: Cost of fetching reed from forest divisions (in Rs./ tonne)

Area	*Extraction charges*	*Loading charges*	*Transportaion charges*	*Miscellaneous*	*Total*
Kulathupuzha	470	110	330	25	935
Konni & Achenkoil	470	125	330	25	950
Ranni	490	135	280	25	930
Urani	550	135	390	25	1100
Meenar	490	135	290	25	940
Moozhiyar	550	135	390	25	1100
Chalakkayam	490	135	290	25	940
Adimaly	365	85	290	25	765
Edamalakkudy	400	100	350	25	875
Pooyamkutty	400	85	290	25	800
Kuttampuzha	365	85	290	25	765
Edamalayar	365	85	290	25	765
Vazhachal	410	130	250	25	815
Nilambur & Mannarkkad	520	130	450	25	1125
Average/tonne	**453**	**115**	**322**	**25**	**915**

Source: Industry Oriented Reed Management Plan, KFD

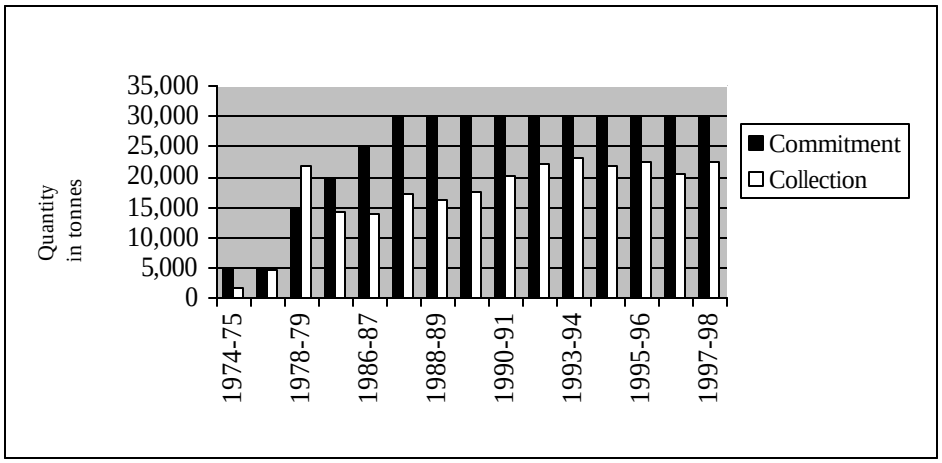
The problem of the Government's inability to supply the committed quantity of raw materials appears to be due to several reasons. Firstly, the commitments were based on incorrect assessment of the growing stock and exaggerated estimation of sustained yield. Secondly the shortages caused by harmful extraction practices appear to have been grossly underestimated. Thirdly, the forest areas from where the resources were to be made available could have undergone significant land use transformation. Fourthly, the productivity of bamboo and reed in the forests could have declined considerably. In the case of bamboos and reeds in Kerala, all these causes seem to have worked in tandem.

Kerala State Bamboo Corporation

The organised traditional reed weaving activities carried out under the Kerala State Bamboo Corporation is concentrated in the Angamaly-Kalady region of Ernakulam district and the Nedumangad-Aryanad region of Thiruvananthapuram district. Mats woven in the Angamaly-Kalady belt are procured by KSBC and sold mainly to the Central Warehousing Corporation's grain storage centres and the sugar mills outside the state. Mats from the Thiruvananthapuram region are mainly utilised within the state and in the production of Bambooply.

Several reports on the functioning of the KSBC show that in the initial years after its inception in 1971, the corporation did not face any shortage of raw material. This was despite the fact the Punalur Paper Mills with its spiralling raw material requirement (of 30,000 tonnes per year in 1972 and 50,000 tpa in 1975) was functioning. But with the starting of HNL and signing of its contract (in 1974) with the state government for a supply of 1,89,000 tonnes of reeds, raw material availability for KSBC became threatened.

Figure 14 KSBC & reeds: Commitment and collection



A conservative estimate of the requirement of reeds by an individual mat weaver is 5 reeds per day or 1,500 reeds per year (Kumar 1985). At this rate, the 10,000 weavers attached to the Bamboo Corporation would require an annual supply of 150 lakh reeds or 20,833 tonnes per year. The actual collection of reeds by KSBC had been at an average of 21,980 tonnes between 1994-95 and 1998-99. Thus it appears that the level of reed collection would suffice to meet the requirement of the registered weavers under the KSBC.

The number of weavers registered under the fold of the corporation had increased from 600 in 1977-78 to 9576 in 1998 (KSBC records). But other official documents of KSBC claim the strength of weavers to be around 12,000 families and the minimum annual reed requirement to be 36,000 tonnes. Mathew (1998:41) had assessed the number of active weavers to be 4,982 out of a total of 12,533 weavers registered with the corporation, or, in other words, just 40 per cent. There was considerable variation in the active participation of weavers under different reed distribution depots. For instance, in the Thottakam depot with 753 registered weavers,

the active members were only 117 (16 per cent) whereas in the Parappuram depot with 270 registered weavers, 245 members (90 per cent) remained active in weaving mats (Ibid).

Table 29 KSBC: Registered and active Weavers & availability of reeds

Name of reed distribution centre	No. of regd. weavers	No. of active weavers	% of active weavers	Reeds supplied No. (in lakh)	Reeds per regd. Weaver per year (in Nos.)	Reeds per regd. Weaver per year (in tonnes)	Reeds per active weaver per year (in No.)	Reeds per active weaver per year (in tonnes)
Kavaraparambu	900	343	38	2.64	293.33	0.41	770	1.07
Mukkannur	798	204	26	2.31	289.47	0.40	1132	1.57
Thuravoor	957	295	31	5.34	557.99	0.77	1810	2.51
Kidangoor	300	200	67	2.41	803.33	1.12	1205	1.67
Puthiyakara	520	139	27	3.48	669.23	0.93	2504	3.48
Thottakam	753	117	16	6.37	845.95	1.17	5444	7.56
Neeleswaram	445	107	24	5.21	1170.79	1.63	4869	6.76
Kottamam	624	291	47	4.04	647.44	0.90	1388	1.93
Okkal	743	146	20	2.44	328.40	0.46	1671	2.32
Kalambattupuram I	242	132	55	3.01	1243.80	1.73	2280	3.17
Cheranellur I	480	69	14	2.06	429.17	0.60	2986	4.15
Cheranellur II	501	152	30	3.87	772.46	1.07	2546	3.54
Parappuram	270	245	91	2.2	814.81	1.13	898	1.25
Kalambattupuram II	792	286	36	5.55	700.76	0.97	1941	2.70
Kaipattoor	597	345	58	2.49	417.09	0.58	722	1.00
Manjapra	933	301	32	4.79	513.40	0.71	1591	2.21
Koodalpad	1257	1008	80	6.41	509.94	0.71	636	0.88
Kuttampuzha	921	402	44	-	0.00	0.00	0	0.00
Mamalakondam	500	200	40	-	0.00	0.00	0	0.00
Total	**12533**	**4982**	**40**	**64.62**				
Average					**579.33**	**0.80**	**1810.18**	**2.51**

Source: Complied from KSBC records and Mathew (1998)

When we look at the resource distribution by KSBC among the registered weavers and considering the percentage of active weavers among the registered total, the picture becomes clearer.

The distribution of reeds to the mat weavers by KSBC was to the tune of an average of 579.33 numbers or 0.80 tonnes per registered weaver per year, far short of

minimum requirement of 1500 reeds per person per year as per Kumar (1985). But considering the active weavers to be just 40 per cent of the total, the distribution was of the order of 1810.18 numbers of reeds per weaver per year or 2.51 tonnes per weaver per year. Thus the availability of reeds per active weaver per year was marginally higher than the conservative estimate of raw material requirement as per Kumar (1985). However, the distribution of reeds by KSBC was insufficient going by the requirement of three tonnes per person per year estimated in the draft report of the Bamboo Development Scheme for Kerala (2000).

It has to be noted that KSBC had been set up with the avowed objective of developing and promoting industries, including cottage industries, based on bamboo, reed, cane and rattan in the whole of Kerala and as such its beneficiaries should include not only the registered mat weavers attached to around 100 depots of the corporation but also the bamboo/reed based cooperative societies and the traditional bamboo/reed artisans spread across Kerala. In principle 30 per cent of the raw material allowed to be extracted from the forests of Kerala should be earmarked and supplied to the *harijans* (the Scheduled Caste members) engaged in the manufacture of bamboo/reed handicraft products.

The strength of the unorganised artisans outside the KSBC network whose raw material needs should have been met by the corporation was estimated to be 3 lakhs in 1983 (Govt. of Kerala diary 1983). Perusal of the Plan Reports (*Vikasana Rekha*) of all local self-government institutions (gram panchayats and District Panchayats) in the state show that the number of people engaged in bamboo/reed craft as a means of livelihood have declined drastically in the last two decades to around 40,000 families.

In order to cater to the needs of at least one member each of the 40,000 traditional bamboo/reed artisan families in the State, the quantum of reeds required as per the conservative estimate of 5 reeds per person per day would be 83,333 tonnes of reeds. And at the rate of requirement of 3 tonne per person per year calculated in the Bamboo Development Scheme report, the raw material requirement would be 1,20,000 tonnes or reed/bamboo.

Against this huge resource requirement, KSBC has so far claimed only an allotment of 36,000 tonnes (259 lakh numbers) of reeds. This is partly due to scarcity of the raw material in the state and partly due to the corporation's inherent constraints that

prevent it from expanding the volume and area of operations. Despite diversifying into production of 'Bambooply' in 1985, KSBC's production volume of this value-added ply-board remained low. In 2001, the corporation could utilise only 20 million sq. ft out of 70 million sq. ft. of reed mats (28.57 %) procured from the weavers for production of Bambooply. Brought up in the subsidised mode of production organisation, KSBC could not succeed either in attempting any further value addition of bamboo/reeds or in marketing its signature product Bambooply in an effective manner. According to Kurian A.K., Manager (R&D), KSBC, the major problem the corporation faced was in "marketing bamboo mats and matboards" and this led to "excess production" of mats. In such a situation, KSBC has often been forced to curtail its collection and distribution of reeds to the mat weavers, despite its constant litany on scarcity of reeds.

KSBC, to many of its critics, has remained an "uneconomic industry that diverted bamboo from alternative, higher value uses" with the subsidies it enjoyed (to the tune of Rs 19 million per year) working as disincentive to both conservation as well as sustainable utilization of bamboo resources in Kerala (World Bank 1998).

The official allotment to KSBC has been just 30,000 tonnes of reeds. And the corporation's annual collection of reeds has always fallen short of the allotted quantity. This was "due to scarcity of reeds in the forest areas, caused by indiscriminate collection of industrial concerns," a note submitted by the corporation to the minister of forests in 1999 said. As a "most genuine and practical approach to the problem," KSBC had suggested "reservation of reed forests in Kuttampuzha, Kolathirumedu, Thundathil, Goodrical, Adimaly, Vadasserikkara, Naduvathumuzhi and Mankulam forest ranges for the collection of *Naitheetta* (weaving reed preferred for mat weaving) alone and to permit the corporation to extract the available *naitheetta* from other reed areas, limiting the quantity within the annual allotment" (KSBC 1999). "Unless this is done, the age-old cottage industry will face total annihilation," the note had warned.

Under the existing reed collection system, KSBC and HNL worked the same coupe in two stages in a year. The traditional sector worked the area first as they required reeds of larger size and this was followed by the industrial sector which took out all reed culms which were capable of yielding pulp According to Basha (1991), the system of two agencies approaching the same clump at different times of the same year caused

more damage to the resource base. The corporation's claim has been that the cutters under its fold practice only selection felling and thus reserving exclusive areas for KSBC would save at least that much of reed forests from overexploitation by the industrial concerns. Despite the fact that many of KSBC's reed cutters have been provided with training in identifying and extracting only those culms suitable for weaving mats, field observations do not substantiate the claim that the extraction practices of the corporation is selective and sustainable. There are also large numbers of *benami* (*u*nauthorised) reed cutters who carry out the work on the strength of cutting passes rented out by the registered reed cutters without caring much for the rules.

Cooperative Societies

A large number of cooperative societies were formed in the bamboo sector during 1960s. The state government had supported these cooperative societies with liberal financial help in the form of share capital support, grant for purchases of land and meeting part of the expenditure on pay and allowances of managerial staff during the initial five years [Muraleedharan and Rugmini (1988)]. Around 40 cooperative societies with total membership strength of around 5,000 bamboo/reed artisans existed in the 1980s (Nair and Muraleedharan 1983). A majority of members of these societies belonged to Scheduled Caste communities traditionally dependent on mat and basket production. Unlike KSBC and the PPI units, these societies were not given any direct access to raw materials. They had to collect reed from KSBC and supply them to their workers.

These cooperative societies organised on the principles of self-help and mutual help, however, turned sick within a short time and only around 10 per cent of them survived. Most of the functioning ones remained chronically sick (Mathew 1998:54). Thus cooperative societies have not been successful in ensuring adequate distribution of raw materials to bamboo artisans. Based on his study of the unorganised household bamboo-processing sector in Adimaly panchayat in Idukki district Jayasankar (2000) had observed that the failure of the co-operative societies was due to the lack of commitment and professionalism of the persons entrusted with the task of managing these institutions. The goal of eliminating intermediaries for which the societies were set up has not materialised: "the intermediaries have succeeded in toppling the

functioning of the societies and to make the societies function to serve their pr ivate interests" (Ibid).

Unorganised bamboo artisans

Within the hierarchy of bamboo user-groups in Kerala, the position of the unorganised bamboo/reed artisans is at the lowest rung socially, economically and politically with regard to rights over resources. The majority of such artisans belong to the Sambhava or Paraya community, downtrodden castes in the Hindu caste system that has prevailed in Kerala to this day. The tribal bamboo/reed artisans also remain totally unorganised. By the term 'unorganised' what is meant here are the groups of bamboo/reed artisans who fall outside the KSBC supply chain. Even those artisans who obtain reed supplies through KSBC's reed distribution centres are also unorganised in all other aspects of production including technical, financial and marketing support.

Table 30 Distribution of bamboo/reed craft workers in Kerala

Serial No.	*Districts*	*No. of panchayats in which bamboo craft continued*	*No. of panchayats in which bamboo craft faced crisis*	*No. of panchayats where bamboo craft did not exist/ not mentioned*
1	Thiruvananthapuram	12	13	53
2	Kollam	15	11	44
3	Pathanamthitta	33	2	19
4	Alappuuzha	22	1	51
5	Idukki	23	1	27
6	Kottayam	33	1	24
7	Ernakulam	35	14	25
8	Thrissur	57	17	20
9	Palakkad	53	15	2
10	Malappuram	62	22	10
11	Kozhikode	40	11	22
12	Wayanad	8	11	5
13	Kannur	23	21	38
14	Kasaragod	9	15	13
	Total	**425**	**155**	**353**

Source: From 'Plan Reports' (Vikasana Rekha) of various LSGIs in Kerala

KSBC supplies to traditional artisans:

The Bamboo Corporation's 13 reed distribution centres (RDCs) are concentrated mostly in central and south Kerala and thus do not cater to a large proportion of traditional bamboo/reed artisans in the state. There are only three RDCs in north Kerala namely the ones at Perinthalmanna and Nilambur both in Malappuram district and Vadakara in Kozhikode district. A comparison with the panchayat-level distribution of bamboo/reed workers in Kerala would reveal that the establishment of RDCs was not proportionate to the concentration of unorganised workers engaged in the bamboo craft in the State. The above table shows that the highest concentration of bamboo/reed craft workers in Kerala was in Malappuram district. Here bamboo craft was reported to be active in 62 grama panchayats and in another 22, the craft was on the verge of extinction. Similarly, no RDC was set up in Palakkad district where the craft existed in 53 panchayats and faced extinction in 15 others. The district also had the highest concentration of the Kavara community people, who were exclusive bamboo/reed artisans.

According to KSBC records, the target for total sale of reeds through these three RDCs for the year 1999-2000 was five lakh tonnes out of a total target of 90 lakhs (5.55 %) set for the 13 RDCs under the corporation. In other words, the corporation's target for sale of reeds to the traditional artisans in the two districts was 694 tonnes in the year against a total sales target of 12,500 tonnes.

Even this distribution of the meagre quantity of reeds through the RDCs is saddled with several problems. The distribution is highly erratic in time and the quantity allocated would be in proportion to the stock available with the corporation and not in proportion to the number of basket/mat weavers in a locality, their raw material demands or their productivity etc. KSBC did not take any account of such factors related to the artisans who bought the reeds from RDCs. The corporation neither collected their products for marketing nor offered them any technical or financial assistance.

The sale value of reeds in such depots included reed collection and transportation charges. Thus the price realised from the unorganised sector remained higher than the charges levied from weavers attached to the depots closer to the Corporation headquarters at Angamaly in south Kerala. For instance, while the average cost of a

reed measuring about 15 – 20 ft. paid by the mat weavers in Angamaly remained Rs.2 – 2.25 in 2002, the price collected from unorganised artisans at the Meppayil (Vadakara) RDC sub-depot in Kozhikode district ranged from Rs. 3 to Rs.3.30 per reed (or Rs. 60 to Rs. 66 for a bundle of reed containing 20 numbers).

Unscientific methods adopted for the transportation of reeds from the collection centres to the depots (partly through the river and partly through the road under pressure from the transporting workers of the corporation) caused considerable delays as well as wastage of reeds. As a result, the reeds supplied to the weavers/artisans, especially those in regions away from the KSBC headquarters at Angamaly, often comprised of poor quality reeds. Sometimes the reeds would be too dry or too small and thus useless to the artisans.

Supply of bamboo and reed by KFD under the Seigniorage Pass system:

The seigniorage pass system for supply of certain types and quantities of forest resources to specified user groups is a colonial instrument that has remained almost unaltered to this day in India. Even the introduction of the National Forest Policy 1988 which considered "meeting the requirements of fuelwood, fodder, minor forest produce and small timber of the rural and tribal populations" as one of the basic objectives of such a policy formulation and stated that the domestic requirements of tribals and other poor people living within and near the forests "should be the first charge on forest produce," (National Forest Policy 1988: 4.3.4) did not bring any significant change in the seigniorage system.

The origin of the system goes back to the Indian Forest Acts of 1878 and 1927, typical colonial instruments meant to keep control on exportable high value products like teak, sandalwood, rosewood etc. Under these Acts, the "rights" of the local communities on meeting their *bona fide* needs were recognised only at the time of 'forest settlement' and later on only certain "privileges" were granted. The 'privileges' were in reality only "concessions against obligations to assist the government against pilferage, theft, fire and such damages to the forest crop. The legal provisions had not addressed the democratic needs of 'forests for the people and of the people" (Adkoli 2002). Under the Indian Forest Act 1927 [Section 2 sub-section 4(a)], several substances widely used by the people including charcoal, catechu, wood oil, resins, barks, bamboos and reeds were defined as "forest produce"

even when they were not found in or brought from forests or not. And under sub-section 7 of Section 2, 'timber' included fallen or felled trees, palms, bamboo and canes.

Modelled on the Indian Forest Act, the Kerala Forest Act, 1961 and its subsequent amendment in 1974 too defined 'trees' to include "palms, bamboos, stumps, brushwood and canes" [S2 clause (f) sub-clause ii (l)] and 'forest produce' to include "plants not being trees (including grass, creepers, reeds and moss)… found in or brought from a forest" [S2 clause (f) sub-clause ii b].

Further, the Kerala Forest Produce Transit Rules, 1975 (based on Section 39, 40 and 76 of the Kerala Forest Act 1961) stipulated that no forest produce shall be imported, exported or transported within the state either by land rail or water unless accompanied by a pass [Rule 3 Clause (iii)]. The passes (in form VII) for removal of fuel, charcoal, bamboos and reeds purchased from reserved forests or unreserved government lands on payment of seigniorage fees would be issued by Range Officer of the forest range or any other officer specially authorised to do so by the conservator of forests [Section 8, Transit Rules, 1975]. In forest divisions were transport of reeds was affected by land in head-loads, head-load passes were to be issued separately (in form VIII). The head-load passes giving a description of the produce being transported and its value stipulated per bundle of 30 reeds would be valid for just one day or 24 hours. The Transit Rules also stipulated that the "fees paid as seigniorage for articles of minor forest produce (sic) including reeds and bamboos shall not be refunded on any account" [Section 8 (2)].

For the people living within or near the forests, it is indeed an ordeal to get a seigniorage pass sanctioned by the Forest Department official. First of all one had to approach the village authorities for a certificate to prove one's *bona fides*. Finding out and locating the appropriate KFD official authorised to issue the pass was the second step in the process and this invariably took two-three days. The fee to be paid, as seigniorage, was relatively hefty as it included the basic fee, sales tax and Forest Development Tax (FDT). Exemptions from the tax apply only to schedule castes and tribals. At the 1999 rates, this stood at a basic fee of Rs. 12 for a bundle of reed containing 20-25 numbers, Re. 1 as sales tax and Re. 1 as FDT. In the case of bamboo the seigniorage charge in the same year amounted to Rs. 775 for 5 culms of bamboo inclusive of a basic fee of Rs. 750 and the assortment of taxes. Even though the rate

was calculated on the basis of tonnage, no local user would ever be given more than just five culms of bamboo at a time. This restriction on quantity virtually ruled out using bamboo for the roof of even the smallest of huts, as it would require a minimum of 20-25 bamboo culms. Then, the seigniorage fee was highly discriminatory because the local user was forced to pay the fee at the rate of around Rs. 2400 per tonne of bamboo in 1999 in contrast to industrial consumer Grasim Industries paying a paltry Rs. 426 per tonne of bamboo.

The direct and indirect charges involved in getting the seigniorage pass were thus quite high. And even if a person managed to eventually get a pass issued, it would be virtually impossible to use it legally because its validity was only for 24 hours. The rule stipulated that the poor tribal or the villager should identify the resource allocated, fell it and remove it as head-load within 24 hours. This stipulation made the whole seigniorage pass system simply unworkable, forcing the local people to either to abandon bamboo altogether or take resort to clandestine means to get it.

A comparison of this seigniorage supply system that prevailed in Kerala with the rights and concessions on the supply of bamboo from the forests in a few other states would reveal how myopic the Kerala Forest Department and the Kerala Government had been.

For instance in Madhya Pradesh, a highly differentiated system of supply of bamboo under the *nistar* rights (customary rights over forests) had been in place. The Forest laws of the state not only recognised a variety of user groups and uses of forest bamboo but also stipulated clear norms on apportioning the resources in proportion to these varied requirements. The state had recognized bamboo artisans, betel vine growers, rural *nistar* rights holders, building contractors, incense stick makers, manufacturers of frames for *bidi* rolling etc. as different user groups of bamboo.

The pricing system of bamboo favoured the rural rights holders most, as they had to pay the lowest rate of Rs. 0.25 per bamboo (plus extraction and transportation costs and forest development tax) for a supply of 250 bamboo poles per family per year. Such a system was in place until 1997 when a policy revision insisted that *nistars* should buy bamboo from the open market at prevailing prices. Nevertheless the concessions offered to other groups including the *basods*, the bamboo artisans, remained in tact.

Each artisan family in MP was entitled to 1,500 bamboo poles per year at a price of Rs 0.60/bamboo for the first 500 bamboos and Rs.0.75 each for the additional 1,000 bamboos. The *pan barejas*, the betel vine growers, were entitled to a maximum of 1,000 bamboos / family/ year at the rate of Rs1.50 per bamboo. Other consumers such used more than 500 culms such as fruit growers, building contractors, incense stick makers, and manufacturers of frames *bidi* (rural cigarette) storing etc. were entitled to five notional tons (1 notional ton= 0.8 ton) of bamboo per year at a price of Rs. 1115 /notional ton. Businessmen had to pay an additional charge of Rs.200 and, building contractors, Rs. 150 over this basic rate. For all other consumers, the maximum supply per family per year would be 50 poles of bamboo at a rate ranging from Rs.7.70 for a 4.6-metre pole to Rs.13.75 for a 7.3-metre bamboo pole.

Similarly in Gujarat, people living inside the forest area were entitled to 800 bamboos per family per year and those living outside the forests, 125 bamboos per year per family. The quantity earmarked decreased with increase in distance from the forests. The charge payable by the former was Rs. 66 per 100 bamboos (inclusive of cutting charges) whereas the latter paid Rs 81 for 100 bamboos.

Constraints in the distribution system

Industrial supply & Long-Term Agreements (LTAs): The long-term agreements virtually leased out vast forest areas for a substantial period of time (20 years in the case of Grasim and HNL) for exclusive extraction by the company using its own hired labour force. There was no compulsion on the KFD to employ local, especially tribal, labour. If the companies had hired tribal labour for felling bamboos it was on the one hand out of monetary considerations such as lower wages payable to tribal workers and on the other with the intent of exploiting indigenous knowledge of forest resources.

Under the Long Term Agreements, the forest department decided the felling series and cycles and also the felling rules. However, there was a clause in the LTA with Grasim Industries that the felling rules could be modified only in consultation with the company. Initially there were no penal provisions against violation of felling rules; the department could only "serve a notice to the company drawing its attention to this fact and requiring it to abide by the rules" (Principle Agreement with Grasim: Clause 6). The forest department did not have control over the contractor or the labour

engaged by him for carrying out felling. The Government's right to claim compensation for violation of rules was introduced in the case of Grasim only in 1976, a long 14 years after the company began to extract raw materials from the forests. Again, it was only as an afterthought thatthe company's responsibilities in preventing and reporting forest fires were fixed in the LTA. The economic check measures imposed on the companies too could have been ineffective. The advance deposits and security deposits claimed from PPI units, for instance Rs. 20,000 as advance deposit and Rs. 5,000 as security money claimed from Grasim in the 1976 LTA, could have been just peanuts for the big PPI unit.

"Corruption and waste were inherent in the contract system," according to Guha (1994:33) who has pointed out that "the need to replace contractors by forest labour cooperatives has been stressed by all the Five Year Plan documents." Despite several pressing ground realities such as the high unemployment rate and relatively high levels of poverty among the tribal communities in the state, Kerala's achievements in replacing contract labour in forestry operations with labour provided by tribal cooperatives have been poor, except in the case of MFP collection for which exclusive rights were granted to Tribal Service Cooperative Societies (TSCS) in 1978. Nevertheless, while the TSCSs in Kerala were not engaged in collecting bamboo, in other states such as Andhra Pradesh, Bihar and Madhya Pradesh the contract system for collection of bamboo was replaced with departmental working system. Gujarat, Maharashtra, Rajasthan and Jammu and Kashmir had also gradually brought the working of almost all forest coupes of timber, fuel-wood and charcoal under the tribal cooperatives (Government of India, 1982).

Both in the case of Grasim and HNL, the contract system of extraction prevailed whereas in the case of Kerala State Bamboo Corporation, the resource extractors are traditional reed cutters registered under the corporation. Hence KSBC could exert some control over the activities of the reed cutters, however theoretical that might be. There is a large informal sector of reed cutters in the case of KSBC where registered reed extractors sublet their cutting rights to other groups of people such as the adivasis (tribal people) and migrant Tamils who actually did the work. Based on his study, Mathew (1998) has assessed the size of the informal sector to be 10 per cent of the KSBC sector. And as most of the reed cutters have organized themselves into trade unions, they have often been able to put up a counter pressure on the corporation

against any reforms in the practices regarding collection of reeds. The bamboo corporation had around 2,500 registered reed cutters in its fold during 1991. At a time hundreds of reed cutters worked a forest coupe so that it was humanly impossible for the few forest guards to monitor or have control over them (Olassa *et al.* 2000). "The labour force swarms the reed forests and in the greed to collect more number of reeds in minimum time all the mature reeds are cut from the clumps which are near the loading points in order to avoid long-distance dragging or headload transport," says Basha (1991).

The payment for the reed cutters engaged by HNL is on the basis of the weight of reeds procured, a condition that promotes cutters to fell immature reeds too (which also would have more moisture content and thus add to the total weight) leading to excessive harvesting. The reed cutters of KSBC, on the other hand, are paid on the basis of the grade of reeds determined in relation to their quality and suitability for mat weaving, a stipulation that helps in limiting the volume of extraction. The relative difference on the quality of reeds required by the pulp industry and the handicraft sector of mat weaving is an important distinction that has a bearing on the volume of extraction and thus on the sustainability of the resource base. The mat weavers in the handicraft sector need mature reeds whereas the age of the reed is immaterial to the pulp industry. Thus, in theory, the extraction by KSBC should not have paused any problem for the regeneration of resources. "Of the two sectors, the traditional sector is less harmful than the other," says Basha (1991). However, as permission has been granted to KSBC to collect and remove reeds throughout the year including the 'closure period', i.e., the rainy season starting June when new shoots appear in a reed clump, the extraction system of KSBC too could lead to depletion of the resource base.

Responses to raw material crisis

The failure of the systems for distribution of resources has evoked varied responses from the user groups in the forest industry sector in the country depending on the different choices available to each group. In most cases, the immediate response of the companies as well as the governments was to expand the resource catchment areas further. The long-term choices available to the PPI have been broadly three in nature: augmentation of the resource base through either captive forest-plantations or non-forest plantations; modification of technology in such ways as to utilize other suitable

raw materials in the production process and/or to improve the raw material use efficiency; abandoning the production unit altogether to shift to greener pastures and new avenues. Whether a user-group adopted any or a combination of the choices depended on several factors including economic viability and social acceptability of the choice and the prevailing government policies.

Expanding ecological footprint

Short-term, *ad hoc* solutions adopted by the PPI and the governments had led to the expansion of resource catchment areas in the case of all bamboo/reed user groups in Kerala, including the traditional sector. Expansion of catchment area has several implications. From the point of view of forest management, this made the system more inefficient by slackening the monitoring of felling practices and scattering resource regeneration measures. From the point of view of forest ecology, opening up fresh catchment areas allowed further inroads into deeper forests not only for the particular user group but also for all future encroachers, thus spreading ecological damage over space and time.

The Centre for Science and Environment, a non-governmental organisation, had assessed the ecological footprints of PPI unit in India as part of the Green Rating Project (GRP). The first GRP analysis had covered Grasim and HNL in Kerala. CSE defined 'ecological footprint' as "the amount of land that is blocked to fulfil the raw material requirement of a mill, the ecological burden that the mill's fibre sourcing has on the natural environment" (CSE, 1998). Based on the data provided by the company on the quantities and sources of bamboo and wood raw materials used in the production process and assuming the average annual yields of bamboo and wood in India to be 4.0 metric tonnes (MT) per ha and 10 MT/ha respectively, CSE estimated that Grasim utilised 1,391.51 sq. km of terrestrial area to produce 44,044 MT of pulp every year. The per unit ecological footprint of Grasim was calculated to be 3.16 ha.

Similarly, taking into account all the diversified types of raw materials utilised by HNL (imported pulp, eucalyptus, reeds, bamboo, hardwood and softwood) and their sources (i.e., whether they were from natural forests, plantations, farm forestry etc.), the GRP team estimated the per unit ecological foothold of HNL to be lesser at 1.55 ha.

With the commissioning of the de-inking plant and the increased use of waste paper in the production of newsprint, HNL's ecological footprint would have faded further in recent years.

Forestlands for captive plantations?

For the PPI and other wood-based industries in the country, supplies from natural forests managed by the government had always been the first choice for raw material as long as the seigniorage rates charged remained far below market prices and the extraction costs were nominal. However, with the costs going up and the supplies dwindling, the next best option was to set up and manage captive plantations on forestlands leased at low prices. The PPI had always put pressure on state governments to apportion forestlands for this purpose.

Since 1971, when the 30,000 acres of private forests Grasim had purchased from Nilambur Kovilakam was taken over by the Kerala government, the company had made several requests to get forestlands assigned for exclusive captive cultivation. Different state governments and a few official committees had compassionately considered these requests. For instance, the Committee to Study the Supply of Pulpwood to the Large-scale Timber-based Industries in Kerala, 1989, chaired by K. Mohanachandran, Secretary, Industries, had recommended an alternative solution to earmark select eucalyptus plantations of KFD to four industrial units in the state, giving the companies exclusive rights over the produce (but not ownership rights over the land) in return for corporate investment and participation in improving the management and yield of the forests. But Grasim (through its letter dated 28-08-1989) declined to invest in intensive cultivation in forestlands kept under the control of KFD.

Grasim President R.N. Saboo had repeated the demand in an official meeting on January 28, 1998, chaired by the Chief Minister of Kerala, brandishing the usual weapons of the company, a threat of closure and an offer to invest on fertilisers and other inputs needed by the existing plantations (Govt. of Kerala 1998). But the Kerala Government could not offer any forestland to Grasim because by then a clearance of the union Ministry of Environment and Forests had become mandatory for assigning forestlands. Under the FCA 1980, only public sector companies could be provided with forestlands.

By this time, a Working Group set up by the Planning Commission, Government of India, to examine the prospects of leasing out degraded forestlands to the private entrepreneurs/ Forest Corporations for production of industrial raw material had also rejected the idea of leasing forests to the private entrepreneurs. Such leasing would be against the interest of farmers, be socially more costly, further distort the market for pulpwood (already deformed through subsidies for bamboo) and unleash a plethora of claims from sawmills, cottage units, plantation industries etc, the committee cha ired by Dr. N. C. Saxena, Secretary, Department of Rural Development, had reported. "Using forests for growing raw material for industry would be setting the clock back to the 1960s, showing that we learnt nothing from the mistakes of the past 30 years," the Working Group report had warned, adding that "the degraded forests required … protection and recuperation, which could be done only by working with the people, where industry had neither expertise nor patience." (Planning Commission 1998).

Only HNL in Kerala benefited from the policy on captive lands. Between 1987-93, HNL used about 1.5 lakh tonnes of reeds and eucalyptus from approximately 80,000 ha of Kerala Forests (CSE 1998). From 1987 onwards when the production capacity was raised to 1,00,000 MT, HNL had been facing raw material scarcity. HNL had already begun to procure forest raw materials from private sources besides importing pulp from other states. In 1993, the government sanctioned 5,600 ha of forestlands to HNL for meeting the company's additional requirement of pulpwood. However, much of the degraded forestlands thus allotted turned out to be rocky patches unfit for any cultivation. So HNL could put to use only 1062.68 ha out of the area allotted by the government. The first plantations were started in 1998 (200 ha), the 2nd in 1999 (798 ha) and the third in 2000 (64.07 ha). Acacia auriculiformis was the species chosen for low-elevation areas and Eucalyptus grandis for the High Ranges. The yield expected from the captive plantation was around 60-80 tonnes per ha for acacia.

Farm Forestry

The pulp and paper industry (PPI) in India had always been in the forefront of demanding abandoning government controls over forests, involvement of private sector in forestry as well as wasteland development programmes, leasing of forestlands for setting up captive plantations, long-term institutional investment support, lifting of ceiling on cultivable lands and many such policy changes. In tune with this line of argument, the industry had often expressed its doubts over, if not

outright rejection of, the concept of 'farm forestry' promoted in the National Forest Policy, 1988 which exhorted the industry to meet its raw material requirements through linkages with local farmers. Drawing a clear line of differentiation between farm forestry and captive forestry, advocates of the PPI had argued that the former did not guarantee constant supplies, was prone to the vagaries of competing and open market-driven land uses, created logistic problems on account of small size and scattered nature of farmers' plots and was bound to be technologically inferior (Sharda and Ramakrishna 2002).

Out of the four major bamboo/reed based manufacturing firms in Kerala, only Hindustan Newsprints Ltd was successful in gradually bringing down dependency on natural forests as well as forest-based plantations through farm forestry programmes. HNL had been running a successful farm forestry programme from 1996 and had introduced a unique 'Gate Purchase Scheme' in 1998. Under the farm forestry programme, 55 lakh seedlings of various pulpable species – *Eucalyptus grandis*, *Eucalyptus tereticornis*, *Acacia mangium*, *Acacia auriculiformis*, *Albesia*, Casurina, Reed, Bamboo and silver oak – were distributed to farmers and farming societies spread over Kerala. In 2002 alone HNL distributed 50 lakh seedlings. There were 87 nurseries run by voluntary organizations supported by HNL.

The active number of farmers participating in the farm forestry scheme is not known. In Kottayam district alone, there were nearly 2000 farmers taking part in the farm forestry programme. Around 130 voluntary organisations have by now joined the programme. Around 2.75 lakh MT of raw materials have been purchased under the Gate Purchase Scheme from farmers since 1998. Thus HNL has reduced its dependence for raw materials on government sources to 40 per cent, meeting 20 of its needs through its own captive plantations and the remaining 40 per cent though purchases from outside the state and Gate Purchases under the farm forestry programme.

Under the Farm Forestry Programme, HNL gave free technical support on cultivation practices to farmers who took up more than 500 seedlings. Earlier there was fertiliser supply through IFFCO. But as chemical protection made farming uneconomical, the supply of fertilisers and pesticides has been given up. In places such as Vattavata, farmers have devoted large portions of waste/barren lands to cultivate pulp trees. The Malankara Estate, for instance, planted around 3,000 bamboo saplings. Many small

farmers grew even two or three trees in the corner of their garden lands, devoting anything between 10 and 50 cents of land for growing such trees. The purchase prices paid by HNL for the farm forestry products in 2002 were Rs. 1,650 per tonne of *E. Grandis*, Rs. 1,600 for Eucalyptus hybrid and Rs. 1,750 per tonne of bamboo. A freight subsidy of Rs. 2 was also paid for loads brought from Palakkad district. In the same year HNL did not buy bamboo from Government Sources because, "the prices were uneconomical" (company officials). This time HNL extracted 20% Reed and 20% wood from Government sources.

Technology changes for fibre-use efficiency

Compared to the 1970s and 1980s when wood and bamboo constituted the chief raw material for paper and board manufacture in India, use of non-wood fibre resources increased considerably in the 1990s. The raw material utilization profile of the industry as a whole has changed considerably with non-wood fibre resources accounting for 36 percent of raw materials in 1996 and the utilisation of bamboo going down to 38 percent and recycled fibre rising up to 26 percent (MoEF 1999).

Coupled with the technological changes required for this change in raw material profile, several units in the PPI had also improved their process to achieve better fibre use efficiency. Here too HNL stood taller in comparison with the private sector PPI unit Grasim. With the Chemi-mechanical pulping (CMP) method it utilized, HNL could utilise 88-90 per cent of the cellulosic raw material and the loss of raw material would be only 10-12 per cent (Savur 2003:II: 534). However, according to CSE's assessment, HNL's CMP process could achieve only 66-72.5 per cent efficiency against the maximum possible 80-85 per cent efficiency. In the Chemical Pulping (CP) line too HNL's achievement of 43-50 per cent efficiency was slightly (5%) short of the maximum possible, according to CSE. According to CSE's GRP report, HNL's overall (CMP+CP) fibre use efficiency at 61.6 per cent was lower than global standards for newsprint production.

However, in contrast to HNL, the Grasim unit at Mavoor, which had persisted with the outmoded sulphate process, could achieve a green-fibre use efficiency of only 29 per cent. "What is worse, the trend in fibre-use efficiency has consistently remained at a low level and no initiatives have been taken to increase it," said the GRP scorecard, which gave Grasim the 25th rank among 27 PPI units in the country rated for their environmental credentials.

Summary and conclusion

Sustainable management and utilization of resources demands that the resource, the associated lands and the user groups including people dependent on the resource should be managed in an integrated manner to meet the several social, economic, ecological, cultural and spiritual needs of present and future generations. This principle is equally applicable to resources in their natural settings such as forest resources and man-made resource systems such as forest plantations. The scale and intensity of forest management operations, the uniqueness of the affected resources, the relative ecological fragility of the forests, the social and economic vulnerability of people directly affected by resource management systems, the economic costs and benefits incurred by local communities or the society as a whole need to be considered in detail for assessing the sustainability of a resource management system.

Sustainable policies

An important principle of sustainable development is that any activity in question complies with national or local policies and international conventions or agreements aimed at sustainable development. In the Indian context, the first such policy initiative was the National Forest Policy of 1988, which ruled that "the domestic requirements of fuel wood, fodder, minor forest produce and construction timber of the tribal people should be the first charge on forest produce" and that industries should, as far as possible, raise their own raw materials in association with local farmers. The policy prescribed that "the life of tribals and other poor living within and the near forests revolved around forests and the rights and the concessions enjoyed by them should be fully protected." Our study in the context of Kerala shows that bamboo resource management in the state has so far remained in the mould of the old colonial Forest Policy Resolution of 1894, which emphasized state control over forests and exploitation of forests for augmenting state revenue. In fact, trade in bamboo never increased state revenue; on the contrary it only added a huge burden of subsidies to the state exchequer, the magnitude of which has not been properly assessed yet.

The non-compliance with policies, norms and rules have been widespread: Despite provisions for supplying part of the forest resources to 'right-holders,' the Kerala Forest Department could simply stop doing so in order to meet the larger commitment to the organized industry. While collection of bamboo and reed from the forests

required legal permits and identity cards, nearly 10 per cent of the reed cutters who supplied reeds to the Kerala State Bamboo Corporation worked without passes; 'leakages' of raw materials and finished mats were sizeable in the reed sector despite KSBC holding monopoly rights over extraction and supply of reeds to weavers; only 3.70 percentage of the households in Thrikkaipetta village in Wayanad district bothered to get a pass for collecting bamboo/ reed from the forestlands; in the two tribal hamlets surveyed, no one possessed a signiorage pass for fetching an authorized head-load of bamboo.

Such non-compliance with norms passed because of the haziness regarding rights, privileges and concessions within forest laws. Under the Indian Forest Acts of 1878 and 1927 the "rights" of the local communities for meeting their *bona fide* needs were recognized only at the time of 'forest settlement' and later on only certain "privileges" existed. The 'privileges' were in reality only "concessions against obligations to assist the government against pilferage, theft, fire and such damages to the forest crop". Unlike the long-term agreements with corporate entities in the Pulp and Paper Industry, these privileges did not entail legally enforceable commitments.

An important forest policy guideline that has not been followed in earnest in the bamboo sector management in Kerala is the one regarding participatory forest management (PFM). The PFM, under which forest and forest-fringe people could be enjoying better control over forest management and benefits realizable out of non-timber forest produce such as bamboo, has not made any headway in Kerala. More democratic legal provisions that enable village councils enjoy total control over natural resources as under the Panchayati Raj (Extension to Scheduled Areas) Act (PESA) applicable in tribal villages in Schedule V areas in the country remains to be even discussed seriously in Kerala.

Impact on rural employment opportunities:

An important social principle of Sustainable Forest Management is that community relations and workers' rights are protected. "Forest management operations shall maintain or enhance the long-term social and economic well being of forest workers and local communities. In NTFP harvest, use or production shall not negatively impact subsistence utilization or traditional harvesting practices by Indigenous People or other social groups" (Forests Stewardship Council).

An indication of adherence to this principle would be the range of opportunities available to the resource-dependent people to maintain and improve employment based on the resource. On this count, the bamboo sector in Kerala has clearly been unsustainable. As we have seen, the number of traditional workers in the bamboo sector declined sharply by one-third -- from 3,00,000 reported in the Government of Kerala diary in 1983 to around 1,00,000 working members in 40,000 families as reported in the Development Reports of the grama panchayats (LSGIs) in1998, in the three decades of intensive industrial extraction of bamboo and reed from the forests. The Kerala State Bamboo Corporation set up with the objective of improving the livelihood of traditional bamboo/reed workers in the state could only stem the rot partially. It could support only around 12,000 families of reed weavers and around a thousand reed extractors. Depletion in local availability of raw material has been one of the reasons for large-scale migration of people away from bamboo processing.

Benefits and costs:

Sustainable resource management should encourage the efficient use of the resource in order to ensure economic viability and a wide range of environmental and social benefits. Ensuring economic viability involves, first and foremost, assessing the existing resource harvest as extractive or destructive. While the beginning of large-scale exploitation of bamboo resources in the country was based on the misplaced notion of availability "*in perpetuum*", there seems to have been some anticipation of an impending crisis caused by overexploitation, because even in1950s and 1960s FAO had started propagating eucalyptus as an alternative to bamboo. Nevertheless, there were no earnest efforts to verify whether the harvesting techniques and rates of extraction of bamboo would cause any long-term harm or ensure renewal of the species to offset declines in population or health in situations where long-term harm could not be avoided.

To be economically and ecologically viable, resources management should take into account the full environmental, social, and operational costs of production, and ensuring the investments necessary to maintain the ecological productivity of the forest. On all these counts, the performance of the bamboo sector in Kerala has been miserable. The environmental costs involved at both ends of the production lifecycle of the PPI units, i.e., at the point of resource extraction and in the discharge of process wastes into the atmosphere as well as river systems, have never been properly

acknowledged. In an interview the state Minister for Industries, Suseela Gopalan, had said with characteristic disdain: "no industry can be run if one paid attention to the environmentalists and their calculations…(Business Line, September 23, 1999).

The costs borne by the society at large in subsidizing the PPI industries have been huge: for instance, an estimation by Sridhar (2000) put the cumulative cost of subsidizing Grasim Industries over 34 years at a whopping Rs. 28,000 crores. The World Bank has assessed the subsidy to the two PPI units to be in the range of 33 per cent of the market prices, amounting to approximately Rs. 175 million for 1997-98. Krishnankutty and Chundamannil (1985) had calculated the annual loss in the sale of eucalyptus to the pulp factories during the early 1980s as Rs. 6.7 million.

According to Chundamannil (2001), forest plantations in Kerala had always been managed on "a low input conservative approach." The same author has also pointed out how the investment priorities in the forestry sector in Kerala were skewed in favour of unprofitable eucalyptus over the dependable teak. During the Third Five Year Plan (1961-66) and the subsequent three annual plans, KFD had uncritically gone about expanding eucalyptus plantations, investing as much as 55 per cent of the total investment in plantations on eucalyptus alone. During the same period, only less than one per cent of the total annual expenditure was made available for natural regeneration in felled forests (Chundamannil 1986).

To be viable, forest management should minimize waste associated with harvesting and on-site processing operations and avoid damage to other forest resources. However, forest working plans have often pointed out how wasteful the harvesting practices of Grasim Industries had been. In the case of reeds, repeated harvesting by KSBC and HNL lead to virtual clear-felling, destroying the resource base. In the case of KSBC, wastage at all the points of production – felling and hauling of reeds in the forests, their transportation through river and over road, collection and distribution, processing and storage and marketing of mats and matboards, wastages are significant so that they are recorded in the Annul Reports.

Sustainable harvest levels:

The rate of harvest of forest products shall not exceed levels that can be permanently sustained. This is a crucial principle for sustainability of resource management over generations. Yet this is also one of the most difficult to follow. So far there has not

been any conclusive prescription on the sustainable levels of harvest for bamboo and reed forest in Kerala. Such data are not available for plantations either. An annual cut of 6.5 per cent of the total stock every year was prescribed by the 1959 bamboo survey. Even this was based on the assumption that scientific management would increase the regeneration rate in the bamboo forests to be 33 per cent of the stock. While imponderables such as bamboo flowering (natural or induced by overfelling, forest fires etc.) complicated the harvest levels by calling for clear-felling (100 per cent cut), other factors such as forest fires destroyed whole bamboo forests. Absence of studies on natural regeneration after clear-felling and destruction of forests through fires made the yield and harvest prescriptions highly suspect.

Environmental Impacts:

In order to be ecologically sustainable, forest management practices should conserve biological diversity and its associated values, water resources, soils, unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest. Recognizing, maintaining and enhancing the value of forest services and resources such as watershed functions fisheries etc. are key to sustainable operations.

In contrast to such prescriptions what really happened in the case of bamboo forests in Kerala have been illustrated in our brief discussion on the transformation of the Muthanga forests in Wayanad. Here the ecological impacts of conversion of good bamboo forests into eucalyptus plantations and the subsequent failure of efforts to re-convert plantations into natural forests have been shown to be great. The impacts of ecological destruction were extensive: it increased human wildlife conflicts and the misery of forest dependent adivasis.

The conversion of natural forests into eucalyptus and acacia plantations introduced to feed the PPI factories had begun with grasslands and then spread to all types of forests and even non-forested common lands under the social forestry programme. Eucalyptus plantations in Kerala had faced several problems such as site species mismatch, termite attacks, pink disease in nurseries and plantations etc. Ensuring sufficient regeneration in coppice-felled areas was also a problem. Frequent fires too damaged large areas of eucalyptus plantations, which did not have the resilience of teak (Chundamannil 2001). The fate of other plantations – that of acacia, bombax,

wattle etc. started without adequate pilot studies were not much different with productivity remaining low and profitability poor.

Management:

Broad management goals for sustainable forest resource management include overall improvement of management practices, incorporation of full costs of management and production into the price of forest products, promoting the highest and best use of forest resources, reducing damage and waste, and avoiding over-consumption and over-harvesting. Ideally, management plans clearly stating the long-term objectives of management and the means of achieving them should guide the operation of resource management. Constant monitoring to assess the condition of the forest, yields of forest products, management activities and their social and environmental impacts is an integral component of this.

In the case of bamboo resource management such principles have not been strictly followed. Detailed management plan have been prepared only for reeds and not for bamboo.

From constraints to opportunities

As a concluding note it has to said that many of the constraints pointed out above are showing signs of disappearing with information on the great potential in bamboo seeping into the bureaucratic circles. The formation of a Kerala State Bamboo Mission on the lines of the National Mission on Bamboo Technology and Trade Development is a good beginning in this direction.

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