PATTERN OF INVESTMENTS IN FORESTRY AND ITS IMPLICATIONS ON SUSTAINED YIELD MANAGEMENT IN KERALA

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CERTIFICATE

I hereby affirm that the research for this dissertation titled "Pattern of Investments in Forestry and its Implications on Sustained Yield Management in Kerala" being submitted to the Jawaharlal Nehru University for the award of the Degree of Master of Philosophy in Applied Economics was carried out entirely by me at the Centre for Development Studies, Trivandrum.

Trivandrum
31-12-1986

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Certified that this dissertation, the bona fide work of Shri Mammen Chundamannil, has not been considered for the award for any other degree by any other University.

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C O N T E N T S

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TABLES

CHAPTER I

I N T R O D U C T I O N

Production of wood and provision of environmental services are the two important functions of the forests. Wood is a renewable resource but its production can be sustained in the long run only if the level of harvest is matched by increments in the growing stock. If harvest levels in a given period exceed the increase in stock, it would result in depletion of the stock. Although wood is a renewable resource, old growth moist forests in the tropics are considered a non renewable resource due to its continuous evolution over 50 million years.[1] Conversion of old growth forests to other uses, removal of the forest cover from the catchment areas and depletion of wood resources will adversely affect the conservation of diversity of the forests, protection of water sheds and the ability of the forests to sustain production. The primary objective of forest resource management should be to prevent such a process and to sustain the flow of output and services from the sector. However the achievement of this objective will depend on public policies regarding forest resource utilisation.

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1. See Gomez-Pompa et. al. (1972), Poore (1976), Richards (1979)

An important feature of the forest resource is that it is both a stock and a flow. At a general level, the standing trees can be considered as the stock and the timber harvest (output) the flow. Forest management essentially involves managing the stock and flow in order to achieve the overall priorities of the State. Depending on the priorities of management the stock can be augmented, the flow increased or environmental values improved. However, increasing any of the three beyond a point will have adverse impact on others, so that at higher levels they become incompatible with each other. Ideally what the State should attempt to achieve from forest resource management is sustained yields. Forest sustention requires the management of the stock, the flow and the environmental effects in an optimum and non-depleting manner.

The achievement of sustained yields has been an important objective of our National Forest Policy. However, when we examine the trends in the sector, it becomes evident that the depletion of natural forests has been taking place at an alarming rate.[2] Consequently there has been rapid deterioration in the forest environment and ecology.[3]

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2. NRSA estimates that the average annual forest loss was 1.5 million Ha in India and 0.12 million Ha in Kerala between 1972-75 and 1980-82 (CSE 1985). Chattopadhyay (1984) estimates that the reduction in natural forest cover in Kerala was 0.41 million ha. between 1965 and 1973.

3. See Nair (1985).

An important factor that is likely to have contributed to this situation is the pattern of investment in the forestry sector. If investment in extraction is not balanced by investment in regeneration, depletion of the stock will occur. Enhanced extraction over and above the increase in stock will affect future yields and impair the ability of the forests to provide sustained yields. Since many of the costs and benefits from forestry are continuous and of a long term nature, past and present investments will have important long term consequences. This is particularly important since production can be enhanced in the short run by unsustainable exploitation or liquidation of the growing stock.

It is evident from the foregoing discussion that a systematic analysis of the pattern of investment in forestry and the factors shapping it will provide useful insights into the actual priorities and performance of the sector. However, there has been no such study for the country as a whole or for any State.

Forests in Kerala has been a frontier for agricultural expansion and an important source of fuelwood, timber for construction, industrial raw material and a variety of medicinal plants and minor forest produce. Since the pressure on forest resources to meet the rising demand for various products will continue to

intensify in the future, an analysis of the nature and direction of public investments in this sector has important policy implications.

Objectives of the Study

The major objectives of the study include the following:

1. To examine the relevance of the concept of sustained yield in forestry and its usefulness for evaluating the performance of the sector.

2. To study the pattern of investments in forestry in Kerala from 1956 to 1980.

3. To examine whether wood production from the forests has been consistent with the principles of sustained yield management.

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4. To analyse the implications of the pattern of investment and production on future production, revenue and sustainability.

Methodology and Data Source:

Investments can be evaluated both in the physical and the financial plane. In the physical plane only improvements in the growing stock can be considered as

investment while production (extraction) will be considered disinvestment or liquidation of the capital. In the financial plane both outlay in increasing the growing stock and outlay in production can be considered investment. In this study the term investment is used in the financial sense. While expenditure on timber extraction fetches almost immediate returns, investments on growing timber (regeneration) has a long gestation period. For the purpose of this study, expenditure on timber extraction will be considered short term investment and expenditure on timber growing will be considered long term investment.

The study is mainly based on secondary data from the forest depentment published through the Department's annual Administration Reports. This is supplemented with information available from various documents including the records of the forest depentment at their headquarters. The period of the study correspond to 1956-57 to 1979-80. The initial year coincides with the formation of Kerala State and also the beginning of the Second Five Year Plan. The terminal year coincides with the termination of the pre-revised Sixth Plan after just two years.

The investment pattern is analysed for the Five Year Plan periods. The division of the entire period according to the Five Year Plans gives an opportunity to

analyse the changes in investment priorities in successive Plans.

The annual expenditure of the Forest Department is classified for the purpose of this study into: (1) investments in production and conservation of wood resources (2) infrastructure and establishment costs and (3) others. Investments in wood production is again classified into short term and long term investments. Short term investments are for current production viz. harvesting or extraction of timber from the forests. Long term investments are for growing timber or for replenishing the stock of timber. Investment in conservation of wood resources goes for protecting the forests from fire. The category of expenditure included under 'others' consist of expenditure on wildlife sanctuaries, tribal welfare programmes, survey of forest boundaries and all items not included in the first two.

Forest plantations in Kerala have the features of both short term and long term investments. Clearfelling of natural forests which invariably precede the establishment of plantations satisfy the short term revenue objectives while plantations represent long term investment. However short term and long term effects have been kept separate in this study by accounting the expenditure on clearfelling forests and raising plantations separately.

In order to measure the changes in priorities over time index, numbers of the level of investment in different activities have been constructed. Changes in area under plantation, output and revenue were analysed and the profitability of different investments were evaluated. To find the link, if any, between the investment priorities and revenue objectives, the pattern of investment and the profitability of each investment option was compared. Further it was examined whether short term investments for enhancing the immediate revenue gets priority over long term investments.

Given the commitment for sustained yield in the forest policy of the State, the pattern of investment in forestry and its impact on production and forest land use is evaluated in terms of the necessary conditions for forest sustention. The question whether forestry investment and forestry development during the study period has been consistent with the principles of sustained yield is also discussed. Finally the implications of the observed pattern of forestry development in Kerala on future forest revenue and output and on forest based industries are examined.

The results of this study is presented in five chapters. Chapter II traces the development of the sustained yield concept and the commitment for sustained

yield in Indian forestry. The controversies regarding sustained yield regulations and the necessary conditions for sustention is also examined. The third chapter analyses the pattern of investment and the trend in the output and revenue. The fourth chapter examines the pattern of investment in the light of the principle of sustained yield and attempts to identify the factors that have influenced the investment policy. The implications of the pattern of forestry development on future production, revenue, forest based industries and on community stability are brought out in the fifth chapter. It also gives a summary of the main findings and outlines the limitations of the study.

CHAPTER II

THE CONCEPT OF SUSTAINED YIELD IN FORESTRY

Introduction

In an economy with a variety of demands for forest products and services the objectives of forest management will depend on the target group for whom this resource has to be managed. The target group can be any one or more groups in society such as modern or traditional industries, fuelwood users, consumers of high quality timber etc. It can also be the future generations. The approach to forest management according to the target group and objectives of management can be summarised as follows:

Target Group	Objectives	Approaches
1. Present population	Maximising current consumption, income and employment.	Maximising present production, revenue and employment.
2. Future generations	Conservation	Creation of biosphere reserves, minimising current consumption, afforestation, habitat improvement.
3. Present and future generations	Sustained yield	Identification of renewable areas and creation of a normal forest and harvest of the normal yield; conservation of non-renewable areas.

It can be argued that in the long term development of the forest sector, the principal objective should be sustained yield. Sustained yield can be regarded as a compromise between present and future requirements and also as a theoretical ideal against which actual forestry development can be evaluated. Our attempt in this chapter is to examine the extent to which this concept can be used for evaluating the development in the forestry sector. But we would like to emphasize one point here by way of a disclaimer: the purpose of this chapter is not to examine the concept of sustained yield in any comprehensive manner; in any case, the purpose of the present study is not a systematic and full-fledged application of the concept to a concrete case. Rather, it is to adopt the notion of sustained yield as a unifying conceptual basis of several objectives of forestry policies (as they have evolved in various countries) and thus to use it as a framework within which to analyse and evaluate the pattern of public investment in forestry in Kerala.

The discussion in the rest of this chapter is as follows: In Section I the evolution of the concept of sustained yield in various countries including India is reviewed in order to bring out how sustained yield has been the predominant philosophy in forest management in these countries. In Section II the main criticism

against sustained yield are examined and its continued relevance is brought out. The concluding section will briefly touch upon the necessary conditions required for the effective implimentation of the idea of sustained yield in particular the relationship between the objective of sustained yield and the pattern of investment in forestry which is our empirical focus.

I

Evolution of the Concept in Europe

The sustained yield concept as we know it today originated in Europe. The French Ordinance of 1669 by King Louis XIV is considered the pioneering declaration of a forest yield regulation policy. Although sustained yield was not explicitly mentioned the technical clauses, particularly the 'table of cutting'[1], implicitly contained elements of the sustained yield principle (Rubner, 1984). All forests belonging to the crown, the church and the communal forests were gradually brought under the regulation of the Forestry Commission by the eighteenth century. Although much of the well managed royal forests were destroyed after the French Revolution, sustained yield became an accepted goal in other European countries, particularly in Germany.

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1. felling regulations.

The concept 'sustained' was used in German forest literature as early as 1713 by von Carlowitz. The initial emphasis on sustention relating to utilisation shifted to sustention relating to all the effects of the forest and in early eighteenth century Prussia the Chief of the State Forest Authority was already advocating the latter form of sustention (Wiebecke and Peters, 1984).

The German antecedents of sustained yield has been a controversial subject. The critics of sustained yield regulation maintain that it was adopted in Germany due to a particular set of conditions which are irrelevant to modern free market economies. They argue that German society during the eighteenth century was characterised by stable social and political conditions where a regulated (normal)[2] forest existed and the growing industrial and ship building activities created a demand for wood which had no technological substitute at that time (Behan, 1975). Others point out that sustained yield regulation preceded the industrial revolution and it was actually a result of the turbulent period marked by internal strife between protestant and catholic princes and bloody peasant rebellions. The usurpation of the commons by powerful princes was accompanied by

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2. Distribution of the growing stock in such a manner as to provide for steady and continuous output.

formalising the use rights over pasture, litter, certain classes of wood etc. enjoyed by the local community to appease the 'powerless but dangerous' peasantry. Sustained yield regulation was a device for manipulating forests to produce multiple benefits for local requirements and an instrument for ordering social and economic conditions during turbulent times. The social meanings of sustained yield, unrecognised by the critics, is stressed by Lee (1984) wherein the society's commitment to creating a future by perpetuating the basic biological conditions that support important sectors of society is reflected.

Two other countries in Europe where sustained yield has had long traditions are Switzerland and Sweedon. In Switzerland the ecological functions of forests were recognised even in the middle ages and a system of permanent forest regulation known as 'ban forest' existed. This was meant for the permanent protection of settlements and traffic routes below the forests. Ban forests were not tended or felled but grazing was allowed since there was no regeneration area. The mountain forests were thus sustained but timber yield was negligible.

More favourably situated forests adjoining to villages were used as communal property and town and

village regulations on the quantity each village, trade and early industries could remove was stipulated. However the common property nature of the village forests could not ensure forest sustention. Late eighteenth century and early nineteenth century Switzerland was marked by forestry debates initiated by academics and foresters trained in Germany. A beginning with sustained yield practices in village forests was made in the second half of the nineteenth century when Federal regulations which emphasised sustained yield came into existence (Schuler, 1984).

In Sweeden forest dependent economic activity has ancient roots. Iron smelting and copper mining were integrated with charcoal production in the forests. Forest use by early industries were characterised by the industry migrating from the mine area to the forested parts to secure wood charcoal. Forest conservancy in Sweeden started not with the early industries but by the trade interests. Export demand for sawn wood created a market for large sized logs. Saw mill companies secured limited cutting rights from the State forests and entered into delivery contracts with forest owning farmers. The State Policy regarding forests in the nineteenth century was complex. The Government encouraged exploitation and conservation simultaneously. On the one hand forest exploitation brought in revenue but forest

conservation was necessary to ensure the economic stability of the rural areas. Along with large saw mills, co-operatives of farmers owning large forest tracts emerged. Gradual consolidation and integration of both activities stabilised forestry in Sweeden. Later the saw mills and farmers' co-operatives established pulp mills achieving vertical integration and ensuring forest sustention (Gaunitz, 1984).

Sustained Yield Regulations in U.S.A.

Gifford Pinchot, known as the father of American forestry, was the most ardent advocate of a sustained yield policy in U.S.A. Pinchot's education in Europe where regulated forests and sustained yield practices were well established, influenced his forestry outlook. At the time of creation of State Forest Reserves (1891), timber companies owing large tracts of forests were in business. Partly to neutralise their opposition to the creation of reserves, Pinchot's policy in State reserves stressed on local requirements and community stability which became the corner stone of U.S. Forest Service sustained yield policy.

At the turn of the century, the operational definition of sustained yield in U.S. was that, harvest should be equal to growth increment or the net addition

to stock. By 1920 when inventory information revealed that the national forests were dominated by old growth where net increment was very low, the basis of sustained yield shifted from net increment to the growing stock volume.

The shift in emphasis permitted a much larger harvest than the increment in the old growth forests. However with the onset of depression in the 20's, falling timber prices and over-production by lumber mills which had sunk large investments in timber lands and mills created a crisis. David T. Mason of the Forest Service came up with a new definition of sustained yield to save the situation. The new definition prescribed "limiting the average annual cut to the continuous production capacity" (cited in Parry et. al. 1983, p.152). This change represented a compromise between the European concept of 'harvest equals growth' and the industries' practice of rapid liquidation of the stock. For the immediate object of limiting annual yield, community stability was the strongest argument in favour of sustained yield. Mason as member of the Timber Conservation Board argued that community stability could be achieved by coordinating public and private timber supplies on a sustained yield basis. The 1932 National Industrial Recovery Act upheld conservation of natural resources and sustained yield as fundamental policy objectives.

The Act defined sustained yield as "to provide without interruption or substantial reduction of raw material for industry and community support" (cited in ibid., p.152). Later a more formal Sustained Yield Forest Management Act was passed in 1944. One of the major purposes of the legislation was to promote the stability of forest dependent communities by establishing co-operative sustained yield units in which private and federal lands would be managed jointly. For a variety of reasons much progress in the direction was not achieved.

By 1948 the focus of sustained yield again shifted from regulating the growing stock to maintaining evenness of harvest or what has come to be known as the even flow doctrine. Yet another development was the passing of the Multiple Use Sustained Yield Act in 1960. The Act defined sustained yield as the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land. The Act formally recognised that renewability should not be limited to timber resources alone but all other outputs has also to be managed in a renewable manner (Brown and Carder, 1977).

The focus again shifted to even flow when it was realised that the domestic wood products industry was

dependent on national forest timber. The 1963 policy provided for an "even flow of national forest timber in order to facilitate the stabilisation of communities and opportunities for employment" (cited in Parry et. al. op cit, p.153). Industrial requirements gained primacy but the whole policy was critically reviewed since 1969 when a Forest Service study revealed that continuation of the existing harvest levels would lead to a significant decline in yield during the rotation following conversion. In spite of industry protests harvest levels were reduced and an emergency directive modified the even flow policy to non-declining even flow. The non-declining even flow policy was embodied in law by the National Forest Management Act of 1976. The non-declining even flow policy represents the most specific articulation of the commitment for sustained yield and the National Forest Management Act (1976) in U.S.A. represents one of the strongest legislative support for sustained yield forest management so far adopted in any country.

Sustained Yield in Communist Countries

Across ideological boundaries forest sustention is endorsed as a guiding principle in forest management in the twentieth century. The forest policy of the Soviet Union is guided by the principle of continuous

and in-exhaustible forest use (CIFU) which in essence do not differ from the non-declining even flow policy of the U.S. The economic aspect of extended forest reproduction is stressed more than the temporal aspect of forest sustention in the Soviet policy. Intensification of forestry through higher investments to achieve increasing yields is an important objective of Soviet forestry (Moiseev ad Sinitsin, 1981).

The most spectacular forestry achievement in the twentieth century is that of China. The phenomenal rate of afforestation is almost entirely the effort of the collective sector. In no other country has there been such integration between agriculture and forestry (Westoby, 1975). With hardly any forests to begin with, forest sustention consists in creating a resource base rather than tinkering with the harvest level. China's success in expanding the resource base through popular participation is unique.

Commitment to Sustained Yield in India

The sustained yield concept developed in the west found a place in the colonial forest policy in India. However, the initial interest in forest sustention in British India was limited to safeguarding the existence of the more valuable teak forests on which the supply of

ship building timber for the navy depended. During the first half of the nineteenth century, several reports on the value and regeneration status of the forests were commissioned by the British Indian Government. Reports on the forests of Tanasserim, Pegu, Bombay, Madras, Malabar were submitted by Wallich, Mc Celland, Gibson, Cleghorn and Helfer respectively.[3] The need for conserving the valuable timber bearing forests and hill forests for commercial timber production and ecological protection was stressed in all the reports (Stebbings, 1922).

The Forest Acts of 1865 and 1878 laid down the procedure for creating and administering forest reserves. Sustained supply of forest products for the local population was not the primary objective of these Acts. The need for ship building timber, railway sleepers and construction timber for public works projects was the overriding objective (Taylor, 1981). The Forest Acts were preceded by the Rules for assigning 'waste lands' for cultivation. Forests and other non-revenue generating lands were considered 'waste' which had to be rapidly converted to crop lands to benefit the State. Even in Princely States such as Travancore Wasteland Rules for assigning forests for coffee

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3. Bourdillon's Report on the forests of Travancore was published in 1893.

cultivation and expansion of cardamom estates were enacted in 1865 closely following those in British India (Bourdillon, 1893). Forest reservation was adopted as a policy only when the potential wealth and revenue generating capacity of the forests were recognised (Shiva, 1986).

The Forest Act of 1878 was tempered by the National Forest Policy of 1894 which directed that where "an effective demand for culturable land exists and can only be supplied from forest area, the land should ordinarily be relinquished without hesitation" (cited in Government of India, 1976, p.17). It may be infered that sustained land revenue was considered as good as or better than sustained forest revenue. The National Forest Policy of 1894 declared that the "sole object with which the forests are administered is public benefit". Four classes of forests were identified (1) protection forests for climatic and ecological needs, (2) valuable forests for commercial timber and revenue, (3) minor forests and (4) pasture lands for meeting the local needs (Troup, 1917).

The 1894 Forest Policy was followed by the National Forest Policy of 1952. During the interval of half a century, important changes took place in the intensity of forestry, legal status of forests,

transportation, wood based industries, etc. (Nair and Chundamannil, 1985). Expansion of agriculture inside forest reserves consequent to food shortage during and after the Second World War was also an important feature during this period.

The Forest Policy of 1952 focussed on the economic aspects of forestry. Departing from the 1894 policy, agricultural expansion at the expense of forests was discouraged. It was stated that forestry was entitled to an adequate share of the land. The commitment to forest sustention was clearly stated in the 1952 policy. The need for sustained supply of timber and other forest produce required for defence, communications and industry and the need for ensuring progressively increasing supply of grazing, small timber and firewood was emphasised along with the need for evolving a system of balanced and complementary land use where each type of land is allotted to that form of use under which it would produce most and deteriorate least; the need for checking denudation in the watersheds, progress of erosion and desert invasion; the need for afforestation for amelioration of the physical and climatic conditions and for promoting the general well-being of the people and finally the realisation of the maximum annual revenue in perpetuity consistent with the other objectives were stressed in the 1952 policy.

Subsequently these features of the forest policy were incorporated in the Working Plans of the State Forest Departments as objectives of forest management.

The foregoing review of historical evolution of the sustained yield concept shows that sustained yield is a widely accepted principle of forest management. The concept has acquired a variety of meanings in different regions and over time. Although a good part of the literature is connected with yield regulation or the technical aspects, the important objectives for doing so are often a concern for community stability and meeting local needs in perpetuity. The multiple use possibilities and its preservation has also been an important objective. Sustained yield practices ensure conservation of options and conservation of quality of the environment.

Conservation of options is to ensure diversity in the resource base and flexibility in addressing programmes for the future generations. Conservation of quality is intended to ensure that the present generation at lease maintains the quality of the environment and the natural heritage passed on to future generation is neither impared or diminished (Weiss, 1983). However this concept has been a subject of intense criticism by economists subscribing to the laissez faire perspective.

II

Criticisms of Sustained Yield

Most of the criticisms arise from a mistaken notion about the regidity and narrowness of the sustained yield concept. As the practitioners and advocates of sustained yield draw their inspiration from Europe where the concept first developed, a common criticism of sustained yield policies in other regions is that instead of modifying the concept, acquired from Europe to suit the vastly different conditions elsewhere, the advocates of sustained yield attempt to modify the forests to fit their theories (Clawson and Sedjo, 1984).

Another criticism of sustained yield stems from the confusion regarding sustained yield and the preoccupation of early German foresters with the creation of normal forests and insistance on normal yields which is mistakenly taken to mean constant yields. "The traditional or classical concepts of normal forest, sustained yield etc. on which forest management has so long been based will not do. The basic objective of management of a forest resource is to meet society's needs be it production of raw material for industrial and commercial use and or other goods and services and not achieving a normal forest... There is no sanctity for sustained yields, the yield can and would vary on the

exigencies of the situation" (Misra 1982, p.199-200). And that "sustained yield principle over the years became such a fetish with foresters that it became a kind of fetter that chained down foresters and forest management for well over 100 years and prevented them from assuming a more flexible and dynamic approach towards production" (ibid., p.192). According to the National Commission on Agriculture, "more importance was placed on conserving forest capital and on attaining normal forests. Forests were worked on a sustained yield basis and expenditure for works on improvement, such as cultural operations, construction of roads, etc. was mainly guided by the revenue earning potential of the forests in a particular region and not always towards making an overall development of country's forests with a wider objective" (Government of India 1976, p.13) and it goes on to attribute the "conservation oriented forestry practised at present" for the low contribution of the forestry sector in the NDP which was just 1.5% in 1972-73 (ibid., p.8).

In both these cases sustained yield is characterised as some sort of undesirable influence which has only to be banished to meet society's needs and attain wider objectives of development. These criticisms reflect insufficient understanding of the sustained yield

concept. As Thirgood (1984) commended in the context of criticisms from American economists, "these critics most often are labouring under their own misconception of the essentials of sustention and are attacking a strawman they themselves have constructed out of their lack of real understanding of the practical applications" (Thirgood 1984, p.xi).

Another important criticism of sustained yield drawn from the German antecedents is that Germany was a wood deficity country. The volume of imports were adjusted to make up for the deficit and demand fluctuations. Sustained yield is criticised for being a static supply theory into which demand for timber entered hardly at all (Clawson and Sedjo, 1984). This certainly is an important point. Sustained yield policies can succeed in dynamic economics only if large price fluctuations for forest produce can be tolerated or imports are economically feasible.

Criticisms that rigid sustained yield harvest may cause great fluctuation in prices and that stable harvest level need not necessarily lead to employment stability (Waggener, 1977) are justified to a certain extent. But rigidity of harvest level is not inherent in the sustained yield principle and fluctuating harvest need not bring about greater employment stability.

Sustained yield does not ensure stability in employment. In fact mechanisation and industrial concentration can reduce employment even when harvest levels are maintained. For instance it has been reported that even with rising yield and harvest levels, employment in forest based industries has actually shrunk in Tasmania due to changes in industry structure (Dargavel, 1980). Employment stability, where achieved, is incidental. However, sustained yield practices can smoothen the transition from one level of harvest, income or employment to another level in a much smoother manner than any other means to achieve the same. This has also implication to community stability which has been a persistent concern for forest sustention and which has remained a vague objective. Community could be taken to mean the producing community, the users and consumers, a provincial State or the country as a whole. Further, stability can refer to harvest levels, prices, income, employment and similar other variables. Stabilisation of all the characteristics simultaneously would not be practicable and stability at the national level need not lead to stability at the local level and vice versa (Waggener, 1977). As a rationale for sustained yield, community stability has been at best an elusive goal (Klemperer, 1981).

It has been suggested that sustained yield management is not relevant in forests where the crop consists of low value species and that sustained yield can be economically practised only after replacing the original crop with more productive plantations after clearfelling. This argument is valid for forests set apart for commercial wood production. Compared to clearfelling systems where a high degree of mechanisation is possible and where inputs can be concentrated spatially, management of natural forests for wood production under sustained yield management is a land extensive and labour intensive technique where the overhead costs per unit out turn are much higher. But if timber production for profits is not the only goal and multiple use is desired, maintaining the natural forests would permit the production of non-timber outputs, enhance recreational, wilderness and watershed values and retain the natural diversity which would permit the conservation of options regarding future use of the forests.

Another criticism is that sustained yield is inappropriate where forests continue as a common property resource in which 'help yourself harvest' is practised (Clawson & Sedgo, 1984). This is a valid criticism but the solution lies not in abandoning or postponing

sustained yield management but in redefining forest boundaries, securing people's support for forest policies and reorienting forestry for local community needs. Forest encroachments and illicit felling of trees very often arises out of inappropriate land tenure policies and in situations where a large section of the population is either landless or have uneconomic holdings and have acute scarcity of fuel wood.

It is also argued that where factors such as demand, prices, interest rate, and technology are changing it is illogical to stick to sustained yield. It is also argued that with the development of improved transportation and trade sustained yield (which is intended for local self sufficiency) becomes non-essential (Osmaston, 1968; Misra, 1982). Regarding the changing market situation for forest produce and capital, it would be best to adopt a flexible policy in respect of harvest levels in commercial forestry but in the absence of legal safeguards against timber mining and institutional arrangements to ensure that forest productivity is maintained, the risk of rapid deforestration would be high. The argument against sustained yield in the context of improved transportation and trade has only limited validity for developing countries who would find it difficult to earmark foreign exchange for forest

produce imports when the need arises. Further international trade in forest produce is mostly in high value decorative veneer and plywood logs and not ordinary construction timber and fuelwood which developing countries with high population require. Due to the high relative bulk of forest produce cost of imports and even long distance internal transportation would be high. It would be prudent to plan for at least the essential forest produce to ensure regularity in supply and as a security against disruption of trade.

Yet another argument follows the view that foreign exchange is the most critical constraint in the development process and therefore accelerated liquidation of the forest capital to earn valuable foreign exchange is justified even at the cost of sustained yield management (Clawson & Sedjo, 1984). This advice to tropical developing countries inspired by transnational logging companies has been exposed by Westoby (1975) as a device to plunder the resources by external agencies with the collusion of corrupt politicians or other power brokers within developing countries. Westoby characterizes the export oriented exploitation of tropical forests during the two decades prior to 1975 as "reckless, wasteful, even devastating. Nearly all the operations have been enclavistic that is to say that have had

no profound or durable impact on the economic and social life of the countries where they have taken place. Of the revenue which has accrued, a small part has remained in the countries to which the resources belonged. Of that fraction a not inconsiderable sum has gone to line the pockets those empowered to secure or negotiate concessions" (Westoby 1975, p.211). Further as trade barriers exist in developed countries against processed forest products, the export options open to most tropical countries is limited to selling unprocessed logs which fetch a very low price far below the replacement cost.

Yet another issue on which sustained yield often criticised in its response to technical changes. To understand this aspect one has to consider two types of technical changes. (1) Changes that enhance the utilisation of species not used hitherto and (2) Changes that result in savings in wood used. In the former case the immediate effect is the possibility of increased price realisation for species which are currently considered worthless or of a low value. During the Second World War and afterwards more and more timber species became marketable in India. The response was to expand selection felling to include the newly acceptable species also. When more species per unit area become marketable, the extraction costs per unit area falls and the

price realised per unit area increases. This is profitable for the forestry enterprise. But if technical changes in utilisation is not accompanied by improvement in the regeneration techniques, it will amount to timber mining and would be antogonistic to sustained yields.

In the second case where changes in technology result in savings in the use of wood in areas such as substitution of wood with other materials or with high strength wood based panel products like plywood, medium density boards etc., the wood requirement at a given level of demand would be lower. Also technical changes that reduce wastage of wood during processing such as in sawing, peeling etc. would also have the same effect. But even in this situation whether prices would fall will depend on the magnitude of substitution or the volume of savings achieved. Further new products such as wood based panel products could open up fresh markets and could actually result in higher price realisation.

The possibility of technical changes would only add to the relevance of sustained yield particularly in natural forests since liquidation or replacement of low value species association with more valuable plantations may not be justifiable in the long run. Further, natural species associations are better suited to a particular site than others which has an added risk of failure.

Since there are a number of criticisms against sustained yield it is useful to examine whether there are any alternatives available to this. Although critics stress that sustained yield is inappropriate no valid alternative which has universal appeal have been proposed (Joshi, 1974). The few alternatives that are suggested are based on short run economic efficiency criteria such as, marginal costs or additional investment should be less than or equal to marginal revenue and decisions regarding stocking levels, length of rotations, etc. should be flexible to allow for maximisation of economic returns to investment (Duerr, 1960) or a variable yield policy which can accommodate resource reallocation to achieve maximisation of present value of benefits to society (Klemperer, 1981). These suggestions are not strictly alternatives but only emphasise that market forces should be permitted more freedom to achieve economic optimisation. This is definitely a more narrow perspective compared to sustained yield which stands for social optimum. Economic efficiency can be incorporated into the sustained yield principle.

Although maximising the net present value of benefits is economically the best course of action, accounting all the input and output streams would be too complex or even infeasible since forestry involves

positive and negative externalities which may not be amenable to quantification. Then again adopting the policy of maximising the NPV will have important implications on the output mix, crop composition and the forest environment.

There is no unique level of sustained yield output. Production levels in sustained yield forests will depend on the level of inputs and the size of the sustained yield unit will determine the allovable cut during a given period. When the size of the planning unit is larger the allowable cut would also be correspondingly larger and a range of output levels is possible with varying degrees of intensification and investment levels. In the literature on sustained yield the initial emphasis on output maximisation (maximum sustained yield) has shifted to value maximation (maximum economic yield) which in turn has been replaced by the concept of socially optimum yields (optimum sustained yield). Forest laws, foresters and academies have defined sustained yield to suit the economic conditions of society and forests of particular region. After a review of the definitions Wiebecke and Peters has defined forest sustention as "the endeavour to facilitate the continuous and optimal provision of all tangible and untangible effects of the forests for the benefit of present and future generations" (Wiebecke and Peters 1984, p.178).

This definition has been generally accepted as the most comprehensive and universal definition of the concept (Thirgood, 1984).

The fundamental assumption of sustained yield management of forests is that the resource is renewable. Therefore sustained yield management can be applied only in renewable forests. Harvesting of non-renewable forests constitutes timber mining which conflicts with the sustained yield concept. Application of current forestry technology, in many parts of the world, particularly in the tropics, may result in either "excessive successional retrogression, excessive depletion of the site nutrient capital or some other ecological change which will seriously impair the ability of the site to grow trees" in successive rotations (Kimmins, 1974, p.29). It has also been pointed out that most plantation forestry cannot be classified strictly as sustained management due to the adverse environmental effects. Extensive monoculture plantations can produce undesirable effects since a general ecological rule of land use is that "impacts on the environment become more adverse as the type of land use becomes more uniform, more expanded, more intensive and they become greater as the type of land use becomes continuous" (Plochman 1981, p.45).

When the forests are managed for serving local needs such as fuelwood, raw material for housing and cottage industries or for environmental benefits sustained yield management is considered the most appropriate. One of the original as well as persistent arguments in support of sustained yield is its assumed contribution to community stability. Large scale plantation to supply wood raw material for integrated pulp mills are also suited for sustained yield management. Sustained yield is relevant when harvesting old growth forests is envisaged. Non declining even flow, a component of sustained yield stipulates that harvest should not exceed the sustainable level of out turn in the subsequent rotations. Or that the old growth liquidation is spread out to last till regenerated areas are mature for harvest.

Sustained yield can accommodate economic and social optimisation as well as spatial and temporal optimisation. Spatial optimisation refers to optimisation of land use between different uses to the best advantage. Allocations of land between forestry and other uses and within each sector has to be optimised along with the introduction of sustained yield management. Temporal optimisation seeks to ensure that future generations are not deprived due to exhausion of resources.

In summing up, the discussion on sustained yield shows that the concept continues to be relevant because of several reasons the important ones being,

1. It is prudent and conserves options regarding resource use in the future.

2. It permits multiple use of the forest resources.

3. It can smoothen the impact of change from one level of output, income, employment or crop composition to another,

a n d

4. It has been a traditional goal in many countries across the globe and is a fundamental principle of modern forest management. Sustained yield can contribute to conserving the quality of the environment and it is in consonance with the World Conservation Strategy (IUCN, UNEP, WWF 1980).

Necessary Conditions for Practising Sustained Yield Forestry

Though the concept of sustained yield is very useful, there are certain pre-conditions for translating this into actual practice. These include: (1) sufficient knowledge regarding the resource base, (2) Land zoning to stabilise the area under production forestry and environmental forests, (3) Creation of a

normal forest and achievement of regeneration to the normal extent, (4) Conservation of the environmental forests to sustain the forest effects, and (5) Ensuring full realisation of multiple use possibilities and orientation of forestry to enable achievement of communite stability.

Knowledge of the resource base consists of present and potential availability of resources, the possibility of renewability of resources, the input requirements for sustained production and the risk of degradation. When the renewable and non-renewable areas are identified and the optimum size of production and environmental forests are decided, land zoning to stabilise the forest area, production and environmental effects is indispensible. In production the principle of forest sustention requires that normality in age class composition is achieved so that the volume of production can be maintained without decline. It is also necessary that regeneration should be achieved to the normal extent. In areas identified as protection or environmental forests it is necessary that optimum vegetative cover is maintained to prevent erosion. Areas rich in genetic resources should be maintained as biosphere reserves and unique forests, landscapes or wild life habitat should be preserved as national parks. And finally forestry should ensure that multiple use possibilities are fully utilised and all

sections of forest users and forest produce consumers are optimally served. When multiple use is assured and output levels and prices stabilised the objective of community stability would also be served.

III

Sustained Yield and Patterns of Investment

In the foregoing review we have examined the evolution of the concept of sustained yield in various countries and the major criticisms levelled against it. Our analysis shows that the concept continues to remain useful as a policy objective in forestry. However, the objective of forest sustention can be translated into actual practice only through an appropriate investment policy. The forest investment policy has to be synchronised with sustained yield objectives. The investment pattern should ensure that the production levels are sustainable, diversity and multiple use is ensured and environmental effects are sustained. Investment in extraction and investment in regeneration have to be balanced in such a way as to avoid depletion of the stock. What should be the ideal balance between short term and long term investment to achieve sustained yield would depend on such factors as the nature of the forests, rate of growth, regeneration status and the

relative cost of extraction, regeneration, necessary inputs, etc. Investment should be so directed that the productivity or productive capacity is improved or at least maintained. In this, investment in afforestation for optimising forest cover and stocking levels and fire control to prevent deterioration also plays an important role.

Though the role of investment in achieving the objective of sustained yield is well recognised, our current knowledge about the manner in which investment pattern in forestry is matched with the objective of sustained yield in our type of forests and the factors that contribute to the mismatch between the two is totally inadequate. To gain insights into these issues it is essential to examine the investment pattern in forestry in a concrete situation and see whether it is consistent with the objective of sustained yield. Our attempt in the ensuing chapters is not to evaluate the observed pattern of investment against an optimum investment pattern, but only to see whether the investment policy followed has been broadly oriented towards achievement of sustained yields. As a prelude to this in Chapter III we shall examine the pattern of investment in Kerala forestry.

CHAPTER III

PATTERN OF INVESTMENTS IN FORESTRY

This chapter is presented in three sections. Section I examines the pattern of expenditure in forestry and compares it with the revenue from the sector for various plan periods. Section II analyses the short term investments in wood production and Section III analyses the long term investments. The preference for short term investments over long term investments and for particular plantation species in the long term investments is also discussed in this chapter.

I

Trends in Expenditure and Revenue in Forestry

The annual expenditure and revenue from forests during the various plan periods is given in Table 3.1. It can be seen that while both revenue and expenditure increased steadily during the entire period, revenue increased faster than the increase in expenditure. It is interesting to note that expenditure on forestry as a percentage of the revenue realised increased from 28 percent to 37 percent between the second and Annual Plan (1966-69) period, but declined steadily during the subsequent period to 23 percent. The decline in the percentage share of expenditure since 1966-69 can be

interpreted in two ways (1) Efficiency in management has resulted in more than doubling the revenue while growth in expenditure was kept under control or (2) Forest management was oriented towards maximising the current surplus generated from this sector while long term production potential was undermined. In the course of our analysis we shall examine which of the two interpretations is more nearer to the actual situation.

Table 3.1

Pattern of Expenditure and Revenue in Forestry

Plan Periods		Annual Average Revenue 1970-71 prices Rs. lakhs	Annual Average Expenditure 1970-71 prices Rs. lakhs	Expenditure as percentage of Revenue
II	1956-57 to 1960-61	612	170	28
III	1961-62 to 1965-66	781	255	33
Annual	1966-67 to 1968-69	839	310	37
IV	1969-70 to 1973-74	958	320	33
V	1974-75 to 1977-78	1,377	397	29
Annual	1978-79 to 1979-80	1,955	440	23

Source: Administration Report of the Forest Department (various issues), Government of Kerala.

Table 3.2 gives the percentage distribution of the total expenditure among various activities. An interesting feature that emerges is that while establishment and infrastructure costs have increased their relative share from 39 to 45 percent, expenditure on production and conservation of wood show a relative decline.

Table 3.2

Percentage Distribution of Expenditure in Forestry

Plan Periods	Infrastructure and establishment	Production and conservation of wood resources	Others	Total
II	38.6	53.1	8.3	100
III	33.9	55.6	10.5	100
Annual	33.1	60.0	6.9	100
IV	38.5	52.7	8.8	100
V	43.6	46.9	9.5	100
Annual	45.4	45.0	9.6	100

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Among infrastructure and establishment expenditure, pay and allowances for the staff has the highest

share forming 75 to 87 percent during the various plan periods (Table 3.3). Communications and buildings accounted for 13 to 18 percent and 5 to 8 percent since. But as a percentage of the total forestry expenditure communications and buildings accounted for only 2 to 6 percent with a maximum during the annual plan period. In our analysis of the investments in production and conservation of wood resources we have excluded the component of establishment and infrastructure expenditure since it is difficult to distinguish the portion of expenditure that is due to routine administrative needs and that required exclusively as complimentary to an investment programme. Further distributing the salary of the staff, which is the major component, among different investment programmes would be quite arbitrary. The pattern of expenditure on establishment and infrastructure is given in Table 3.3.

Table 3.3

Distribution of the Annual Average Expenditure on Establishment and Infrastructure in Percentages

Plan Periods	Salary and allowances	Office expenses	Training	Equipment	Vehicles	Roads and Buildings	Total
II	80	2	2	-	-	16	100
III	82	3	2	-	-	13	100
Annual	75	3	3	-	1	18	100
IV	87	3.5	2	-	0.5	7	100
V	85.7	4	1	0.3	4	5	100
Annual	82	4	1	0.3	4.7	8	100

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

We have also excluded the component of expenditure classified as "others" from the preview of the analysis of investment since this has very little direct relationship with production. In sum, in the subsequent analysis of investment in forestry we have taken into account only those components that have been directly contributing to the production and conservation of wood.

Table 3.4 gives the distribution of investment in production and conservation of wood resources during the various plan periods. It can be seen that short term investments have by far been the largest component and that it has been increasing steadily in absolute terms. Long term investments show wide fluctuations with a peak during the Annual Plan period (1966-69). Investment in conservation of wood resources has been negligible.[1]

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1. No separate accounts are available for the Second and Third Plan periods.

Table 3.4

Pattern of Annual Average Investment in Wood Production and Conservation of Wood Resources in 1970-71 Prices

in Rs.'000

Plan Periods	Short term investments	Long term investments	Conservation of wood resources	Total
II	8,280	763	-	
III	10,840	3,310	-	
Annual	13,350	5,155	48	
IV	14,201	2,529	325	
V	15,392	3,041	363	
Annual	15,207	4,464	375	

Source: Administration Report of the Forest Department (various issues), Government of Kerala.

II

Short Term Investments

Short term investments in wood production consist of expenditure on harvesting. Harvest from natural forests and from plantations constitute wood production in any year. In natural forests timber extraction is carried out in two stages. The first is selective felling and the second clearfelling. When wood production is

the only objective and land use is to continue unchanged selective felling is practised. When land use change is envisaged and forests are to be cleared for raising plantations or for other purposes such as agriculture, reservoirs, etc. selective felling is followed by clear-felling.[2] Although as a share of the total expenditure in forestry investment in extraction of timber has been declining the actual amount of investment has been increasing in absolute terms. It may be noted that private agencies account for a substantial part of extraction from forests which is not included in our analysis. In clearfelling coupes the timber is sold standing and the cost of extraction is borne by purchasers. Major plywood units directly undertake selective extraction. Therefore the actual level of investment is much higher than the figures used in this study.

Trends in wood production

No published figures exist on the distribution of the total wood production according to selective and clearfelling. We have attempted to overcome this difficulty by using the volume of timber received in various

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2. Felling rules for selective felling vary depending on whether selective felling alone is envisaged or clearfelling is to follow. In the former only 8 to 12 trees per ha above 150-180 cm girth can be extracted while in the latter all trees above 100 cm girth and all teak trees irrespective of size is extracted by selective felling while rosewood trees are retained.

government depots as a proxy for the outturn from selective felling and the remaining portion of the total wood production is taken as the production from clearfelling. This approach has several limitations. The total wood production figures itself may not be reliable since widespread pilferage that occur go unaccounted and estimates of timber production from clearfelling coupes which are removed by purchasers may not be accurate. Another reason is that it is not clear how wood production from selective felling coupes operated by plywood units are accounted. A third reason is that teak wood from plantations and selective felling coupes reach the depots and no separate accounts are available. However as no other estimates are available the present classification is adopted.

Table 3.5 gives the production of timber[3] from selection and clearfelling. Timber production has increased from one lakh cubic meters to five lakh cubic meters between the Second and Annual Plan periods. During the beginning of the study period the contribution of clearfelling to total production of timber was only 5 percent. It increased to 45 percent during the Annual

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3. Lops and tops of felled trees in selection felling coupes are sold as firewood. It is not included in the timber production figures since they are given in a different unit than that of timber. Conversion into a common unit will involve assumptions regarding wood densities, moisture content and differences between solid and stacked volume.

Plan period (1966-69) and it has declined to 36 percent by 1980. Increased production from clearfelling is due to expansion of forest clearance for reforestation with plantations and for releasing land for non forestry purposes.

Table 3.5

Distribution of Average Annual Production of Timber (in Round Logs) from the Forests

Plan Periods	Percentage production from selective felling	Percentage production from clear cutting	Total Timber Production	
			in '000 m^3	Percentage
II	95	5	117	100
III	66	34	304	100
Annual	55	45	514	100
IV	56	44	512	100
V	59	41	534	100
Annual	64	36	441	100

Source: Computed from Administration Reports of the Forest Department (various issues), Government of Kerala.

Timber Yield

The Administration Reports of the Forest Department do not give any indication as to the area subjected to selective and clearfelling in any year. However, we have been able to obtain unpublished data on the area and production of timber, from selective and clearfelling for three years (Table 3.6). The available figures show that yield from selective felling[4] operations range from 20 to 30 m^3/ha and that from clearfelling is relatively steady at around 40 m^3/ha.

Profitability in Timber Harvesting

Investments in timber extraction fetches an immediate revenue. In clearfelling coupes the standing timber is auctioned enblock and the revenue in obtained in the same year. Expenditure of the department in clearfelling coupes is only for boundary demarcation, issue of permits for the removal of timber, etc. The actual extraction costs being borne by the purchasers, the revenue earned by the department is the net revenue. In selection felling coupes on the other hand the department invites bids for felling and transporting the marked trees to Government depots. The cost of extraction and transport upto

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4. Yield from selective felling is calculated by dividing the production from selective felling by the sum of the area subjected to selective and clearfelling since selective felling is carried out in clearfelling area also.

Table 3.6

Area, Production and Yield of Timber from Selective and Clearfelling

Year	Area subjected to		Production of timber from		Yield per Ha from	
	Selective felling '000 Ha	Clear felling '000 Ha	Selective felling '000 M^3	Clear felling '000 M^3	Selective felling M^3/Ha	Clear felling M^3/Ha
1977-78	4.1	7.3	237	292	20.8	40.0
1978-79	5.3	4.5	259	188	26.3	41.5
1979-80	5.7	3.7	288	146	30.5	39.0
Average	5.0	5.2	262	209	25.9	40.2

Source: Forest Department (unpublished) files.

the depots are thus borne by the Government. However direct extraction by large plywood units after paying seigniorage is also in vogue. The sale of timber from selection felling coupes may not take place in the same year. Sometimes the revenue would be obtained only in the next year. As it is difficult to disaggregate the revenue from the sale of timber from the current and previous year's production, it is not being attempted. As only the annual average revenue during the different

plan periods are used for this study the error may not be large.

Investment revenue and profit from the extraction and sale of timber have steadily increased during the study period in real prices (Table 3.7). However, profits as a percentage of investments declined from 596 percent to 471 percent during 1956-69 and then it has shot up to 927 percent by the end of the period. The initial decline can be explained by the excess of production over the market demand. During the period 1956-69 production increased by about five times from 1 lakh to 5 lakhs m^3. Another reason is that the increased production was composed of a larger share of low value timber from clearfelling coupes. Production from clearfelling as a percentage of total wood production increased during this period from 5 percent to 45 percent (See Table 3.5).

Table 3.7

Average Annual Investment on and Revenue from Timber Extraction in 1970-71 Prices

(in Rs. lakhs)

Plan Periods	Investment in timber extraction	Revenue from timber sale	Profit from timber operation	Profit as percentage of investment
II	83	577	494	596
III	108	726	617	569
Annual	134	762	629	471
IV	142	895	753	530
V	154	1151	998	648
Annual	152	1562	1410	927

Source : Computed from the Administration Reports of the Forest Dept. (various issues), Govt. of Kerala.

The increase in the percentage of profits from 471 to 927 between the annual plans of 1966-69 and 1978-80 can be interpreted as the effect of demand catching up with the increased level of production and the stability in the level of production. The production has remained just over 5 lakh cubic metres of timber during the Annual Plan and the Fourth and Fifth Plan periods. During 1978-80 period however the production declined slightly to 4.4 lakh m^3. This may be a reason for the very high profits during the Annual Plans of 1978-80. Apart from the forests a substantial amount of wood is produced from the house compounds and estates outside the forests. The increased profits of the forest department may also reflect the exhaustion of timber in the non-forested areas. The nationalisation of private forests in Kerala in 1971 may also have contributed to the higher price realisation in Government forests. It is significant to note that since the Annual Plan period 1966-69 the increased revenue and profits from timber operation were obtained not from increased in the production of timber but due to the price effect. In fact the production declined slightly at the end of the period (1978-80). Krishnankutty et. al. (1985) reports that the compound annual growth rate in the auction price of important timber species in forest depots increased around 2 to 6 percent between 1968-69 to 1976-77 and since 1976-77 the rate of increase was around 18 percent.

The expenditure and revenue in relation to the production of timber would be a more useful indicator of the profitability of the investment in timber extraction. Table 3.8 shows the average annual expenditure and revenue per unit volume of wood production.

Table 3.8

Average Annual Expenditure and Revenue from Timber Extraction per m^3 of Production in 1970-71 Prices

Plan Periods	Expenditure for timber extraction Rs./m^3	Revenue from timber extraction Rs./m^3	Profits per m^3 of production Rs./m^3
II	71	494	423
III	36	239	203
Annual	26	148	122
IV	28	175	147
V	29	215	186
Annual	34	354	320

Source: Computed from the Administration Report of the Forest Department (various issues), Government of Kerala.

The pattern of expenditure, revenue and profits per unit volume of timber output is similar to profits as a percentage of investments (Table 3.7). Expenditure, revenue and profits per unit volume of output declined sharply from the II Plan to the Annual Plan period and have steadily increased since. However in constant prices the initial high figures for all the three have not been reached subsequently. The decline in expenditure per unit volume of output from 1956 to 1969 period is due to the heavier reliance on clearfelling where costs are borne by the purchaser. As explained earlier, the decline in revenue and profits per unit volume of output during the first half of the study period is due to increased production and demand falling behind the supply. The increase in the revenue and profits per unit volume of output in the second half of the study period may be due to demand picking up particularly from wood using industries which have built up processing capacity in the wake of increasing supplies in the earlier period.

The higher priority given for short term investments in wood production by the department, as reflected in its share of the total expenditure by the department, is perhaps due to the very high level of profits associated with this activity. Immediate returns may be an added attraction.

II

Long Term Investments in Wood Production

Expenditure on growing of trees either as plantations or for supplementing natural regeneration in selectively felled forests comprise the long term investment in wood production. Due to several reasons plantations account for the bulk of the long term investments in wood production. The preference for plantations over other types of forest regeneration methods is that infrastructure and supervision costs per unit area and per unit volume of wood output would be minimum. Knowledge of and experience in managing plantations makes it possible to plan the programme of activities in advance. Plantations are more amenable to a centralised system of administration and review of activities whereas natural regeneration calls for a more de-centralised and locally autonomous decision making.

The growing stock, allowable cut and expected value of the crop can all be estimated with reasonable accuracy for even aged plantations when compared to naturally regenerated areas. Also it is easier to make a project report or feasibility study of a plantation programme than on natural regeneration. The technique of natural regeneration is still imperfect or continues to be in the realm of trial and error. And, regeneration cannot be ensured in any reasonable time. Natural

regeneration calls for skills and knowledge of the local ecological condition which are very hard to come by. It also requires constant attention and tending which means more outlay on labour as well as supervisory staff.

Investment in Plantations

Investment in plantations increased by more than seven times in constant prices from the second plan to the annual plan (1966-69) period. In the fourth plan the annual average investment was only half the level reached during the previous annual plan period. In the fifth and the last annual plan period there is a rising trend but the level is much lower than that of the 1966-69 period. As a percentage of the total expenditure of the department investment in plantations increased from 5 to 17 percent during 1956-69 but afterwards it remains in the range of 7 to 10 percent.

As in the case of timber extraction some cost of plantation establishment is externalised. New plantation sites are leased out for temporary cultivation of tapioca in a system known as taungya. Two crops of tapioca are permitted in the newly cleared forest land. The taungya contractor is responsible for replacing casualities in the plantations from the departmental nursery and for keeping the plantation weeded. The cost of weeding of young plantations is therefore not included in the departmental accounts.

Table 3.9

Average Annual Investment in Plantations

Plan Periods	Average Annual Investment on Plantations		Percentage share of plantation investment in total expenditure
	in current prices Rs.'000	in 1970-71 prices Rs.'000	
II	398	763	4.5
III	2174	3310	13.0
Annual	4559	5155	16.6
IV	2779	2529	7.8
V	5221	2955	7.4
Annual	8432	4158	9.5

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Area and Composition of Plantations

More than 25 different species of plantations are listed in the Administration Report of the Forest Department. However, pure and mixed teak plantations (69%) and eucalypts (23%) account for the bulk of the area and investment. Table 3.10 shows the area under plantations of different species in 1979-80.

Table 3.10

Area Under Plantations of Different Species in 1979-80

Species	Area in Ha	Percentage to total
Teak	73,927	53
Teak and Matchwood mixture	22,174	16
Eucalypts	32,817	23
Cashew	4,698	3
Bamboo	965	1
Others	5,702	4
Total:	1,40,283	100

Source: Administration Report of the Forest Department for the year 1979-80, Government of Kerala.

The pattern of expansion in the area under plantations indicate that the area of all plantations added during the different plans have been in the range of three to five thousand hectares per year. Except for the second and Annual Plans (1966-69) period there was an acceleration in the additions primarily due to the spurt in the pace of eucalypts planting. Annual area planted up with eucalypts increased from 2 percent of the total new planting to 54 percent during the Annual Plans. However the pace was not maintained afterwards and during the Fifth Plan period the growth is negative indicating that the

area has shrunk. This is partly due to the fact that some eucalypt plantations were transferred to the newly formed Forest Development Corporation during this period. The net addition of teak plantations was more or less stable at around two thousand hectares per annum.

Table 3.11

Average Annual Area of Plantations Added During the Different Plan Periods in Ha

Plan Periods	Teak	Teak & matchwood mixture	Eucalypts	Others	All plantations
II	1,664 (45)	951 (25)	84 (2)	1,050 (28)	3,749 (100)
III	2,389 (46)	1,242 (24)	1,638 (32)	- 108 (-2)	5,161 (100)
Annual	2,052 (30)	1,156 (17)	3,729 (54)	- 77 (-1)	6,860 (100)
IV	1,483 (31)	641 (49)	2,368 (13)	354 (7)	4,846 (100)
V	2,472 (73)	795 (24)	- 126 (-4)	220 (7)	3,361 (100)
Annual	2,710 (62)	269 (6)	883 (20)	545 (12)	4,407 (100)

Note : Figures in parantheses denote percentage addition during each plan period.

Source: Administration Report of the Forest Department (various issues), Government of Kerala.

The addition of area under plantations denote net addition (i.e. if 100 ha of mature plantation is felled and the same area regenerated, it may not be noticed in the table). However when a plantation is felled and the area not regenerated by the same species it would show a negative addition during the particular period. Occasionally a decline in the area under plantations would only mean that the area under some failed plantations have been deducted from the accounts, sometimes replanting of a failed area may be recorded as an addition.

The distribution of investments between the different plantations is given in Table 3.12.

The sharp increase in the total investment in plantations in the Third and Annual Plan (1966-69) period has already been mentioned. During this period it can be seen that investment in teak plantations declined from 61 percent of the total to 33 percent while the share of eucalypts jumped from just 1 percent to 55 percent. This sharp jump in the share of eucalypt plantation was due to the flow of Central Government assistance for raising pulpwood plantations during this period. During the Annual Plan period (1966-69) a separate Industrial plantation Circle was organised with a conservator and supporting staff exclusively for raising eucalypt plantations. The reason for this sudden shift in investment

Table 3.12

Annual Average Investment in Different Plantations in 1970-71 Prices

(in Rs.)'000

Plan Periods	Teak	Teak & matchwood mixture	Eucalypts	Others	All Plantations
II	467 (61)	126 (17)	11 (1)	158 (21)	763 (100)
III	1313 (40)	393 (12)	1375 (41)	229 (7)	3310 (100)
Annual	1714 (33)	470 (9)	2848 (55)	123 (3)	5155 (100)
IV	1025 (40)	312 (12)	925 (37)	266 (11)	2529 (100)
V	1055 (36)	305 (10)	897 (30)	698 (24)	2955 (100)
Annual	1797 (43)	477 (12)	1208 (29)	675 (16)	4158 (100)

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Note : Figures in parantheses denote percentages to total.

priorities will be discussed later. Since the Annual Plans (1966-69) investment in eucalypts have declined both in absolute terms as well as in its share of the total investment funds, share of pure teak plantations and mixed teak plantations have been fairly stable since the III Plan

period ranging from 33 to 43 percent and 9 to 12 percent respectively. Other plantations consisting of more than 20 different species shows great variations in its share of the total investment funds. Individually each of the different species that make up the 'other plantations' represent only a small fraction of the total investment. The preference for teak and eucalypts is very marked.

Table 3.13 shows the index of growth in the average annual investment in plantations with second plan period as the base. While the index of investment in All Plantations was 676 during the annual plan period that of eucalypts registered a whopping 25,542. The massive boost in the investment in eucalypts is evident. Partly the low initial level of investment is responsible for the shooting up of the index but even in absolute terms investment in eucalypts have exceeded that of teak during the Third and Annual Plan (1966-69) period.

Revenue from Plantations

Sale of wood in the form of poles from thinnings and logs in the case of final felling represent the revenue from plantations. The stream of revenue is different for different species of plantations. Eucalypt plantations are normally coppiced every 10 years and managed on a rotation of 30 years. Taungya leases in young plantations for the cultivation of tapioca as an inter crop also fetches revenue. But revenue from

Table 3.13

Index of the Growth in Annual Average Investment in Different Plantations with Base 1956-57 to 60-61 Period - 100

Plan Periods	Teak	Teak and matchwood mixture	Eucalypts	Others	All plantations
II	100	100	100	100	100
III	281	312	12,331	145	434
Annual	367	373	25,542	78	676
IV	219	248	8,300	168	332
V	226	242	8,046	441	388
Annual	385	378	10,836	426	545

Source: Computed from the Administration Reports of the Forest Department (various issues), Government of Kerala.

taungya is not available separately because it is aggregated in 'other items' in the revenue statements of the department. Clearfelling of natural forests prior to raising plantations fetches substantial revenue. But income from clearfelling of natural forests being unrelated to the plantation as such is not included in the revenue from plantations. Table 3.14 gives the revenue from plantations and natural forests during the different plans.

It can be seen from the table that the revenue from timber extraction from natural forests account for more than 90% of the sale value of timber. This is partly due to the fact that despite one and a half centuries of planting tradition no attention has been paid to creating normality in the age class of plantations. The large scale expansion of plantations took place since the 1960's and therefore most of the teak and matchwood plantations are in the younger age classes. But eucalypt plantations are felled every 10 years or so and therefore the plantations raised in the 60's would have been felled during the period. It is obvious from Table 3.14 that investment in plantations have not influenced the composition of revenue from wood production in Kerala during the period 1956-1980.

Table 3.14

Average Annual Revenue from Plantations and from Natural Forests in 1970-71 Prices

Rs. lakhs

Plan Periods	Revenue from plantations	Revenue from natural forests	Total Revenue from sale of wood
II	49(8)	528(92)	577(100)
III	80(11)	645(89)	726(100)
Annual	37(5)	725(95)	762(100)
IV	79(9)	816(91)	895(100)
V	78(7)	1073(93)	1151(100)
Annual	130(8)	1432(92)	1562(100)

Note : Figures in parantheses denote percentages to total.

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Table 3.15 shows the distribution of revenue from plantations during the different plan periods. It can be seen from the table that teak contributes more than 90% of the revenue from plantation investment. Eucalypt plantations which receive around 50% of the total investment in plantations brought in only negligible revenue.

Table 3.15

Distribution of Average Annual Revenue from Plantations During the Different Plan Periods in 1970-71 Prices

Rs.'000

Plan Periods	Teak	Teak & match-wood mixture	Eucalypts	Other plan-ta-tions	Aoo plan-ta-tions	% of plan-tation revenue to total forest revenue
II	4,588 (94)	34 (1)	0 (0)	232 (5)	4,854 (100)	7.9
III	7,966 (99)	1 -	7 -	53 (1)	8,021 (100)	10.3
Annual	3,503 (95)	6 -	7 -	163 (5)	3,679 (100)	4.4
IV	7,332 (93)	166 (2)	56 (1)	327 (4)	7,881 (100)	8.2
V	6,798 (87)	257 (3)	335 (4)	414 (6)	7,804 (100)	5.6
Annual	11,726 (90)	156 (1)	453 (4)	628 (5)	12,963 (100)	6.6

Note : Figures in parentheses denote percentages to total.

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Due to the complexity in disaggregating investment on and revenue from plantations, no attempt is made to determine the profitability of plantation investment. The stream of investment on various items such as planting, weeding, thinning etc. have to be matched by the stream of revenue for each plantation and the profits discounted using an appropriate discount rate. The revenue and investment data used for this study is the total revenue and investment for the State as a whole. Even if division wise data is collected it would not be possible to identify a particular year's revenue with the particular plantation and then locate the stream of investments that have gone into the plantation; upto seventy years before in the case of teak plantations.

Based on the average yield obtained in teak plantations in Konni Division, the Net Present Value of one hectare of teak plantation in a rotation of 70 years at 5 percent discount rate is reported to be Rs.6,781/- and if the lease rent from taungya is also considered the NPV becomes Rs.9,323/-. Where the costs and benefits are Rs.15,686/- and Rs.22,467/- respectively without taungya, and Rs.14,124/- and Rs.23,447/- with taungya (FAO, 1984).

In an analysis of the investment and revenue from eucalypts in Kerala for the period 1961-62 to 1978-79 considering a felling cycle of 8,9,10 and 11 years Krishnankutty and Chundamannil (1986) have estimated that

the scheme is running at a mean annual loss of Rs.23 lakhs at 1970-71 prices. The loss sustained by the Government is primarily due to the fact that eucalypt wood is supplied to industries at concessional prices.

Teak and matchwood mixed plantations are yet to be felled but the revenue and profits are expected to be similar to pure teak plantations since in actual composition there is not much of a difference.

Revenue from plantations arise due to past investments. Therefore the revenue from plantations will have no relation with the investments in the same year i.e., the gestation period in plantations has to be considered unlike in timber extraction from natural forests. However, to get an idea of the level of investments or the relative priority given to plantation investment a comparison of the level of investment and revenue from plantations during the different plan periods is shown from Table 3.16. The current surplus of revenue over investment shown does not indicate profitability or otherwise from the current investment. It is presented merely to show the net returns in each period from plantation activity.

Except during the annual plans (1966-69) investment in plantations was less than half the current plantation revenue during the period. But the current surplus

from plantation activity has never exceeded 7 percent of the total revenue of the department. Plantation investment as percentage of total forest revenue remains in the range of only 1 to 6 percent. Further it has been declining since the Annual Plan (1966-69). Thus it is evident that plantations have a low priority in the allocation of investment funds in forestry.

Table 3.16

Average Annual Investment and Surplus from Plantations During the Different Plan Periods in 1970-71 Prices

Plan Periods	Plantation investment as % of plantation revenue	Plantation investment as % total forest revenue	Current surplus of revenue over investments in plantations	Current surplus from plantations as % of total forest revenue
II	16	1	41	7
III	41	4	47	6
Annual	140	6	-15	-2
IV	32	3	54	6
V	38	2	48	4
Annual	32	2	88	5

Source: Computed from Administration Reports of the Forest Department (various issues), Government of Kerala.

Preference for Particular Species

The predominance of teak in the plantation programme in Kerala is due to several reasons. The first teak plantation in India was started in Nilambur in 1842 by the East India Company to meet the demand for ship building timber of the British Navy. The success of these plantations was widely appreciated and since then there has been a continuous expansion in the area under teak. Teak, being a valuable multipurpose timber has a good market demand and the cost of raising is very low making it a very attractive financial proposition. Being a hardy indigenous species it has no major pest or disease problems. The rapid height growth in the initial years enable it to overtop any weed growth enhancing the survival capability. Although raised as a long rotation crop, yield from thinnings carried out in the 4th, 8th, 13th, 20th and 44th years fetches a high revenue before the final felling at 55th to 70th year depending on the locality. The long tradition of raising teak with the associated expertise of the forestry staff coupled with the high profitability have contributed to the marked preference for teak among the long term investment options.

The matchwood plantations were started as a Five Year Plan Scheme to meet the raw material needs (box and splints) of the match industry. Bombax ceiba is the most

important matchwood species planted in this scheme. Ailanthus triphysa and Euodia luna-ankenda have also been planted in a few places. There was central assistance specifically for raising matchwood plantations. Due to the lack of experience with raising bombax and the uncertainty in its performance, matchwood plantations were raised with an admixture of teak as a precaution against failure and due to the strong preference for teak on economic grounds. At the time of planting equal number of teak and bombax are planted. The prescribed rotation is 30 to 40 years with two thinnings at the 8th and 13th years. Either due to the failure of Bombax or due to their removal during thinning most of the matchwood plantations consist predominently of teak.

Eucalypts plantation programme was started during the second Five Year Plan as an experimental scheme to afforest the high range grass lands. A Central Government sponsored scheme for raising pulpwood gave a boost to the eucalypts planting programme during the Third and Annual Plan period (1966-69). The perceived rise in the demand for paper products along with development, and the anticipated short-fall in the supply of pulpwood together with the pulp industry's pressure contributed to the acceleration in the pulpwood plantation programme. The Central Government contribution for raising eucalypt plantation was Rs.10.3 lakhs during the third plan and Rs.106.3 lakhs

during the Annual Plan (1966-69). As part of this contribution has been spent for infrastructure development and establishment charges, it is not fully reflected in the investment figures used in this study. The reasons for directing the Central assistance in favour of expanding eucalypt plantation and their implications are discussed in the next chapter.

Regeneration in Selectively Felled Forests

Apart from plantations, long term investments in wood production consists of regeneration operations in selectively felled forests. The nature of activities include planting of seedlings collected from adjoining areas or raised in nurseries and weeding and girdling of unwanted species. Although it is prescribed in all Working Plans, regeneration Operations in selectively felled areas are seldom taken up. However it was practised in some divisions on a very small scale by the initiative of local officers. Augmenting regeneration in selectively felled areas was taken up as a scheme by the department only since the mid seventies. Table 3.17 shows the investment in augmenting regeneration in selectively felled forests. The negligible investment that goes into regeneration operations in natural forests is evident from the table. Investment in regeneration as a percentage of the revenue from the sale of timber from natural forests is far below 1 percent.

Table 3.17

Annual Average Investment in Regeneration Operations in Selectively Felled Forests

Plan Periods	in current prices	in 1970-71 prices	As percentage of total expenditure	As percentage of revenue from sale of wood from natural forests	As percentage of total revenue
	Rs.'000	Rs.'000			
II to IV	NA	NA	-	-	-
V	155	86	0.22	0.08	0.06
Annual 1977-78 & 1979-80	619	306	0.70	0.21	0.15

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Regeneration operations are limited to a small fraction of the area selectively felled. For example, in Ranni forest division where extensive evergreen forests exist selective felling was carried out in 4925 hectares during the period 1975-76 to 1980-81 while regeneration operations were undertaken in only 90 hectares during the

same period accounting for less than 2 percent of the area felled (FAO, 1984).

Unlike in plantations where a stream of returns are expected from the very first year in the form of taungya lease rent, sale of poles from thinnings etc., investment in regeneration operation in natural forests are expected to fetch a return only after a lapse of 120 to 180 years when the seedlings planted are expected to reach the exploitable girth. The plywood industry, one of the major consumers of wood from selective felling requires large diameter logs for peeling. Anticipating the nature of demand after more than 100 years is bound to be erroneous and if a positive discount rate is used the investment will become uneconomic. Absence of returns in the short run may be a factor contributing to the negligibly low level of investment in regeneration operations in selectively felled areas.

Short Term Vs. Long Term Investments in Wood Production

Table 3.18 shows the pattern of investment in wood production during the different plans. The marked preference for short term investment can be observed from Table 3.18. Among long term investments, plantations account for the bulk of the investment funds and investment in regeneration of natural forests is marginal. However, investments in plantations increased from 8 to

28 percent of the total investments from the II plan to the Annual Plan (1966-69) period. The choice of investment priorities and the implications of the pattern of investment on future revenue, production etc. will be discussed in the next chapter.

Table 3.18

Pattern of Average Annual Investment in Wood Production

Plan Periods	Total Investment in Wood Production		Short Term Investment Extraction of Timber Percentage	Long Term Investment	
	Rs. lakhs 1970-71 Prices	percentage		Plantation percentage	Regeneration in natural forests percentage
II	90.4	100	92	8	-
III	141.5	100	77	23	-
Annual	185.0	100	72	28	-
IV	167.3	100	85	15	-
V	184.3	100	83	16	1
Annual	196.7	100	77	21	2

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

Table 3.19 shows the Index of growth of investment with base 100 during the Annual Plan period (1966-69). It can be seen from the table that both the short term and long term investments have increased in real terms upto the Annual Plan period (1966-69). After that while the short term investments has increased, long term investments has actually declined. The increase in the short term investments and the decline in the long term investments have almost balanced each other and so the total investment has remained more or less constant since the Annual Plan period (1966-69).

Table 3.19

Index of Growth of Annual Average Investment (in 1970-71 Prices) with 1966-67 to 1968-69 Period as Base

Plan Periods	Short Term Investments	Long Term Investments	Total Investment
II	62	15	49
III	81	64	76
Annual	100	100	100
IV	106	49	90
V	115	59	100
Annual	114	87	106

Source: Computed from Administration Reports of the Forest Department (various issues), Government of Kerala.

Conclusion

During the period 1956 to 1980 forests have been a surplus generating resource for the government. The total expenditure as a percentage of the revenue earned from forests was around 30 percent. Around half of this expenditure represented investments in production and conservation of wood resources and the rest was accounted by expenditure on establishment and infrastructure (mainly staff salaries) and other miscellaneous items.

Among investments in production of wood, short term investments which consist of harvesting accounted for around 80 percent. Long term investments in timber growing showed wide fluctuations ranging from 8 percent to 29 percent. The pattern of long term investments show a peak during the Annual Plan (1966-69) period and a decline afterwards. Rapid expansion of plantations particularly eucalypts availing Central Government funds have contributed to the higher level of investments during the Third and Annual Plan period.

Among plantations teak (pure and mixed) accounts for the largest share of investments followed by eucalypts. The marked preference for teak is due to its high profitability, accounting for more than 90 percent of the revenue from plantations while it has been estimated that eucalypt plantations are running at a loss due mainly to the subsidised supply of eucalypt wood to industries.

Wood production from forests rose from one lakh cubic meters to five lakhs cubic meters between the Second and Annual Plan (1966-69) period and it has been fairly stable since then showing a slight decline during 1978-80. Profits from short term investments in timber production have been steadily increasing during the entire study period. But profits as a percentage of investments declined from 596 percent during the second plan to 471 percent during the annual plan period and then shot up to 927 percent by 1978-80. The increasing volume of production between the second and annual plan (1966-69) would have affected the profits during this period. But in the subsequent period while production remained steady increase in demand and higher price realisation has enhanced the profitability of investment in timber extraction. Outright sale of standing timber where the cost of extraction is borne by purchasers as in clearfelling coupes and in some selection felling coupes is one reason for high profitability.

Although natural forests account for more than 90 percent of the revenue from the sale of wood, investment to augment or sustain the supply from these forests in the form of regeneration operations in selectively felled forests and in fire protection has been negligible.

CHAPTER IV

ACHIEVEMENT OF SUSTAINED YIELD IN FORESTRY AND FACTORS INFLUENCING THE INVESTMENT POLICY

In the analysis of the pattern of investments in forestry, it was seen that the investment policy was oriented towards short term gains. In the first section of this chapter we have attempted to evaluate the developments in the forestry sector using the framework of sustained yield. Our argument is that although sustained yield has been a prominent feature of the forest policy and the working plans, the investment policy in this sector was not directed at achieving the goal of forest sustention. In the second section we have tried to identify the factors that have influenced the investment policy.

I

SUSTAINED YIELD IN KERALA FORESTRY

In order to evaluate the extent to which the investment policy and the actual management of forestry has affected forest sustention we have examined the following components of sustained yield: (1) sustainability of production and revenue, (2) achievement of normality in the age structure of the crop and regeneration, (3) optimisation of stocking in the forests, (4) maintenance of diversity, and (6) sustention of environmental effects.

While judging the analysis that follows, it is to be kept in mind that our assessment of the performance of forestry is not based on a direct investigation on the changes in the growing stock and forest land use which would have been the ideal method. In this context it may be noted that the prevailing understanding about the changes that have occurred in the pace of extraction, forest composition and output stream are totally inadequate. To a limited extent we have taken care of this handicap by incorporating the available evidence with our inferences on the pattern of investment to identify the direction of changes that has taken place in Kerala forestry.

Sustainability of Production and Revenue

For long term sustention of output levels and environmental services from forests the first condition that is to be satisfied is that there should be stability in the area under forests. It is difficult to prescribe what should be the optimum area under forests. The Forest Policy Statement of 1952 stipulates that one-third of the land surface should be maintained as forests. The policy clarifies that in mountainous and hilly regions the extent of forest cover should be 60% and in the plains 20%. The extent of forests in Kerala as reported by different government agencies is far short of the optimum suggested by the forest policy. Table 4.1 gives the different estimates of forest area and the extent of forest loss during different periods.

Table 4.1

ESTIMATES OF FOREST AREA AND FOREST LOSS IN KERALA

Agency	Reference year	Estimate of forest area		Reference period	Estimate of forest loss in '000 Sq.Km.	Basis for estimate
		in '000 Sq.Km.	as % of geographic area			
1. Kerala Forest Dept.	1979-80	11.3	29	-	-	Legal reserves
2. GOI/UNDP/FAO						
Preinvestment survey of forest resources	1970	9.4	24	1940-70 1960-70	3.45 1.02	de-facto control by Forest Dept.
3. State Land Use Board	1975-76	7.7	20	-	-	Village records
4. National Remote Sensing Agency	1980-82	7.4	19	1972-75 to 1980-82	1.2 per annum	Satellite photo
5. Centre for Earth Science Studies	1973	6.6	17	1905-65	6.4	Survey of India toposheets and satellite photo
	1984	3.5 to 3.9	9 to 10	1965-73	4.1	

Source: (1) Administration Report of the Forest Department for the year 1979-80, (2) Chandrasekharan 1973, (3) State Land Use Board 1986, (4) CSE 1985, (5) Chathopadhyay 1984.

Basically the differences in the estimates are due to the definition of forests and the methodology used. While some estimates are based on official records, which might be outdated, others rely on satellite photographs, survey data etc. Although the reference periods are different the massive scale of forest loss is apparent. This decline in forest area is bound to affect sustained yield management adversely.

During the study period timber production and revenue showed appreciable growth. It was pointed out that over 80% of the forest revenue was obtained from timber extraction from the natural forests where investment in regeneration was negligible. Further, decline in forest area undermines long term production potential and revenue. Although the effect of these factors on production and revenue is not expected to be evident immediately, table 4.2 shows that a marked decline is already evident. This could be an indication that the limits of extensive felling has been reached and that the production and revenue cannot be sustained at the earlier levels. The average annual production of timber declined by half between the Fifth Plan and the Sixth from 534 thousand m^3 during 1974-78 to 280 thousand m^3 during 1980-85. The wide fluctuations in output particularly the sharp decline is inconsistent with sustained yield management. Forest revenue in real prices has also

declined by half between 1979-80 and 1984-85 in spite of an upward trend in the real price of timber since the mid seventies (Krishnankutty et. al. 1985).

Table 4.2

FOREST REVENUE AND OUTPUT SINCE 1979-80

Year	Total Revenue in 1970-71 prices Rs. lakhs	Production of timber in '000 M^3
1979-80	2,023	435
1980-81	1,777	530
1981-82	1,845	256
1982-83	1,669	420
1983-84	1,282	111
1984-85	1,000	83
Annual Average 1980-85	1,515	280

Source: Administration Reports of the Forest Department (various issues), Government of Kerala.

The pattern of timber production, showing a rapid rise upto the Annual Plan (1966-69) and continuation of the high level of production till the Fifth Plan followed by the subsequent decline, when viewed together with the concentration of investment funds in timber extraction

and shrinking of forest area, could be seen as the result a policy directed at enhancing the short term production at the cost of sustainable production from forests. The fall in revenue since 1979-80 even while the real price of timber is rising adds to the inference that the forest investment policy followed during the study period has ignored sustainability of production and revenue from forests.

Achievement of Normality

In order to maintain a steady level of harvest without reduction in the levels of production it is necessary to achieve normality in the crop composition. For this two conditions are to be satisfied. First, the age class distribution of the crop has to be brought as close as possible to normality. Second, normal regeneration should be achieved. Normality in age class distribution means that each age class is represented by equal or equiproductive areas and normal regeneration means that equal or equiproductive areas, which is not less than the annual extent of extraction, is replenished. It is not necessary to have all age classes sequentially in each Range or Division; it would be enough if the forests of the State as a whole conform roughly to the theoretical ideal. In this context we have examined the normality in age class distribution of teak plantations and also the natural forests in Kerala.

Teak plantations which account for more than half the area under plantations in the State and which is a long rotation crop, shows a preponderence of younger age classes deviating markedly from the theoretical ideal. The distribution of teak in different age classes is shown in Table 4.3.

Table 4.3

AGE CLASS OF TEAK PLANTATIONS IN KERALA IN 1980

Age Class in Years	Percentage area in each class
Less than 10	35
10 to 20	34
20 to 30	12
30 to 40	8
40 to 50	6
50 and above	5

Source: Files of the Forest Department

A high proportion of younger age classes increases the potential yield of timber. But given the exhaustion of good sites for raising new plantations and the current ban on clearfelling, it is highly doubtful if the faster pace of converting natural forests into teak can be

maintained. If not, the future yield will decline sharply violating the principle of non declining even flow which is cardinal to sustained yield.

Selectively felled natural forests are usually not regenerated in Kerala. But wherever it was attempted it was confined to a negligible fraction of the area felled. Natural regeneration in selection forests is either absent or destroyed by frequent fires in the dry season compromising the chances of creation of normal forests and adversely affecting future yields (Karunakaran, 1982). Misra (1982) states that "in spite of over 100 years of scientific forest management in India, where one of the objectives of management has, throughout, been the creation of a normal forest, there is hardly any example of a normal forest having been created anywhere", (p.193). This is true for Kerala also revealing that creation of a normal forest and forest sustention has not been a genuine concern in the actual practice of forestry, notwithstanding its reiteration in policy statements and Working Plans. FAO (1984) analysing the management of evergreen forests in Kerala concludes that "the so called selection system practised now is oriented towards mining existing forests to meet immediate wood requirements. The high present yield is secured from hitherto unexploited areas. Therefore there is no guarantee that future yield would be of a similar magnitude" (p.84).

For determining the normal yield or the allowable cut during a period the substained yield principle stipulates that the production does not exceed the periodic increment in the crop. In old growth forests where the net investment is low the approach could also be based on the volume of the growing stock. But if the growing stock volume is considered to determine the allowable cut, the investment policy should ensure that the regeneration effort match the extent of felling and that there will be no decline in production in the subsequent rotations.

Working Plan prescriptions to augment regeneration in logged over forests in Kerala have been consistently ignored in the investment policy. The coverage of schemes for augmenting regeneration has been marginal. For instance, while the extent of selection felled forests in Ranni Division was 1,148 ha. in 1979-80 efforts at regeneration was limited to just 20 ha. In several divisions not even a token attempt was made in this direction. The backlog of areas selectively felled remaining to be regenerated, given this pattern, would be staggering.[1]

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1. No estimates for the total area subjected to selection felling and the backlog of regeneration is available for Kerala. Even in countries where forestry is a leading sector in the economy this has been a major problem, e.g. in Malaysia the backlog of regeneration increased from 111,000 ha.to 170,000 ha. between 1957 and 1967 (Sirin 1969). In Canada it was estimated that over 27 million ha. of cut over and burned forest land which require treatment existed in 1977 (Canadian Institute of Forestry, 1978).

In Kerala "vast tracts of selection felled forests remain untreated jeopardising the ability of the system to yield a sustained supply of timber" (FAO, 1984; p.75). The natural regeneration that occur is lost due to uncontrolled fires in the dry season or smothered by profuse weed growth due to excessive openings.[2] The selective felling carried out in the forests of Kerala is inconsistent with the sustained yield principle since the regeneration aspects are ignored. Conscientious European foresters in the Indian Forest Service have pointed out the inconsistency quite early.[3] Thus it can be seen that normality in the extent of regeneration in selection felling area and normality in the age structure of plantations have not been achieved in Kerala.

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2. Even if only ten trees are removed from a hectare, upto 50% of the canopy is opened up due to felling damages and laying out of extraction roads (Marn and Jonkers 1981).

3. "the quasi selection system practised in India does not conform to thed(efinition (of the true-selection system), in that it takes little or no account of the attainment of the normal forest and the establishment of regeneration to the normal extent, while in too many cases it does not even consider the silvicultural requirements of the species. The selection system if applied correctly requires the most intensive and skillful working and is suitable only for areas of comparatively small extent; indeed it is probably the most difficult of all silvicultural systems to apply correctly. For this reason it is unsuitable for ordinary Indian conditions. The fact that the term selection system has been erroneously applied to fellings of a selection type in India does not alter matters" (Troup 1916, p.51).

Optimisation of Stocking in the Forests

Even though no estimates on the changes in the stocking levels or the density of trees in the natural forests are available, certain factors point to a serious depletion in the stocking levels in natural forests. The important reasons for considering that there has been a decline in the stocking levels are (1) Neglect of fire protection in natural forests, (2) Selective felling without ensuring regeneration in felled areas, (3) Widespread pilferage of forest produce, and (4) Expansion of the road net work into hitherto inaccessible forests.

The very low investment in fire protection and the partiality towards eucalypts plantations has already been discussed in the previous chapter. The expansion of the road network accompanying the expansion for forestry activities and the construction of dams, canals and electricity transmission systems has increased human activity and fire hazard in forests. Since seedlings and young regeneration are more succeptible to fire future yield is greatly compromised.

Selection felling practised in Kerala is an important reason for the reduction in the stocking levels in natural forests. Often selection felling is the first step in a chain of events culminating in forest blanks or land alienation for other purposes. The continuation

of selection felling even when it is known that regeneration of the felled area is impossible (given the available technology and current level of investment) can be viewed as a wilful liquidation of the growing stock. Added to the creation of gaps within forests due to forestry activities particularly selection felling, damage due to illegal exploitation or pilferage is substantial. The growing demand and rising prices for forest produce makes illegal felling highly lucrative and the activity is greatly facilitated by the development of accessibility inside forests. This process has gained momentum and has become a serious problem in Kerala as well as in other forested regions.[4]

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4. According to Vohra (1985) "Forest officials who tried to check illegal extractions soon found themselves rendered ineffective in much the same way as other limbs of the bureaucracy were emasculated when they proved to be a nuisance to predatory politicians. As a result, the more cynical and unscrupulous members of the State forestry establishments soon came to terms with the criminal elements and began to share in the loot of the very resource they were supposed to look after. Formidable mafias based on the triangular alliances between the currupt bureaucrat and the currupt politician and the currupt businessman emerged in all States and became a most powerful threat to the conservation of the country's tree cover" (p.50-51).

Forest blanks or denuded areas within forests are a good indicator of the absence of tree growth or the sub-optimal stocking in the forests. The National Remote Sensing Agency estimates that the extent of forest blanks in Kerala above 100 acres was 1,131 Sq. Km. in 1980-82 excluding 399 Sq. Km. of barren hill ridges and rock outcrops (State Land Use Board, 1986). For the Iddukki Catchment it was estimated that forest blanks, grasslands etc. comprised 23% of the area (NRSA, 1984). Another estimate for the same catchment using the land use map of Iddukki showed that forest blanks consisted of 25% while another 5% of rock outcrops existed (Nair, 1984a). The current productivity of these areas is next to nothing and the cost and feasibility of reclaming these lands for any sustainable use is not known. What is certain is that the expansion of forest blanks is not conducive to forest sustention.

Among plantations, stocking in eucalypt plantations show great variation due to its susceptibility to fire and fungal diseases. In teak plantations which is relatively more hardy due to its indigenous status, stocking cannot be considered optimal. Although Chandrasekaran (1973) estimates that 82% of teak plantations had stocking levels over 60%, other evidence (KFRI, 1979) indicates that the actual stocking is much less. Yield from periodic thinnings can be used as an indicator

of the stocking levels. At the time of planting 2,500 seedlings per ha. are planted which is reduced to 1,250 during the first thinning and further to 625 in the second thinning. If the stocking is 100%, the thinning yield should be 1,250 and 625 poles in the first and second thinnings respectively. Table 4.4 shows the average yield obtained in three important teak plantation areas in Kerala. The very low level of thinning yield is sufficient evidence to conclude that the stocking in teak plantations is far below the optimum. Further the mean annual increment for teak plantations according to the yield tables for All India Site Quality I to IV are 8.7, 6.4, 4.2 and 2.0 m^3/ha. respectively (FRI & C, 1970). The actual achievement is far short of even the third quality plantations.

Table 4.4

AVERAGE PRODUCTIVITY AND THINNING YIELD IN TEAK PLANTATIONS

Average yield in different divisions	MAI m^3/ha	Thinning yield in number of poles	
		First	Second
Nilambur Division	2.604	404	321
Konni Division	2.339	41	63
Kozhikode Division	1.316	133	71

Source: KFRI, 1979.

Maintenance of Long Term Productivity in Plantations

Long term maintenance of productivity of plantations involves prevention of site deterioration due to erosion, compation etc. and addition of appropriate soil nutrients to balance their depletion by the plantation. The need to maintain site productivity was stressed in the context of teak plantations in Kerala in the Third Silvicultural Conference in 1929. To minimise the adverse effects of pure teak plantations it was recommended by Champion (1932), the Central Silviculturist, that maintenance of adequate undergrowth and strict fire protection was essential. This was endorsed by the Fourth (1934) and Fifth (1939) Silvicultural Conferences. Fire protection particularly in plantations and regeneration areas were given high priority in forestry in those periods that further investigation on this problem was not undertaken. However it was the high profitability of teak plantations which was decisive in the approach adopted.[5]

Seth and Yadav (1959) confirmed that the problem was acute where sufficient undergrowth was absent and where fire protection was neglected. The performance of teak deteriorated when plantations were extended up the

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5. After going through the available evidence Champion concludes that "from the purely economic view point the value of teak timber is so much more greater than any other species and that relatively poor teak is almost always a sounder proposition than any other possible alternative" (op. cit. p.30).

slope and in lateritic areas. Jose and Koshy (1972) analysing soil characteristics under teak plantations in Nilambur found that organic matter content decreased and soil deterioration occurred upto the age of 30 years in newly formed plantations and thereafter it was gradually built up. They also found that considerable compaction of soil had . . . taken place in the second rotation areas. Alexander et. al. 1980 found that taungya cultivation with tapioca in young plantations accelerated soil erosion and contributed to its deterioration.

The total neglect of fire protection in teak plantations in Kerala, the large scale expansion of teak plantations during the study period to the hills and the practice of leasing young plantations for taungya cultivation with tapioca to save on weeding costs would certainly have a aggrevated the problem of site deterioration due to erosion.[6]

Compared to long rotation plantations the problem of site deterioration and depletion of nutrients from the site is more serious in short rotation forestry crops such as eucalypts. Recycling of nutrients by litter fall is prevented since recycling starts only after growth has

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6. Annual erosion losses upto 152 tonnes per ha. of soil has been reported from teak plantations in Trinidad while it was only 17 tonnes in the adjoining natural forests (Evans, 1982).

reached its peak, before which the crop is harvested. As the biomass is concentrated in the stem which is removed from the site at the time of harvest nutrient removal is very high compared to perinnial crops where only fruits, nuts or latex is removed. Short rotation forestry is more similar to farming than traditional forestry and technically it is possible to overcome most of the deleterious effects by better management practices and more inputs.[7] In Kerala neither precautionary cultural practices are adopted nor appropriate inputs are added to prevent site deterioration.

The possibility of site deterioration under eucalypt plantations and consequent fall in productivity has been brought out in a number of studies. According to Shiva et. al. (1986) the exceedingly high water demand of eucalypts would create negative hydrological consequences. Another serious problem is the very low ground cover provided by the eucalypts canopy exposing the soil to the baking action of the sun and enhancing the run-off and soil loss during rains.[8] Problems of insufficient

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7. In a review of plantation forestry in the tropics Evans (1982) suggests that "foresters may have to learn from the farmer the importance of regular inputs - intensive cultural practice, fertilising, genetic improvement - to ensure that productivity is maintained" (p.425). But, as Eckholm (1976) points out "the real question is not whether it is possible but whether it is economic" (p.150) and feasible to attempt some of the technical suggestions requiring increased inputs.

8. The Soil and Water Conservation Research Institute, Ootty, found that interception of rainfall in eucalypts plantations was only 2.9% while it was 33.8% in the adjoining shola forests (CSE, 1985).

ground cover is aggrevated by the allelopathic (toxic) effect of the eucalypts litter which inhibits the establishment of a natural ground cover. Further the scanty leaf litter is itself not easily biodegradable because eucalypts pollutes the soil for decomposing organisms (Shiva and Bandopadhyay, 1985).

The experts panel constituted by the Economic and Planning Council of Karnataka to study the effects of eucalypts found that Eucalyptus hybrid (which account for more than 60% of the eucalypt plantations in Kerala) increases the acidity of the soil (CSE, 1985). Lundgren (1978) after a comprehensive review of soil conditions and nutrient cycling under natural and plantation foresting in the tropis reports that "following forest clearance, practically all evidence show that establishment of the most commonly used fast growing species (conifers, eucalypts, teak) is associated with a more or less pronounced deterioration of soil physical, biological and chemical conditions" (p.20). Most of the studies on soil effects have been carried out on comparatively favourable sites. Lundgren concludes that there is strong evidence to suggest that the establishment of large scale, short rotation plantations on more marginal soils in the low land humid and sub-humid tropics would result in more dramatic soil effects.

FAO (1980) endorses the conclusions of Lundgren and adds that the speed of deterioration will depend on

initial soil conditions, climate, management practices and the species used. Eventually it will adversely affect the growth of the trees itself. "On more favourable sites there may be no significant effect for 2 to 3 rotations but on poorer soils with high rainfall the effects may become apparent by the second rotation" (FAO 1980, p.9).

Analysing a sample of 70 eucalypt plantations in Kerala Krishnankutty and Chundamannil (1986) found that the mean annual increment (MAI) achieved was less than 5 m^3/ha in rotations ranging from 9 to 12 years. The productivity obtained was far short of the estimated 23 m^3/ha/yr using the climate-vegetation productivity (CVP) index of Paterson (Kulkarni & Seth 1968) and much below the minimum required for conforming to the definition of fast growing species, which is above 10 m^3/ha/yr (Qureshi, 1967), despite the fact that it is propagated in the Five Year Plan Scheme for raising plantations of 'quick growing species'.

According to Nair (1984b), eucalypt plantations in Kerala instead of enhancing the productivity has contributed to marginalisation of land. Another study by the Chief Conservator of Forests in Kerala has noted that "in view of the high rainfall and high microbial population in our natural forests eucalypts is an undesirable species for reforestation as a monoculture. And extensive eucalypts monoculture will not be conducive either to

production forestry or for preservation of site factors" (Nair 1986, p.69). It is obvious that eucalypt plantations in Kerala do not constitute sustainable forestry.

Maintenance of Diversity

Forestry development in Kerala has concentrated on timber extraction from the natural forests and clearing primary forests for reforestation with monoculture plantations or other purposes. Both these activities adversely affect maintenance of diversity. The dramatic decline in forests and creation of forest blanks have already been mentioned. Forest clearance and species erosion, apart from being a loss of a potentially useful resource, could have much wider social impacts.[9] Given the multiplicity of forest produce obtainable from the forests and the multiplicity of forest dependent groups in society, the principles of forest sustention enjoins that all possible products and effects be managed in an optimum and sustainable manner.

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9. When drastic loss of species occur the vegetation becomes impoverished. "The species which do survive are the hardy small bodied, rapidly reproducing species which we often recognise as pests. Impoverished landscapes are hard to live in not simply because the number of species is low, or because the primary productivity is low, but because they are plagued by organisms that are pestiferous" (Woodwell 1981; p.49). For instance, the National Institute of Virology, Pune, found that the Kayasanur Forest Disease which killed 139 persons in 1983 in South Karnataka was associated with forest clearance (CSE, 1985).

Long term investment in forestry has been concentrated only on the production of high value teak timber and industrial pulpwood. Fuelwood, inexpensive construction timber and minor forest produce has not been a priority in forestry investment. The wood consumption pattern estimated for 1981 indicated that fuelwood accounted for 88.5% of the total wood consumed in Kerala (Muraleedharan et. al. 1984). Although a large quantity of fuelwood and assorted wood were made available in the course of forest clearance activities no effort has been made to sustain or augment their production. Therefore it can be seen that maintenance of diversity in the growing stock or in the output stream has not been a serious concern in Kerala forestry.

Sustention of Environmental Effects

Maintenance and regulation of stream flow is one of the important functions forests perform. Forests control torrential flows during rains and assist the recharging of underground aquifers which sustain the dry season flow. To sustain environmental services from forests it is essential that the forest cover is maintained in the catchments and fire protection ensured.

The National Forest Policy (1952) and all forest Working Plans give high priority for watershed conservation. But in the actual practice of forestry in Kerala,

watershed conservation is completely disregarded. In a review of successive Working Plans in Quilon District, FAO (1984) found that the extent of the 'Protection Circle' which is supposed to represent sensitive catchment areas shrank considerably from Plan to Plan and occasionally cut-over selection forests were brought back to the protection circle.

Over 80% of Kerala's average annual rainfall of 3200 mm falls in about six months. Forest clearance or fire in the catchments will have serious effects on the sustainability of stream flow, peak flows, water quality, siltation, irrigation etc. Already power cut due to insufficient dry season flow into hydro electric reservoirs in Kerala is a regular phenomena. While studies on the forest cover and siltation rate in the more disturbed watersheds in Kerala are yet to be conducted the available study on Peechi irrigation reservoir which has one of the least disturbed catchments show that the reservoir capacity has declined from 113 million m^3 to 88 million m^3 between 1957 and 1982 (KERI, 1983).

The lack of information on the impact of deforestation on stream flow and erosion in Kerala does not mean that the problem can be ignored.[10] The rapid pace

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10. Peak flow increases upto 45 times following forest clearance have been reported from East Africa and 1,000 to 3,000 times increase in the sediment load and erosion losses following forest fires have been recorded in Australia and Arizona (Pereira, 1973).

of forest clearance for forestry and non-forestry purposes in Kerala and the absence of effective fire control is not conducive to the sustention of environmental effects.

In sum, the declared priority for sustained yield forest management is not evident in the actual practice of forestry in the State. Sustention of forest production and forest effects, conservation of forest resources and community stability which have traditionally been the justification for government control over forestry and monopoly ownership of forest resources have remained a distant objective in Kerala. The limited investment that has gone into the sector has been directed at unsustainable mining of the natural forests for short term economic gains ignoring the conservation aspects. The small proportion of long term investment has been directed at producing expensive teak timber and pulpwood. In the next section an attempt is made to identify the factors that could possibly have influenced the investment policy in forestry in Kerala.

II

FACTORS INFLUENCING THE INVESTMENT POLICY

A variety of economic and political factors have influenced the investment policy in Kerala forestry. A full treatment of these factors is beyond the scope of

this study. For the present purpose we shall confine our analysis to the following factors: (1) Demand for land, (2) Demand for produce, and (3) Government objectives such as maximising revenue and political expediency.

Demand for Land

Demand for forest land originate mainly from the agriculture sector, utilities and the pulp industry. Colonisation of forest land for agricultural expansion and settlements have been a regular feature in Kerala. Government sponsored plantations schemes and resettlement programmes have frequently involved clearance of forests. Migration into forests were encouraged by the Government during the late 40's and 50's as part of the 'Grow More Food' Programme. During the last decade several public sector corporations have been established in Kerala to raise rubber, cardamom, oilpalm and even sugarcane in the forest lands cleared for the purpose. Repatriates from Sri Lanka and evacuees from project sites are also resettled within forests. Unauthorised settlements on forest land in anticipation of eventual regularisation by the government have also steadily eroded the area under forests.

Construction of irrigation and hydro electric dams, canals and transmission lines have also involved large

scale forest clearance. The accessibility created by these activities have often induced much larger land use changes inside forests than that required for the projects. Forests have also been cleared for large scale industrial plantations of eucalypts.

Large scale forest clearance or forest land use changes involves investment in clearfelling. The large investment in extraction of timber noticed in the analysis of the investment pattern could, to a certain extent, be due to decisions regarding forest land use changes and independent of the regular forestry planning exercises. Therefore demand for forest land from different sectors of the economy is an important factor that shapes the forest investment policy.

Demand for Forest Produce

Demand for forest produce originates from the household sector, traditional and modern industry sectors. Household demand for fuelwood and construction timber is mostly met from non forest sources. A variety of minor forest produce obtained from forests are the source of livelihood for the people living in and around the forests. About three lakh workers are engaged in reed collection and weaving of mats and bukets alone. Among industries, the plywood and pulp industries are the major consumers of wood from the forests.

There are 9 large scale (DGTD) and 79 small scale plywood units, 5 veneer units and one particle board and fibre board units each in Kerala. Karunakaran (1982) estimates that an annual supply of 52,000 m^3 of timber would be available from the forests according to the prescriptions contained in the current Divisional Working Plans while the installed capacity of the industry is 1,86,000 m^3. As allotment of wood from the forests is based on the installed capacity, the plywood units have rapidly increased their installed capacity. But supplies have not increased correspondingly. Capacity utilisation in the plywood industry (DGTD units) in Kerala during 1983 was only 36% (Nagaraju and Venkataraman, 1986).

The demands of the plywood industry and that for railway sleepers are met by selection felling in the natural forests. Due to the increasing demands, selection felling operations have penetrated progressively into the interior parts of the forests leaving behind a trial of depleted forests. As limits to the expansion of selection felling into unexploited areas have almost been reached there has been some proposals to intensify the extraction from the remaining areas by switching over to a monocyclic system of harvest instead of the current polycyclic system (KFRI 1977, Sub Committee on Raw Materials to the Wood Based Panel Industries 1985). For practical purposes these proposals suggest that the minimum girth limit and

the limits to the number of trees that can be removed per unit area be removed. The implications of this for the industry as well as for sustained yield management is discussed in the next chapter.

The pulp industry in Kerala consists of three units producing rayon, paper and newsprint. For full capacity utilisation, the annual requirement of forest produce is 3,30,000 tonnes of eucalypt wood, 60,000 tonnes of bamboo and 2,74,000 tonnes of reeds (Karunakaran, 1982). The overall capacity utilisation by the pulp industry in Kerala during 1981-82 is reported to be 50% (Muraleedharan et. al. 1984). The Central Government assistance for raising pulpwood plantations in Kerala and the subsidised supply of pulpwood from plantations have already been mentioned. Before plantation grown eucalypt wood became available the demand for pulpwood was met by bamboo and reed which was both abundant and cheap. Bamboo and reed resources are also the main stay of the traditional mat and basket weavers in Kerala. Intensive extraction by pulp industries and land use changes has drastically reduced the availability of the resource.[11] The situation of abundance of forest raw materials during the late 1950's has turned into scarcity in less than two decades.

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11. The share of bamboo in the total pulp used by the industry in India declined from 70% in 1958 to 56% in 1970 and further to less than 30% in 1980 (Podder, 1980). Indicating both growth in demand and scarcity.

Given a situation of resource scarcity, the competition between traditional and modern industries could prove fatal for the former. On the one hand the ever receding frontier of natural forests increases the labour time in searching and collecting the required raw material. And on the other, when the resource is no more available within walking distance of the workers' settlements they are forced to rely on the market where a discriminatory price prevails.[12] Although the Kerala State Bamboo Corporation was set up in early 1970's to cater to the raw material requirements and marketing needs of the traditional sector, it has not been able to solve the raw material scarcity of the traditional sector.[13]

Table 4.5 compares the traditional and modern reed based industry with regard to the investment requirements and income generated. Although the value added is much higher in the modern sector, income generated per tonne of reed is more than two and a half times higher in the traditional sector than in the modern sector. Investment and energy requirements are also higher in the modern sector.

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12. Agarwal (1985) quoting Madhav Gadgil reports that while the price of bamboo is Rs.15 per tonne for the pulp industry, it is Rs.1,200 per tonne for the traditional sector in Karnataka. The situation in Kerala is not much different.

13. For instance the Corporation could collect only 13,233 tonnes of reeds from the forests during 1984-85 which works out to only 0.04 tonnes per worker while Nair (1985a) estimates that the annual per worker requirement was around 1 tonne. Thus the KSBC could supply only less than 5% of the total requirement of the traditional sector.

Table 4.5

CHARACTERISTICS OF REED BASED INDUSTRIES

Input/output Ratios	Traditional Sector			Modern Sector
	Mat weaving	Basket weaving	Table mat production	Pulp & paper
Fixed capital investment per worker (in Rs.)	50(1)	15	200	71,000
Power and fuel consumption per worker per year (in Rs.)	0.2	-	1.5	18,850(2)
Consumption of reeds per worker per year(in tonnes)	1.2	0.8	1	38
Wages and salaries per worker per year (in Rs.)	900	720	800	10,775
Wages and salaries per tonne of reeds	750	900	800	284

1. Based on the accounts of the Kerala State Bamboo Corporation. Fixed capital mostly consists of warehouses for storage of furnished products, office building, vehicles, etc.

2. Based on the accounts of Punalur Paper Mill for 1980-81 during which the capacity utilisation has been 20%.

Source: Nair (1985a) Bamboo-reed based industry in Kerala State, India.

The policy of encouraging modern sector units and subsidising forest raw materials has resulted in rapid increase in the processing capacity which has outstripped the supply of the resource. Not only has the supplies to the traditional sector been disrupted, many modern sector units now face acute scarcity of raw materials. The government policy has been to accommodate the growing demands as far as possible and intensify the extraction from the forests. The substantial economic and political clout of the forest based industries coupled with the fact that sustainable forest use is not a statutory requirement in India creates a situation where industrial demands gets primacy over other sectors and even the need for forest sustention.

Revenue Demand and Political Compulsions

The demands for forest land and forest produce by itself would not have influenced the investment policy, as much as it has, but for a certain coincidence of interest between these demands and the short term interests of the government. The increasing commitment for development and welfare schemes on the one hand and the limited option for raising finances on the other makes the surplus from forestry attractive to the government. Although forests provide only a small percentage of the total revenue, it is one of the major source of non-tax revenue. During 1980-81 forest revenue accounted for 7.14% of the total

State revenue but as a percentage of the total non-tax revenue it accounted for 30% share. Given the low level of industrialisation and a politically powerful farm lobby, raising the level of taxes is a difficult option.

It is expected of the forest administration to try and increase the forest revenue or at least maintain the achievement of the previous year. Given the long term nature of forestry, the current revenue can be increased only by increasing timber extraction. Forest clearance for creating plantations, resettlement schemes, reservoirs, roads, canals etc. have the immediate effect of increasing the harvest and consequently the revenue. Forest clearance activities and intensification of extraction improve accessibility, communication facilities and increases the land values in adjoining areas. The coincidence of short term economic and political interests among different groups including government for forest clearance activities creates its own momentum for further clearance.

A corollary to the objective of maximising revenue is that of minimising expenditures. Investment that do not contribute to short term revenue objectives such as regeneration operations in selectively felled forests, fire protection, cultural operations in plantations etc. are nominal and extremely inadequate.[14]

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14. These features are not unique to forestry in Kerala. In an analysis of forestry investment in developing countries, Schreuder (1970) found that actual investment was concentrated in forest clearance activities and establishment of primary processing industries in contrast to tree growing activities.

The annual investment in forestry in Kerala during the study period has been less than Rs.18 per hectare of forest area reported by the Forest Department (see Table 4.6). As a share of the revenue obtained from forests, total investment has ranged from 10 to 22% during the different plan periods showing a declining trend after the Annual Plan (1966-69) period. Partly this is due to the discontinuation of Central Government assistance for eucalypt plantations which boosted the plantation investments during the Third and Annual Plan period. It is also interesting to note that the decline in investment in subsequent periods is not due to the decline in revenue from forests. But it has been largely due to the government policy of maximising revenue from the sector.

The implications of the marked preference for short term revenue generating activities in the investment policy and the policy of maximising short term revenue from forests is briefly discussed in the next chapter.

Table 4.6

ANNUAL AVERAGE INVESTMENT PER HECTARE OF FOREST AND AS PERCENTAGE OF FOREST REVENUE

Plan	Total investment per Ha in Rs./Ha in Rs. 1970-71 prices	Investment in harvesting in % of revenue	Investment in Tree Growing in % of Revenue				Total investment as percentage of revenue
			Plantations	Regeneration in selection forests	Fire protection	Total	
II	8.00	13.53	1.24	-	-	1.24	14.77
III	12.52	13.88	4.23	-	-	4.23	18.11
Annual	16.41	15.91	6.14	-	0.06	6.20	22.11
IV	15.09	14.81	2.64	-	0.34	2.98	17.79
V	16.63	11.17	2.15	0.06	0.26	2.47	13.64
Annual	17.73	7.77	2.13	0.16	0.19	2.48	10.25

Source: Computed from the Administration Reports of the Forest Department (various issues), Government of Kerala.

CHAPTER V

CONCLUSIONS AND POLICY IMPLICATIONS

The objectives of the study were to examine the investment pattern in Kerala forestry and to see whether it was consistent with the concept of sustained yield in forestry. In that process we have also analysed the factors that have affected the investment policy. The following are the main findings.

Major Findings

The investment policy followed in Kerala forestry was weighted in favour of short term gains. The bulk of the investment was on harvesting timber from the natural forests, while long term investments in regeneration was extremely small. Although wood production had increased five-fold during the study period, the expenditure per unit of production had declined, indicating a higher share of clearfelling in the wood production. Over 80% of the total investment in wood production had gone for timber extraction while plantations received less than 20%. Short term investments showed an upward trend throughout the study period while the index of long term investment showed wide fluctuation with a marked fall after the Annual Plan (1966-69) period. Although timber extraction from the natural

forests provides over 80% of the forest revenue, investment in regeneration and fire protection in the natural forests was negligible.

Investments in plantations represented less than 6% of the forest revenue during the different plans. Even as a percentage of the revenue from plantations during each plan period investment was below 40% except during the Annual Plan period (1966-69) when it was 140% of the current revenue from plantations. Availability of Central Government funds for raising pulpwood plantations during the post Third Plan period contributed to the higher investment in plantations.

It appears that expectation of short term revenue and availability of investment funds from outside sources influences the pattern of forestry investment.

The pattern of investment and the development of forestry in Kerala during the study period were not consistent with the principles of sustained yield management. Maintenance of a sustainable level of timber harvest and revenue from the forest has been compromised due to the reduction in the forest area and degradation induced by forestry, fire and illicit felling. The problem has been compounded due to insufficient investment in regeneration. Continuing reliance on selection felling without ensuring regeneration affects future yields.

Long term investments have been concentrated on just two species viz., teak and eucalypt, even here sustainability of production in successive rotations appear doubtful. The pattern of forestry development has reduced the diversity in the growing stock and output steam. Creation of normality in the age class composition has not been achieved. Sustention of forest effects has also been ignored. Watershed conservation has not been a genuine objective with forestry.

While judging the above findings it is useful to keep in mind the following limitations of the study.

Limitations

(a) In the present study we have not attempted a direct investigation of the performance of forestry or calculated the sustainable level of output given the current level of long term investment or to work out the optimum level of long term investment to sustain the current level of production. We have not gone into how diversity is to be maintained and environmental effects sustained, except mention that natural vegetation should be preserved in sensitive zones and that they are vital for long term progress of society. Which are the specific areas where the vegetation has to be preserved and what is the minimum extent of such areas for sustaining the forest effects have not been addressed in this study.
(b) As this study was based on secondary information,

we could not provide a comprehensive analysis of the performance of forestry resulting from the changing pattern of investment.

Due to the aggregated form in which much of the information is available such as revenue from the sale of timber, timber production etc. a more detailed analysis was not possible. While some of the reported data are obviously over estimates such as area under forests or even extent of plantations, some others are gross under estimates such as total wood production from forests or investment in extraction of timber. Area under failed plantations are seldom deducted from the accounts. Illicit removal of timber and under reporting of extraction by contractors goes un-noticed. Due to the practice of selling standing timber the department's investment in timber extraction do not reflect the actual investment that go into this activity. Such limitations of the data do not greatly affect the analysis as this study is concerned mainly with only the broad trends in the direction of investment, output and revenue. Despite the limitations in the data and approach, the findings of the study has certain implications on the future flow of revenue from this sector, availability of raw materials to the wood based industries and on community stability. These are briefly discussed below.

Forest Revenue

Since over 80% of the forest revenue is being obtained from timber extraction from the natural forests, the future possibility of maintaining or increasing the revenue would depend on the extent of unlogged areas, the economic feasibility of logging inaccessible areas and the price of timber. On the first two counts the potential is rather limited since all accessible forests have already been logged and clearfelling of natural forests has been stopped for the present. Expanded selection felling also may not fetch substantially higher net revenue since the cost of extraction would be high. An alternative in this situation is to enhance the revenue from forest plantations.

Teak plantations could turn out to be a significant source of revenue since there is no possibility of a fall in price for teak and since almost all non-forest sources of large sized teak has been exhausted. Although teak plantations account for over 90% of the revenue from plantations, currently they constitute less than 10% of the total revenue. Eucalypt plantations on the other hand have been running at a loss due primarily to subsidised supply to the pulp industry. Eucalypt plantations fetch less than 2% of the forest revenue. Even if a more rational pricing policy is adopted and enforced it is unlikely that eucalypt plantations will contribute significantly to forest revenue. Revenue from minor forest produce is also not expected to be substantial.

Thus the picture that emerges shows hardly any scope for increasing the income from forests. In fact a declining trend in revenue and timber output from forests has already set in since 1979-80. The implications of this secular decline is that the natural bounty has been depleted and the plunder-and-move-on phase of public forestry is not feasible any longer. A way out of this situation is to make substantial investments to undo the damage already done and to increase the productivity and stocking levels of forests. But given the scarcity of investment funds in the State it is unlikely that it will be forthcoming from the State Government. The more likely scenario is for soliciting investors who would be willing to invest in the Government forests. The traditional source of finance viz. plan funds from Central Government sponsored schemes are already being supplemented by institutional finance channelled through public sector corporations and the World Bank. It is likely that wood based industries also could be given rights over forest land to induce investments in forestry. The far reaching implications of this suggestion was not examined within the scope of this study.

Wood Based Industries

Decline in domestic production of wood and rise in prices has very serious implications for the wood based industries in the modern sector. Low level of capacity

utilisation, high cost of raw materials and increased expenditure for transporting wood from outside the State will involve lower returns to capital invested, lower tax revenues and reduction in the employment potential. Already closure of factories and lay offs on account of raw material shortage are a regular feature in the two private sector pulp units in the State. Although it is not clearly established that lay offs and closure are unavoidable, shortage of wood raw material in relation to industrial requirements is very real.

The State Government has two options: (1) intensive exploitation in the immediate future, and (2) conservation oriented approach to wood supply. The first option can only be a temporary phase since the available resources are finite and insufficient in relation to the demands on it. The second possibility of limiting the wood supply to the sustained yield capacity of the forests after meeting the non-industrial requirements will require sufficient political courage. Under the prevailing socio-political milieu, the possibility is more for the intensive exploitation of the resources that remain. The reduction in natural forests and exploitation by the modern sector has already adversely affected the traditional sector engaged in the collection and primary processing of a variety of minor forest produce and manufacturing of medicines, handicrafts and furniture have been badly affected due to

the reduction in the natural forests and accelerated pace of exploitation by the modern sector.

The policy of favouring the modern sector in the allotment of forest raw material has far reaching implications for resource use efficiency, employment and the environment. Proposals to intensify selective felling if carried out will have the effect of total denudation of the selection forests. Intensification of exploitation in the present circumstances can serve only to enhance the short term availability of wood and profits to the industry at the cost of irreversible damage to the forests since no method to ensure regeneration considering the technical, institutional and financial constraints identified by FAO (1984) is proposed. Depletion of raw materials available for the traditional sector will cause severe unemployment and it is bound to have serious economic and political repercussions.

Community Stability

In spite of semantic problems, community stability has been an important justification for advocating or justifying sustained yield management. As all forests in Kerala are under public ownership, community stability can be taken to mean stability of the consuming community or users of forest produce and beneficiaries of forest effects. For the consumers of forest produce output, price and employment stability are the most important.

The unsustainable nature of timber production from the forests has been already pointed out. Not only is price stability elusive even the most favoured consumers viz., industries who get wood at highly subsidised prices experienced upward revision of timber prices several times during the last decade.[1]

On the employment front while the modern forest based industries are not expanding, in fact some are re-trenching existing workers, the traditional sector is on the verge of collapse due to destruction of forests and unequal competition with the modern sector. From the status of self-employed artisan, the traditional sector workers, are increasingly becoming wage earners and piece rate workers in an already saturated labour market. Those who continue in the traditional calling have had to migrate to areas where forest raw materials are still available. How long the forest dependent community can hold on is difficult to say.[2] Tribals and other forest dwelling communities have been the worst affected due to the conversion of forest lands to plantations and other uses.

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1. For eg. the public sector Travancore Plywood Industries Ltd., Punalur, had to pay Rs.484 per m^3 in 1979-80 for Vellappine (Vaterio indica) which cost only Rs.125 per m^3 during 1972-75.

2. At least for the reed based traditional workers even their last frontier viz. the Edamalayar-Pooyamkutty belt is threatened due to the proposal to construct a chain of hydro-electric dams which will innundate a good part of the remaining reed area.

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