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

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I. Introduction

Bamboo[1] is a plant that is recognised to have a close association with human life and civilisations since ancient times. 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. The cultural and material links between bamboo and human societies appear to remain intact to this day in several regions of the world. Bamboo grows more rapidly than many 'fast-growing species' of plants and is regarded as one of the best renewable resources on earth that can mitigate many environmental and economic problems of the modern age. It provides not only economic security to several human societies but environmental security to the biological systems as well without which the former would be unsustainable.

Bamboo often meets the basic necessities of food and shelter of the neglected human and animal populations within forests and forest-fringe villages. 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 world. 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. Bamboo serves as a basis for employment and income generation to many others being raw material for a wide range of small and medium-scale enterprises. The contribution of bamboo to the economy of the earth and the life of its peoples is enormous. Today, over 2.5 billion people live in association with bamboo. 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.

The problem

The 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

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rather abrupt transformation in the stocking of bamboo in several forest regions in India depicting stark images of "bamboo famine" and the associated 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 have been many and inter-related. All human interventions, whether organised or not, on forest land-use have affected the stock and flow of bamboo from the forests. In particular, commercial extraction by corporations, business concerns, individual entrepreneurs, and 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 (e.g. construction of dams) of agencies or government institutions 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 bio-mass, 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 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, the extraction/processing of bamboo is governed by an elaborate set of policy instruments. These regulations, interventions, and policies are 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. In India 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 the size of state-owned forests increased over time in India – it constituted 77.20 percent of the total forest area in 1949-'50 and went up to 92.30 percent in 1967-'68 and 95.20 percent in 1973 – "nationalisation of forests didn't improve forest wealth as such. 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). 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, distorted 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.

A huge edifice of formal institutions set up to implement the policies of the governments as well as informal institutions and customary systems that the people 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 co-operative 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, we note that studies have attempted to delineate the entire production to consumption system (PCS) of bamboo in several countries and in the process to identify 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). By following the above trail, the present study is an attempt to identify the constraints in developing bamboo as a resource for sustainable development through a case study of inter-sectoral allocation of bamboo and reed resources in a particular area in the State of Kerala in south India.

Objectives of the study

In main, the study looks 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. In the process it seeks 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;
(6) describe the modes in which the gaps in demand and supply were sought to be filled by the various user groups themselves;
(7) assess the social, economic, political, and ecological impacts of these gaps; and
(8) 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-generation equity i.e. "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 social and cultural development as well. 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 recognising and assessing sustainability or threats to sustainability. Ever since the 1992 Earth Summit recognised the important role that indicators could help countries to make informed decisions concerning sustainable development, work on evolving sets of indicators of sustainable development have been taken up by several organisations of the UN system, intergovernmental and non-governmental organisations 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 has not, 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.

The research thrust

The subject matter of the study has undergone 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. This has resulted in 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 with 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. 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 Kerala.

Methodology

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 bamboo 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 Rekha*s (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 scrutinised 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 large proportion of the supplies of bamboo to the Grasim Industries Ltd, the main industrial unit in the present study.

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 the convenience of carrying out the survey among a cross-section of bamboo user-groups. 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 was conducted among 54 households in Meppadi *panchayat* and 10 households in the neighbouring Muttil *panchayat* in Wayanad district for (1) identifying the various rural uses of bamboo and (2) the source of raw materials for meeting these requirements as well as (3) understanding the system of procurement of raw materials, and (4) the costs involved.

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.

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

2. Bamboo in a Kerala Village

According to a recent study (Nair, et al, 2001), the forests in Wayanad division 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. 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*.

We made an attempt, through a baseline survey, to identify the stakeholders and understand the functioning of the bamboo sector in Thrikkaipetta village in Meppadi *panchayat* of Wayanad district. The village had an average presence of bamboo clumps in the plains that could be found in any village in the hilly Wayanad district as it also had nearly 100 acres (42 ha) of forested hilly terrain, where reeds were available in plenty.

Village profile

Administratively, Thrikkaipetta village formed Ward I area of the Meppadi *Grama Panchayat*. It is a small village, 12 km away from the district headquarters Kalpetta, under the limits of the Meppadi Forest Range, the foothill of the Manikkunnumala being the administrative boundary between the forests and the village. The hill proper has been classified as a 'vested forest.1

Most of the land in the village was used as agricultural land. Till recent times, the wetlands in the village were used mostly for rice cultivation. However, large extents of paddy fields were now being used for cultivating banana, ginger, etc. According to local elders, the village was once very rich in bamboo and reed. During the 1940s, migrants from various parts of the State had started settling in this village and in the process bamboo and reeds were cleared for cultivation of other crops.

Of a total of 789 households in the village, 77 were found 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, 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 co-operative society. But they enjoyed no other social or job security supports such as memberships in trade unions, welfare funds, life insurance protection, and health care.

Out of the households located on the Manikkunnumala, 75 percent of the respondents used firewood and kerosene as cooking fuel. Nearly 25 percent 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 through MFP collection. On an average, a person got 12 days of work in the agricultural 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 that the people collected through the legal channel of the tribal co-operative 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.

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. All respondents opined that the availability of both bamboo

and reeds had declined within the forest area they were familiar with. 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 percent 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. 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

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*.

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 two groups, the Oorali kurumas and Mullu Kurumas, made several bamboo products such as baskets, winnows, mats, cradles, etc. 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. 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, a migrant backward community, settled at Thrikkaipetta, were traditional bamboo weavers. Until recently, they continued to produce bamboo/reed items for selling in the local towns and for direct house-to-house sales.

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.

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 large basket (about five 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 (e.g. 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. The winnower (*muram*) was another major product made of bamboo. 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. 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 like Mananthavady and 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. The price also varied with the product size as illustrated by the price prevailed at the time of the survey.

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.

Table 2.1Price 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

Production at the local bamboo craft centre

The training-cum-production unit of Uravu provides training-cum-employment to over 40 local residents, over 60 percent of them women.

On a monthly average, the centre created 516 man-days of work in bamboo processing alone (89 man-days of work for men and 427 man-days 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)2. 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 percent.

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.

3. 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 to identify (1) the household-level uses of bamboo, (2) the approximate quantity of bamboo required for the various uses, and (3) the sources of bamboo for meeting these requirements.

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/bedroom, etc., and in the construction of the house as 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.

Findings of the survey

The survey 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 3.1).

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.

The survey findings showed that, on an average, a household used 63 bamboo poles per year, which worked out to nearly four 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 pertain 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) was 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

Table 3.1 Uses of bamboo in the households, home-gardens, and agriculture 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

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.

Of the 64 houses surveyed data regarding utilisation of bamboo in construction of dwellings was available from 54 households. Among them, 11 houses (making up 20.37 percent) used bamboo as the roof support structure. On an average, such *kacha* 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.

Table 3.2 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

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 percent of the sample of households was found to be using bamboo in products or applications like 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 and streams.

Sources of bamboo for meeting rural needs

Nearly one quarter (23 percent) of the households in the survey depended on multiple sources for getting their bamboo resources including 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. The relative importance of different sources used for meeting the bamboo needs is presented in Table 3.3.

It was found that half of the households (50 percent) 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. The 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 may be said that forests provided a convenient

Table 3.3 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 1) Collected using forest passes	3.70
2) Collected through local extractors	50.00
Multiple sources	23.43

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 percent of the bamboo used by the rural households was from the forests. A significant proportion of the households (23.43 percent) 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 a very small percentage (3.70 percent) 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 percent 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 home gardens.

Permission in the form of a transit pass issued by the Forest Department is required for cutting and transporting bamboo from the home gardens as bamboo is regarded as a "forest produce" under the Kerala Forest Act (For a detailed discussion on this, see section on Distribution of bamboo from forests in Kerala). Even though the fee 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 percent) 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 percent of the households in the sample possessed 20-50 cents of land and 26.56 percent 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. Other factors

that prevented rural households from growing bamboo included non-availability of planting materials of more appropriate species, 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.

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, without virtually any value-addition in the households. Structural properties of bamboo poles such as strength, length, lightweight 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 finish 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 'Bamboo ply', 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 percent 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 practised 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 Kerala with elsewhere in the bamboo-rich areas would be interesting. A study carried out in the Jorhat district in Assam State (Anup Chandra, et al, 2002) had found that the average consumption of bamboo in the

Titabar block of the district was of 145.37 numbers per household per year. That figure was 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, more than one 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 percent 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 percent, Indonesia 16 percent, Japan 24 percent, Myanmar 30 percent, Nepal 50 percent, and Thailand 33 percent. In contrast, India used only 6 per cent of bamboo for rural construction (against 66 percent in pulp production until recently) though the all-India average figure may not reflect the regional diversities in the country, especially in the case of the Northeastern States (UNDP, 1997). 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 study had observed that "the most important use of bamboo in the farming villages was in house construction".

Grasses, leaves, reeds, bamboo, thatch, and mud had remained the predominant roofing material of 74.1 percent of all residential houses in Kerala (76.9 percent of rural houses and even 56.7 percent 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 percent of houses (28.10 percent rural houses and 16.90 percent 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.

Presently, among the 65.95 lakh households in Kerala, members of 44.94 lakh households (68 percent) lived in permanent houses and 14.24 lakh (21.6 percent) 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 lakh and repairing at least 2.3 lakh 'livable' houses (10 percent 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.

Based on a sample survey carried out by in Wayanad, Thiruvananthapuram, and Thrissur district in late 1990s, Muraleedharan and Anitha (2000) had found that of an average of 1.2-

1.6 lakh houses built in Kerala every year, 20 percent, i.e., 24,000-32,000 houses were *kutcha* houses and, out of these *kutcha* houses, 40 percent numbering 9,600-12,800 used bamboo in their roof structure.

Our field observations in the sample village in Wayanad district have shown that the construction of roof structure of an average house required 26 bamboo poles. Thus, if 40 percent of the *kutcha* houses in Kerala (9,600-12,800 houses) were to use bamboo for roof structures (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 it is important to note from the point of the present study that the period of the above 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).

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 across the globe as well 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 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 percent 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/ 50th the amount of energy for processing.

Against the backdrop of the vast, global potential of bamboo as a structural material and the "wood of the 21st Century" (Sastri, 2002), the use of bamboo in constructions in Kerala remained 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: Home gardens 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 percent (and the forests only 37 percent) 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 scaffold 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). The inability to account for the 'leakage' of the resource from the forests remains a lacuna of the study. 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 home gardens mostly in Palakkad and Thrissur districts and to some extent on the low-levels of supply to Palakkad from Kannur and Kasargod districts. Thus the studies had not touched upon the bamboo availability and supply scenario in Wayanad district where the present survey was carried out.

The question, whether the home gardens 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) 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 percent of the farmers in the village were found to be obtaining their supplies of bamboo branches through traders. Only 17 percent of the farmers could depend on the home gardens in the nearby places. Again, only seven percent of the farmers were self-sufficient in obtaining bamboo branches from their own clumps. 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-'97.

The present study based in Wayanad district has found that one cannot really generalise upon the notion of self-sufficiency of the bamboo home gardens 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 percent 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 Forest Department, 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 home gardens (33 percent), private depots (33 percent) and forestlands (34 percent), there are considerable variations in this between districts (Muraleedharan, et al, 2000). 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 percent compared to 20 percent in Thiruvananthapuram and none in Thrissur.

The ground reality in Wayanad remains that not only individual rural households but groups of village artisans and even some of the organised bamboo-craft production centres as well 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 deep-rooted, multifarious links between tribal communities and forests have been explained by several authors as well as official reports. Twenty-three percent of Kerala's *adivasi* population, approximately 73,000 persons belonging to more than 30 different tribes, lived inside forest reserves. Although the *adivasis* made up only 1.1 percent 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.

Around 36 percent of the *adivasi* population in the State lived in Wayanad, according to the 1991 Census. Roughly a century ago, 90 percent 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 of 17 percent of the population in the district.

Noolpuzha 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 percent) 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. Of 7,013 houses in the *panchayat* area, 50.69 percent 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 provided by the government.

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.

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.

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 four 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 could 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.

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.

4. Bamboo and Reed in Kerala: The Resource Base

Bamboo surveys: The cart before the horse

Hitherto there has 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'.

The first survey 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 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.

Bourdillon (1892) had recorded one of the earliest accounts of the status of forests in Kerala. During his travels, Bourdillon observed reeds, mainly *Ochlandra travancorica,* as forming the undergrowth of forests over very large areas in different parts. 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*.

Bamboo resource assessments in Kerala

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. 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) the imperial forest managers had looked into the possibility of supplying at least 20,000 tonnes of air dry bamboo annually to the firm.

One of earliest bamboo surveys called, *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 (Government 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. 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 and that "supplies from neighbouring forest divisions will have to be earmarked for the proposed rayon grade pulp plant". 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 was carried out in 1959. Even before the commencement of the survey, the Kerala Government had committed itself on providing 1,60,000 tonnes of bamboo (and 3.2 lakh 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 3 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.

Yield assessment

A summary result of the 1959 Bamboo survey is given Table 4.1.

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 percent of the number of culms in a clump. The survey report (Sivarajan, 1959) went on to assume that "with

Table 4.1 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
Wayanad	18667	38247	0	0	566
Palghat	5989	14240	0	0	0
Kozhikode	34798	93870	2450	5341	3913
Nilambur (Govt.)	18865	46334	775	814	480
Nilambur (Pvt.)	20988	24013	6481	9527	6670
Nenmara	32260	99415	0	0	0
Total	**131567**	**316119**	**9706**	**15682**	**11629**

Source: Compiled from Sivarajan, et al, 1959

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 percent 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 5400 acres would be available for extraction.

Bamboo flowering and clear-felling

Bamboo was already flowering then in many forests and this provided a possibility of clearfelling and totally utilising 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 clear felling. Again, in the true spirit of scientific forestry, restrictions were suggested even for clear felling. 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 clear felling. It was calculated that clear-felling 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 clear-felling was huge. It was 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. Clear felling 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 clear-felling was permitted, what was the need for practicing selection felling? That appears to be exactly what the Gwalior Rayons thought and practised.

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 and sheds for cattle. In and around bamboo growing areas, bamboo was 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.

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 (Grasim Industries) 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. From the survey results, it may 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 (Table 4.2).

Table 4.2 Grasim's share in 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

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 percent) were earmarked for supplies for the proposed industry. In terms of the bamboo yield in the survey area, the reservation for the Birlas' amounted to 97.51 percent of the total stock in the surveyed area: an absolute monopoly. 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. Also there was not an efficient system in place for practising it. The ruling assumptions regarding the availability and characteristics of bamboo within forestry literature were negative. These ranged from the FRI's early observations that "bamboo would be available *in perpetual"* to the notion that bamboo was a "noxious weed" like lantana fit to be classified under "injurious plants."

Prescriptions on felling

The felling prescriptions were also based on unscientific calculations and assumptions. 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 intact 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 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) [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 organisation 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) has said: “FAO’s mandate went much beyond managing forests to develop pulp and paper industry as well as agriculture.”

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 FRS survey 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 utilisable 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.

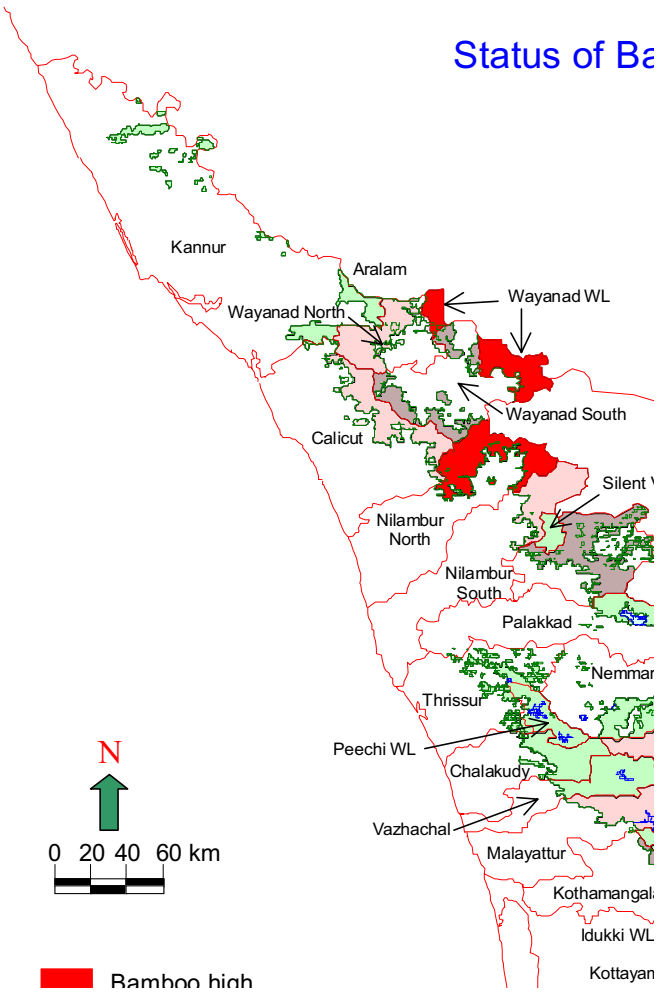
KFRI’s assessment (2001)

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 (Fig. 4.1). 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 percent) 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 percent) that comprised of the Northern Circle and the Wayanad Wildlife Sanctuary. The Southern region came third with 21.70

Figure 4.1 Status and distribution of bamboo in Kerala forest



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 percent and 4.66 percent of the bamboo stock in the State respectively. In these cases also the Wildlife Sanctuaries/National Parks of the region were included.

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 could 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 (Table 4.3) 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 4.3 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 bet.estimates in 1973&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 observed 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." The document had admitted even these levels were "likely to lead to depletion because sound silviculture and management practices were not strictly applied". Then, how it found a drastic increase in the stock?

The paradox remains unexplained. One plausible argument, often put forth by forest department officials, is that the stock of forests has 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.

Another explanation could be that the tools adopted for the study might not have been perfected to give accurate results. 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 sq km during 1973 and 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 sq km, with a growing stock of 45,60,000 tonnes. The allowable annual cut was prescribed as 2.45 percent 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, which revealed 717 sq km 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 must 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 sq km 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 percent 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".

Resource augmentation

Large-scale industrial utilisation of bamboo had started in the country on the assumption that bamboo would be available "*in perpetuum*". 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 together with human interference in the natural bamboo stands the resource base could neither be protected nor expected to provide sustained yield.

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 appeared 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.

The track record of KFD in setting up plantation of bamboo to augment 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 **(Fig. 5.1)**. 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 of 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 percent of the growing stock against the actual regeneration of 8-10 percent of the growing stock observed in the Nilambur forests. While there were no serious attempt to assess the regeneration of stock in the natural bamboo stands in the Kerala forests since then, the ground reality remained 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 stated the average productivity of bamboo culmns in Kerala to be around two 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) 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.

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 percent of the total investment in plantations on eucalyptus. During the same period, only less than one percent of the total annual expenditure (or less than one percent 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) achieved 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. 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) had 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 practised 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 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.

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-'67 and 1990-'94. Between 1950 and 1982, the forest cover in Wayanad decreased by 1086 sq km and the plantation area increased by 468.82 sq km (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. Under pressure from local environmental groups as well as 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".

After the conversion of natural forests into plantations, "there were no natural forests left in the forests in Karadimunda (1304.93 ha), Maragatha (2055 ha), Thottamoola (1961.68 ha), and Noolpuzha (2017 ha) 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). The agitation was, however, 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 lakh 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) 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 attested by several reports. Also 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. 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). She 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.

Forest fires also may provoke bamboo to flower. The forest managers and scientists consider bamboo flowering as a botanical enigma. As Sharma (1991) has remarked, “several theories exist concerning the causes of flowering but all are without any experimental proof or any other evidence.” 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.

5. 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). 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 distinguished 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'. Even though the system of seigniorage passes and supplies to the 'right-holders' were retained in principle, it was not rigorously implemented. And "the system was discontinued in the early sixties …to meet the commitment of supply to Gwalior Rayons and HNL" (Surendranathan Asari, seminar paper, KFRI).

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 o leaves) as well the price realised for each category used to be recorded meticulously in the ARs from the days of the British rule. It was only much later, 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 the accounting system seemed 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 (e.g., Shiva, et al, 1991). Many authors have also scrutinised the nature, scope, and extent of various concessions and privileges on forestland and forest produce granted to different groups of users. Nevertheless, it remained a matter of debate whether the demands of the rural population or the demands of the industry influenced the pattern of utilisation 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).

Until demand arose from the organised 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.

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. Of the total revenue of Rs 225.40 lakh earned by the Travancore princely state in 1931, the timber industry's contribution was the second highest at Rs 43.90 lakh, after Rs 78.20 lakh contributed by textiles (Namboodiripad, 1948). 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. 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).

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, accounting for 19.20 percent in 1973-'74 and wood availability, a major factor contributing to the growth of the plywood industry, had not received the attention it deserved (Nair, 1977). 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. 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, had 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 based on 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). According to Savur, 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 17 October 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). 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). 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 3 May 1958 had the following major features:

1. 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.
2. 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).
3. 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.
4. 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.
5. 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 up to a maximum of 1000 tonnes per year and acquisition of land for developmental schemes such as dams (the acquisition of which would be equally compensated in other areas).
6. 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).
7. 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.
8. The government shall provide the company other sites for erection of sheds, depots, storehouses, bungalows, staff offices, and such sites shall be rent-free.
9. There shall be no rent payable for the CAs and the ACAs.
10. The seigniorage payable for the bamboo extracted would be Re 1 per 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. 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, and bungalows.

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). Needless to say, the rate was "one-to-two thousandth of the market price of bamboo" [Chundamannil, 1993 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 of 6 August 1962 had the following major features:

1. It extended the Additional Contract Areas to cover the Government Reserve Forests in the Forest Divisions of Wayanad, Palakkad, Kozhikode, and Nenmara.
2. 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.
3. The 16 private forests in the Nilambur area earlier included illegally under the CAs were deleted.
4. 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 up to 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 (14 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 lakh 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 nationalising 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 (21 June 1972), but later the Supreme Court of India upheld the Act on 18 September 1973.

The Second Supplemental Agreement (10 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 main features of 1974 agreement were the following:

1. The Government agreed to ensure supply of 2 lakh tonnes of raw material annually.
2. 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.
3. 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.
4. 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.
5. 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.

6. Government committed itself to replant bamboo areas destroyed for silvicultural needs with pulpwood species.

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 (20 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).

The Fourth Supplemental Agreement (27 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 7 July 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 its 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 which had the following major features:

1. 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).
2. 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.
3. 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.
4. The government and the company mutually agreed to withdraw all pending disputes and litigation.
5. 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.

It must be mentioned that 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. This agreement was made in order to facilitate the reopening of the factory but it 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.

Hindustan Newsprints Ltd

Hindustan Newsprint Limited (HNL), a Government of India enterprise was incorporated as a wholly owned subsidiary of the Hindustan Paper Corporation limited (HPC) on 7 June 1983. The Government of India had established HPC on 29 May 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 choice of the mill site (Savur, 2003). The mill rolled out the first newsprint reel on 26 February 1982 and went into commercial production on 1 November 1982. HNL took over the business of the Kerala Newsprint Project with effect from 1 October 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 percent 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 up to those bestowed on Birla, or rather those grabbed by Gwalior Rayons" (Savur, 2003). 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 percent 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.

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.

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.

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.

KFD's Working Plans for the Nilambur Forest Division have given two explanations for the drastic decline in bamboo resource availability in the area. The first explanation was that extensive bamboo flowering caused the damage."

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 percent 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 percent of the total stock to be the optimum sustained annual yield as recommended by the 1959 survey). 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 (Table 5.1).

Table 5.1 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

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 practised. 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). 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.

6. 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 was so 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. 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. 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 seemed 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 on many years recorded in minute detail the number of bamboo poles allocated to Grasim Industries from each forest division, there were no clear records on how much bamboo Grasim could actually collect from each coupe allotted. Thus, between the records of KFD and Grasim, there were differences in the annual allotment figures and the actual collection figures.

Forest department records very often showed 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 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 whopping 1,60,000 tonnes of bamboo per year, a 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 fulfil 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 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.

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).

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 with acacia or such other soft/hard wood. The allotment of eucalyptus remained highly erratic toughing 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 the government worked out 90,297 tonnes, roughly 10 percent short of commitment. When we look at the total picture of raw material commitment and allotment (Table 6.1) it becomes clear that the allotment of all raw materials put together was above the commitment made during the decade.

Table 6.1 Grasim Commitment and 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 appeared that the government had fulfilled its moral and political obligations to the major pulp and paper industry in the State during the 19990s. However, there was a catch. The government had only allotted raw materials; the real collection of raw materials by the user company had fallen short of the allotment in most years of the decade. For the decade as a whole, the actual collection of raw materials had only been around 47.41 percent of the total allotment ad 73.89 percent of the commitment. 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 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. 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 percent and Sales Tax @5 percent) 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 lakh. 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 of 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 pertain 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 percent discounting with a land rent of Rs 2500/ha/year, forest economist Mammen Chundamannil (2001) had calculated that the minimum price of eucalyptus should have been Rs 2000/tonne, that of acacia Rs 3000/tonne and wattle wood 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 percent of the market prices, amounting to approximately Rs 175 million in 1997-'98 (World Bank, 1998).

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

A 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). 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). 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 are worth mentioning 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) 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 percent moisture content (or 1.05 lakh tonnes at 10 percent 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, the 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.

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. 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 percent of the total commitment on reeds and 39.70 percentage of total quantity allotted (Table 6.2).

Table 6.2 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	189000	163000	42422	22.45	26.03
1983-'84	189000	189000	46385	24.54	24.54
1984-'85	189000	182200	42098	22.27	23.11
1985-'86	189000	163400	55284	29.25	33.83
1986-'87	189000	88140	76217	40.33	86.47
1987-'88	189000	97300	59576	31.52	62.23
1988-'89	189000	165700	57086	30.20	34.45
1989-'90	189000	189000	80123	42.39	42.39
1990-'91	189000	189000	100674	53.27	53.27
1991-'92	189000	173500	70893	37.51	40.86
1992-'93	189000	189000	100674	53.27	53.27
1993-'94	189000	189000	91619	48.48	48.48
1994-'95	189000	189000	75720	40.06	40.06
1995-'96	189000	186500	62995	33.33	33.78
Total	2,646,000	2,353,740	934,497		
Average				35.32	35.32

The official estimate of actual collection of allotted raw material is around 45 percent 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:

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

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 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 (KSBC) 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 showed 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.

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 appeared 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). Other official documents of KSBC, however, claim the strength of weavers to be around 12,000 families and the minimum annual reed requirement to be 36,000 tonnes. Mathew (1998) 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 percent. There was considerable variation in the active participation of weavers under different reed distribution depots.

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 percent 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).

KSBC was 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 co-operative societies and the traditional bamboo/reed artisans spread across Kerala. In principle, 30 percent 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 lakh in 1983 (Government of Kerala Diary, 1983). Perusal of the Plan Reports (*Vikasana Rekha*) of all local self-government institutions (*grama panchayat*s and District *Panchayats*) in the State showed that the number of people engaged in bamboo/reed craft as a means of livelihood declined drastically in the last two decades to around 40,000 families. In order to cater to the needs of at least one member in 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 percent) procured from the weavers for production of Bamboo ply. 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 Bamboo ply 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.

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* (unauthorised) 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.

Co-operative societies

A large number of co-operative 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 co-operative 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 co-operative societies organised on the principles of self-help and mutual help, however, turned sick within a short time and only around 10 percent of them survived. Most of the functioning ones remained chronically sick (Mathew, 1998). Thus co-operative 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 private interests".

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.

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. Table 6.3 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 lakh (5.55 percent) 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. 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.

Table 6.3 Distribution of Bamboo/Reed Craft Workers in Kerala

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

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

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 & reed by KFD under 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 tribesfolk and other poor people living within and near the forests "should be the first charge on forest produce," (National Forest Policy, 1988) 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, and rosewood. 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 where 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 is the second step in the process and this invariably took two-three days. The fee to be paid, as seigniorage, is 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 tribespeople. 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 is calculated on the basis of tonnage, no local user is ever given more than just five culms of bamboo at a time. This restriction on quantity virtually has 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 is highly discriminatory because the local user is 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 are thus quite high. And even if a person managed to eventually get a pass issued, it is virtually impossible to use it legally because its validity is 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 has 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 recognised 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*, and 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 bareja*s, the betel vine growers, were entitled to a maximum of 1,000 bamboos / family/ year at the rate of Rs 1.50 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 that the 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.

According to Guha (1994) "Corruption and waste were inherent in the contract system," and that "the need to replace contractors by forest labour co-operatives has been stressed by all the Five-Year Plan documents." Kerala's achievements in replacing contract labour in forestry operations with labour provided by tribal co-operatives have been poor, except in the case of MFP collection for which exclusive rights were granted to Tribal Service Co-operative 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 co-operatives (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 exerts 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 percent 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 utilise 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 August 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 28 January 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 (Government of Kerala 1998). The Kerala Government could not, however, 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 chaired 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). 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 organisations 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 percent, meeting 20 percent of its needs through its own captive plantations and the remaining 40 percent 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 percent Reed and 20 percent 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 utilisation 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 utilised, HNL could utilise 88-90 percent of the cellulosic raw material and the loss of raw material would be only 10-12 per cent (Savur, 2003). 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 percent efficiency. In the Chemical Pulping (CP) line too HNL's achievement of 43-50 percent efficiency was slightly (5 percent) 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 percent 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 percent. "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.

7. Summary and Conclusion

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. 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 emphasised 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 the burden of subsidies to the state exchequer. And the non-compliance with policies, norms, and rules has 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 organised industry. While collection of bamboo and reed from the forests required legal permits and identity cards, nearly 10 percent 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 percent 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 authorised head-load of bamboo. Such non-compliance with norms passed because of the haziness regarding rights, privileges, and concessions within forest laws.

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), under which forest and forest-fringe people could be enjoying better control over forest management and benefits realisable out of non-timber forest produce. 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. 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 in 1983 to around 1,00,000 in1998 – during 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 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 in 1950s 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. The costs borne by the society at large in subsidising the PPI industries have been huge: for instance.

To be viable, forest management should minimise waste associated with harvesting and on-site processing operations and avoid damage to other forest resources. However, the harvesting practices of Grasim Industries had been wasteful. 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

Sustainable harvest levels

The rate of harvest of forest products shall not exceed levels that could 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. 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 doing so, maintain the ecological functions and the integrity of the forest. Recognising, 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, is revealed by our study. 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.

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.

As a concluding note it has to be 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.

End Notes

1 The term ‘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.*

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

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

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

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

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