

ON
PRODUCTION FORESTRY-MAN-MADE
FORESTS



AUGUST 1972

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OF THE
NATIONAL COMMISSION ON AGRICULTURE**

**ON
PRODUCTION FORESTRY-MAN-MADE
FORESTS**



GOVERNMENT OF INDIA

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SUMMARY OF RECOMMENDATIONS

FORESTRY MANAGEMENT OBJECTIVES IN FUTURE

1. It is essential to redefine the objectives of forestry management in future in the context of rational development and utilization of forestry resources in India. There should be a changeover from the present conservation oriented forestry to a more dynamic programme of production forestry. Considering the advantages of an aggressive man-made forestry programme, the future production programme should concentrate on clear-felling of valuable mixed forests, mixed quality forests and inaccessible hardwood forests and planting these areas with suitable fast growing species yielding higher return per unit area. The resulting produce from the clearfelled areas should be utilised in wood based industries by locating additional units wherever required. (Paragraph 3.16)

REQUIREMENTS, SUPPLY AND INVESTMENT

2. The estimated demands for sawnwood, pulpwood, panel products and roundwood by 1980 and 1990 indicate that a substantial quantity of the raw material requirements, both conifers and hardwood, will have to be produced from India's forests. For this, and additional investment of Rs. 242 crores in the current decade will be required for clearfelling and planting of about one lakh hectares annually from the time the programme is taken up. To meet the minimum requirements of raw material during the next decade, the investment needs for clearfelling and plantations will be Rs. 306 crores. Simultaneously, intensification of management for increased production in the coniferous forests would also be necessary. (Paragraphs 4.7 & 4.11)

3. The necessary industrial development will require an investment of Rs. 815 crores during the current decade of which paper and pulp industries will account for Rs. 611 crores. In the next decade, the investment in industry will be Rs. 1187

crores including Rs. 979 crores for paper and pulp.
(Paragraph 4.11)

4. With the development of the forests and the industrial utilization of forest material, it should also be possible to enter the export market for timber and paper products aggressively during the 90s. The necessary organisation to take up export promotion vigorously will also have been built up by then.
(Paragraph 4.14)

FINANCE PRODUCTION FORESTRY PROGRAMME

5. The programme should be taken up from the beginning of 1974 and funds should be found for an investment of Rs. 173 crores during the fifth Five Year Plan for clearfelling, plantation and maintenance. Since such large funding for one sector from the State Plans is obviously difficult, institutional sources will have to be tapped for meeting a substantial part of this amount.
(Paragraph 5.5)

6. In order that institutions are in a position to finance the programme, the States should take for the revenue only an equivalent of the average revenue of the previous three years they have been receiving from the areas that would be brought under the programme and leave the rest of the income from clearfelling to support the programme. (Paragraph 5.6)

7. For the development of pulp and paper industries during the Fifth Plan, mainly those States, which have large areas of untapped forests, must make a substantial public sector investment in these industries. As the investment performance of the private sector has not been very encouraging, and its investment capacity in the Fifth Plan is doubtful, the States may have to invest between Rs. 160 crores and Rs. 340 crores in the industry programme.
(Paragraphs 5.7 & 5.8)

8. Since institutional investment can flow only when there is a Company or a Corporation to take the funds, the agency to implement the man-made forestry programme and the supporting forest industries in the State should be organised in the public sector as a fully owned State Company or a Corporation.
(Paragraph 5.9)

IDENTIFICATION OF PRODUCTION FORESTRY PROGRAMME

9. There is a clear need for augmenting production to meet the demand for paper. The paper and pulp industry should

be treated as a priority industry in the public sector.
(Paragraph 6.4)

10. It is expected that smaller industries like saw mills, plywood, particle board, rayon pulp etc. will be put up by the private sector once the massive programme has been accepted in the planning. In a few places, saw mills may have to be located by the Forest Corporation itself if the private sector is not active enough. It should be possible to find the funds for these marginal investments from institutional sources.
(Paragraph 6.9)

11. In order to enable the industries programme to start early, the States should give priority to the exploitation of inaccessible forest, followed by mixed quality forest and valuable forest.
(Paragraph 6.11)

SOCIAL FORESTRY

12. The state sector forestry programme should provide for social forestry which aims at ensuring protection, recreation and firewood needs of the community, as distinct from production forestry.
(Paragraph 7.1)

INSTITUTIONAL CHANGES

13. State Forest Corporations may be organised by the States to take advantage of the financing procedure indicated in this Report. Each State may have one or more Corporations according to the size of the programme and the location of the forests under the programme. Such of the Corporations that take up supporting paper and pulp industry can either set up the industry as a subsidiary of the Corporation or form separate/companies with investment in equity. The areas selected and considered fit for commercial production should be transferred by the State Governments to these Corporations.
(Paragraph 8.2)

14. The land and its standing timber transferred to the Corporation will be valued and these two values together will form the basis of equity capital against which it can borrow from institutions. Where these values are not adequate to generate sufficient funds in time for the industrialisation programme, the State Governments may have to subscribe additional equity funds to the Corporations from their Plan resources.
(Paragraph 8.2)

15. The Forest Corporations will have to be manned by very competent technical personnel who have expertise in forestry and related timber management, marketing and industries. Their selection and subsequent training should be started immediately in order to enable them to execute the programme. (Paragraph 8.4)

16. The personnel of the Forest Corporation should normally be on tenure deputation from the Department of Forestry. The cadre of Forest Department should carry sufficient deputation reserve for this purpose. It is desirable that the Department of Forestry is fully represented on the Board of the Corporation. (Paragraph 8.5)

17. Agricultural Refinance Corporation is the only institution now giving long-term agricultural credit and as such will be the appropriate institution to finance the plantation operations on a long-term basis. In order to minimise the cost of credit which the programme can bear, Agricultural Refinance Corporation should be enabled to advance these loans directly to the Forest Corporation. In case this is not possible, a Central Forest Credit Corporation should be organised to take up the responsibility for providing long-term finances for the plantation and development programmes. (Paragraph 8.10)

18. The industrial programme based on forest raw material may be financed through the long-term industrial lending institutions like IDBI, ICICI and IFC. (Paragraph 8.11)

PLANTATION STRATEGY

19. The massive programme of man-made forests will require careful selection of the species to be raised, the mixture to be followed and estimation of production. Each State has to evolve its own strategy with regard to the proportion of species and areas to be devoted to different kinds of produce keeping in view the national requirements. (Paragraphs 9.2 & 9.5)

20. Since long-term investment of capital is required in the establishment of plantations, the decision on rotation should be taken on the basis of economic criteria. (Paragraph 9.25)

PRICING

21. There must be an incentive for a change-over from the low-cost low-yield forestry to a commercial high investment economic forestry. Accordingly, the price for the produce

should be so fixed as to pay for the cost of clearfelling and plantations, and leave a profit. (Paragraphs 10.1 & 10.5)

22. There has to be a rational pricing policy in future for bamboo and pulpwood, which are the two main raw materials required for paper and pulp making. The paper industry should be in a position to pay higher royalty if uniformity of raw material is assured through plantations. The industry can pay still higher price, if the plantations are within a reasonable distance from the factory. It should be possible for both the forester and the factory to take a reasonable view in this matter and plan the programme of man-made forests to make it a profitable venture. (Paragraphs 10.2 & 10.6)

EMPLOYMENT

23. The programme of production forestry recommended in this Report is expected to provide annual direct employment of 50 million man days or 2,50,000 man years (worked out on the basis of 200 working days in a year), mainly in the rural sector of the hilly and backward regions, where most of the unexploited forests are located. This does not include the additional employment to be generated through the industrial programme. This massive labour requirement will mean organising, raising and training a labour force of sizeable magnitude and the States must start thinking in this direction. Wherever feasible, employment may be provided to students during summer holidays for specialised work of short duration. (Paragraphs 11.1, 11.10 & 11.12)

ORGANISATION AND TRAINING

24. The details of location of the areas that would be taken in the programme and the annual felling, exploitation and plantation series will have to be worked out by each State. A Planning and Project Analysis and Estimation Cell should be created and a Project Leader appointed in each State where the programme is taken up. The Cell will work out all the details before the end of June 1973 so that the programme of exploitation can start from the beginning of 1974. The Project Leader will select his team mates. He will ultimately be in-charge of the Forest Corporation. (Paragraph 12.2)

25. Simultaneously with the establishment of the Cell, the Project Leader should work out the structure of the Corpo-

ration and the staff requirements and their training and the financial implications of the programme in consultation, with the Chief Conservator of Forests and the financial expert of the Corporation, so that the State authorities could finalise the credit arrangements with the Agricultural Refinance Corporation or the Central Forest Credit Corporation as the case may be.
(Paragraphs 12.3, 12.4 & 12.5)

26. A strong Forest Utilisation Cell should be immediately developed under the Chief Conservator of Forests which would take up the work of planning the industrial complex, look into the export promotion aspects of forest products and have liaison with Central Government for paper and pulp development. The Cell should, in addition, ascertain private sector investment in the industries and where such investments are lacking, advise the Chief Conservator of Forests and the Project Leader of the requisite and feasible industry that the State would have to put up to support this programme.
(Paragraph 12.6)

27. When the State enterprises include sophisticated industries like paper and pulp, a strong Industrial Cell should be created by the State Government and placed under an able leader to prepare detailed project feasibility reports.
(Paragraph 12.7)

28. In order to ensure constant Central support to the programme particularly for its industrial part, the Forestry Division in the Ministry of Agriculture of the Central Government should be strengthened by a Planning Cell headed by an Additional Inspector General of Forests. This Cell will act as the trouble-shooter for the States and get their problems solved with the Central Ministries of Industry, Finance, Banking etc. The Cell will also take the lead in export promotion of various forest materials and wood based products.
(Paragraph 12.8)

29. In order to make the Planning Cell more effective the Ministry of Agriculture should take up to the Economic Committee of the Cabinet such problems as may arise in the Cell for which an inter-departmental agreement satisfactory to the programme cannot be obtained by mutual consultations.
(Paragraph 12.9)

30. For sophisticated industries like paper and pulp, the States may not have large number of experts in the country to enable each of them to have strong Industrial Cell to support

its programme. A Brains Trust of the top technical experts of such industries available in the country should, therefore, be formed by the Planning Cell in the Forestry Division supported, if necessary, by indigenous and foreign consultancy to help the State in the formulation of detailed project reports.

(Paragraph 12.10)

31. The employment scheme of the Planning Commission for technical persons in the Fourth Plan can be made use of in funding the Cells in the State sector. (Paragraph 12.11)



SECTION I

INTRODUCTION

1.1 The Terms of Reference given to the National Commission on Agriculture on Forestry refer to "Development of forestry, including farm forestry as a factor in agricultural progress and as a source of raw material for industry, exports as well as for sustaining the ecological balance in Nature, and for providing employment opportunities to large sections of tribal and other population living in these areas". The Commission has selected for immediate study, some of the aspects having a bearing on forest development in the future.

1.2 The contribution of forestry sector to the national products has been negligible so far. The average gross revenue from forests under the present system of working is as low as Rs. 21.50 per hectare. This sector employs only 0.2 per cent of the rural working force. On the other hand, as this Report will disclose, the forestry sector has got much greater potential both in regard to production and employment. If, therefore, we can develop our forests on the lines indicated in this Report, we shall not only be able to raise the per hectare production both in respect of volume and value, but also create much more employment for skilled as well as unskilled hands. A properly planned development of the forests, we are convinced will also give a substantial support to the economy of the backward areas and the tribal population which depends for growth on the expenditure on forestry activities. Moreover, we have found that if we increase the production of adequate raw material from the forests, we can establish a large number of industries based on this raw material and also enter the export market. This will have sustaining impact on the employment in the secondary and tertiary sectors.

1.3 A good deal of thought has been devoted by the world foresters on the concept of intensification of management of forests and related forestry development particularly in developing countries. This has been emphasised by the F. A. O. in a recent paper which has dealt with modernising institutions

to promote forestry development.* This paper stresses that, "production forestry is a business, and that organisation of forest service must, therefore, differ in some important respects than that of other government departments in which the duties are limited to the provision of services". In order to enable the forestry sector to develop its full potential the following suggestions have been made in the paper :—

- (a) Forestry and forest industries administration should be given a relatively extra governmental and more business like character by making it a Corporation.
- (b) Means need to be found for integrating the growing side of forestry with the industrial side. To this end, it may be advisable for governments either to control forest industries or to participate in their ownership and management.
- (c) Specialists in the field of forestry development planning, and the nonwood services of forestry, should be assigned to the ministries or other units that are responsible for national or regional development planning. They should, however, remain members of the forest service, and be ultimately responsible to the head of that service.
- (d) The administration of forestry departments should be guided not by the general body of rules and regulations which govern the civil service, but by a special set of rules and regulations which take into account the characteristics of the forestry and forest industries sector, and the business nature of government forestry.
- (e) The distribution of field personnel should be rationalised, special attention being paid to the input/output relationships that are involved in the development of staff in different areas.
- (f) Above all, the nation must be development-oriented, and governments must provide forest administrations with the necessary funds to perform their manifold duties. This may mean a special dispensation with regard to the time-honoured system of allocations through annual budgets.

Hungary, which has Five Year Plans like India, finances its afforestation projects in an interesting manner. Each forestry unit pays a sum, fixed on the basis of the logging returns into a centrally managed fund. Afforestation of the annual cutting area is financed from this fund.

1.4 The Commission is convinced that a new commercial approach to forestry development has to be built up. The development in the forestry sector so far has been hindered due to paucity of funds and peculiar institutional system under which the development programmes are being funded. In order to bring about an uninterrupted development in this sector to meet our future requirements, it will be necessary to change the present financing pattern. All this will require immediate policy changes if the programme has to be taken up from the Fifth Plan onwards. It is in this context that the Commission has decided to make specific interim recommendations. The Commission has identified for immediate recommendations the need for investment in the forestry and forest industries' sectors in the next two decades based on the requirements, the source from where such investment money would be forthcoming in future and the organisational changes necessary to implement the programme.

1.5 Vice Chairman and some Members of the Commission visited various States and held discussions with the Secretaries of State Forest Departments and Chief Conservators of Forests on this problem. Regional Conferences with the Secretaries of State Forest Departments and Chief Conservators of Forests were also organised at Bangalore, Bhubaneswar and New Delhi. Discussions were held with the Ministry of Finance (Department of Banking), Reserve Bank of India and the Agricultural Refinance Corporation on the question of financing. The Commission also issued questionnaire to the States to elicit their views on the problems of forestry development and financing. In arriving at the conclusions, we have considered the views expressed and the material furnished to us. We have also kept in view the expert opinion given by the Working group on Forestry and the Study Groups set up by the Commission on "Forestry Economics, Financing and Budgeting" and "National Inventory, Timber and Fuel Trends and Prospects".

SECTION II

FORESTRY BACKGROUND—A REVIEW

Forestry in India's Economy

2.1 India has about 75 million hectares of land under forests comprising about 22.7 percent of the total land area. The cultivated area is about fifty percent of the total geographical area of India. Although, the forest area is a little less than half of the cultivated area, the contribution of forestry sector to the Gross Domestic Product is very small and is not commensurate with its potential. The contribution of Forestry (Forestry and Logging) sector to the Gross Domestic Product (at current prices) in 1969-70 was merely 1.6 percent while Agriculture sector contributed about 46 percent during the same period.

2.2 While Agriculture and ancillary activities in 1961 provided employment to over 70 percent of the rural working force, forestry and Logging accounted for only 0.2 percent.

2.3 The revenue from India's forests so far has been also very negligible. The national average gross revenue per hectare from India's productive forests under the present system of working is only Rs. 21.50.

2.4 The income from India's forest land, when contrasted with that in other countries of the world, will appear to be dismally low as is evident from the Table below:—

TABLE I

Revenue per hectare from Forest Areas in Selected Countries of the world.

Country	Gross forest revenue per hectare in Rs.	Net revenue per hectare in Rs.
India	21.50	11.50
Austria	336.00	80.00
United Kingdom	N.A.	140.00
West Germany	565.00	130.00
Switzerland	494.00	190.00

SOURCE : Cost Studies in European Forestry—Royal College of Forestry, Study No. 48—1967.

2.5. The annual Plan investment per hectare in India's forests during the Fourth Plan will be about Rs. 2.40. How small this investment is in comparison with the investment in other Asian countries is revealed in Table below :

TABLE 2

Investment per hectare in Selected Forest Areas in Asian countries.

Country	Investment per hectare in U.S. Dollars	Investment per hectare in Rs.
Japan	25.4	190.50
Korea	15.8	118.50

SOURCE : Forest Research Institute, Dehradun.

Relevance of Man-Made Forests

2.6 The experience of other countries shows that forestry can give higher returns per hectare provided we are able to adopt intensive management including creation of man-made forests on a far larger scale than has hitherto been possible for lack of adequate investment. Man-Made forests and intensive forestry practices require higher expenditure per hectare in inputs and labour than what conservation forestry normally absorbs. On the other hand, the net revenue per hectare that we are able to harvest is many times the net revenue we get in conservation forestry. It is true that at present with an average Plan and non-Plan expenditure of Rs. 10 per hectare, we are getting a gross revenue of Rs. 21.50 and a net return of Rs. 11.50 per hectare from our forests. As against this, if we adopt progressive methods we expect a much higher net return as in other countries, for example, in West Germany where an expenditure of Rs. 435 brings a gross income of Rs. 565 and a net return of Rs 130 per hectare.. It may be argued that our expenditure return ratio is much better for a poor country than that obtained in the more advanced countries. If we had unlimited forest lands under our control, this argument would have been valid but our problem is limitation of land that can be utilised for forestry. We have to maximise return per hectare of forest lands. Our agriculture got out of the rut of low production and perpetual shortages only when we went for scientific agriculture with balanced inputs at high cost as against traditional agriculture with low cost inputs. Forestry will not be contributing its due share to the national income unless each hectare of forest land yields a net income many times more than what we get

now. The net income per hectare from higher investments can be sizeable adding to the national product in the agriculture sectors. The higher investment will automatically provide job opportunities for a large number of skilled and unskilled personnel in the forest areas and generate further employment in the secondary and tertiary sectors of input production and services. The expenditure generates growth in other sectors also.

Constraints in the Development of Forestry Sector in India

2.7 The need for increasing the forest production and improving our forest stands is well known to our foresters. From the time the Second Five Year Plan was formulated, active steps were taken to include a programme of man-made forests in the Plan and non-Plan sectors. Even then, as the Table below shows, the relative proportion of investment in plantation in the successive Plans was far short of what the magnitude of the task appeared to require.

TABLE 3
Investment in Man-made Forests

Plan Period	Total investment on forestry sector (Rs. in crores)	Total investment in man-made plantations (Rs. in crores)	Investment in man-made plantation as percentage of total investment	Total area under man-made forests (ha)	Investment on plantations per hectare (Rs.)
First Plan (1951-56)	8.5	1.4	16	50,023	280
Second Plan (1956-61)	21.2	6.8	32	217,397	313
Third Plan (1961-66)	45.9	15.0	32	324,860	462
Annual Plans (1966-69)	40.8	18.4	45	319,301	576
Fourth Plan (1969-74)	94.0 (outlay)	38.8 (outlay)	41	621,240 (target)	62.4

SOURCE : Central Forestry Commission, Ministry of Agriculture.

The table shows that by the end of Fourth Five Year Plan only about 2 percent of the total forest area in India will be brought under man-made forests. It is thus evident that the

investment in man-made forests so far has been very low. We have to understand the constraints which have led to the low investments in man-made forests so far touching only a fringe of the total forest area capable of conversion, if we are to find an acceptable solution to the problem of increasing the contribution of the forestry sector to the national income.

Past System of Management

2.8 The past system of management was largely conservation oriented owing to limited market demand and inadequate funds for raising plantations. The demand for forest materials was mainly in the form of sleepers, sawn timber and roundwood. Even then the demand was highly selective, both in respect of species and sizes and till a few years ago, many hardwoods growing in our forests had no timber value. Clearfelling and planting with a single or a pre-determined mixture of a few species entailed the marketing of a large quantity of several species which had no value except as fuelwood. As fuelwood had very little value except in our urban sector, any large felling could not have paid for even felling charges. Against this background, even in good areas of growth within reasonable reach, the foresters followed the practice of selective felling and improvement rather than clearfelling and plantation. Areas with poor communication and too far away from markets were left without exploitation because the cost of harvesting and bringing the timber to the market would have been prohibitive. Hence, the man-made forests were largely located in areas where the stands were poor and no problem of marketing the existing timber arose. The change in thinking came with the mounting demand in the country for newsprint, paper and for packaging material.

Recent Development

2.9 The paper industry in the country mainly depended on bamboo as raw material for paper pulp. The newsprint industry was based on hardwood for mechanical pulp and bamboo for chemical pulp. With the growing demand for newsprint and paper, it was found that unless we hinged over to pulpwood for the bulk of our requirements because of the limitation of bamboo for pulp, the paper industry would face a serious raw material shortage in the future. Faced with this realisation two approaches were accepted. Firstly, pulpwood plantation on a short rotation basis was accepted as a Plan scheme and initially financed from the Central sector. The programme mainly

based on hybrid *Eucalyptus* was readily accepted by the foresters and targets were substantially fulfilled. Secondly, mixed hardwoods were to be used in increasing proportion in the pulp for paper making. Several existing paper factories have already adopted this change with success. These developments have for the first time giving a value to the pulpwood in our forests which so far could not find a market even as fuelwood. This has also introduced into the forest economy short rotation pulpwood plantations which can give returns on investment on a short term basis instead of a long term investment necessary for raising plantations of hardwood on long rotations. This has brought the sector within commercial financing possibility for the first time.

2.10 Another interesting development in the recent past has been the increasing demand for packaging materials. A growing economy has raised the demand for packaging material very substantially. Various classes of timber which formerly had no market are now being absorbed for manufacturing cases used for packing machinery, and various commodities like fruits and fruit products. There is no doubt that the ultimate solution to this should be a pulp backed industry manufacturing specialised packaging material for individual commodities so as to avoid wastage of timber material.

2.11 Yet another development is the growing demand for fuel in the urban markets which may give a value to fuelwood in clearfelling areas at a reasonable distance from the urban centres. Increasing price of fuelwood is making this a possible economic proposition in some areas.

2.12 The changes in demand for forest material mentioned above will give a better value for clearfelling of areas and can sustain a programme of pulpwood plantations. However, unless the paper or newsprint factory is sufficiently close to the source of pulpwood or the saw mills and processing units are reasonably close to the raw material sources, the cost of transport of the material to established factories will be too prohibitive to enable the foresters to benefit from this market. Thus leads us to the next big constraint in the way of development of man-made forests.

Integration between Forestry and Forest Industries

2.13 A serious drawback in the development of forestry sector in India has so far been the lack of integration between

forestry and forest industries sectors. This lack of linkage has often resulted in diffused programmes and plans in these sectors. The requirements of specific industries should be a major reason for initiating forestry activities which means a close link between the two.

2.14 In most of the countries the development of wood based industries has been based on plantation forestry. The forest and forest industry sectors possess a number of economic and technical characteristics which enable them to act as an important base for economic growth. By properly integrating forestry with industries, significant employment opportunities in rural areas can also be provided. Forest industries can provide excellent means of alleviating the problems of under-employment particularly in backward regions.

2.15 It must be emphasised that production forestry is a business and it must, therefore, be closely linked with marketing and utilisation. A forest production programme in isolation will not succeed. Therefore, future production programme must be related to utilisation and the present gap between forestry production and its utilisation must be bridged. If it means a change in the structure and organisation of the forestry services, it must be attended to. If a programme of large scale clearfelling of forests is undertaken the timber resulting from clearfelling must be rationally utilised. The rational development and utilisation of forest resources which take into consideration the links between forest industries and forest production, will also reduce transport cost.

2.16 In India, this lack of integration is mainly due to the dichotomy where the production of forest raw material is in the public hands (Forest Service) and the manufacturing (forest industries) is in the private hands. In a situation like this, Industrial decisions are often taken without the forester, who are concerned with the supply and growing of the raw material. This peculiar situation has perpetuated the present lack of integration between the two sectors.

2.17 From the economic standpoint also, there is a strong justification for bringing about a close link between the resource development and utilisation. The profitability of any plantation project when it is considered in isolation is quite different from when it is linked with utilisation. This is so because in the latter case the profitability is an integrated one.

Inadequate Finances for Development

2.18 Even for forest production programmes, the money allocated so far has been very meagre. This low input has been reflected in the management practices and the lack of intensified management has resulted in low production from India's forests. Lack of funds has also prevented programmes of increasing production by clearfelling forests and their replacement by plantation thus attaining higher production per unit area.

2.19 The allocations made in the Five Year Plans for the development and expansion of forestry production programmes in India clearly indicate the inadequacy of funds allotted. A comparative statement of the outlays and expenditure in successive Five Year Plans (1951-74) in Agriculture and Forestry Sectors is given in Table 4.

TABLE 4
*Public Sector Outlay in the Fourth Five Year Plan
and Expenditure in the First, Second, Third &
Annual Plans*

Plan Period	Total outlay	Total expenditure on agricultural programmes (including forestry)	Actual Expenditure		%(Rupees in Crores) % to total outlay	
			Forestry	Agricultural programmes (excluding forestry)	Forestry	Agricultural programmes (excluding forestry)
First Plan (1951-56)	1,960	206	8.5	197.5	0.4	10.1
Second Plan (1956-61)	4,600	276	21.2	254.8	0.5	5.5
Third Plan (1961-66)	8,573	725	45.9	679.1	0.5	7.9
Annual Plans (1966-69)	6,756	1,003	40.8	962.2	0.6	14.2
Fourth Plan (1969-74) Outlay	15,912	2,429	94.0	2,335.0	0.6	14.7

SOURCE : Indian Agriculture in Brief (11th Edition) Expenditure figures on Forestry have been taken from the Central Forestry Commission.

In spite of increasing allocation of funds for forestry development in the successive Plans, the picture remains relatively static in that a meagre and almost fixed allocation of 0.4 to 0.6 per cent of total Plan allocation was made in each Plan for the forestry sector. When the allocation in forestry sector is taken and contrasted with that of agriculture, it will be seen that of the total outlay on Agriculture in the Fourth Plan only 3.8 percent has been allocated to forestry. This inadequate allocation has adversely affected forestry development in all the States.

2.20 Added to the inadequate investments, uncertainties of budget allocation have also to considerable extent impeded the growth of Forestry sector. According to the present budgetary system, the forest department has to seek funds for carrying out its developmental activities from the general grants of the Government. As a result, the Forest Department has to compete for funds with other Departments of the Government. Invariably it happens that in the overall strategies for development in the States, the schemes of the Forest Department do not find adequate priorities as compared to the schemes of other departments. Therefore, the activities of the Forest Departments have been restricted by the overall budgetary constraint. A glaring example is the Fast Growing Species Schemes which originally started as a Centrally sponsored scheme to bridge the gap between demand and supply of industrial wood. After the scheme was transferred to the State sector it has suffered considerably owing to the inadequate financial provision in the State sector. This illustrates as to how a well conceived programme can suffer due to lack of funds and also due to present method of allocation funds.

2.21 A scrutiny of the expenditure as compared to the revenue earned in the Forest Department activities in each State clearly demonstrates that the expenditure has no relation to the revenue earned. (Appendix-1). While it is normal to expect that an enterprise earning a substantial revenue should at least plough back a certain percentage for its own development, this is not so in the forestry sector under the existing budgetary system.

2.22 Moreover some schemes which are not developmental in nature are also included in the Plan schemes, thus further reducing the funds available for development in the forestry sector.

2.23 Even if a provision is made for development schemes, its implementation is hindered due to uncertainty of the resource

position and allocation being subject to cuts. These uncertainties of budget allotment also have prevented considerably the development of the forestry sector.

Existing Institutional Arrangement

2.24 The existing institutional arrangements also have stood in the way of the forestry sector playing its rightful role in the national economy. The rigid adherence to prevailing rules and procedures which is imperative under existing forest administration does not permit the service to manage forests as a commercial enterprise and fulfil its proper role in the economic life of the country. This is largely true in the case of production forestry programmes. Executive and policy decisions are often divorced from each other and the present peculiar institutional system in which executives are not always decision makers has resulted in the forestry sector not being able to develop its full potential. Numerous examples can be cited to show how this institutional system has prevented the effective working of the Forest Department. A commercial production programme needs decision on the spot and unless and until a suitable institutional system is evolved, where the executive and policy decision making are combined in one, forestry sector may not be able to develop its potential in the future.

2.25 The programme of forestry production must eliminate the existing constraints and the key to the future of production forestry in India lies in removing these. This points towards a complete reorientation of outlook towards forestry practices in the future

SECTION III

FORESTRY MANAGEMENT OBJECTIVES IN FUTURE

3.1 A change-over from conservation forestry to a programme of man-made forestry has many implications. A new outlook has to be brought in completely replacing the present one. This may involve many important policy decisions regarding financing, organisation, control and research. We propose to deal with all these aspects in this Report and in order to understand the recommendations we consider that some statement of the broad changes and the implications will be helpful.

Productive Forests

3.2 In order to support the hypothesis that a substantial area is available for conversion on a large scale to meet the present and future demands in India, statistics regarding the productive hardwood forests in India have been collected and are presented in Table-5. The statistics on productive forests for each State are given in Appendix II.

TABLE 5

*Productive Hardwood Forests in India (1971)**

Category of Forest†	Total area in '000 hectares	Percentage to total**
Minor Forests	12,491	41.3
Mixed Quality Forests	9,800	32.4
Valuable forests	6,371	21.0
Inaccessible forests	1,606	5.3
TOTAL	30,268	100.0

*Data incomplete as some States did not report. The Statistics also include marginal coniferous forests of the Eastern States.

†For the explanation of categories see the Foot Note to the Statement in Appendix II.

**Percentage to total of reporting States.

3.3 The statistics on coniferous forests mostly spruce and fir also indicate under-exploitation as will be evident from Table-6.

TABLE 6
Productive Forests in India (Conifers)

State	Area under coniferous forests in '000 ha.	Volume of growing stock of coniferous in '000 m ³	Prescribed yield in '000 m ³	Outturn* in '000 m ³ (1969-70)
Himachal Pradesh (1)	425	70,000	700	576
Jammu & Kashmir (2)	755	91,000	913	377
Uttar Pradesh (3)	521	40,000	558	302
TOTAL :	1,701	201,000	2,171	1,150

SOURCE : (1) Himachal Forest Souvenir—Central Board of Forestry Meeting, Oct. 1966.

(2) Jammu & Kashmir Forest Record No. 1 (Second Edition) 1969.

(3) Uttar Pradesh Forest Statistics, 1969.

Economics of Conversion

3.4 Table-5 will show that, in the States which have reported, the valuable forest stands comprise about 21 percent of the productive forest area (excluding protection forests). These forests have a good growth of hardwood and coniferous species like teak, sal or pine which have a high value in the market. Though the stand may be called a teak area or a sal area in the case of hardwood forests, the percentage of teak or sal in the forest may be as low as 20. These are about the best stands of valuable forests we generally have. Clearfelling of these valuable stands of teak in Maharashtra will give a present net worth of Rs. 57 to Rs. 113 per hectare on a rotation of 80 years. As against this, if we have an area of pure stand of teak under identical conditions, the present net worth on maturity will be about Rs. 1,580 which is many times more. Conversion of mixed forests into plantation forests has started paying dividends in West Bengal where, in Cooch Behar, the natural forests yielding a revenue of Rs. 1472 per hectare were planted with teak which have already yielded a revenue of Rs. 26,000 per hectare over a 40 year period from thinning only and the total revenue may go up to

* Statistics on outturn have been compiled from Forest Statistics Bulletin No. 13, Central Forestry Commission.

more than Rs. 1 lakh at the end of the rotation period. This shows that even in the areas where we have valuable stands, it will pay us to clearfell such areas and replant with suitable valuable species on a planned basis.

3.5 The economics of man-made forestry becomes much more significant when we consider the area of mixed quality forests of potential value but of low economic content today. Table 5 shows that, for the States that have reported, such stands occupy 32.4 percent of the productive forest area (excluding protection forests). In these areas the stands are mixed and the valuable timber is very limited. At the same time, if the area is clearfelled and planted with valuable species, the soil and terrain is such that very good growth can be obtained. The present revenue from such mixed forests is mostly from selection or coppice fellings resulting in partial exploitation and utilisation. Replacement of these forests by planting with economic species will increase their value manifold.

3.6 Table 5 shows that in the States that have reported, there are over one million hectares of over-aged inaccessible forests in remote areas which are deteriorating and await immediate exploitation. The States of Himachal Pradesh and Uttar Pradesh, which are also expected to have large areas of such forests have not yet reported. The stands in these forest areas are good and valuable. They need to be brought under scientific management forthwith. It will be possible by good management to repopulate the areas and transform the forests into valuable stands of both conifers and hardwood suitable for the market.

3.7 Clearfelling of an area in any one of these three classes of forests mentioned above will give large amount of raw materials for forest based industries. If we seek to exploit only the timber and roundwood that is only marketable, some portion of the raw material will be left unutilised. Development of a market for utilisation of this material as pulp or fuelwood will bring full value to the forest stands. Compared to fuelwood, industrial raw material like pulpwood can stand longer transportation and this market has to be developed for the economic working of remote stands. The paper mills and other wood based industries, if brought closer to the forest stands, will give better economic returns.

3.8 Cost of raw material at the factory site has to be normally low to enable the factory to compete in the market. This requires lessening of the average transport distances from the raw material

source to factory site. In the Pre-Investment Survey carried out in Bastar in Madhya Pradesh, it has been found that 4496 sq. Km. of unexploited mixed forests can give enough pulpwood for a newsprint and a paper factory including a plywood and sawmill complex to be located at the centre of the area. It has also been estimated that the unexploited area in Bastar alone can support six such complexes. But the raw material is remaining unutilised due to inaccessibility. We need paper and newsprint in the country. We have the raw materials. If we can have the suitable link up of the industries with the sites of the raw material availability, the circuit is complete. Without the industry at the correct location, much of the material resources will be destroyed as waste in the exploitation of the timber and roundwood resources of the forest stands.

Benefits from a Man-made Forestry Programme

3.9 The most important desirable characteristics of forests for economic wood production in the future will be :

- (i) Suitability of the wood produced for the end purposes proposed;
- (ii) Large volumes per unit areas;
- (iii) Homogeneity of materials; and
- (iv) Accessibility in relation to markets.

The large areas of India's forests which are being recommended for clearfelling are lacking in these characteristics. They contain a multitude of different species with different wood properties. Though research in utilisation may be expected to extend the list of utilisable species to some extent there will remain a long residue of species with defects such as excessive hardness, heaviness, twisted grains, brittleness, presence of oils or abrasive materials, poor seasoning ability and impregnation qualities, which will render them economically useless. The deficiencies of natural mixed hardwood forests and other degraded forests in India will become more apparent as living standards improve and there is more demand for timber.

3.10 By correct choice of site and species, it may be possible to create forests on sites which are both capable of producing satisfactory rate of growth and readily accessible to markets. Conversion of these mixed forests into plantation forests has

started paying dividends in West Bengal and Maharashtra as we have noted in paragraph 3.4.

3.11 Apart from the monetary benefits, these plantation forests have also the advantages of suitability and homogeneity of end product, high growth rates and short rotations. By correct choice of species much more rapid growth rates can be achieved than in natural forests. This applies very much under Indian tropics with continuous long growing season. Rapid growth rates will ensure early establishment with rapid production of large volume per unit area. The production of large volume per unit area means that for a given yield, plantation forests need considerably smaller areas than natural forests. Rapid growth rates will also enable harvesting to be carried out after a shorter rotation. The expenditure on plantation forestry can be recovered in a shorter period. Costs of harvesting, management, protection and transport per unit of wood extracted are correspondingly reduced. Rates of return on capital invested from fast grown, short rotation crops may, in some conditions, be extremely attractive.

Problems

3.12 Although plantation forestry has many decided advantages, it has problems as well viz. selection of species with reference to site, quality of seed, difficulties in seed procurement, risks of diseases and insect attack, improvement of techniques, long term effect on soil and productivity etc. All such difficulties will have to be solved through continuous research efforts. Forest research base is currently very inadequate leading to accumulation of large number of basic and applied problems of conservation and development of existing resources. In order to make forestry research more effective and particularly to make the plantation forestry succeed, the existing research base both at the Centre as well as in the State needs to be completely reorganised and very much augmented.

Implications

3.13 A change-over from selection felling or no felling to clearfelling brings in its wake increased labour opportunities for cutting, sizing and transport of timber. A change-over from conservation forestry to man-made forestry brings in its wake a demand for new labour for organizing the nurseries and planting of seedlings. In a man-made forest the under-growth has to be controlled till the natural canopy of the ~~planted~~ species takes

control. This can be done by weeding or intercultivation and weeding. Both require new labour. The management of the man-made forests has to be more scientific than in conservation forestry. This will require a higher level of expert staff. Forestry has so far given very limited labour opportunity to the rural population living near the forests. Man-made forests will be able to give labour to a large number of the rural population and also to skilled labour. Incidentally, in the Darjeeling hills, where the transformation is being attempted, it has been found that it is difficult to get adequate supply of normal type of axe-men for felling and cross-cutting timber. Mechanical saws have to be used to get this work done. This gives an opportunity for educated youngmen to take up a new vocation of offering custom service in mechanical, sawing and cutting. With the programme of man made forests, it should be possible to have a better built in programme of soil conservation alongwith the new plantations.

3.14 Today with the growth pressures in the urban areas and the disappearance of anythings green from the urban landscape, holidaying in the forests and hills can be a new boon to the urban man. Foresters will have to think seriously of providing recreational facilities in the forests for holiday and rest. Creation of woodlands in selected spots with boarding facilities can built up this amenity to the public and bring the forester greatful thanks. Man-made forests can deal with this problem much quicker than conservation forestry.

3.15 A change-over from conservation oriented forestry to intensive man-made forestry will, therefore, give us the following advantages :—

- (a) Immediate increase in timber and pulpwood availability for meeting the present demand.
- (b) Creating incentive for increasing installed capacity of industries consuming forest produce thereby creating additional employment in secondary and tertiary sectors.
- (c) Planning future production of pulpwood according to market preferences, both internal and international, and reduction of wasteful growth.
- (d) Built-in soil conservation programme.
- (e) Large scale additional labour employment opportunities in both skilled and unskilled categories in the primary sector.

(f) Increased and planned recreational facilities.

3.16 The Commission, therefore, strongly recommends that there should be a change-over from the present conservation oriented forestry to a more dynamic programme of production forestry. Considering the advantages of an aggressive man-made forestry programme, we feel that the future production programme should concentrate on clearfelling of valuable mixed forests, mixed quality forests and inaccessible hardwood forests and planting with suitable fast grown species yielding higher return per unit area. The resulting produce from the clear-felled areas should be utilised in wood based industries by locating additional units wherever required.



SECTION IV

REQUIREMENT, SUPPLY AND INVESTMENT

4.1 A change-over from conservation oriented forestry to intensive and man-made forestry gives us several advantages which we have noted in the previous section. Whilst the necessity for the change-over does not appear to require any special pleading, the phasing of the change-over needs some scrutiny. We have already pointed out that the main reason for the conservation oriented forestry in the past was the lack of demand for secondary species. We have, therefore, to consider carefully the requirement and the supply position and identify the gap in the supply for initiating the change-over.

Sectoral Analysis made by Prof. Gregory

4.2 A preliminary sectoral analysis of the forest and forest industries sectors has been completed recently for the Planning Commission by a Ford Foundation Consultant, Professor G.R. Gregory, in which estimates of India's requirements in 1980 and 1990 for each category of industries and investments necessary in forestry and forest industries sectors have been made. This analysis indicates a foreign exchange requirement of Rs. 149 crores for continued import of pulp and paper between 1971 and 1980. To achieve the level of production indicated in this analysis, it has been concluded that the investments in forestry and forest industries sector would be Rs. 81 and Rs. 340 crores respectively by 1980.

4.3 The Commission while agreeing with the methodology adopted by Professor Gregory has found it necessary to revise the estimates of requirements and supply projections for 1980 and 1990. Assumptions and the details of the revised calculations are given in Appendix III.

4.4 The estimate of investment upto 1980 as calculated by Professor Gregory appears to have been scaled down to match the capacity in the Forest Departments keeping in view the past performance. But the capacity of the Forest Departments is

much more. The estimate of low investment in this sectoral analysis was also due to various assumptions made viz. constraints in the paper industry for development in the next few years and low present consumption on which the estimates of future requirements were based. This study also assumed continued imports of pulp and paper in the decade 70's which although rational, may not be acceptable to Indian planners. This conscious planning for import also resulted in low investment requirement in this study. The Study also indicated that by the decade 80's self-sufficiency target could be attained but no conscious effort for export was assumed.

Future requirements

4.5 The revised requirements of raw material by 1980 and 1990 based on estimated consumption are indicated in Table-7.

From this Table it will be clear that India's industrial forestry production programme must be geared to increase production from the present level of 8.92 million m^3 to 25.55 million m^3 by 1980 and 41 million m^3 by 1990.

4.6 Of the present production of 8.92 million m^3 , the hardwood production is about 7.63 million m^3 and conifers 1.29 million m^3 . This recorded production was less than consumption which was estimated to be about 15 million m^3 in 1970. The difference is accounted for by imports of finished products and also non-recorded production. In respect of fuelwood, the picture is more alarming. Of the total consumption of 203 million m^3 of fuel only 13 million m^3 is said to come from the forests. It is assumed that the bulk of the fuelwood comes from treeslands but in actual fact this may also include substantial pilferage from the forests. The fantastic demands for fuelwood in the future point towards the need for a planned provision for fuelwood in our future forest production programme.

4.7 The requirements for 1980 and 1990 indicate that in the next twenty years a substantial quantity of raw material, both conifers and hardwoods, is to be produced from India's forests. India will have to produce about 4.95 million m^3 of conifers by 1980 which will mean an increase of 3.66 million m^3 of additional timber of conifers and about 12.98 million m^3 of additional timber of hardwood from the present level of production. By 1990 production will have to further increase by an additional 4.10 million m^3 of conifers and 11.04 million m^3 of hardwoods.

10 NCA/72-3.

TABLE 7
Total Industrial Raw Material Requirements by 1980 & 1990

	By 1980				By 1990		
	Conifers (in '000 m ³)	Broad leaved (in '000 m ³)	Total in '000 m ³)	In '000 tonnes	Conifers in '000 m ³)	Broad leaved (in '000 m ³)	Total in '000 m ³) In '000 Tonnes
Pulpwood	1,555	3,478	5,033	..	4,461	8,271	12,732 ..
Sawnwood & Sleepers	1,816	10,836	12,652	..	2,395	14,605	17,010 ..
Panel Products	189	755	944	..	281	1,126	1,407 ..
Roundwood	1,385	5,542	6,927	..	1,887	7,549	9,436 ..
Total Industrial Wood (excluding							
Bamboo)	4,945	20,611	25,556	..	9,024	31,551	40,575 ..
Bamboo for Paper Pulp . . . .	..	..	..	2,199	..	..	1,954
Bamboo for other uses . . . .	..	..	..	2,173	..	..	2,960
Total Bamboo . . . .	..	..	..	4,372	..	..	4,914

4.8 Due to successful conservation oriented forestry practices in the past, the country has large stands of unproductive, undeveloped, old growth timber as well as vast areas of mixed forests from which so far limited yields was harvested. In view of this, it is reckoned that the future supply of industrial woods will come from the coniferous forests of the Northern Himalayas by infrastructure development and by clear felling of presently inaccessible hardwood forests, mixed forests of low economic content and valuable forest stands capable of significantly increased production from unit areas. Clearfelling will only be silviculturally permissible if adequate measures are taken to plant up the clearfelled areas. Hence all the areas will be planted up with selected species which will meet the future requirement. It may be emphasised here that we have the capacity to plant larger areas by clearfelling and planting and in the process can support a large number of industries. The main bottleneck is finance. If the financial problem is solved, the foresters in the country can adequately handle the rest of the requirements in research, organisation and administration necessary for clearfelling and planting large areas to meet the gap between demand and supply.

Investment Needs

4.9 In order to meet the gap between supply and requirements by 1980 and 1990 as worked out for sawnwood, pulpwood, panel product and roundwood, substantial investments will be required. These investments will be of two kinds, viz. investments for clearfelling and plantation of the existing categories of forests identified earlier and also investments in wood based industries to utilise the larger amount of material that will be available as a result of clearfelling and plantation. The details of investments in clearfelling and plantation and in industries upto 1980 and 1990 are given in Appendices IV and V. All the investments specified are derived directly from the estimates of requirements made for the period '80s and '90s. The investments in clearfelling will be for infrastructure development including purchase of machinery in specific cases, and in plantations for all aspects including establishment, staff, machinery etc. The per hectare clearfelling and plantation costs have been worked out on the assumption that money could be borrowed and include payment of interest etc.

4.10 In the forest industries, investment costs have been calculated on the basis of capital required per tonne or per m³ of additional production. For paper industries, investment costs are inclusive of pulp production. As paper making involves a

series of processes and further, as some of the processes can be isolated and set up independently, it is useful to give investment estimates after specifying what is included in such an estimate. As far as possible, the estimates given in the Appendices indicate the average cost, based on the present world experience, of the type of sophisticated paper and pulp making plants to cover the various possible demands for quality paper in the future. It needs to be emphasised that these estimates are solely for the purpose of evaluating investment needs in the near future and these are not to be taken as firm figures for setting up a paper mill at a given site for which a detailed feasibility study would be needed. The estimates, nevertheless, provide guidance for future planning.

4.11 Appendices IV and V indicate that by 1980 an additional investment of Rs. 242 crores will be required for clearfelling and plantations. This will mean clearfelling and planting of about one lakh hectares annually in the forests from the time the programme is taken up. For increased production from coniferous forests intensification of management will be necessary. The necessary industrial investment to absorb the fruits of the forestry sector's activities will be Rs. 815 crores of which the investment for newsprint, printing and writing paper, industrial paper, absorbing and other papers excluding dissolving pulp will be Rs. 611 crores. During 1981-1990 the investment will rise to Rs. 306 crores in clearfelling and plantations and Rs. 1187 crores in the forest industries sector of which the paper industries will account for Rs. 979 crores. This works out to an additional investment of about Rs. 34 crores annually during the '70s (assuming the investment will commence from 1974) in clearfelling and plantations and about Rs. 116 crores annually in the forest industries sector. In the Fourth Plan, the amount provided for clearfelling and plantation is only Rs. 8 crores annually which shows how inadequate the investment has been as compared to the need.

Export possibilities

4.12 Export market in tropical hardwoods was not well developed before the last world war. Even then, there was a positive export drive and Indian hardwood travelled to the world markets in other continents. Subsequently this effort was withdrawn because of the understanding that we were short of raw material for our own requirements. The demand was calculated without matching actions or increasing production. The ban on export of timber is being gradually relaxed but we are faced with the phenomenon that we are not able to secure the export market for the small amount of timber we are prepared

to export. This contrasts glaringly with the fact that in recent years both Europe and North America have become large importers of tropical broad leaved timber varieties. The main suppliers are Africa, Malaysia and Philippines. A recent study made by the Indian Team to the conference on forestry products organised by the GATT has revealed that there is a great demand for tropical sawn timber and logs in European countries particularly in the United Kingdom, West Germany, Belgium, Italy, Netherlands, etc. and that if an attempt is made, India can make a sizeable dent in the markets. Some of our Indian timber can very conveniently be shipped to those European countries. Some of the Asian countries like Japan and South Korea can also provide suitable markets for our timber both in the log and sawn forms. It is a pity that when tropical hardwood has come in the world trade as an established commodity, India is not in the exporters' market. The world trade is not only in commodity but also between partners and if India as a partner continues to be forgotten in the market, it will be increasingly difficult to stage a come back. The name of Andaman Timber still lingers with the European importers of Indian timber and if a vigorous export promotion drive is undertaken, there is no reason why India cannot export substantial quantities of timber in the future. India has first of all to introduce her timbers in the European and North American markets to enable the customers to judge these new species against their present preferences. With aggressive sales promotion, Indian timber can get into world markets. The world trade in wood and wood based panels increased from 4,000 million dollars in 1967 to 5200 million dollars in 1969. In this trade, the contribution of Latin America was 96 million dollars in 1967 against 673 million dollars by the Far East. Latin America's trade increased to 172 million dollars in 1969 whereas the volume of export from the Far East increased to 940 million dollars. Malaysia and the Philippines contributed significantly to this trade and during the period Malaysia increased her export of wood and wood products from 195 million dollars to 266 million dollars, a rise of 36 percent. The Philippines increased her exports during the same period from 187 million dollars to 267 million dollars, an increase of 43 percent.

4.13 The European and North American forest products industries supply paper and paper products to a large part of the world. We are also buyers in this market. When we will have so much pulpwood begging for a market, an obvious move would be to increase our paper production and meet our own demand and then enter the world market which these developed

countries have so far been monopolising. The production capacity in these countries are nearing the capability 'apex' and already attention is turned to the tropics for new sources of raw material, pulp and paper products. It thus appears to be reasonable to expect that the tropical countries, which have not made much contribution to the world trade in pulp and paper products, will have great possibilities. These possibilities are further brightened due to technological advances in overcoming the inherent shortcoming of hardwood fibre in its short length by radiation process. The increased export by Japan is an eye-opener. In 1967 the country exported 64 million dollars worth of pulp and paper products but in the next two years the export rose to 101 million dollars, a rise by 58 percent.

4.14 It is true we have not examined the export potential in any depth so far. At the same time, it appears reasonable to forecast that in the '90s of this century we should be in a position to enter the export markets aggressively for timber and for paper and paper products. It is in the '90s that production from planned man-made forests will start getting ready for harvesting and the present handicaps due to assorted mixture of species and diffused production would start receding. It is in view of these possibilities that a more aggressive programme of clearfelling has been suggested in the decade '80s as by that time the organisation will have been built up to take such an aggressive export programme. By then, we must set our house in order and have the required plantations to support the production programmes. If this exercise is done systematically from now onwards, it is not unlikely that the forecasts we have made about additional plantations and industries in the latter half of the '70s and in the '80s would require drastic upward revision.

4.15 In the foregoing paragraphs, we have indicated that the investment of Rs. 224 crores between now and 1980 will be required to clearfell and plant up the areas to meet the minimum requirements. This will mean clearfelling and planting of about 1 lakh hectares annually from the time the programme becomes on going besides intensification of management necessary for increased production in the coniferous forests. This investment will go up to Rs. 306 crores in the next decade in view of the export possibilities that we have underlined. The supporting industrial development will require Rs. 815 crores during the current decade and Rs. 1187 crores in the next decade. We strongly feel that this money must be found and this minimum programme be carried through in order to make the forestry sector contribute its due share to our national income.

SECTION V

FINANCING PRODUCTION FORESTRY PROGRAMME

5.1 The programme of man-made forests requires an initial investment for clearfelling and marketing the produce in the most remunerative manner and immediate planting up the area with selected species. The problem of suppression of weed growth has to be tackled in the inter-space for the first two or three years till the canopy closes up. For the seedlings to be available according to the programme, centralised nurseries under expert supervision will have to be organised ahead of the planting programme so as to fit in with it. If close planting has been adopted to reduce undergrowth, thinning operations will have to be undertaken at intervals for removal of congestion and improvement of forest hygiene. All this requires correct timing and availability of funds according to the requirements of the programme over a period of several years.

5.2 The large scale felling of the mixed forests will be a wasteful exercise unless simultaneously we plan for utilisation of the available raw material in organised industries which are and will be located reasonably close to the areas of harvesting. In paragraph 4.5 we have been given some estimates of the country's future raw material requirements in the field of pulp, paper and newsprint, plywood and panel products. To meet the anticipated gap between supply and requirement in the country by 1980 and 1990, additional industries will have to be located to utilise the additional forest material that we shall be harvesting in a programme of clearfelling and replanting. This industrial investment has to be planned to fit in with the clearfelling and plantation programme.

Present Financing and Need for a New Approach

5.3 We have noted already that the only serious constraint to the programme will be the financial one. The plantation programme so far followed in the country has been a part of direct plan investment in the States or the Central sector. The follow-

ing Table gives the expenditure incurred in such plantation programme from the Second Plan onwards :—

TABLE 8
Expenditure on Plantation

(Rupees in Crores)

Plan Periods	State Sector	Central Sector	Total
Second Plan (1956-61)	6.8	—	6.8
Third Plan (1961-66)	11.2	3.8	15.0
Annual Plans (1966-69)	9.6	8.8	18.4
Fourth Plan (1969-74) Outlay	38.8	—	38.8

SOURCE : Central Forestry Commission, Ministry of Agriculture.

During the Fourth Plan, the investment will be roughly of the order of Rs. 8 crores per annum. This investment is calculated on an average per hectare basis and does not provide for the follow up, viz. cultural operations etc. Experience shows that the per hectare expenses are fixed on an average yardstick and there is often difficulty in meeting the increased expenditure required in particular areas. For example, when the Central Sector Plan for quick growing species was sanctioned and some States found per hectares allocation low for certain areas, they compromised by reducing the density of stocking per hectare and thereby keeping within the allotment. Obviously, they did not thereby solve the basic problem of maximum utilisation of the land and its capacity. If we follow the methods of financing so far adopted, it is obvious that with the best of intentions the allocation for this sector in the Fifth Plan will not go beyond Rs. 12 or Rs. 16 crores per year on an average. As against this, the formulation in Appendix IV shows that by 1980, we are required to invest Rs. 242 crores in the plantation programme and its follow up. Allowing time for the completion of all the preparatory actions, it is unlikely that the programme will get off the ground by the beginning of 1974. This gives a 7-years period to invest Rs. 242 crores. During the Fifth Plan, therefore, we shall have to find about Rs. 173 crores for the programme. It is

obvious that a completely new approach to the financing has to be evolved, which is theoretically acceptable and practically workable so as to enable us to solve the problem

5.4 If we continue to follow the present accounting practices of a Government Department, the income from the clearfelling of any area under the programme will be credited to the State Consolidated Funds and no part will be available to the Forest Department for expansion of harvesting and plantation programme. Clearfelling of an area without immediate replantation and maintenance will lead to deterioration of the land and ultimate loss of good forest area. Clearfelling and raising of plantation and their maintenance should be a package and no part of it should be handled separately either in financing or in management. Further, we have also pointed out that it is in areas of valuable forest stands, mixed forests and inaccessible forests where coppice, selection felling or no felling have been followed that the new programme will be introduced. Therefore, if old practices of management had continued, firstly because there was a paucity of funds for plantation and secondly because there was no planned industrialisation to support the clearfelling, the State's income from this area would have been of a very modest order. Clearfelling will certainly give substantially large income per hectare of clearfelling and per year of operation; but the State will not be justified in claiming the extra income without providing fully for the rest of the programme of plantation and industrialisation which is an organic whole.

Future Financing

5.5 The programme of harvesting, raising of plantation and maintenance would require investment of the order of Rs. 173 crores during the Fifth Plan period. But such large funding is obviously difficult from the State Plan. We have emphasised already that clearfelling and subsequent plantation and maintenance should be a package and no part of it should be handled separately either in the financing or in management. As such, if our programme is accepted, other sources of finance have also to be carefully looked into. The programme would become self generating financially from about the fourth year onwards in some cases and as such we are of the view that institutional finance would be available and has to be availed of for a substantial part of this need. This new system of financing would meet the commitments in the management, allow repayment of loan and provide funds for further expansion of the programme.

5.6 The Commission would, therefore, lay down the first principle for acceptance by the State and the Central planning, that provided we can thereby achieve the massive programme that has been spelt out, the State should take for the State revenue only an equivalent of the average revenue of the previous three years they have been receiving from the areas that would be brought under the programme of clearfelling, plantations and industrialisation and leave the rest of the income from clearfelling to support the programme. This programme, we once more emphasise, comprises harvesting and raising of the plantations and their maintenance plus the supporting industrialisation.

Public Sector Investment in Pulp & Paper Industries

5.7 The Statement in Appendix IV shows that to meet the requirements of timber, plywood, particle boards, newsprint, paper, etc., by 1980 we shall have to invest in supporting industries a capital of about Rs. 815 crores. Out of this, the investment in newsprint and various types of papers will be of the order of Rs. 611 crores of which the investment during Fifth Plan would be about Rs. 440 crores. We may compare this with the proposed investment of Rs. 246 crores in paper and pulp during the Fourth Plan period. This means that during the Fifth Plan period only paper and pulp we shall have to invest substantially much more than what we propose to invest in the Fourth Plan period. The investment in the Fourth Plan in the public sector is to be only Rs. 66.66 crores (Rs. 60 crores by Hindustan Paper Corporation and Rs. 6.66 crores by NEPA Mills). Experience shows that the private sector is slow in its investment in paper and pulp. For the various reasons the paper plants which were expected to take the pulpwood from the quick growing species plantations have yet to be started, though the plantations have already reached maturity for harvesting. Faced with these problems, the Centre decided to invest in the Hindustan Paper Corporation for it to directly put up large paper and newsprint factories. Two of these factories have been approved in the Fourth Plan. The new paper and pulp factories will have to be located near the areas of unexploited forests, which means areas of backwardness. It is not reasonable to expect the private sector to invest in a very large way in these areas. The capacity of the Hindustan Paper Corporation to handle the problem will also be limited by management and personnel problems. There is no escape from the position that if the large amount of pulp material that

will be thrown open by the man-made forest programme is to be absorbed without waste and made into newsprint, paper and pulp for which there is heavy demand in the country, the States will have to take a substantial share in the pulp and paper industry in the public sector. Considering that the States have not made any investment at all in the past in the paper and pulp industry, this will be a completely new venture which has not yet found a place in the industrial frame of the State sector investment. If we hopefully expect the private sector to repeat during the Fifth Plan its proposed investment on paper and pulp as in the Fourth Plan we expect the Hindustan Paper Corporation to invest in the Fifth Plan at least one and half times its investment in the Fourth Plan, we shall leave the tidy investment of about Rs. 160 crores to the State sector in the Fifth Plan.

5.8 As the investment performance of the private sector in the Fourth Plan is not very encouraging, and their capacity to take up further new programme in the Fifth Plan may be doubtful, the investment in the State sector may vary from Rs. 160 crores to Rs. 340 crores. If our first principle stated in paragraph 5.6 is accepted, we have reasonable hope, as will be explained later on, to find the investment in the State sector by following commercial practices. The Commission would, therefore, state as its second principle that during the Fifth Plan, the State and mainly those which have large areas of untapped forests, must take up a substantial public sector investment in the paper and pulp industry.

Financing Pattern

5.9 The man-made forest programme, alongwith its necessary adjunct of forest industries, requires substantial fund which cannot be found from the normal budget and Plan finances in the State sector. If the Forest Department or the Industries Department tries to handle the programme departmentally, we cannot escape the normal constraints of budgeting. On the other hand, if our first principle stated in paragraph 5.6 is accepted it will be found that the plantation programme and the industries programme can be commercialised completely and can have the benefit of institutional investment. Institutional investment can flow only if there is a Company or a Corporation to take the funds. Institutions cannot lend to the State Governments. All these lead to our third principle that the agency to implement the man-made forestry programme and the supporting forest industries in the State should be organised in the public sector as a fully owned State Company or a Corporation. We do not rule out a joint sector approach in the industrial part of the venture.

SECTION VI

IDENTIFICATION OF PRODUCTION, FORESTRY PROGRAMME

6.1 In Appendices IV and V we have tried to analyse and distribute the man-made forestry programme between the various types of forests which have to be turned over from either selection or coppice felling or no felling, to a system of clearfelling and man-made forests. The programme has been adjusted for the various types of forest raw materials for our industrial programme. Each State, after analysing its detailed figures of the various types of forests and going into the details of the industrialisation programme, may find it necessary to make alterations in the areas and types of forests they have to handle. Our suggestions are only indicative and should not be taken as prohibiting adjustments which would give a better picture, both financially and for management.

Programme Identification and Financial Implication

6.2 In the national interest it is obvious that we will have to utilise the vast unexploited forests, which have started deteriorating for lack of exploitation. The first category of these forests is the coniferous forests in the Upper Himalayas where large clearfelling and plantation may not be possible because of difficulties of artificial regeneration. In such cases a system of selection felling and clearfelling in patches may be the answer. Even here the volume of timber that can be extracted on full exploitation, will be very substantial and the material will be very valuable. The pulp will be valuable for paper making because it will be of long fibre. The second category of these forests is coniferous forests in the Lower Himalayas where clearfelling and replantation with commercial varieties is possible and there is a lot of previous experience. Then we have got in the third category the unexploited mixed forests like those in Bastar, Chanda and East Godavari where because of inaccessibility of the area and its distance from the industries, exploitation has been almost negligible so far. In Appendix VI we have tried to analyse the economics of clearfelling and planting an area of 45,000 hectares in the Eastern Himalayas in West Bengal. We can compare

this exercise with the cost of exploitation of the inaccessible, coniferous forests of the Himalayas and the mixed forests in Bastar, Chanda etc. The returns from the coniferous forests may be comparable with the returns assumed in this exercise and the expenditure will also be comparable. Therefore, this exercise can be taken as a model for such areas also. In the mixed hardwood forests of Bastar, etc. costs of exploitation would be cheaper and the economics will be certainly more remunerative. We have not considered it necessary to do the detailed exercise for such forests because this exercise has already been done by the Central Zone Team of Pre-Investment Survey of Forest Resources Organisation in its Report on "Forestry and Industrial Development Opportunities in Bastar and Formulation of a Model Management Plan for a Selected Catchment based on FAO and Pre-Investment Survey Organisation Studies". The exercise in Appendix VI may, therefore, be taken as a suitable model for formulating detailed programmes by the various States.

6.3 The broad assumptions made in this exercise are that the project will be carried out by a Forest Corporation. The entire area of 45,000 hectares will be transferred to the Corporation by the State as its equity contribution. The Corporation should be able to get loan finances from institutions on the basis of the valuation of its land of 45,000 hectares and valuation of the standing timber. The only contribution the State may take from the Corporation during the first 15 years may be an annual equivalent of the average revenue the State had been receiving during the previous three years from the areas transferred to the programme. After the fifteenth year there is enough profit in the venture to pay reasonable dividends to the State on the equity participation. The road building for starting the exploitation is expected to take four years. The first lot of 1,500 hectares can be exploited in the fifth year. It may be possible in particular areas and blocks to start the exploitation earlier than the fifth year. If so, this should be attempted so that the industrialisation programme can be started earlier. It has been assumed that it would be possible to get a loan of not less than twice the equity from the institutional sector for the plantation programme. We would recommend that the institutions should support with loans equivalent to not less than twice the equity. If the land alone is valued (without valuing the standing timber) at Rs.100 per hectare, which is a very modest figure, the cost of construction of roads and other structures till the fourth year can be met by loans from the institutional sector. From the fifth year onwards when the exploitation

starts, there will be money to pay back the interest and the loan requirement will go down. By the twentythird year the borrowed loan will be paid back and there will be surplus revenue in the venture. Appendix VI gives a working scheme for 10 years but a scheme for the entire 30 years can be worked out on this basis.

Industries Programme based on Inaccessible Forests

6.4 In Appendix VII we have given a model for industrial development programme based on exploitation of 45,000 hectares over a period of 30 years. In this model we have suggested that the industries programme should start from the fifth year onwards and should be completed by the eighth year. The investment in the paper and pulp complex is expected to be of the order of Rs. 30 crores. We would recommend that this industry should be treated as a priority industry for which the debt equity ratio can be kept at 2.6:1. In this model, we have got the standing timber as a resource in the equity capital. The annual harvest in a 30-year period is valued at not less than about Rs. 1.4 crores. This is true for the model worked out but may differ from State to State depending on specific area and size and composition of the growing stock. If the standing timber is valued at Rs. 6 crores in the equity, it will be a very reasonable valuation. From the fifth year onwards till the eighth year, the surplus of about Rs. 1.05 crores per year should also be taken towards the equity of the industrial venture. As during these four years we are exploiting 4/30 of standing timber, the equity on the standing timber will have to be reduced by 4/30 leaving Rs. 5.2 crores. This together with the Rs. 4.2 crores added from the surplus from exploitation will give Rs. 9.4 crores equity against which loan can be taken from the institutional sector. On Rs. 9.4 crores at 2.6 : 1 debt equity ratio the industrial venture can raise capital of about Rs. 25 crores. This will be enough to finance the industrial venture. The practice of valuing standing timber for advances is a common practice in banking accommodation to timber contractors. Thus without any plan investment and purely with the help of institutional finance, 45,000 hectares can be transferred into a man-made forest and a paper pulp factory established to absorb all the pulpwood that would be harvested from this area. It may be stressed that the example chosen is of a very favourable area with high density of growing stock and the assumptions made may need detailed scrutiny. But each State can identify such potential area and carry on model exercises to test our hypothesis.

Mixed Forest

6.5 In Appendix VIII we have given model schemes for converting mixed forest stands into man-made forests. The main assumptions made in this exercise are that the State will take from the Corporation an annual contribution equivalent to the average revenue the State had been raising during the previous three years from the areas transferred to the programme. After the fifteenth year there is enough profit in the scheme to pay reasonable dividends to the State on the equity participation. The lands with the standing timber will be transferred to the Corporation as equity by the State. The Corporation can thereby take loans on the value of the land and standing timber. Provision has been made in the calculations for mechanisation to uproot the stumps in clearfelling and to plough the area for cultivation. This is based on the calculations done in the Uttar Pradesh Scheme which has been presented to the World Bank. Statement 8.8 in Appendix VIII is relevant. The actual working of de-stumping and inter-cultivation in West Bengal has shown that for the first three years an income much higher than Rs.100 per hectare can be obtained if we invest in mechanisation. In the income assumptions in Statement 8.9 of Appendix VIII only an income of Rs.100 per hectare for inter-cropping has been provided which is very modest, though full provision is being made for the mechanisation. Obviously each State will have to judge the situation in its areas and opt between mechanisation and manual operations. Not all forests will require mechanisation. The estimate of loan requirements in Statement 8.9 of Appendix VIII shows that against a net income of rupees one crore in the year of establishing the activities from clearfelling of 20,000 hectares, the scheme will require an additional loan of nearly Rs. 3 crores. If we allow valuation of the 20,000 hectares taken annually in the scheme till the tenth year at Rs.100 per hectare and show it as equity contribution to the Corporation, the Corporation in the initial year should be able to take a loan on Rs.0.8 crores net income plus Rs. 2 crores land value. If we assume a debt-equity ratio of 2:1 the Corporation will be entitled to get a loan of Rs. 5.6 crores. In subsequent years upto the tenth year, it will be noticed that the loan required is either less than the net income during the year or even when it is more, it is not more than one and half times the net income. It should, therefore, be possible by adding the net income to equity every year to get the necessary loan accommodation from the institutions. From the tenth year onwards, the repayment schedule in Statement 8.11 of the Appendix shows that the scheme

will have sufficient surplus, after repaying interest and instalment of loan. The scheme requires a moratorium on repayment of interest and capital for the first ten years.

6.6 The exercise done in Appendix VIII is for the mixed quality forests. In some States there are mixed quality forests where clearfelling revenue can be of the order of Rs.3,000 per hectare. The average felling income in these cases would not have been more than about Rs.500 per hectare under the present system. In these areas it would be possible not only to organise plantation programme but also invest in a modest industrialisation programme. Identification of such areas and of the industries to support the areas will have to be done for each State in the country.

6.7 In paragraph 5.7 we have pointed out that the States may have to be prepared to invest Rs.160 to Rs.340 crores in paper and pulp industry during the Fifth Year Plan, if the pulpwood that would be thrown up by the clearfelling programme is to be utilised and our paper needs are to be met. Obviously, the State should organise the industry to support the clearfelling and plantation of the inaccessible forests. These themselves would require about 23 integrated paper and pulp factories of the capacity of 60,000 tonnes each during the '70s.

6.8 If we follow meticulously the phasing that has been suggested in Appendix IV, the paper and pulpwood be forthcoming only at the end of the eighth year from the start of the operations. With the best of intentions, we cannot start this programme before the beginning of 1974. The paper demand is going to be heavy by 1980. So unless we can produce the paper within a period of six years, we shall be in difficulties. Adjustments in detailed planning will, therefore, have to be made. The suggestions that the State Governments may consider in their planning would be:-

- (a) Priority may be given to the inaccessible unexploited areas where the first lot of 15,000 hectares as given in Appendix VII or similar forests can be exploited, within three years of start. The road programme would be simple in areas like Bastar, Chanda and East Godavari. Even in some portions of Darjeeling and the Hills areas of Uttar Pradesh and Himachal Pradesh, it should be possible to start the first exploitation within three years.
- (b) The Corporation should take the loan for the industry on the basis of its equity in land and standing timber

within a year or two of its formation so that the factory will be ready not later than the end of the sixth year from the beginning of the programme.

6.9 It is expected that smaller industries like sawmills, plywood factories, particle board, rayon pulp etc., will be put up by the private sector once the massive programme has been accepted in the planning. In a few places saw mills may have to be located by the Forest Corporation itself if the private sector is not active enough. These investments are marginal and it should be possible to find the funds from the institutional sector. A separate exercise for this funding has not, therefore, been done.

6.10 The investment required in clearfelling and plantation during 1981-90 and necessary industrial development has been calculated and presented in Appendix V. It will be noticed that the programme contemplates clearfelling and planting of additional 8 lakh hectares of mixed forests in order to get timber for export. Not only timber will be obtained but also pulpwood. We have already drawn attention to the fact that we should aim at getting the paper and pulp market of the world for our industries if it is possible. If our export drive fructifies and we are able to get markets for our finished products, we should be able to finance the special programme of additional paper and pulp factories to utilise the pulpwood from this additional 8 lakh hectares of felling. This contingency will have to be kept in mind by the planners. The clearfelling and plantation programme in the '80s inclusive of the 8 lakh hectares for export will require only Rs. 306 crores in ten years or about Rs. 31 crores annually. As we shall be reaching this level of investment in the '70s itself, this is not difficult to achieve in the '80s. The industrial programme in the '80s requires Rs. 1187 crores in ten years as against Rs.815 crores in seven years in the '70s (1974-1980 inclusive). This also is a very modest programme requiring Rs.118 crores every year in the '80s as against Rs.100 crores in the '70s (1974-1980). If we are able to find an export market for our newsprint and paper, we can certainly find the additional investment required to utilise the pulpwood from the 8 lakh hectares clearfelled for export. We should not forget that during the '80s we shall be getting annually a clear profit from the areas clearfelled and planted in the '70s. This additional capital will be available for industrial financing. Statistics in Appendix II show that even allowing for a brisk export programme during the '80s of this century, we shall be required to convert into commercial production only a fraction of the large area available for

production forestry in the nature of valuable forest, mixed quality forest and inaccessible forest. It is difficult at this point of time to forecast how the demand for timber and timber products may change towards the end of the century in the light of the general development in the economy. It is in our interest to change over to production forestry by clearfelling and planned afforestation so that we can maximise the returns to the economy from every section of forest under our control. All this shows that in the '80s and '90s if the world market so allowed, this country would be in a commanding position to capture a part of the world market for timber and industrial products based on forest material. We would, therefore, once again emphasise at this point that it would be in the interest of the country to plan from now onwards for capturing the export market in the world for industrial goods based on wood.

6.11 In view of the facts stated above, We feel our recommendation of clearfelling and plantation in the forest areas identified for the purpose is a fully justified and it is in our interest that the future production forestry programme should be organised on the lines suggested by us. The States should give priority to the exploitation of inaccessible forest, followed by mixed quality and vallable forest. We have recommended that the State Corproation which would take up the programme should borrow money from institutional sources on the basis of 2:1/debt equity ratio and in the industrial part of the venture borrowing should be on 2.6 : 1 debt equity ratio. Our calculation suggest that it is possible to make the forestry and forest industries programme economically viable by borrowing form institutional sources. The State Corporations which would be responsible for initiating the production Forestry programme should carry out detailed project analysis and prepare a shelf of forestry projects indicating both economic and social profitability.

SECTION VII

SOCIAL FORESTRY

Production Forestry and Social Forestry

7.1 In future, a distinction should be made between production forestry and social forestry. This is not a novel concept. The distinction between the two has been brought out lucidly by Jack Westoby *in his inaugural address to the IXth Commonwealth Forestry Conference in India, wherein he has observed.

- (a) A distinction can be drawn conceptually between production forestry –forestry which aims at producing wood for industrial or household use –social forestry, forestry which aims at producing a flow of protection and recreation benefits for the community.
- (b) In principle, production forestry should pay.
- (c) The goals for social forestry should be determined by the amount of investment the community is prepared to allocate to secure the desired social benefits.
- (d) The fact that wood and the physical protection and social benefits are frequently joint products does not rule out this approach.”

He has further explained the concepts in the following words:

“As growing emphasis is placed on procuring from the forest a flow of physical protection benefits and social values, the constraints and limitations imposed on the forester as an economic producer of industrial wood steadily multiply. This is one important reason why a number of countries in the developed world are becoming relatively high cost wood producers.”

*Changing objects of Forest Management by Jack Westoby—IXth Commonwealth Forestry Conference India—1968.

“When funds have been sought for forestry in the past, projects have often been justified on the basis of their major use, with the subsidiary uses thrown in, either as an offset to low profitability or as some kind of premium. Yet, surely the volume of forest derived physical protection benefits and social values which a nation is to have should be determined on the basis of what the nation can afford to pay, having regard to other calls on the public purse. It should not be determined by what the forestry sector is able to provide in the ordinary way of business without going into the red.”

we agree that production forestry should aim at producing wood for industrial and household uses. It must be a commercial programme and should be institutionalised. Social forestry, on the other hand, should aim at creating protection and recreation benefits for the community. We feel that social forestry should also include the activities concerned with growing and meeting the firewood needs of the community in future. Some amount of plantation of protection forests in areas liable to soil erosion must be accepted as social investment by the States. The State sector plantation programme should provide for this in the Fifth Plan.

Recreation Centres

7.2 Holiday resorts can be created in forest beauty spots by the Forest Department. If simple tourist accommodation in the nature of dormitory accommodation or small cottages can be provided at cheap rates at such centres, tourist interest can be developed. This will enable stepping up of the economy of the agricultural population living close to the forests. Forest Corporations may be able to afford these centres as an adjunct to their Rest House sites and may be able to invest some modest amounts in the programme to establish good relations with the local population.

Fuelwood

7.3 According to available statistics, out of the total consumption of 203 million m³ of fuelwood per year, only 13 million m³ is accounted for from the forest sources. It is assumed that the rest of the fuelwood has come from tree lands including private forests and private trees. But the practical experience of foresters indicates that probably a good deal of the fuel requirements of the rural population are obtained by pilferage

from the forests. It is not only a social conscience which should make the foresters try and meet the reasonable demands for firewood at reasonable prices, but the need to protect their valuable forests from poaching and pilferage which causes tremendous loss in ultimate forest wealth should also make them conscious of the need for meeting fuelwood demand in the country. In conservation forestry, where investments are low, the forester may not have noticed the pilferage with much alarm but a programme of commercial forestry should make him think whether he can afford to look upon pilferage with the same blind eye.

7.4 If the clearfelling and plantation programmes are spread throughout the country in reasonable blocks, it is possible to meet the fuel needs of the semi-urban markets within a reasonable distance from the periphery of the exploited blocks. This will immunize the man-made forests in these blocks, from the pressures of pilferage. It is worth the while of the Forest Corporation and the Forest Department to locate fuelwood deposits at key centres round the block and sell fuelwood to those who need it at reasonable prices. They will be able to recover at least pulpwood value for the fuelwood which otherwise would have gone waste in the exploitation. As our man-made forests programme covers larger and larger areas in the country, we may be able to immunize tree lands in semi-urban areas from the pilferage.

7.5 In areas where the existing forests have been left almost treeless and shrubless by indiscriminate exploitation for village fuel and urban fuel, it may be necessary for the Forest Department to undertake fuelwood plantation as a social forestry. This will not be wholly commercial venture. In Madhya Pradesh an experiment is being made to supply agreed quantities of fuelwood and roundwood to villages at low rates against their "nishtar" rights in order to free certain forest areas from attached nishtar rights. These forest areas can be planted with fuelwood and ultimately may reduce the nishtar rights. We shall deal with this subject and the method of financing the same in our Report on Social Forestry.

SECTION VIII

INSTITUTIONAL CHANGES NECESSARY FOR PRODUCTION FORESTRY PROGRAMME

8.1 We have pointed out that the massive programme of man-made forests and wood based industries in the State public sector can be implemented by institutionalising the operations. We have also shown that the programme of clearfelling and plantation will be financed substantially out of the clearfelling revenues and the industrialisation programme can be pushed through with a loan support from the institutional sector in the ventures during Fifth Five Year Plan period, the rest coming from self-generated funds of the clearfelling and development operation. The acceptance of this approach saves the States from finding any funds from their plan resources for a man-made forestry programme and supporting industries. In fact, with this approach a much larger programme than what they could have contemplated can be achieved. On the other hand, it also does not deprive the State of any resources that would have normally accrued if the old methods had continued without a change. After a period of about 15 years, the new approach will give substantial additional revenue to the programme than what the old approach would ever have done. In addition, the new approach will be creating larger additional employment in the forestry and industries sectors which would have been impossible under the old approach.

State Forest Corporations

8.2 For the States to take advantage of this financing procedure, it is necessary to organise State Forest Corporations. A State may have one or more Corporations according to size of the programme and the location of the forest to be taken up under the programme. These Corporations can be named according to the activities they take up. Such of the Corporations that take up supporting paper and pulp industries can either set up the industry as a subsidiary of the Corporation or form separate companies with investment in equity. The areas

selected and considered fit for commercial production activities should be transferred by the State Governments to these Corporations. The Corporations may be required to pay during the first fifteen years a contribution equivalent only to the average felling revenue of that area for the previous three years. The dividend after fifteen years can be fixed on the basis of the programme undertaken and the funds that will be necessary for the programmes. The land and its standing timber transferred to the Corporation will be valued and these two values together will form the basis of equity capital of the Corporation against which it can borrow from institutions. In some cases, where clearfelling and the valuation of the land will not be adequate to generate sufficient funds in time for the industrialisation programme, the State Governments may have to subscribe additional equity funds to the Corporation from their Plan resources. Such an eventuality may arise only in poor areas where the standing timber may not be very valuable.

8.3 Another great advantage in bringing about this institutional change would be that the Corporations as constituted will have substantial autonomy of working needed for a multi-facet programme of the kind contemplated. When large area of forests have to be changed into man-made forests, various marketing problems of clearfelled timber will arise which will require quick decisions for getting best values. Further investments for getting better values may have to be sanctioned quickly so that the operation may get the maximum economic return to the project. All these operations under a departmental approach would be almost an impossibility. A Corporation can so streamline its working that quick decisions can be taken on all these commercial aspects without much loss of time. The only constraint is normal availability of finances in time. The capacity of the Corporations to get finances from the institutions has been explained in Section V. A forward looking Board in these Corporations should be able to organise their finances well ahead so as to meet all such contingencies.

Staffing

8.4 These Forest Corporations will have to be manned by very competent technical personnel who have expertise in forestry and related timber management marketing and industries. As forestry will be the base for all expertise, it will be but proper that Forest Department personnel are suitably selected and trained in various fields of expertise required for these operations. This selection and subsequent training should be started immedi-

ately in order to enable them to execute the massive programmes.

Coordination between Forest Department and State Corporation

8.5 There will be many fields where the Forest Corporation and the Department of Forestry in the State will have to work closely together both in the interest of the State and in the interest of the Corporation. Separate cadres of the Corporation and the Department may create a lot of friction. Further, departmental officers would benefit a lot in their other work if they have a sound training in commercial forestry at first hand. For these reasons, we are of the view that the personnel of the Forest Corporation should normally be on tenure deputation from the Department of Forestry and the cadre of the Forest Department should carry sufficient deputation reserve for this purpose. It is also desirable that the Department of Forestry is fully represented on the Board of the Corporation.

Activities of Corporation

8.6 The activities of these Corporations will be as under :—

- (a) to bring hitherto inaccessible forests in the State into production by proper investment on roads and machineries;
- (b) to plant, grow, cultivate, produce and raise plantation of selected species to meet the requirements of the State for pulpwood, industrial timber and constructional timber geared to the needs of the State and the country;
- (c) to promote forest industries to utilise the wood released as a result of intensified felling programme and utilisation of subsequent planted material; and
- (d) to promote companies, firms, establishments, concerns or undertakings for the purpose of development of industries based on forest produce and to assist and finance any individual or company with capital and credit resources.

Priorities

8.7 Within the framework of the main objective, there could be many more ancillary objectives particularly export of forest material, finished and unfinished. While forming the Corporation in each State the detailed objectives could be laid down. the

requirements foreseen during the '70s. and '80s of this century require clearfelling and plantation of only a fraction of the forest areas which can be usefully transformed into man-made forests. Only after export demands pick up and our industrialisation policy establishes the demand for paper and paper products, we may be in a position to take up a more aggressive change-over programme. As there has to be selectivity in choice of areas during the '70s and '80s for clearfelling it is only proper that we should so select the areas that the programme can be put through without financial restrictions and also substantially benefit forestry. Looked at from this angle, obviously the first priority should be given to the areas of hitherto unexploited forests which are already deteriorating with overgrowth. The second priority would have to be the areas of mixed forests of high and low value which can have still better growth if clearfelled and planted with good varieties of timber species. It would not be in the interest of the programme to clutter up in the first round with those areas of poor lands with very little growth where even with the best of efforts the growth potential would be limited.

8.8 We have worked out two models in this Report for the economics of the man-made forest programme. We have referred to these models earlier in Section VI. Appendix VI is a model for 45,000 hectares of inaccessible forest. Appendix VIII is a model for mixed quality forest area to be clearfelled and planted with various pure species. The models have suggested the choice of certain varieties of timber for the plantation programme and also indicate possible proportions in the total plantations. The choice of the variety, its percentage and the choice of the overall programme will obviously depend upon the local condition and adjustments will have to be made in the detailed plans. The model is only indicative of the possible economics of the plantation programme and possible returns of certain varieties of timber.

Type of Loan Financing

8.9 Before we can settle on the type of institution which can give the loan fund for the programme, let us see the type of loan financing that is required. There are three types of investments required and each has its own loan requirements and phasing.

(a) *Inaccessible Forests* :—The yield from clearfelling and the loan requirements have been estimated in Statement 6.3 of Appendix VI. The disbursement and payment schedule has been given in Statement 6.4. From the fourth year the interest

will be paid and from the fourteenth year the instalment of capital will also be paid. The entire amount will be discharged in the twentysecond year. This programme is for exploitation and plantation only.

(b) *Mixed Quality Forest Programme* :—The yield from lease rent and clearfelling and the loan requirement and its phasing have been estimated in detail in Statement 8.9 of Appendix VIII. The surplus revenue that will accrue from the pulpwood plantation from the tenth year and the thinning and timber exploitation in the pine and teak forests have been analysed in Statement 8.10 of this Appendix. The disbursement and payment scheme in Statement 8.11 of the Appendix gives the phasing of repayment. The proposal is to accumulate the interest and loan for the first ten years and start repayment from the eleventh year onwards in instalments. The whole loan can be repaid by the twenty-ninth year. This leaves a surplus ranging from Rs.1.1 crores to Rs.3.3 crores from the eleventh to the twenty-eighth year for payment of additional royalty to the Government and for other investments in the Corporation. In case the financing institution wants that interest on loan should be repaid after a short moratorium only, it is possible to pay interest also from the third or fourth year from the clearfelling revenue, but to this extent the loan instalments will have to be increased. This is only a question of adjustment of heads. Real repayment will start only from the tenth year.

(c) *Industrial Development and Plantation Programme based on Inaccessible Forests* :—The implications of this programme have been spelt out in Appendix VII. The loan requirements for the initial years and the phasing will be the same as in the model for inaccessible forests in Appendix VI. Interest will be paid from the fourth year onwards. The plantation account is surplus throughout. This is a simple loan programme for plantation development. The industrial loan requires industrial financing, the requirements and phasing of which also have been worked out in Appendix VII.

Agricultural Refinance Corporation as the Lending Agency

8.10 The plantation operations as detailed in our models will require long-term credit with interest payments to start from the fourth year only and the repayment of the loan instalments will start from the tenth year onwards. The only institution now giving long-term agricultural credit of this order is the Agricultural Refinance Corporation but this institution has not so far given loans for periods exceeding 15 years or so. This matter

was discussed with the Chairman of the Agricultural Refinance Corporation. The Corporation will be willing to enter into longer term financing provided it is enabled to do so by its system of lending. This problem can probably be satisfactorily solved. The bigger problem is that the Refinance Corporation under the present terms of business can only refinance loans given by a commercial bank or a cooperative organisation. It cannot give a direct loan. As a result, the long-term financing becomes rather costly to the ultimate borrower. Forestry is a sector which cannot afford to pay high rates of interest. We have allowed a rate of 7 percent interest in our calculations. Any thing more than this will not be realistic. Unless the Agricultural Refinance Corporation is prepared to give a direct loan to the ultimate borrower, it will not be possible to give the loan at 7 percent to the Forest Corporation. This was also discussed with the Agricultural Refinance Corporation and the Department of Banking. There is move to change the terms of business of the Agricultural Refinance Corporation by amendment of the Statute to allow direct long-term financing also. If this is done, then the problem can be solved. In case this is not possible, we recommend that a Central Forest Credit Corporation should be organised to take up the responsibility for providing long-term finance for the plantation and development programme. In our view, the best solution will be to modify the Statute of the Agricultural Refinance Corporation as suggested and allow it to take up this business. During the Fifth Plan period the magnitude of plantation and development loan required will be of the order of Rs.173 crores.

Industrial Lending Institutions for Forest Industries

8.11 The investment required for the supporting industries will be of the order of Rs. 815 crores for the seven year period starting from 1974 and ending with 1980. In the '80s it will be Rs.1187 crores. If the export programme develops, more funds will be required. The industrial programme based on forest raw material may be financed through long-term industrial lending institutions like the Industrial Development Bank of India, Industrial Credit and Investment Corporation of India and the Industrial Finance Corporation of India. The State sector programmes for the paper and pulp projects in the Fifth Plan may be of the order of Rs.160 to Rs.340 crores. If this investment is not made, the calculations made by Prof. Gregory show that by 1980 we shall be importing paper and paper products of a value of Rs.149 crores with hard earned foreign exchange.

SECTION IX

PLANTATION STRATEGY AND SELECTION OF SPECIES

9.1 The future plantation strategy will involve replacement of the existing growth by species yielding higher economic return in both volume and value.

9.2 In the inaccessible hardwood forests the present mature and overmature growth would come for conversion under the scheme and the area would be required to be planted up with species of higher potentiality in growth and production keeping in view the specific requirement of consuming industries. Elsewhere, the low valued present forest crop that is of mixed composition with low percentage of economically valuable species would come up for conversion through which, the uncontrolled mixture in composition, producing assorted timber at harvest, will be replaced by tired and pre-selected species of higher rate of growth and better use in the industries. The composition of the crop to be raised and mixture to be adopted will require proper planning and thorough study of their growth rates under improved techniques. The massive programme of conversion and creation of man-made forests will require careful selection of the species to be raised, the mixture to be followed and estimation of production.

9.3 In the Models in Appendices VI and VIII indications have been given about the species to be raised for making a unit area economically viable. The main point for consideration is that proper selection of species will be very important to make the massive plantation programme a success. While present knowledge and behaviour of certain species are likely to influence selection, it has primarily to be matched with the requirement of the industries which would consume the existing growth and are expected to increase both in efficiency and capacity during the period for the second rotation crop to mature.

End-use orientation

9.4 As forestry deals with long-term crop and the behaviour of markets in future being not amenable to reliable forecasting,

a knowledge of end use for wood-based industries is necessary for proper planning. While different species may be primarily earmarked for different consuming industries, selection of some species with multiple demand would be an important consideration. It may be safe to plan production of pulpwood, for instance, for the domestic market but additional production for international market should preferably come from species which have got other utilities to fall back upon, in case the pulp and paper market does not grow to the present expectation.

9.5 The production during conversion period per hectare, for instance, of the model in Appendix VI of 45,000 hectares is 100 m³ of timber and 300m³ of firewood. The model works on a clear-felling rate of 1500 hectares per annum, thus producing 1,50,000m³ of timber and 3,00,000m³ of pulpwood. As it is planned to complete conversion of the model area in 30 year's time, we have to project requirement of raw material during that conversion period and beyond. In the projection of demand for 1990, an increase of 153% of pulpwood has been forecast. During the corresponding period, the demand for ply, sawn and matchwood is anticipated to register a rise of about 50%. Anticipating near self-sufficiency in that year, it would be safe to assume a subsequent growth rate of 5% per annum. Thus, when projected to the model area, production requirement would work out to 6,75,000-7,00,000m³ of pulpwood required from the same area during rotation after conversion. Similar growth rate may safely be assumed in demands for other products, but a faster growth rate in fibre and particle board industry to substitute solid timber and corrugated papers and moulds as substitutes for packaging materials are likely to keep the demand for large sized timber to about 2,25,000-3,00,000m³ from the area. While planning for afforestation, each State should carry out such exercises and evolve its own strategy with regard to the proportion of species and areas to be devoted to different kinds of produce, keeping in view national requirements. The exercise in Appendix VI has considered growing of pine both for pulpwood and sawn timber.

9.6 Paper and pulp industry is the most important industry based on forest raw materials. The future growth of demand for wood will also be from packaging industry. Packaging paper and moulds require high percentage of long fibre in the pulp to give the necessary strength to the material. In the Himalayan belt the problem is largely solved because the existing crop is of pine, fir and spruce which are of long fibre. In the rest of India

where we depend on bamboo for the long fibre we have to introduce long fibre timber very soon so as to meet the future demand. Necessarily, in the choice of species, conifers of desired qualities will have preference. Trial with exotic tropical pines still continues but in the meantime a few of the species have shown considerable promise. The following coniferous species may prove to be of immense value in future plantation programme in some regions.

Species Selection

9.7 *Cryptomeria japonica*. The suitability of this species as a pulpwood has already been studied and recommended by the Forest Research Institute. It has also a good demand as a saw log and can be retained for longer period, if necessary to overcome uncertain market conditions. In the Eastern Himalayas it produces 740 m³ of pulpwood per hectare on a 30-year rotation. If kept on a 60-year rotation, the total production at final felling works out to 1285 m³ per hectare of which 55% will be small wood and balance saw logs. Extended plantation of this species in altitudinal zones between 1850—2150 metres may prove quite rewarding in suitable areas.

9.8 *Cupressus cashmiriana*. This species has shown encouraging possibilities in the Kalimpong Hills of the Eastern Himalayas where a production of 750m³ of pulpwood per hectare at a 30-year rotation is reasonably expected. The species does not have versatility in demand but it is a denser white wood, the research report on its pulping quality being very encouraging. The ink absorbency of paper from this wood is comparable with the best imported newsprint and the colour of the paper compares favourably with an identical shade of paper used regularly by the Financial Times of London. The plantation of this species on extended scale may prove to be of advantage in suitable regions between the altitude of 1550—2150 metres.

9.9 *Tropical pines*. Tropical pines have been experimented with and seem to be a promising source of long fibre in several parts of India. The potential of quick growing species of tropical pines for the newsprint industry and also as an excellent sawnwood material has been established in many countries such as Chile, South Africa and Southern States of United States, Australia and Newzealand. Some parts of India are favourably placed with regard to the potentialities of quick growing pines. Although some of the Asian countries like Indonesia, Taiwan and South Korea have taken advantage of their natural climatic conditions to grow pine plantations, efforts in India have not been made to

extend plantation of tropical pines. The problem is one of selecting right species and getting the seeds for plantation. In our model in Appendix VIII we have suggested 4,000 hectares of pine in every 20,000 hectares unit for plantation on the assumption that pines could be grown in such areas. The initial plantation can start with species which have been tested and the species which may show better promise in the various silvicultural experiments going on all over the country may be introduced later. These experiments must be vigorously pursued.

9.10 Preliminary trials with tropical pines in various States have shown encouraging results. Of the species so far tried, the following have shown promise in the States mentioned below :—

States	Species
Andhra Pradesh	<i>P. caribaea</i> <i>P. khasya</i>
Himachal Pradesh	<i>P. patula</i> <i>P. massoniana</i>
Kerala	<i>P. caribaea</i> <i>P. elliottii</i> <i>P. insularis</i>
Orissa	<i>P. caribaea</i>
Tamil Nadu	<i>P. patula</i> <i>P. elliottii</i>
Uttar Pradesh	<i>P. patula</i> in hills <i>P. caribaea</i>
West Bengal	<i>P. patula</i> in hills

9.11 The main drawback in the extended plantation of tropical pines so far has been the lack of seeds. This constraint can be overcome with the active help of some international agency and concerted efforts can be made to raise plantation. It may also be necessary to provide adequate foreign exchange for procurement of tropical pine seeds.

9.12 *Bamboo*. Bamboo is a poor yielder of revenue for the forester. To get the best value out of the forest area, probably bamboo will have to go out of the plantation programme in several areas. As we have already pointed out, a realistic approach is necessary in this matter because bamboo has long fibre and is found in most parts of the country. Till we can introduce long fibre wood in the various regions of the country which will reduce the pressure on bamboo, we have to continue bamboo production and also plan the increase in bamboo area. We have also to take into consideration the expanding rural demand

for bamboo for various uses. In our model in Appendix VIII we have suggested a plantation of 2,000 hectares out of every 20,000 hectare units for bamboo plantation. This probably will have to be adjusted taking into account the present pattern of demand in the area and the future plan for industrialisation. As pure stands of bamboo may not be remunerative, we have also to take advantage of all established patterns of mixed forestry where bamboo can be one out of many species that can be accepted in the mixture without detriment to other stands. In this context, a closer study is necessary of the practice of establishing a teak-bamboo mixture and also introduction of bamboo as an understorey in an established plantation.

9.13 *Other Hardwood Species.* The production of short fibred pulpwood or pulpwood from the plains would require selection of species from amongst hardwoods. The States may utilise their own knowledge as they have already sufficient information on the growth and performance of several pulpwood species. Some of the species which may find a place in the plantation programme of some of the States are :

Lagerstroemia flos-reginae producing about 350m³/ha of pulpwood on 30-year rotation;

Gnelina arborea producing about 3000m³/ha of pulpwood on 30-year rotation;

Ailanthus grandis producing about 500m³/ha pulpwood at 30-year rotation; and

Acacia auriculiformis producing about 130m³/ha of pulpwood at 20-year rotation.

Proportion of Planting Area

9.14 Each State has to evolve its own formula for long fibre and short fibre plantation proportion in every 20,000 hectares block as recommended in Appendix VIII. Our model has suggested 8,000 hectares for short fibre pulpwood and 4,000 hectares for long fibre pulpwood. Local adjustments in these areas may be necessary.

9.15 *Eucalyptus* . In the case of shortfibre pulpwood *Eucalyptus* will have a particular value as a plantation genus because of its capacity to grow under various conditions. The seed procurement may not be a problem. The questions of provenance, proper spacing and application of fertiliser are of importance for future success. The present performance of *Eucalyptus*

plantation should not be taken as an index of potentiality of these species. Information on *Eucalyptus* plantation is becoming available in massive quantities but much of this is scattered through diverse publications. There is immediate need to collect this material. It is however quite clear that future work can be organised in two main directions as far as the species are concerned. Firstly, a relatively small number of species should be encouraged which would provide suitable material in areas where planting is desired and secondly, species should be selected for more specialised sites. In this case of species which can be most commonly used and there is likelihood of their satisfactory performance are given as follows :

Eucalyptus teriticornis, *Eucalyptus grandis*,
Eucalyptus gomphocephala, *Eucalyptus deglupta*,
Eucalyptus occidentalis.

9.16 So far in India two species of *Eucalyptus* have shown promise on large scale, namely, *Eucalyptus grandis* in Kerala and *Eucalyptus teriticornis* in Mysore and Uttar Pradesh. Recently *Eucalyptus grandis* in Kerala has been attacked by a fungus. These are hazards of plantation forestry which must be overcome by adequate research and control measures.

9.17 *Poplars*. Potentialities of the genus *populus* may be kept in view when planning for afforestation although its area of cultivation may be restricted. *Poplars* can be grown both inside and outside the forest and will be valued in the future for the extensive range of products that it will yield. *Poplar* plantation will offer in future a number of outstanding advantages, as a plantation investment alternative. Pulpwood can be raised on short rotation and veneer and matchwood logs can be grown on rotation of 20-25 years. In both volume and value growth per hectare *poplar* may outnumber many a hardwood.

9.18 *Poplar* can be grown in sub-mountain regions of India under irrigation with cultivation of food and cash crops during the period of irrigation. The fast rate of growth of *poplar* and the additional advantage of growing agricultural crops for a longer period as an inter-crop makes this investment proposition more lucrative. Current knowledge on growth and yield of *poplar* in India is not sufficient to enable the investors to plant it with considerable assurance. Extended and systematic plantations of these species have been taken only recently on a filed scale and that is why knowledge is lacking. Several
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clones of *populus deltoides* are being tried in the field and are showing considerable promise.

9.19 *Hardwood timber.* The existing growth in the forest is already rich in a variety of saw, ply and furniture timber, the supply of any of these species being generally not in commercial quantity. While sal continues to be the mainstay of saw logs in the Northern India, teak has come in for large scale plantation everywhere and must be a predominant species of choice in man-made forest. In our model in Appendix VIII we have suggested that 6,000 hectares out of every 20,000 hectares unit may be grown with teak. In Maharashtra a teak-bamboo mixture is being established by introducing bamboo in the teak plantation. In areas like Western Mysore where both teak and bamboo grow luxuriantly, introduction of bamboo may have to be delayed so as to avoid the danger of suppression of teak by bamboo. Every area has to evolve its own timings of bamboo introduction. In some States sissoo or some other long rotation crop may be planted instead of teak, the rotation being fixed on financial and market criteria. In specific cases, each State must utilise its experience and knowledge of species and techniques.

9.20 For facility of working, the demands of all the industries requiring large sized logs should be clubbed together for production under one area of felling. In other words, species to produce veneer logs should preferably be grown in mixture with the species of producing lumber. In the hills, a monoculture is not looked upon favourably as detailed protective actions do not match such activities. Here again, mixture may be the solution.

9.21 Intensive research must continue not only to identify the species for each Zone but also to develop the technique for a faster rate of production. As the harvest from the existing coppice growth is in principle not tied to any industry, planning for development of industries on the basis of second rotation crop would be necessary.

9.22 If monoculture affects the ecology, a rotation of broad-leaved species could alternate with conifers. But where logs are required to be produced, the plantation could be mixed with such of the conifers that would go in thinnings, leaving the rest to grow to large dimensioned trees. In such areas, it becomes necessary to carefully select the species to be grown in mixture and amongst the factors that will influence selection, rate of height growth, behaviour of the crown and production at harvest, are important ones.

9.23 In the plains, the mixture of matchwood species would take a different pattern since such species normally cannot be profitably grown in pure plantations and the normal rotation is much shorter than the species grown for other purposes. A pattern has been evolved to plant *semal* in all plantations in the plains at a spacing of 16 metre X 16 metre, giving about 40 trees per hectare at the time of planting. Though the main crop would be managed at 60 years' rotation, *semal* may be completely harvested much earlier. In any case, the species will constitute 1.5% of the crop and would yield 63m³ per hectare at final felling.

9.24 Of the number of species that have made a mark in the veneer industry, *teak*, *Michelia champaka*, *Schima wallichii* *Dipterocarpus* and *Terminalias* are important. *Teak*, *Champ* and *kchima* have comparable height growth, standing between 37-40 metres at 60 years of age. The latter two species have restricted crown development and as such, in a mixture, rarely interfere with *teak*.

Rotation

92.5 Establishment of plantation forest requires investment of capital for long periods. So the decision on rotation should be taken on the basis of economic criteria. One of the main difficulties in determining optimum rotation would be lack of accurate data on costs and reliable price gradients for the products. We feel that if rotations are based on economic criteria there will be considerable scope in reducing both pulpwood and timber crop rotations and the future change in technology will encourage such shortening of rotations. Mechanised felling including uprooting of stumps creates facilities for inter-cropping between lines of planting for production of agricultural and horticultural crops. The effect of such cultivation has been studied on the planted species which show a higher rate of growth. If such practices are followed in areas devoted to production of large dimensioned timber, there is a good prospect of bringing down the rotation of timber crop from 60 years now forecast in our model in Appendix VIII.

9.26 While devoting areas to pulpwood or timber production in areas taken up for conversion, rotation will be influenced by various factors, the chief being the future demand of the industries and the likely yield that will be obtained from the areas. In our model given in Appendix VIII, we have shown that in an annual area of 20,000 hectares, the areas devoted to pulpwood

production and sawn timber should be in the following proportion :

Eucalyptus 8000 hectares ;

Bamboos 2000 hectares ;

Pines both for pulpwood and timber 4000 hectares, and
Teak 6000 hectares for Timber.

We have also indicated that the rotation for *Eucalyptus* should be 10 years and that of pine 30 years and that of teak 60 years. The expected yields from such plantations have also been given. The rotations have been determined on economic criteria. If these yields are taken and the requirements of the industries are known, each State can work its own strategy of earmarking its plantation areas with either to pulpwood or timber including matchwood and plywood.

9.27 We have suggested various combinations in our models given in the Appendices. We feel each State should evolve its own strategy in the future keeping in view the national requirement



SECTION X

RATIONAL PRICING OF TIMBER IN FUTURE

10.1 The poor contribution of forestry so far to our economic growth was due not only to the strategy of conservation forestry, but also to a much deeper malaise. Forests have been looked upon as a source of exploitation without a realisation of the need for investment. Most of the valuable forests are owned by the State. There are a lot of subsidised supplies of timber and forest materials to the rural population. From this an attitude has developed that forest material can be given to others without going too much into the economics of production. In fact, production economics has not received much detailed attention. As a result of all these attitudes in the name of encouragement of industries, forest materials have been leased out for long periods at very nominal rates of royalty. It will not be an exaggeration to say that the present supply of forest materials to forest based industries is heavily subsidised. If the forests are bled both by the rural sector and by the industrial sector, there will be no incentive or initiative left to change-over from the present low-cost low-yield forestry to a commercial high investment economic forestry development.

Pricing of Timber and Pulpwood

10.2 Barring timber which has a large market of individual consumers, the bulk of the forest materials not bound with village rights will be used by the major forest industries like paper and pulp makers and plywood and board makers and as fuelwood requirements of semi-urban and urban-consumers. Pulpwood and fuelwood have to bear a reasonable price if the industry or the consumer is to get the material at the consuming end at a price which is reasonable for the benefit accrued. The forests can cost both pulpwood and fuelwood as a by-product (provided what is marketed is a by-product) and not a plantation specifically to supply a particular type and quality of raw material to an industry or a fuel consumer. The limitation of by-product supply is that firstly, it cannot be an assured supply and secondly, it has to be taken at the place where the forest is being exploited for the main product, viz., timber. This may add a long transport charge to

the end consumer. On the other hand, a plantation approach cannot be sustained on subsidies for any length of time and pricing has to be on the cost of the material with a reasonable profit. The advantage of the plantation approach is that firstly, it can assure a supply of raw material and secondly, the plantation can be located at distances reasonably close to the industry so as to reduce the cost of material at the site of the industry. The difficulty comes in where the industries seek to obtain plantation material at by-product rates. The problem has to be tackled from the angle as to what the raw material can bear at the factory end. If the forester can plan his plantations and supply the material at that rate and make the plantation an economic proposition, then and then only there can be a change-over from the forestry practices of today to a man-made forest programme.

10.3 It is felt that paper and pulp industry of the magnitude that we are contemplating cannot be run on a by-product forest material programme for any length of time. In the Pre-Investment Survey of the Bastar forests, it has been suggested that the paper and pulp industry should be first located on the basis of the mixed hardwood rejects that will be obtained by clear-felling of a certain area round about the factory. The clearfelled areas are to be planted with suitable trees which will give uniform pulpwood in future for the industry. Without such uniformity of raw materials, the quality of the paper and pulp will suffer and the cost of production will be high. Uniform pulpwood reduces production cost at the factory and thereby there is scope for the industry to pay a higher price at factory site for uniformity of raw material as against what it can pay for mixed material without a quality guarantee. The main problem as we see it, is the rational pricing policy in the future, of bamboo and pulpwood which are the two main raw materials required for paper and pulp making.

10.4 Our paper and pulp industry is dependent on bamboo for supply of long fibre material to give strength to the paper manufactured out of the pulp. Till very recently our paper industry used mostly bamboo as the raw material for pulp. When existing bamboo resources within an economic distance of the factory started getting thin, it was decided to include hardwood pulp in the mixture. For starting the paper industry in the country the factories were given very favourable royalty rates for the bamboo. The rates paid by some factories even today are of the order of Rs. 3.90 per tonne of bamboo pulp which is equivalent to about Rs. 1.50 per tonne of dry bamboo in

the forest. These leases are for long periods with right of renewal with only marginal rise in the royalty. Our calculations suggest that the existing price per tonne of dry bamboo will not be an economic proposition today in case bamboo is desired to be grown as a plantation crop.

10.5 Bamboo has other more valuable uses in our economy. The rural population require a lot of bamboo for their hut construction, fencing, agricultural supports, etc. Bamboo fetches as much as Rs. 200 per tonne in areas close to good rural markets. The forester may be tempted to argue that he is supporting the industry at fantastically low prices for his bamboo when he can get a very high and profitable price in the open market. To allow the forester to pick and choose his market for the bamboo will affect our important pulp and paper industry. We have to strike a mean. Organised bamboo plantations must be used partly for supply to the industries and partly for supply to the rural population at open market prices. The proportion will have to depend on the industrial growth and the capacity of the forester to expand his plantations. On the other hand, for the supply to the industry, the forester must be guaranteed a remunerative price which will pay for the cost and leave a profit.

10.6 The paper industries are now paying about Rs. 130 per tonne as landed cost of bamboo at the factory. If the transport cost is reduced, the industry should not grumble at giving the forester his fair share for the bamboo. If plantations are within a reasonable distance from the factory and the exploitation and transport charges are thereby kept low, higher royalty can certainly be paid to the forester without any detriment to the industry. Where factories found their captive bamboo stocks not sufficient, they have paid quite high prices to the Forest Department for bamboo supplies from non-lease areas or the open market. It should be possible for both the forester and the factory to take a reasonable view in this matter and plan the programme of man-made forests to make it profitable venture. Our assessment is that the price of Rs. 80 per tonne we have specified in our exercise is a reasonable price and is certainly not the maximum the factories can afford to pay on a planned development programme.

Pricing of Plantation Pulpwood

10.7 Large scale plantations of quick growing species of Eucalyptus were started and pursued in the country to give pulp wood for our paper industry. Prices fixed for the pulp wood to the industries was also low and many a time had no direct

relation to investment cost. Experience has shown that the yields expected have not been realised in many areas and if the plantation programme is to continue, estimation of yield has to be realistic on the basis of the accumulated experience. Past experience has shown that a man-made forest requires not only a fair investment in the plantation but also a recurring expenditure on maintenance in the plantation, without which the plantation may not yield the best results. In the past, our investments have not always followed this principle. Secondly, the choice of the pulpwood will have to be made on the nature of the terrain and climate and one answer for the whole of India may not be the best answer. In our exercise in Statement 8.10 of Appendix VIII we have estimated that a pulpwood plantation should yield 10m³ per hectare per annum of 100m³ at the end of 10 years. The price of the standing timber should not be less than Rs. 30 per m³ to the industry. Both are possible by proper selection of the species and following the correct silvicultural practices. As a rough guide at present, pulpwood yielding 40% pulp can stand a price of Rs. 120 per tonne at the factory site.

10.8 Pricing is also related to the full utilisation of the forest material which is harvested. Industries like plywood industry and the match factories can utilise only the roundwood portion of the tree above a certain girth leaving the rest of the tree as waste unless another user can be found. A method has been developed to charge the balance also at a nominal price to the industry in order to force the industry to find the user for such material. This method does not always result in the material being utilised or getting the best value. Exploitation of such forests with a mixed demand by the Forest Corporation and distribution of the harvest to the forest industries at a suitable price will solve both the problem of pricing and full rational utilisation.

SECTION XI

EMPLOYMENT IN PRODUCTION FORESTRY PROGRAMME

11.1 In order to bring about a multi-dimensional transformation of the Indian society, self-sufficiency in production is as important as concerted efforts to ease acute unemployment situation. In our economy, the weaker sections of the people are in the rural areas where the number of under-employed and unemployed is sizeable. With the spread of education in this sector as well as in the urban areas, the unemployment amongst semi-educated is also becoming acute. Forests being located generally in backward areas, direct employment in their activities would mainly go to the rural sector. Many of the activities of forests could be performed in a semi-mechanised way thereby creating possibilities of employment for semi-educated persons with a higher wage earning possibility. Such employment in the primary sector would provide an additional benefit in drawing out the semi-educated unemployed from the urban areas. This consideration would be of great importance in some States, as for instance in West Bengal, where, according to the 1961 Census, the number of educated unemployed was found to be two and a half times that of uneducated unemployed.

11.2 The undeveloped forests in the hills provide little employment at present. In the programme recommended in Appendix VI clearfelling and planting of 45,000 hectares would create a sizeable employment opportunity in the area, thereby benefitting the region doubly through increased production of consumable material and increased direct employment in forestry work with additional possibilities in transport, industries and services sectors.

11.3 A 1500 hectares felling plan per year, according to the model in Appendix VI, would generate direct employment of 900,000 man-days in felling and harvesting of the produce now growing. As the felled areas have to be replanted immediately, the employment in nursery work, plantation and maintenance would be an additional 375,000 man-days. Thus, a total direct employment of 1,275,000 man-days would be created when the

programme suggested in Appendix VI is undertaken. Semi-mechanisation would improve the economics of operation and wage earnings of the employed but might reduce the man-days by 25 percent or so. The magnitude of this employment may vary from area to area but it demonstrates the potentiality of direct employment in an area if clearfelling and planting programme in the accessible forests as suggested is undertaken.

11.4 In transport and handling as well as in the industries processing the raw material and additional employment of 775,000 man-days would be created. This we consider as a modest estimate and it does not include employment in the ancillary sectors. This employment is likely to rise significantly at the end of the conversion period, as the expansion of the industries is reckoned to consume nearly three times the raw material on the basis of which the present employment has been estimated.

11.5 In the hills, improvement of communications and development of other infrastructure would be essential to implement the massive programme. In this development, road building programme would be an important part. For intensive working in the pattern suggested, 1 km of road per square Km of forests is considered to be a modest ratio. On this basis about 15 Kms of road will have to be built per year for the model in Appendix VI of 45,000 hectares of undeveloped forests. In this road making programme, further employment of 200,000 man-days would be created.

1.6 In the mixed quality forests as well as in valuable forest stands as given in Appendix VIII, the programme would also generate sizeable additional employment possibilities, the quantum of which would depend on the extent of working at present. The local conditions would influence whether this employment should be primarily for the uneducated unskilled labour or for semi-educated and partly skilled ones. For a model of 200,000 hectares with an annual felling of 20,000 hectares, it is estimated that 6,600,000 man-days of employment per-year will be created through a programme of man-made forests using entirely manual labour at the basic wage rate for off-season principally. For the same programme 2,920,000 man-days of employment per year would be created if semi-mechanisation is adopted but this employment would go to a large extent to the semi-educated with a wage rate round about Rs. 7 per day.

11.7 Employment in the secondary and tertiary sectors under this programme would be more or less in the same proportion as in the case of the other model. If the production

from the present growth is not tied to new industrial units, this employment will be created after the conversion period.

11.8 In Section IV we have suggested that in order to meet the country's requirements of timber and pulpwood between 1974 and 1980 a total area of 7.26 lakh hectares should be clearfelled and planted in the inaccessible hardwood forests and the mixed forests of valuable and low quality stands besides stepping up production in the coniferous forests by infrastructure development.

Future Employment

11.9 Since the programme may not start till 1974 the annual clearfelling and planting areas in these two categories of forests are likely to be about 14,300 and 90,000 hectares respectively. Based on the calculations made in paragraph 11.3 and 11.6, clearfelling and planting of this magnitude will generate direct employment of 44 million man-days annually.

11.10 To this, if we add about 6 million man-days employment that we think will be created by stepping up production of coniferous wood from the northern Himalayan forests, the total annual direct employment in the forests alone, according to our modest estimate, will be 50 million man-days or 2,50,000 additional man-years (worked out on the basis of 200 working days in a year). The employment will be provided in felling and harvesting, nursery and plantation work and maintenance besides employment in road construction. This will increase further in the next decade. This strengthens our view point that the programme of clearfelling that we have suggested will benefit the country doubly through increased production of present and future consumable material and increased direct employment in forestry work for the weaker sections of the people.

11.11 The additional employment generated in the industries sector has not been determined by us. But as suggested in para 11.4, if the industrial employment as worked out for the model is translated for the inaccessible areas of the country as a whole, the total employment in the industrial sector is likely to be about 7 million man-days for this restricted area alone.

11.12 The massive labour requirement in the programme suggested will mean organising, raising and training of labour force of a sizeable magnitude and the States must start thinking in this direction, if they want to take up the programme in right earnest. Wherever possible, employment may be provided to students during summer holidays for specialised work of short duration.

SECTION XII

ORGANISATION AND TRAINING

12.1 The programme that the Commission has recommended to the States in the previous sections requires, during the seven years starting from 1974, an average annual investment of about Rs. 34 crores in clearfelling, plantation and maintenance. The programme also requires during the same period of seven years an industrial investment of Rs. 815 crores in supporting forest based industries out of which at least Rs. 611 crores will have to be directly invested by the States in paper and pulp factories in the public sector. Considering that during the Fourth Five-Year Plan the States would have reached a level of Rs. 8 crores only in annual investments in plantation, the plantation programme suggested by us will require special organisation and efforts to be successful. We have already explained the need for an institutional approach in the matter. This is a new approach to most States and will have to be appreciated. States have not so far directly invested in forest based industries except to a very marginal extent in saw mills and wood treatment plants. A direct investment of Rs. 160 to Rs. 340 crores in pulp and paper factories which are the most sophisticated type of forest based industries, will require a new expertise and tremendous organisation.

Planning and Project Analysis and Estimation Cell in the State

12.2 We have indicated the broad priorities for clearfelling and exploitation of inaccessible areas and we have also emphasised the need for linking this up with a suitable industrial programme for full utilisation of the exploited forest material. In each State, the details of location of the areas that will be taken up in the programmes and the annual felling and exploitation and plantation series will have to be worked out. The area attached to the industrial complex is to be completely exploited in 30 years' time and replaced with suitable man-made forests. Detailed project estimates for the type of raw material that will be thrown up by the above felling and exploitation programmes and new plantation yields will have to be made so that the industries to be organised for utilising the materials can be suitably planned.

In each State, which has to take part in the programme, there is therefore, an immediate need to create a Planning & Project Analysis and Estimation Cell and a Project Leader appointed. The Cell will work out all the details before the end of June 1973 so that the programme of exploitation can start from the beginning of 1974. The Project Leader will select his team mates for the Cell and be ultimately in-charge of the Forest Corporation.

Function of Project Leader

12.3 While the Planning and Project Analysis and Estimation Cell is proceeding with its work, the Leader should also work out the structure of the Corporation and the requirements of the staff at various levels and take steps for the formation of the Corporation and getting the staff in position in time to enable the programme to start at the beginning of 1974. The financial expert of the Corporation should be brought into the working from the beginning itself so that he is quite familiar with the objectives and difficulties.

12.4 The financial support for the plantation programme has to be obtained. The leader of the team, helped by the Chief Conservator of Forests, should take this up and get the details worked out in time so that the State authorities can finalise the credit arrangement with the Agricultural Refinance Corporation in time for the programme to start at the beginning of 1974.

Training of Selected Personnel

12.5 The selected personnel may have to be given suitable training in project analysis and formulation to fit them into the new role in the Corporation. The training programmes for all the staff should be suitably phased and the work organised.

Strengthening of Existing Forest Utilisation Cell in the States

12.6 Once the Planning and Project Analysis and Estimation Cell has worked out the programme of exploitation and the type of raw material and the quantities that can be expected annually during the 30-years cycle, steps will have to be taken to plan and develop the supporting industrial complex. The Royal Commission on Agriculture (1928) had recommended the location of a suitable Forest Utilisation Cell in the Chief Conservator of Forests' Office to enable forward planning and utilisation of forest materials and also to help the planning of conservation and exploitation programmes. Though there are Forest Utilisation Cells in many of the States, this is a very rudimentary

organisation. We recommend that a strong Forest Utilisation Cell should be immediately developed under the Chief Conservator of Forests which would take up the work of planning the industrial complex to support this special programme on a priority basis. The Forest Utilisation Cell would also be working out the export promotion aspects of forest products for the State as a whole and for the Forest Corporation. Having planned the industrial complex, the Forest Utilisation Cell should take steps to ascertain private sector investment in the industries and also liaise with the Central Government authorities to try and avail of the Central programme for paper and pulp development to help the State exploitation, if possible. To the extent private sector investment or Central participation is not forthcoming, the Cell should pass on to the Chief Conservator of Forests and the Project Leader, the type and size of the industries that the State will have to put up to support this programme.

Industrial Cell for Pulp and Paper Industries in the Public Sector

12.7 When the State enterprises include sophisticated industries like paper and pulp, a strong Industrial Cell should be created under an able leader to prepare detailed project feasibility reports. The leader will be the technical expert who will be in-charge of the industrial complex under the Corporation or its subsidiary. He should be supported with the required experts in finance, economics and technology to enable them to handle the job efficiently. Where necessary, suitable consultancy services including the services of Central experts should be sought. The team should work to the time-frame so as to get the industrial complex started according to the requirements of the special programme and the availability of the finances for the scheme.

Planning Cell in the Central Agriculture Ministry

12.8 Under the division of labour between the States and the Centre under our Constitution, industry is a Central responsibility. The financing of the special schemes of plantation and industries will have to come from the Agricultural Refinance Corporation, commercial banks and the industrial lending institutions like Industrial Development Bank of India, Industrial Finance Corporation and Industrial Credit & Investment Corporation of India. These are all controlled by Central legislation and Central Planning. The massive programme we have recommended cannot be put through smoothly at the State level without

constant support from the Central Ministry of Agriculture. The Forestry Division in the Union Ministry of Agriculture should be strengthened by a Planning Cell headed by an Additional Inspector General of forests for support to the States in the programme. This Cell should act as the trouble-shooter for the States with the Central Ministry for getting their problems solved with the Ministries of Industry, Finance, Banking etc. This Cell will also take the lead in export promotion of various forest materials and wood based products.

12.9 The Planning Cell, as we have envisaged as a trouble-shooter, will not be effective without a strong support at the Ministers' level. The programme suggested by us is new, massive and requires a lot of organisation, funds, equipment and expertise both indigenous and foreign. We, therefore, recommend that the Ministry of Agriculture should take up to the Economic Committee of the Cabinet, for quick decisions, such problems as may arise in the Cell for which an inter-departmental agreement satisfactory to the programme cannot be obtained by mutual consultations at that level.

12.10 Though the State Industrial Cells have the basic responsibility for formulating the detailed project reports for the forest based industries for the State to support the special programme, sophisticated industries like paper and pulp do not have large number of experts in the country. Each State as such cannot have a strong Industrial Cell to support their programmes. A Brains Trust of the top technical expertise in such industries may have to be formed by the Planning Cell in the Foreign Forestry Division at the Centre supported, if necessary, by indigenous and foreign consultancy to help the States in formulation of detailed project reports. This group will also be in a position to suggest quick programmes of applied research to the Forest Research Institute, Dehradun, for utilisation of various mixes in the programme of pulp and paper making so that the various mixtures we will be getting from the massive exploitation of existing conservation forestry in the various States can be best utilised.

Funding of the Cell during Fourth Plan

12.11 The normal budget of the Forest Departments in the States and the Plan budgets may not be in a position to provide any substantial funds for the creation of the Cells we have recommended in the State sector. The Planning Commission has

a special scheme for giving employment to technical personnel during the Fourth Plan period. The Commission would suggest that the employment scheme of the Planning Commission for technical persons in the Fourth Plan can be made use of in funding the Cells in the State sector as recommended in the Report. These Cells will be absorbed in the Forest Corporation and the State Forest Department during the Fifth Plan period. The difficulty is only during the Fourth Plan and this fits in very well with the objectives of the unemployment scheme. There is both continuous employment and only a temporary lack of finances in the State sector during the Fourth Plan.

12.12 In paragraph 3.12 and 9.21 we have drawn attention to the need for substantial research to support the man-made forest programme. We have also drawn attention to the need for quick research in various industrial problems that will arise in the utilisation of various types of pulp material in the paper and pulp industry. A strong research base which at present is non-existent will have to be created in the country both in the States and at the Centre to support this programme. The Commission is examining this subject in some detail and will deal with the subject in a subsequent Report. Meanwhile, the States and the Centre may examine in some detail the requirements of the man-made forest programme in the matter of supporting research.

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SECTION XIII

ACKNOWLEDGEMENTS

13.1 The Commission takes this opportunity to thank the individuals, institutions and officers of Central and State Governments for their valuable suggestions either in reply to questionnaire or during personal discussions. In particular, the Commission is grateful to the valuable assistance and contribution made by Sarvashri K.L. Lahiri and S. S. Buit, Chief Conservators of Forests, Governments of West Bengal and Maharashtra respectively. The Commission also wishes to thank Shri V. P. Agarwala, Senior Specialist, Planning Commission - Convenor of Study group on Forest Financing - for bringing to the notice of this Commission various viewpoints which were considered while formulating some of the recommendations. Thanks are also due to Shri S. H. Mahalaha, Deputy Chief Conservator of Forests under whose able leadership the estimates of future requirements were finalised.

13.2 We wish to place on record our appreciation of the valuable work done by Shri B. N. Ganguli, Specialist (Forestry) on the investment requirements of the future and various economic and financial premises and in the preparation of this Report. We would also like to acknowledge the commendable assistance rendered by Shri S. K. Mitra, Joint Director in the write up of the Report. We also wish to thank Sarvashri Anand Singh and M. C. Kukreti, Senior Technical Assistants for their untiring assistance in various stages of its preparation.

Nathu Ram Mirdha, *Chairman*
B. Sivaraman, *Vice-Chairman*

<i>Member</i>	<i>Member</i>	<i>Member</i>
S.K. Mukherjee	T.A. Pai	B.S. Nag.
H.R. Arakeri	M.V. Krishnappa	A.N. Khusro
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Randhir Singh	M.S. Swaminathan	N.K. Panikkar.
	D.P. Singh.	

J.S. Sarma
Member Secretary

NEW DELHI.
August 10, 1972.

APPENDICES



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APPENDIX I

Expenditure on and revenue from Forests under the Control of State Forest Departments (1969-70)

State	Total expenditure (Rs. in lakhs)	Expenditure (Rs. in lakhs)		Forest Revenue (Rs. in lakhs)	% Revenue spent	
		Normal	Plan		Normal	Plan
1	2	3	4	5	6	7
Andhra Pradesh	310.46	253.73	56.73	601.16	42.2	9.4
Assam (including Meghalaya)	193.69	139.85	53.84	376.87	37.1	14.3
Bihar	253.04	157.84	95.20	401.51	39.3	23.7
Gujarat	216.86	148.70	68.16	442.30	33.6	15.4
Haryana	79.76	52.37	27.39	34.44	152.1	79.5
Himachal Pradesh	559.66	389.86	169.80	652.35	59.8	26.0
Jammu & Kashmir	219.61	162.36	57.25	490.00	33.1	11.7
Kerala	313.06	261.35	51.71	822.89	29.6	5.8
Madhya Pradesh	765.55	652.20	113.35	2586.13	25.2	4.4
Maharashtra	891.34	702.95	188.39	859.79	81.8	21.9
Mysore	710.84	523.90	186.94	1401.56	37.4	13.3
Nagaland	32.66	21.89	10.77	15.18	144.2	70.9
Orissa	391.32	170.02	221.30	658.29	25.8	33.6
Punjab	124.70	64.23	60.47	64.33	99.8	94.0
Rajasthan	155.75	123.67	32.08	100.18	123.4	32.0
Tamil Nadu	270.91	194.95	75.96	335.16	58.2	22.7
Uttar Pradesh	735.87	485.83	250.04	2022.14	24.0	12.4
West Bengal	227.35	165.47	61.88	244.70	67.6	25.3
Manipur	7.70	1.34	6.36	5.34	25.1	119.1
Tripura	49.99	39.24	10.75	19.37	202.6	55.5

N.B.—Figures are provisional.

SOURCE : Forest Statistics Bulletin No. 12 (Central Forestry Commission, Ministry of Agriculture).

APPENDIX
Productive Hardwood forests in India (1971)*
(State-wise)

State/Union Territory	(Area in ha)					
	1	2	3	4	5	6
		Minor forests (a)	Mixed quality forests (b)	Valuable forests (c)	Inaccessible forests (d)	Total (Col. 2 to 5)
Andhra Pradesh	.	14,50,020	3,02,600	1,99,100	45,000	1,996,720
Assam	.	83,441	1,75,419***	9,53,138	1,64,470	1,376,468
Bihar	.	13,00,000	16,00,000	N.A.	N.A.	2,900,000
Gujarat	.	7,24,000	Negligible	5,30,000	Nil	1,254,000
Haryana**	.	8,181	18,635	39,415	Nil	66,231
Himachal Pradesh***
Jammu & Kashmir
Kerala	.	N.A.	1,20,000	3,40,000	1,02,000	562,000
Madhya Pradesh****	.	44,00,424	22,00,212	13,57,670	.	7,958,306
Maharashtra	.	20,54,000	9,58,200	7,35,700	3,96,000	4,143,900
Meghalaya***
Mizore

Statistics supplied could not be utilized for the purpose of the adopted classification.

Nagaland*	.	.	.	.	Nil	3,867	22,309	Nil	26,176
Orissa	.	.	.	.	12,95,000	12,95,000	7,77,000	25,900	3,392,900
Punjab	.	.	.	.	Nil	Nil	2,659	Nil	2,659
Rajasthan	.	.	.	.	N.A.	10,40,000	2,60,000	N.A.	1,300,000
Tamil Nadu	.	.	.	.	3,80,800	6,92,808	2,62,382	4,11,692	1,747,682
Uttar Pradesh**	.	.	.	.	..	..	..	..	..
West Bengal	.	.	.	.	4,44,595	65,294	1,00,967	44,109	654,965
Andaman & Nicobar Islands	.	.	.	.	14,000	1,42,862	4,76,419	2,43,109	876,390
Dadra & Nagar Haveli	.	.	.	.	N.A.	15,013	5,004	N.A.	20,017
Goa, Daman & Diu	.	.	.	.	.	Statistics supplied could not be utilised for the purpose of the adopted classification.	.	.	.
Manipur	.	.	.	.	77,700	64,750	77,700	1,68,350	388,500
Assam	.	.	.	.	Nil	10,00,000	2,00,000	N.A.	1,200,000
Tripura	.	.	.	.	2,58,999	1,05,607	32,000	5,200	401,806
TOTAL	.	.	.	.	12,491,160	9,800,267	6,371,463	1,605,830	30,268,720
%	.	.	.	.	41.3	32.4	21.0	5.3	100.00

†Includes marginal coniferous forests of the Eastern States but the area is negligible.

N.A. Statistics not available.

*Excluding village forests of 207,200 ha.

**Unclassified forests not included.

***Data not reported by the State.

****Although Madhya Pradesh has reported 'nil' under inaccessible forests, a sizeable forest of this category occurs in Bastar & Abujmahar area.

*****Some of the areas have already been planted and others are in the process of being planted.

- (a) *Minor Forests*.—These are forests which are normally marginal and have been depleted due to over exploitation and uncontrolled grazing in the past for meeting the local demands of the population. These forests could be planted by application of better inputs.
- (b) *Mixed Quality Forests*.—Mixed quality stands are of comparatively low economic value at present but have much higher potential. These forests have low proportion of valuable or economic species. Their clearfelling and conversion to valuable stands of economic species would result in appreciably higher production within a comparatively short period.
- (c) *Valuable forests*.—Valuable stands are yielding substantial revenues at present but are still not producing optimum return which the site is capable of. Their conversion would lead to substantial higher out-turn and revenue per hectare.
- (d) *Inaccessible Forests*.—Forests situated in remote areas have mature and over mature stands leading to attendant deterioration. These forests have remained largely unworked or are partially worked due to lack of infra-structure or high exploitation cost.

APPENDIX III

Requirements of Forest Raw Material in 1880 and 1990

1. Methodology and Assumptions

1.1 A preliminary sectoral analysis of the forest and forest industries sectors has been recently completed by Professor G. R. Gregory, a Ford Foundation Consultant, for the Planning Commission. The methodology adopted in this report was utilised in working out the revised raw material requirements for the decades 1980 and 1990. Based on available data of Indian production for all major forest based industries, estimates of India's requirements in 1980 and 1990 were made for each industry on the basis of projected population and per capita Gross Domestic Product. From these estimates it was possible to determine the wood that must be provided by India's forests if these products are to be produced. The detailed estimates are presented in the accompanying tables.

1.2 The term "requirements" is used as the amount of a product that would be consumed by a population of the specified size, receiving the assumed per capita income provided, wood products are supplied at the same relative prices and under the same quantitative restrictions on consumption, that exist during base period.

1.3 Estimates of population and income during 1980 and 1990 were taken from estimates of the Planning Commission. For 1980, population was estimated at 680 millions and per capita Gross Domestic Product at Rs. 670; for 1990, population was estimated at 800 millions and per capita Gross Domestic Product at Rs. 900.

Estimates of wood product consumption in 1980 and 1990 were based on the following assumed income elasticities adopted from the F.A.O. studies for the region with suitable modifications.

Sawnwood	. . . . .	0.8
Plywood	. . . . .	2.0
Particle Board and Fibre Board	. . . . .	1.0
Newsprint, writing and printing paper	. . . . .	2.0
Industrial paper	. . . . .	2.5
Absorbing tissue	. . . . .	3.0
Roundwood	. . . . .	0.5

2. Revised Requirements of Raw Materials

2.1 The base study by Prof. Gregory has used the production data provided by the Central Forestry Commission which are in turn based on the sta-

tistical returns from the States. Examination of the source data and data from other sources like the Planning Commission studies and the Ministry of Industrial Development indicated certain error and gaps possibilities due to non-reported production. Certain forestry production from non-government forests and from agricultural lands appears to have been omitted. These and other sources of errors that might have cropped up in the calculations and other relevant information in respect of various products have been examined while revising the requirements calculations.

2.2 Certain mis-classifications in the production returns from the States were also noticed. Normally, the trees are sold standing to the forest lessees and they fell and convert the material to various utility classes which are subsequently processed for the production of consumer goods. In practice there is no recognised use of wood as pulpwood. Some paper mills purchase what is commonly called fuelwood and use it as pulpwood, others purchase it as a waste material from saw mills. The recorded production of pulpwood can thus remain grossly under-estimated. Similar is the situation in regard to poles and pit props. The case of fuelwood is equally intriguing. From the available information only about 10% comes from recorded sources.

2.3 No studies have been made on the use of non-industrial wood in the rural and in the semi-urban areas from the consumer end on an all India basis. Isolated studies have, however, been made in respect of certain regions surveyed by the Pre-investment Survey of Forest Resources. These individual regional studies show very great variation from the assumed figures up-till now in respect of products like sawnwood, roundwood and poles and fuelwood. Although these studies could not be taken as representative or averages for the whole country, they do indicate the possible errors of assessment and point to the need for more systematic studies for the country. While analysing the data the basic consumption data of forest raw material and forest products were corrected and up-dated on the basis of the data provided by the regional studies conducted by Pre-Investment Survey and various other State agencies.

2.4 The revised requirements for 1980 and 1990 and the supporting tables from which these requirements have been obtained are given in statements 3.1 to 3.8.

Statement 3.1
Total Industrial Raw Material Requirements by 1980 and 1990

Item	By 1980				By 1990			
	Conifers in '000m ³	Hardwood in '000m ³	Total '000m ³	'000 Tonnes	Conifers in '000m ³	Hardwood in '000m ³	Total '000m ³	'000 Tonnes
Sawnwood	1,816	10,836	12,652	..	2,395	14,605	17,000	..
Panel Products	189	755	914	..	281	1,126	1,407	..
Pulp & Paper (Bamboo, Bagasse etc.)	1,555	3,478	5,033	2,760	4,461	8,271	12,732	3,117
TOTAL (Industrial wood)	3,560	15,069	18,629	2,760	7,137	24,002	31,139	3,117
Roundwood (forest and non- forest excluding fuel wood)	1,385	5,542	6,927	..	1,887	7,549	9,436	..
Total (total wood including fuelwood)	4,945	20,611	25,556	2,760	9,024	31,551	40,575	3,117
Bamboo (non-industrial forest and non-forest) . . . . .	..	..	..	2,173	..	..	..	2,960
TOTAL	4,945	20,611	25,556	4,933	9,024	31,551	40,575	6,077

Statement 3.2

Fuelwood Requirement 1970 to 1990

(From Forest and Non-Forest)

Items	Fuelwood Requirements (Million m ³)			
	1970	1975	1980	1990
Fuelwood	203	233	256	300



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Statement 3.3

Requirement of Sawwood

Product	Year	Production ('000 units)	Import ('000 units)	Export ('000 units)	Consump- tion, ('000 units)	Consump- tion (per '000 persons	Conversion factor (m ³ /(r) unit)	Raw material requirement ('000 m ³ /(r))
1	2	3	4	5	6	7	8	9
Sawnwood (conifer)	1970	575	..	..	575	1.073	2.2	1265
	1980	780	..	..	780	1.147	2.2	1716
	1990	1,160	..	..	1,160	1.450	2.0	2,320
Sawnwood (broad leaved)	1970	3,590	..	..	3,590	6.698	2.2	7,898
	1980	4,880	..	..	4,880	7.176	2.2	10,736
	1990	7,265	..	..	7,265	9.081	2.0	14,530
Sawn Sleeper	1970	166	..	..	166	0.310	2.4	398
	1980	83	..	..	83	0.122	2.4	200
	1990	83	..	..	83	0.104	1.8	150
Total Sawnwood	1970	4,331	..	..	4,331	..	..	9,561
	1980	5,743	..	..	5,743	..	..	12,652
	1990	8,508	..	..	8,508	..	..	17,000

Statement 3.4
Requirement of Panel Product.

Product	Year	Production ('000 Units)	Import ('000 Units)	Export ('000 Units)	Consumption ('000 Units)	Consumption 'per '000 persons	Conversion factor m ³ (r)/Unit	Raw material requirement ('000 m ³ (r))
1	2	3	4	5	6	7	8	9
Plywood	1970	130.0	1	8	123.0	0.229	2.5	307
	1980	320.0	..	20	300.0	0.440	2.5	750
	1990	587.2	..	..	587.2	0.734	2.0	1,174
Veneer	1970	2.7	..	0.2	2.5	0.005	1.9	5.1
	1980	3.0	..	..	3.0	0.004	2.0	6.0
	1990	3.0	..	..	3.0	0.004	2.0	6.0
Particle Board	1970	8.8 (Tonnes)	..	..	8.8 (tonnes)	0.016	Made from Waste	..
	1980	150.0 "	..	..	150.0 "	0.221	..	..
	1990	228.0 "	..	..	228.0 "	0.285	..	..
Fibre Board	1970	23.8	..	..	23.8	0.044	2.5	59.5
	1980	75.0	..	..	75.0	0.110	2.5	187.5
	1990	113.6	..	..	113.6	0.142	2.0	227.2
Total Panel Product	1970	132.7*	1	8.2	125.5*	..	..	371.6
		32.6**			32.6**			
1980		323*			303*	..	..	943.5
		225**		20.0	225**	..	..
1990		590.2*	..	..	590.2*	..	..	1407.6
		341.6**			341.6**	..	..

*Refers to Plywood and Veneer (in m³).

**Refers to Particle Board and Fibre Board. (in tonnes)

Statement 3.5
Requirement of Pulp and Paper

Product	Year	Production ('000 Units)	Import ('000 Units)	Export ('000 Units)	Consump- tion ('000 Units)	Consump- tion (per '000 persons)	Conversion factor (m ³ /(r) Unit)	Raw material requirement production '000 m ³ (r)
1	2	3	4	5	6	7	8	9
Mechanical	1970	20.4	..	..	20.4	0.038	2.3	46.9
Wood Pulp	1980	219.0	..	..	219.0	0.322	2.3	504.0
(Hardwood)	1990	500.4	..	..	500.4	0.626	2.3	1150.9
Mechanical	1970	..	..	..	..	..	..	..
Wood Pulp	1980	117.0	..	..	117.0	0.172	2.3	269.0
(Conifer)	1990	300.2	..	..	300.2	0.375	2.3	690.5
Chemical	1970	78.7	60	..	138.7	0.257	4.5	354.0
Wood Pulp	1980	315.0	..	..	315.0	0.463	4.5	1417.0
(Dissolving)	1990	647.0	..	..	647.0	0.809	4.5	2912.0
Chemical	1970	396.8	..	..	306.8	0.704	3.0	1191.0
Wood Pulp	1980	733.0	..	..	733.0	1.078	3.0	2199.0
(Bamboo)	1990	651.0	..	..	651.0	0.814	3.0	1953.9
Chemical	1970	60.0	..	..	60.0	0.107	4.0	240.0
Wood Pulp	1980	121.0	..	..	121.0	0.178	4.0	484.0
(Hardwood)	1990	382.0	..	..	382.0	0.478	4.0	1529.0

Statement 3.5—Contd.

1	2	3	4	5	6	7	8	9
Chemical wood Pulp (Conifers)	1970 1980 1990	21.0 257.0 754.0	.. .. ..	.. .. ..	21.0 257.0 754.0	0.039 0.378 0.943	5.0 5.0 5.0	105.0 1285.0 3770.0
Hard Wood (Semi- Chemical)	1970 1980 1990	.. 537.0 1071.0	.. .. ..	.. .. ..	.. 537.0 1071.0	.. 0.790 1.340	.. 2.0 2.5	.. 1074.0 2679.0
Chemical Wood Pulp (Bagasse)	1970 1980 1990	60.6 30.0 26.5	.. .. ..	.. .. ..	60.6 30.0 26.5	.. .. ..	1.9 1.9 1.8	115.0 57.0 48.0
TOTAL :	1970	891.5	70	8	953.5	..	..	*746 m ³ 1687 t
	1980	2860.0	..	not determined	2860.0	..	..	*5033.0 m ³ 2760.0 t
	1990	5470.0	..	not determined	5470.0	..	..	*12732.0 m ³ 3117.0 t

*Refers to wood only.

Note : Bamboo pulp, rag waste etc. details of which have not been indicated in the body of the Statement have been included in the totals. As such the totals will not tally.

Statement 3.6
Requirement of Total Roundwood from Forest and Non-forest

Product	Year	Production (‘000 Units)	Import (‘000 Units)	Export (‘000 Units)	Consumption (‘000 Units)	Consumption (per ‘000 persons)	Conversion factor [m ³ /r Units]	Raw Material requirement production [‘000 m ³ / (r)]
1	2	3	4	5	6	7	8	9
Roundwood (from forest)	1970	4,020	..	..	4,020	7.500	1.0	4,020
	1980	5,323	..	..	5,323	7.830	1.0	5,323
	1990	7,250	..	..	7,250	9.062	1.0	7,250
Roundwood (non-forest)	1970	1,212	..	..	1,212	2.260	1.0	1,212
	1980	1,604	..	..	1,604	2.359	1.0	1,604
	1990	2,186	..	..	2,186	2.732	1.0	2,186
TOTAL :	1970	5,232	..	..	5,232	9.8	..	5,232
	1980	6,927	..	..	6,927	10.2	..	6,927
	1990	9,436	..	..	9,436	11.8	..	9,436

Statement 3.7
Requirement of Fuelwood

Product	Year	Production (‘000 Units)	Import (‘000 Units)	Export (‘000 Units)	Consump- tion (‘000 Units)	Consump- tion (per ‘000 persons)	Conversion factor (m ³ /(r) Unit)	Raw material requirement production [‘000 m ³ / (r)]
1	2	3	4	5	6	7	8	9
Fuelwood (from forest)	1970	13,000	..	..	13,000	24.25	1.0	13,000
	1980	35,000	..	..	35,000	51.47	1.0	35,000
	1990	50,000	..	..	50,000	62.50	1.0	50,000
Fuelwood (non-forest)	1970	190,000	..	..	190,000	354.48	1.0	190,000
	1980	221,000	..	..	221,000	325.00	1.0	221,000
	1990	250,000	..	..	250,000	312.50	1.0	250,000
Total fuelwood	1970	203,000	..	..	203,000	378.7	1.0	203,000
	1980	256,000	..	..	256,000	376.5	1.0	256,000
	1990	300,000	..	..	300,000	375.0	1.0	300,000

Statement 3.8
Requirement of Non-Industrial Bamboo

Product	Year	Production (‘000 Units)	Import (‘000 Units)	Export (‘000 Units)	Consump- tion (‘000 Units)	Consump- tion (per ‘000 persons)	Conversion factor [m ³ /(t) Unit]	Raw material requirement production [‘000 m ³ / (t)]
1	2	3	4	5	6	7	8	9
Non-industrial bamboo from forests	1970	1,490	..	..	1,490	2.780	1.0	1,490
	1980	1,973	..	..	1,973	2.901	1.0	1,973
	1990	2,690	..	..	2,690	3.361	1.0	2,690
Non-industrial bamboo from non-forests	1970	150	..	..	150	0.280	1.0	150
	1980	200	..	..	200	0.294	1.0	200
	1990	270	..	..	270	0.338	1.0	270
TOTAL :	1970	1,640	..	..	1,640	3.059	..	1,640
	1980	2,173	..	..	2,173	3.196	..	2,173
	1990	2,960	..	..	2,960	3.700	..	2,960

APPENDIX IV

Statement 4.1

Investment Requirements during 1980 in forest Industries sector

Industries	Investment in Rs. per unit of additional product	New production required (‘000 tonnes or ‘000 m ³)	New capital required (‘000 Rs.)
Sawnwood (000 m ³) (1)	150	1,412	211,800
Plywood & Veneer (‘000 m ³)	800	190	152,000
Particle Board	1,000	141	141,000
Fibre Board	940	51	47,940
Newsprint (2)	3,600	476	1,713,600
Printing & writing paper (3)	5,000	430	2,150,000
Industrial paper	4,200	271	1,138,200
Absorbing paper	6,000	44	264,000
Others	3,000	283	849,000
Dissolving Pulp (4)	5,000	297	1,485,000
TOTAL			8,142,540
Total for newsprint, printing and writing paper, industrial paper, absorbing paper and others(5)			6,114,800 or 611 crores

- (1) Excludes sleeper production as no additional sawing is required.
- (2) Based on H.P.C. integrated newsprint mill and also based on Asian Newsprint Study by FAO for Uttar Pradesh.
- (3) Based on a Study made by a reputed consulting engineering firm of New Delhi.
- (4) Dissolving Pulp—This item has been calculated but excluded from the total of pulp and paper as it is felt private sector would absorb this investment.
- (5) Investment in Sawnwood, Plywood and Veneer, Particle Board and Fibre Board will also be absorbed by private sector

Statement 4.2

Investment Requirements during 1980 in production forestry programme (Logging and Plantation)

Forestry Production Programme (Logging and Plantation)	Investment per Additional m ³ of timber/or per ha cost of plantation (i)	Additional coniferous production (in '000 m ³)	Additional hard- wood production (in '000 m ³)	Capital required in ('000 Rs.)
From indigenous conifers by infrastructural development	110	3,660	..	402,600
Bringing inaccessible hardwood forests (1,00,000 ha) by clear- felling (yield 40 m ³ /ha.)	80	..	4,000	320,000
Clearfelling valuable forests (50,000 ha.) (yield 40m ³ /ha.)	80	..	2,000	160,000
Low quality mixed forest (4,00,000 ha.) (yield 15 m ³ / ha.)	70	..	6,000	420,000
From existing plantation (1,24,000 ha) mostly <i>Eucalyptus</i> to be regenerated by cop- pice (yield 8m ³ /ha. per year)	15	..	1,000	15,000
<i>Plantation Investment</i>				
Tropical pine (1,76,000 ha) (ii)	1,687	..	..	296,912
Fast growing species (2,75,000 ha.)	1,647	..	..	452,925
Teak and other commercial species (2,03,000 ha.)	1,468	..	..	298,004
Bamboo (72,000 ha.)	800	..	..	57,600
TOTAL				2,423,041 or 242 crores.

(i) Areas clearfelled will be planted. The annual clearfelling and planting target pine plantations will be 1.04 lakh hectares between 1974 and 1980 since the programme will start from 1974.

(ii) Incidental clearfelling material from this area has not been accounted for.

APPENDIX V

Statement 5.1

Investment Requirements During 1990 in Forest Industries Sector

Industries	Investment in Rs. per unit of additional product	New Production required (‘000 tonnes or ‘000 m ³)	New capital required (‘000 Rs.)
Sawnwood (in ‘000 m ³)	150	2,765	4,14,750
Plywood and Veneer (in ‘000 m ³)	800	247	1,97,600
Particle Board	1,000	78	78,000
Fibre Board	940	39	36,660
Newsprint	3,600	491	1,767,600
Printing & Writing paper	5,000	818	4,090,000
Industrial paper	4,200	517	2,171,400
Absorbing paper	6,000	77	462,000
Others	3,000	433	1,299,000
Dissolving pulp	5,000	272	1,360,000
TOTAL			11,877,010
Total for newsprint printing & writing paper, industrial paper, absorbing paper & others.			9,790,000 or 979 crores.

Statement 5.2

*Investment Requirements During 1990 in Production Forestry
Programme (Logging and Plantation)*

Forestry Production Programme (Logging & Plantation)	Invest- ment per additional m ³ of timber or per ha. cost of planta- tion	Addi- tional coniferous produc- tion in (‘000 m ³)	Addi- tional hard- wood produc- tion in (‘000 m ³)	Capital required in (‘000 Rs.)
From thinning of pine wood plantation raised in previous decade (yield 4 m ³ /ha/year) .	30	704	..	21,120
From Coniferous forests by bringing infrastructural deve- lopment	110	3,409	..	374,990
From fast growing spp. planted earlier (2,75,000 ha)	30	..	2,750	82,500
Bringing additional 1,00,000 ha. of inaccessible forests (yield 40 m ³ /ha.)	80	..	4,000	32,000
By felling additional (50,000 ha.) valuable forests	80	..	2,000	160,000
By felling additional mixed forests (2,00,000 ha.) (yield 15 m ³ /ha)	70	..	3,000	210,000
<i>Plantation Investment</i>				
Pine (220,000 ha)	1,687	..	..	371,140
Teak & other commercial species (1,30,000 ha)	1,468	..	..	190,840
By felling & planting of addi- tional 8,00,000 ha. of mixed quality forests not specifically geared to the requirement of 1990 but for export . . . .	..	..	..	1,330,400
TOTAL				3,060,990 or 306 crores.

APPENDIX VI

Economic and Financial Analysis of converting Hardwood Temperate Forest in Eastern Himalaya of West Bengal—A Model

Description of Forests & Suggested Conversion

1. In the Eastern Himalayas particularly in Darjeeling District temperate hardwood forests consisting of species like *Michelia excelsa*, *castanopsis*, *Machilus*, *Quercus* and a host of other species in the lower zones occur. Much of this standing timber is either mature or over-mature and have ceased to produce increment. These forests are in remote areas and have remained hitherto inaccessible. It is, therefore, highly desirable that these forests are converted to utilise the growing stock before they are completely deteriorated. Since the area is capable of producing higher increment per unit area the existing stock could be replaced by valuable industrial timber species to obtain higher production per unit area. Species which can be successfully grown are *Pinus patula*, *Cryptomeria Japonica* and *Cupressus cashmiriana*.

Existing Method of Exploitation

2. Due to lack of roads in the Eastern Himalayas and almost complete absence of modern logging techniques and the requisite equipment, the existing method of exploitation relies entirely on manual labour. Since skyline cranes, trucks and tractors are not in use, it is not possible to extract the timber in the form of logs. In this method there is wastage both in the felling and conversion and it is estimated that only about 40% of the total round wood volume is converted into stem timber. The West Bengal State Government has already started converting these forests on a large scale by using modern logging techniques. There is need for modern logging for exploitation and consequent utilization of these forests.

Need for Investment

3. These inaccessible forests would require infrastructure development and machineries consequently involving investment. Due to paucity of State Government's resources much of the area has still remained unexploited. It would be worthwhile to take money from the institutional sector to finance development. This economic model examines the feasibility of financing the infrastructure development and plantation through commercial sector and the requirement of finances for a unit area including phasing of loan requirement and interest and capital payments. It is presumed money could be borrowed at 7%.

Experience

4. Considerable experience has already been gained by the State of West Bengal on the use of long and short distance skyline cranes, cable cranes, mountain tractors, and the use of improved saws and axes and other basic logging equipment for felling.

By using modern logging equipment, percentage conversion has been increased to 80. A net increase of about 40 per cent in the present out-turn by the existing method has been achieved. The techniques of raising forest plantation has also been perfected although the seed procurements is a bottle neck.

The Project

5. The project will consist of felling of trees and their conversion into logs at the stump site with the help of modern tools and transporting of logs with the help of skyline crane from the felling site to a convenient place for sale. The clearfelled area will be planted up with *P. patula* on a rotation of thirty years. Alternate species for planting could be *Cryptomeria Japonica* or *Cupressus Cashmiriana*. These have not been considered. The financial analysis has been worked out for 10 years presuming that money could be borrowed at 7%. The analysis could be carried through for the entire period of 30 years. On the basis of converting 1,500 hectares annually, it is proposed to convert the entire area of 35,000 hectares within the project boundry in the next 30 years. It is presumed that the material felled during the process will be linked with industrial utilisation by suitably locating an industry although its non-establishment should not influence the decision to convert the forests as the market already exists. The phasing of loan requirements suggests that in the first 4 years before the project becomes on going about Rs. 8.18 million will be required. This loan can be taken by valuing the land and the resources appropriately to obtain the equity capital against which borrowing can be made. From 5th year the revenue from timber felling will be enough to form the equity capital for further borrowing and payment of interest. At the end of 24th year the programme becomes self sustaining. The nominal surplus from 15th year will be utilised for future development needs.

6. It must be emphasised that the model has been worked out with certain parameters. This is no way rigid and each State has to do its own exercise based on the economics parameters prevailing in their regions to arrive at more precise formulation of the project and estimates of benefits and costs.

7. The details of investment costs and benefits are given in Statements 6.1 to 6.4 including the foot-notes to the Statements.

8. It will be seen that the benefit cost ratio will work out to 1.28 assuming 7 per cent and discount rate and the internal rate of return will be between 9 and 10 per cent.

6.1 Statement on Abstract of Investment Costs on Infrastructure and Plantation for 10 years
(Annual area 1,500 hectares)
(Million Rupees)

Year	Area in ha.	Road con- struction & main- tenance costs	Investment on Infrastructure for tapping the resources				Total (Col. 3+6+7)	Investment on Plantations for higher production per unit area in future				Grand Total (Co- lums 8+12)	
			New pur- chase	Main- tenance	Total (Col. 4+5)	Staff for felling		Plan- ta- tion	Staff	Con- tin- gency	Total (Col. 9+10+ 11)		
1	2	3	4	5	6	7	8	9	10	11	12	13	
0	.	1,500	1.125	3.300	0.090	3.390	0.072	4.587	1.200	0.060	0.040	1.300	5.887
1	.	1,500	1.140	..	0.090	0.090	0.072	1.302	1.358	0.120	0.080	1.558	2.860
2	.	1,500	1.155	..	0.090	0.090	0.072	1.317	1.470	0.180	0.120	1.770	3.087
3	.	1,500	1.170	..	0.090	0.090	0.072	1.332	1.470	0.240	0.160	1.870	3.202
4	.	1,500	1.185	..	0.090	0.090	0.072	1.347	1.470	0.300	0.200	1.970	3.317
5	.	1,500	1.200	..	0.090	0.090	0.072	1.362	1.470	0.360	0.240	2.070	3.432
6	.	1,500	1.215	..	0.090	0.090	0.072	1.377	1.470	0.420	0.280	2.170	3.547
7	.	1,500	1.230	..	0.090	0.090	0.072	1.392	1.470	0.480	0.320	2.270	3.662
8	.	1,500	1.245	..	0.090	0.090	0.072	1.407	1.470	0.540	0.360	2.370	3.777
9	.	1,500	1.260	..	0.090	0.090	0.072	1.422	1.470	0.600	0.400	2.470	3.892
TOTAL	.	15,000	11.925	3.300	0.900	4.200	0.720	16.845	14.318	3.300	2.200	19.818	36.663

6.2 Statement on Expenditure on Staff, Maintenance & Contingency

(Area in Hectares)
(Cost in Rupees)

Year	Plantation		Staff for felling		Total Col. (3 + 5)	Annual Contingency		Maintenance of Machinery and repair	
	Area	Annual Expenses	Area	Annual Expenses		Area	Cost	Area	Cost
1	2	3	4	5	6	7	8	9	10
0	1,500	60,000	1,500	72,000	132,000	1,500	40,000	1,500	90,000
1	3,000	120,000	1,500	72,000	192,000	3,000	80,000	1,500	90,000
2	4,500	180,000	1,500	72,000	252,000	4,500	120,000	1,500	90,000
3	6,000	240,000	1,500	72,000	312,000	6,000	160,000	1,500	90,000
4	7,500	300,000	1,500	72,000	372,000	7,500	200,000	1,500	90,000
5	9,000	350,000	1,500	72,000	432,000	9,000	240,000	1,500	90,000
6	10,500	420,000	1,500	72,000	492,000	10,500	280,000	1,500	90,000
7	12,000	480,000	1,500	72,000	552,000	12,000	320,000	1,500	90,000
8	13,500	540,000	1,500	72,000	612,000	13,500	360,000	1,500	90,000
9	15,000	600,000	1,500	72,000	672,000	15,000	400,000	1,500	90,000

6.3 Statement on Loan Requirements and Phasing of Loans based on Investments* (Financial Analysis).
Annual Area 1,500 hectares.

Year	Total expenditure				5	6	7	8	9	10	11	12
	Roads	Machinery	Staff	Sub								
1												
0.	.	1.125	0.825	0.072	2.022	..	2.022	..	2.022	2.022	..	..
1.	.	1.140	0.825	0.072	2.037	..	2.037	..	2.037	4.059	..	..
2.	.	1.155	0.825	0.072	2.052	..	2.052	..	2.052	6.111	..	..
3.	.	1.170	0.825	0.072	2.067	..	2.067	..	2.067	8.178	0.572	Nil
4.	.	1.185	0.090	0.072	1.347	1.300	2.647	3.150	0.069	8.247	0.577	0.572
5.	.	1.200	0.090	0.072	1.362	1.558	2.920	3.150	0.347	8.594	0.601	0.577
6.	.	1.215	0.090	0.072	1.377	1.770	3.147	3.150	0.598	9.192	0.643	0.601
7.	.	1.230	0.090	0.072	1.392	1.870	3.262	3.150	0.755	9.947	0.696	0.643
8.	.	1.245	0.090	0.072	1.407	1.970	3.377	3.150	0.923	10.870	0.761	0.696
9.	.	1.260	0.090	0.072	1.422	2.070	3.492	3.150	1.103	11.973	0.838	0.761
10.	.	0.150	0.090	0.072	0.312	2.170	2.482	3.150	0.170	12.143	0.850	0.838
11.	.	0.150	0.090	0.072	0.312	2.270	2.582	3.150	0.282	12.425	0.870	0.850
12.	.	0.150	0.090	0.072	0.312	2.370	2.682	3.150	0.402	12.827	0.898	0.870
13.	.	0.150	0.090	0.072	0.312	2.470	2.782	3.150	0.530	13.357	0.935	0.898

*It is proposed that actual felling will be taken up in the 5th year after roads have been built sufficiently and machineries have been procured.

NOTES :

1. The loan requirements have been based on the assumption that the net revenue of Rs. 2,100 accruing to the project is after payment of Rs. 400 to the State Government as it was getting already.
2. Interest payment will start after the 5th year and accumulated interest at the end of 4th year will be paid in the 5th year.
3. The capital cost of the machinery will be met in the first 4 years.



6.4 Statement on Disbursement and Payment Schedule

(Rs. in million)

Year	Loan-requirement	Loan outstanding at the end of	Surplus revenue (net)*	Payment of interest at 7%	Repayment of loan	Surplus available after paying	Surplus available after paying interest & loan***
1	2	3	4	5	6	7	8
0	2.022	2.022					
1	2.037	4.059					
2	2.052	6.111					
3	2.067	8.178					
4	0.069	8.247	nil	0.572			
5	0.347	8.594	nil	0.577			
6	0.598	9.192	nil	0.601			
7	0.755	9.947	nil	0.643			
8	0.923	10.870	nil	0.696			
9	1.103	11.973	nil	0.761			
10	0.170	12.143	nil	0.838			
11	0.282	12.425	nil	0.850			
12	0.402	12.827	nil	0.870			
13	0.530	13.357	nil	0.898			
14		13.357	2.250**	0.935	0.950	1.315	0.365
15		12.407	2.250	0.868	1.120	1.382	0.262
16		11.287	2.250	0.790	1.400	1.460	0.060
17		9.887	2.250	0.692	1.500	1.558	0.058
18		8.387	2.250	0.587	1.629	1.663	0.034
19		6.758	2.250	0.473	1.629	1.777	0.148
20		5.129	2.250	0.359	1.629	1.891	0.262
21		3.500	2.250	0.245	1.729	2.005	0.276
22		1.771	2.250	0.124	1.771	2.126	0.355

23	.	.	Nil	2.250	2.250	2.250	18,000 (Final yield from clear-felling of Plantation).
24	.	.					
25	.	.					
26	.	.					
27	.	.					
28	.	.					
29	.	.					
30	.	.					
31	.	.					
32	.	.					
33	.	.					

* Surplus revenue has gone for payment of interest.

** Yield from thinning of young plantation.

*** Surplus available after paying interest and loan will be utilised for further development work.

Explanatory note to Statement 6.1 and 6.2

*Costs per hectare for logging**Roads*

On the basis of 1 Km. of road per sq. Km. or 100 hectares of forests.

New Construction Rs. 75,000/Km.

$$\text{or } \frac{75,000}{100} = \text{Rs. 750 per hectare}$$

Road maintenance Rs. 1,000
 $\frac{1,000}{100} = \text{Rs. 10 maintenance per hectare.}$

Machineries

Mechanised hauling by ropeways will have to be combined with road construction in most places, and short distance skyline crane (Kupfer skyline 300 m or Czechoslovakian Transport Cableway 500 m) will be utilised.

For every 50 hectare unit, an investment of Rs. 1,10,000 is necessary including spare parts.

These machines will work for 10 years or will tackle 500 hectares.

Staff for Logging

For 1,500 hectares of area, the supervisory staff will be according to the requirement in the field. But normally for drawing up a commercial project, overhead on staff should be kept as low as possible. Hence the executive staff has been kept at minimum. It may be emphasised that each State may establish its own norm and adjustments may be possible. The annual pay of staff etc. for logging a 1,500 hectare area has been kept as Rs.72,000. This includes the pay of 1 D.F.O., 2 Rangers, 2 Foresters, 6 Forest Guards and 3 Clerks. The staff pattern is only suggestive.

Maintenance Cost (including pay of Crane & Tractor Operator)

No. of working days in a year — 150

No. of working hours — 450 hours

One unit will clear 60 hectares of forests (actual felling). Each day the machine is working for 3 hours.

Pay of Tractor Driver etc.	Rs. 12/-	Per day
Price of Petrol & Oil	Rs. 10/-	„
Repairs	Rs. 2/-	„
	<u>Rs. 24/-</u>	

$$\text{The maintenance cost/hectare} = \frac{\text{Rs. } 24 \times 150}{60} = \text{Rs. 60.}$$

Plantation Cost

Establishment	Rs. 800 per hectare.
Staff	Rs. 40 per hectare annually
Contingency	Rs. 27 per hectare annually
Maintenance cost 2nd year	Rs. 150/ha
Maintenance cost 3rd year	Rs. 75/ha

Explanatory note to Statements 6.3 and 6.4

Benefit that will accrue due to the project will consist of the following :—

Higher yield that will be obtained from the area because of new roads and logging machineries.

Higher price per unit of stumpage due to efficient conversion.

Lower plantation costs due to roads.

Better supervision and fire control.

Better growth from the plantations.

Quantification of benefits will be as under :—

Average volume of timber on the Singalila Range, Kalimpong Area is about $\frac{1}{2}(106+102)=104 \text{ m}^3$.

It is assumed that 80% of this volume will be converted into logs and sold in depot in other words 83 m^3 of timber will be sold, 20% being cut and logging wastes.

Average price of timber logs in depot is Rs. 40/m³*.

∴ $83 \times 40 = \text{Rs. } 3320 \text{ or Rs. } 3300/\text{ha}$.

Less felling costs @ Rs. 10/m³** = Rs. 3300—800 = Rs. 2500/ha.

A figure of Rs. 2100 is adopted as an average of the area. (The rest of the revenue will go to the State exchequer and not as a part of the programme).

If the old practice of timber felling would continue then 40% of the stand ing volume will be extracted and sold at Rs. 10/m³ instead of Rs. 40 per m³. Or $\text{Rs. } 40 \times 10 = \text{Rs. } 400/\text{ha}$.

∴ Benefit due to the project only	Rs. 2,100
	Rs. 400
	<hr/>
	Rs. 1,700
	<hr/>

Due to replacement by plantations the following benefits will accrue to the project.

Thinning yield at 10th year @ 50 m³ per hectare valued at Rs. 30/m³=
Rs. 1,500 per hectare.

Final yield at 30 year @ 300 m³/ha. at Rs. 40/m³= Rs. 12,000/ha.

If the project was not undertaken Rs. 400 would have come from the area.

∴ The actual net benefit because of the project is Rs. 13,500—
Rs. 400=Rs. 13,100.

Benefit in terms of employment directly and indirectly due to the project have not been worked out but will be considerable.

*This price has been taken as an average. In the specific case, an average price of Rs. 100 per m³ has been obtained. This higher price has also been considered to work out another model in 'Appendix VII.

**It varies from Rs. 9 to 10 per m³.



APPENDIX VII

Financing Development of Pulp and Paper Industries in the Public Sector based on standing Forest Resources—A Model

1. Assumptions

1.1 This model demonstrates how the much needed integration between forestry and forest industries in the public sector can be brought about in the future in India by converting the hitherto inaccessible hardwood forests in some States. The assumption is that if a suitable area is located, then the resources could be utilised to start the industries by initiating the process of clearfelling and plantation. The standing forest resources will not only provide the raw material but will also provide the much needed capital. Clearfelling of these forests will enable mobilisation of sufficient capital further borrowing from institutional sectors to finance the development of industries and thus a new approach to financing can be utilised for the development of pulp and paper industries in the public sector.

1.2 The model demonstrates the possibility of establishing a pulp and paper unit in an inaccessible forest area in the Eastern Himalayas extending over an area of about 45,000 hectares. The growing stock consists of temperate hardwoods.

1.3 The category of utilizable timber in an area of 80 hectares after clearfelling as obtained in the field is given in the statement below.

Statement 7.1

Total Volume and Volume per Hectare

Utility Class	Total volume in m3	Percentage of volume	Volume per hectare
Volume of timber for construction	6,872	86	86
Plywood, Veneer and others	1,128	14	14
TOTAL	8,000	100	100
Pulpwood Volume	20,000	..	250

N.B.—The total growing stock of timber is 100 m3/hectare and the pulpwood volume of 200 m3/hectare is adopted for the model.

1.4 The model assumes that the entire 45,000 hectares area will be converted into plantation of either *Cryptomeria*, *Pinus Patula* or *Cupressus Cashmiriana* over a period of 30 years by annually clearfelling and planting 1500 hectares. It also presumes that 45,000 hectares are in compact blocks so that the annual felling and planting area of 1500 hectares is in a concentrated patch. It can always be argued that such conditions may not exist. But the assumption in the model is implicit.

1.5 It is also presumed that the area is suitable for planting and the plantations will give a thinning yield at 10th year of 50 m³/hectare and sanwood + pulpwood at 30 years.

1.6 Before clearfelling is undertaken the area has to be opened up by road. Machineries for logging have to be purchased and other infrastructural facilities will have to be made.

1.7 If the area is clearfelled on the basis of the data given under paragraph 3, the annual availability of wood from the 1500 hectares clearfelled area will be as given in the Statement below :

Statement 7.2
Annual Wood Availability in m³

Utility Category	Total wood in m ³
Construction timber	1,29,000
Plywood and miscellaneous	21,000
Pulpwood	3,00,000*

*Pulpwood although available may not be utilised in the beginning.

1.8 Once the road is built and the necessary infrastructure is put up, timber could be sold near any forest depot. The total value of timber excluding pulpwood for which there will be no market initially, will be as below :—

Statement 7.3

Annual value of Wood as a result of Clearfelling

Utility Category	Price per m ³ *	Total in million Rs.
Construction	100	12.90
Plywood & others	50	1.05
TOTAL		13.95
Plywood or Fuelwood	10	3.00
Total including Pulpwood		16.95

*Actual price obtained in a specific case.

N.B.—Annual available capital resources will be Rs. 13.95 million till the pulpwood finds a market.

1.9 In order to enable the programme to go on uninterruptedly it will be better if the entire area is transferred to a Corporation, which will be able to borrow money from institutional agencies on the basis of land and existing timber resources. It is presumed that the institutional finances will be available and the industrial lending institutions like I.F.C., I.C.I.C.I., and others will support the industrial programme.

1.10 Based on the annual availability of raw materials, the industries that can be sustained in the area are shown in the Statement below :—

Statement 7.4

Annual Raw Material Availability and the Size of Industries

Categories of industries	Annual Raw material availability* m ³	Annual capacity of the unit
Pulp and paper mills based on hardwood (5 m ³ hardwood/Tonne of finished product)	3,00,000 m ³	60,000 Tonnes
Integrated saw mill unit (Saw milling, seasoning & treatment plants)	1,00,000m ³	50,000m ³
Plywood and Veneering (Taking 40% conversion)	20,000 m ³	5,000 m ³ (Total production 1.0 million Sq. m).

*The model assumes that the necessary feasibility studies will be undertaken before the paper unit is established and that the minimum long fibre requirement will be met. It may be stressed here that the model demonstrates a possible financing approach. The technicalities will have to be gone into by each State after identifying such a project.

**The Saw mills and plywood unit will be from the private sector and as such has not been considered in the model.

2. Capital Requirements

2.1 Before any industrial programme is undertaken it is necessary first to lay the infrastructure in this inaccessible forest areas to bring the timber out. Therefore, the investment has to be phased out. It is presumed that the infrastructure development will take 4 years and from the 5th year onwards the actual felling will start.

2.2 It is also presumed that the industrial development preparation will start from 5th year after adequate finances have been obtained.

2.3 The annual investment requirements for infrastructure development is given in the Statement below :—

Statement 7.5

Annual Investment Requirement for Infrastructure and Plantation (for 10 years only)

(Rs. in million)

Year	Investment on roads and other infrastructure*	Plantation** investment	Total (2+3)
1	2	3	4
0	2.022	..	2.022
1	2.037	..	2.037
2	2.052	..	2.052
3	2.067	..	2.067
4	1.347	1.500	2.847
5	1.362	1.500	2.862
6	1.377	1.500	2.877
7	1.392	1.500	2.892
8	1.407	1.500	2.907
9	1.422	1.500	2.922
10	0.312	1.500	1.812
11	0.312	1.500	1.812
12	0.312	1.500	1.812
13	0.312	1.500	1.812

*Roads (a) Rs. 75,000 and density of road 1 Km. per sq. Km. of forest.

Machinery (b) Rs. 1,10,000 for 50 hectares unit (life span 10 years) to be obtained in 4 years.

Staff (a) Rs. 48 per hectare annually, Road Maintenance } during
Rs. 1,000 per Km., Maintenance of machinery } clear-
Rs. 60 per hectare. } felling

**For plantation, an average of Rs. 1000/ha including the cost of staff, etc., has been adopted.

2.4 The industrial planning will be staggered according to the following :—

Paper industry to be established by a process of initiation starting from fourth year to synchronise with the year of felling. The investment

requirements for industries alongwith clearfelling and plantation investment is given in Statement 7.6

Statement 7.6

Investment Requirements for Clearfelling, Planting and for Pulp and Paper Industries

(Rs. in millions)

Year	Investment on roads and afforestation	Plantation	Investment on paper industry@	Total (2+3+4)
1	2	3	4	5
0 . .	2.022	..	..	2.022
1 . .	2.037	..	..	2.037
2 . .	2.052	..	..	20.52
3 . .	2.067	..	..	2.067
4 . .	1.347	1.500	75.00	77.847
5 . .	1.362	1.500	75.00	77.862
6 . .	1.377	1.500	75.00	77.877
7 . .	1.392	1.500	75.00	77.692
8 . .	1.407	1.500	..	2.907
9 . .	1.422	1.500	..	2.922
10 . .	0.312	1.500	..	1.812
11 . .	0.312	1.500	..	1.812
12 . .	0.312	1.500	..	1.812
13 . .	0.312	1.500	..	1.812

@Based on Rs. 5,000/ tonne of additional production. The phasing may be done according to the availability of finances.

3. Financing

3.1 If the area is transferred to the Corporation it will have no money to start with, and will have no liquid cash till it has started clearfelling from the fourth year. The pulpwood and fuelwood will not be sold till the eighth year. Therefore, the Corporation will have no cash as equity capital against which it can float loan in the market. The only possibility is to value the land and against this, money could be borrowed from the institutional sector. Total land is 45,000 hectares. If this land is valued without the standing timber at Rs. 100/hectare then the total equity becomes Rs. 4.5 million requirement for infrastructure development is about Rs. 8.178 million. Against Rs. 4.5 million this money could be borrowed on the basis of 2 : 1 debt equity ratio and the programme of infrastructure development can be undertaken to initiate the process of clearfelling.

3.2 The capital resources picture after felling starts would be different from the fourth year onwards and is given in Statement 7.7.

Statement 7.7
Capital Resource from Fifth Year

(Rs. in million)

	Gross revenue from clear- felling	Net revenue* after deducting felling cost	Payment of interest at 7%**	Surplus avail- able after plantation expenditure and interest payment
1	2	3	4	5
0	..	..	..	..
1	..	..	..	..
2	..	..	..	..
3	..	..	..	..
4	13.95	12.60	0.572	10.53
5	13.95	12.60	0.572	10.53
6	13.95	12.60	0.572	10.53
7	13.95	12.60	0.572	10.53
8	16.95	15.60		
9	16.95	15.60		
10	16.95	15.60		
11	16.95	15.60		
12	16.95	15.60		
13	16.95	15.60		

*Deducting felling costs @ Rs. 9 per m³

**Interest on the accumulated borrowed capital during the first four years.
Capital payment will be made after completing the industrial venture.

3.3 In four years the surplus available from clearfelling will be Rs. 42 million. This equity will not be enough to float a loan of Rs. 300 million required for the industrial venture. In the equity capital standing timber can also be valued now since the infrastructure development has taken place and the timber has a market. If the standing timber on the entire 45,000 hectares is valued at Rs. 69 million as the equity, it will be a reasonable valuation. This has to be reduced to 4/30th on account of exploitation in the first four years, leaving the equity to Rs. 52 million. Thus, the total equity would be Rs. 94 million against which a total of Rs. 244 million can be taken as loan from the industrial lending institutions on the basis of 2.6 : 1 debt equity ratio.

3.4 The money borrowed can be paid back with interest and capital after a reasonable period once the paper mill starts production from the eighth year. The profitability of a paper mill complex is well tested and does not require elaboration. The exercise can, thus, be carried through.

4. *Benefits from such an approach*

4.1 The benefits from such an approach to financing will be manifold viz., inaccessible forests will be brought under production, mixed-wood will be replaced by plantation of species giving higher production per unit area; forest industries and forest plantation activities can be integrated; the required locational placement of forest industries will be made in a rational manner; and the forest resources will be used as a source for stimulating investment in the public sector.

4.2 An approach to financing industrial development programme based on the existing capital resources of the forests has been detailed. This exercise may need more detailed scrutiny and each State may have to change the parameters depending on the area. However, the concept may be utilized to finance development programme of the forest industries in the public sector.



APPENDIX III

Economic and Financial Analysis of Converting Mixed Quality Forests of Low Economic Value — A Model

1. Description of Forests and Suggested Conversion

1.1 In most of the States within the productive forest zones, areas of mixed quality forests occur in large proportion. These forests stands have a comparatively low economic value at present but the areas have much higher potential. At present the stands consist of comparatively low proportion of valuable economic species. Their clearfelling and conversion to valuable to valuable stands of economic species would result in appreciably higher production within a comparatively short period.

2. Existing Method of Exploitation

2.1 These forests are being managed under various silvicultural systems viz. selection, coppice with reserves and improvement fellings. Some States have already taken up large scale conversion of these forest stands into plantation of quick growing as well as long rotation commercial timber species with the object of higher production per unit area.

3. Need for Investment

3.1 These forests would require to be clearfelled and planted on a large scale. Due to paucity of State Government's resources much of the area in each State has still remained unconverted. It would be worthwhile to take money from Institutional sector to finance development. This economic model examines the feasibility of financing the conversion and plantation programme of an area including phasing of loan requirements and interest and capital payment. It is presumed money could be borrowed at 7 per cent.

4. Experience

4.1 Most of the States have experience of converting these forests into profitable plantations. The species are known, the techniques of raising them are also perfected and site suitability is known. Excepting for pines, the large scale introduction of which is constrained by lack of seeds, all other species are well tested now in most of the States.

5. The Project

5.1 The projects shall consist of identifying suitable areas in each State within forest areas specified above. These forest areas will be clearfelled. Areas for clearfelling will be so chosen that continuous areas are available for concentrated plantations. It is hoped that the clearfelling material will be

utilised and for this a close link will be established between felling, plantation and utilization. If industries are required to utilize this material steps will be taken to set up these industries.

5.2 The project envisages taking up plantation of the clearfelled areas in blocks of 2000 hectares. For a 20,000 hectares annual unit proposed, the proportion of planting areas will be as under :—

	hectares
Eucalyptus or other fast growing Spp.	8,000
Bamboo	2,000
Pine	4,000
Teak	6,000

5.3 The targets of plantation have been based on the requirements of pulp-wood and construction timber. The object of providing employment to weaker section of people has also been kept in view. A short rotation crop of Eucalyptus or other fast growing species and pine will give a quicker turn over and consequently more employment to the rural sector which is one of the objectives of new forestry programmes in this country. Although in the scheme only four species have been considered—other species can also be included in the plantation programme depending on the experience of the States.

5.4 Agrisilviculture may be practiced in the plantation areas for at least 3 years where possible. In the model this has been considered feasible. The programme as envisaged in the model becomes self-sustaining after 10th year although payment of interest and loan is spread over till the 28th year. Surplus revenue obtained after the 10th year can be used for further development.

6. It must be emphasised that the model has been worked out on certain parameters. This is in no way rigid and each State has to work out its own exercise based on the economic parameters prevailing in their regions to arrive at more precise Project Formulation and benefits and costs.

7. Project Costs

7.1 Various cost assumptions and the details are given in the accompanying Statements (8.1 to 8.8) along with footnotes.

8. Project Benefits

8.1 Benefits from such a project will be replacing existing low quality mixed forests by a more valuable fast grown species giving higher return per unit area both in volume and value. It will also provide employment to weaker sections of people. The monetary benefits and the various parameters on which they are based is given in the accompanying statements including the detailed financial analysis (8.9 to 8.11).

8.2 The benefit cost ratios for *Eucalyptus*, *bamboo*, *pine* and *teak* plantations are 1.23, 1.01, 1.13 and 1.26 respectively assuming a 7 per cent discount rate and the internal rates of return varies from 7 to 10 per cent.

8.1. Statement on Abstract of Investment Costs

(Model Plantation Project of 20,000 hectares annually)

(Rs. in million)

Year	Annual Planting Area under different species (in hectares)					Planting & main- tenance expendi- ture in- cluding fire pro- tection	Staff	Rent, Office expendi- ture etc.	Capital Cost	Total Cost (Col. 7+ 8+9+ 10)
	Eucalyp- tus or other fast growing species	Bamboo	Tropical Pine	Teak	Annual planting area					
1	2	3	4	5	6	7	8	9	10	11
0 Year	8,000	2,000	4,000	6,000	20,000	17,800	0.800	0.510	20,550	39,660
1st Year	8,000	2,000	4,000	6,000	20,000	18,800	1.520	1.020	3,620	24,960
2nd year	8,000	2,000	4,000	6,000	20,000	19,250	2.240	1.530	2,030	25,050
3rd Year	8,000	2,000	4,000	6,000	20,000	19,880	2.960	2.040	2,100	26,980
4th Year	8,000	2,000	4,000	6,000	20,000	20,900	3.680	2.550	1,750	28,880
Total for 5 years	40,000	10,000	20,000	30,000	1,00,000	96,630	11.200	7.650	30,050	145,530
5th Year	8,000	2,000	4,000	6,000	20,000	21,320	4.400	3.060	..	28,780
6th Year	8,000	2,000	4,000	6,000	20,000	21,720	5.120	3.570	..	30,410
7th Year	8,000	2,000	4,000	6,000	20,000	21,720	5.840	4.080	..	31,640
8th Year	8,000	2,000	4,000	6,000	20,000	21,720	6.560	4.590	..	32,870
9th Year	8,000	2,000	4,000	6,000	20,000	21,720	7.280	5.100	..	34,100
Total for 10 Years	80,000	20,000	40,000	60,000	2,00,000	204,830	40.400	28.050	30,050	303,303

8.2 Statement on Cost of Planting and Maintenance of *Eucalyptus**(Rs. in million)
(Areas in hectares)

Year	Planting		Maintenance		2nd Year		3rd Year		4th Year		5th Year		Total Cost (Col. 3+5+7+9+11+13)
	Area	Cost@ Rs.	Area	Cost@ Rs. 50 per ha.	Area	Cost@ Rs. 25 per ha.	Area	Cost@ Rs. 35 per ha.	Area	Cost@ Rs. 35 per ha.	Area	Cost@ Rs. 35 per ha.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
0	8,000	8,000	..	..	..	..	..	..	..	..	..	..	8,000
1st	8,000	8,000	8,000	0.400	..	..	..	..	..	..	..	..	8,400
2nd	8,000	8,000	8,000	0.400	8,000	0.200	..	..	..	..	..	..	8,600
3rd	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	..	..	..	..	8,880
4th	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	8,000	0.280	..	..	9,160
5th	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	8,000	0.280	8,000	0.280	9,440
6th	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	8,000	0.280	8,000	0.280	9,440
7th	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	8,000	0.280	8,000	0.280	9,440
8th	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	8,000	0.280	8,000	0.280	9,440
9th	8,000	8,000	8,000	0.400	8,000	0.200	8,000	0.280	8,000	0.280	8,000	0.280	9,440
TOTAL	80,000	80,000	..	3.600	..	1.600	..	1.960	..	1.680	..	1.400	90,240

* Cost break up is given in the Explanatory Note to the Statements 8.2 to 8.7.

8.3 Statement on Cost of Planting and Maintenance of Bamboo*
(Rs. in million)

Year	Planting		Maintenance 1st Year			Total cost (Col. 3 + 5)
	Area in hec- tares	Cost @ Rs. 500 per hectare	Area in hec- tares	Cost @ Rs. 50 per hectare	Cost @ Rs. 50 per hectare	
1	2	3	4	5	6	6
0 Year	1,000
1st Year	1,100
2nd Year	1,100
3rd Year	1,100
4th Year	1,100
5th Year	1,100
6th Year	1,100
7th Year	1,100
8th Year	1,100
9th Year	1,100
TOTAL 10 Years	20,000	10,000	18,000	0,900	0,900	10,900

*Detailed cost break up is given in the Explanatory Note to the Statements 8.2 to 8.7.

8.4 Statement on Cost of Planting and Maintenance of Tropical Pine*

(Area in hectares)
(Rs. in million)

Year	Planting	1st Year		2nd Year		3rd Year		4th Year		5th Year		6th Year		Total cost (Col. 3+5+7+ 9+11+ 13+15)	
		Area Rs. 1000 per ha.	Cost@ Rs. 50 per ha.	Area Rs. 25/ ha.	Cost Rs. 25/ ha.	Area Rs. 35/ ha.	Cost@ Rs. 35/ ha.	Area Rs. 35/ ha.	Cost@ Rs. 35/ ha.	Area Rs. 100/ ha.	Cost@ Rs. 100/ ha.				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0 Year	4,000	4,000	..	..	..	..	..	..	..	..	..	..	..	..	4,000
1st Year	4,000	4,000	4,000	0.200	..	..	..	..	..	..	..	..	..	..	4,200
2nd Year	4,000	4,000	4,000	0.200	4,000	0.100	..	..	..	..	..	..	..	..	4,300
3rd Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	..	..	..	..	..	..	4,440
4th Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	4,000	0.140	..	..	..	..	4,580
5th Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	4,000	0.140	4,000	0.140	..	..	4,720
6th Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	4,000	0.140	4,000	0.140	4,000	0.400	5,120
7th Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	4,000	0.140	4,000	0.140	4,000	0.400	5,120
8th Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	4,000	0.140	4,000	0.140	4,000	0.400	5,120
9th Year	4,000	4,000	4,000	0.200	4,000	0.100	4,000	0.140	4,000	0.140	4,000	0.140	4,000	0.400	5,120
TOTAL	40,000	40,000	1,800	..	0.800	0.800	0.980	0.840	0.700	1,600	46,720

*Details are given in Explanatory Note to the Statements 8.2 to 8.7.

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8.5 Statement on Cost of Plantation & Maintenance of Teak*

Year	Planting		Maintenance First Year		Maintenance Second Year		Maintenance Third Year		Fertiliser Fourth Year		Total cost (Col. 3+5+7+9+11)	
	(Area in hectares)		(Rs. in million)		(Rs. in million)		(Rs. in million)		(Rs. in million)		(Rs. in million)	
	Area	Cost @ Rs. 800/ per ha.	Area	Cost @ Rs. 50/ ha.	Area	Cost @ Rs. 25/ ha.	Area	Cost @ Rs. 35/ ha.	Area	Cost @ Rs. 100/ ha.	Area	Cost @ Rs. 100/ ha.
1	2	3	4	5	6	7	8	9	10	11	12	13
0 Year	.	.	6,000	4,800	.	.	.	.	.	.	.	4,800
1st Year	.	.	6,000	4,800	6,000	0.300	.	.	.	.	.	5,100
2nd Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	.	.	.	5,250
3rd Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	.	5,460
4th Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	6,000	6,060
5th Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	6,000	6,060
6th Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	6,000	6,060
7th Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	6,000	6,060
8th Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	6,000	6,060
9th Year	.	.	6,000	4,800	6,000	0.300	6,000	0.150	6,000	0.210	6,000	6,060
TOTAL	60,000	48,000	2,700	1,200	1,470	3,600	56,970					

*Details are given in the Explanatory Note to the Statements 8.2 to 8.7.

8.6 Statement on Annual Expenditure on Staff

(Area in hectares)
(Cost in Rs. million)

Year	Area under Eucalyp- tus	Cost @ Rs. 40/ ha.	Area under Pine	Cost @ Rs. 40/ ha.	Area un- der Teak	Cost Rs. 40/ ha.	Area un- der Bam- boo	Staff expendi- ture	Total cost (Col. 3+5 7+9)
1	2	3	4	5	6	7	8	9	10
0 Year	.	8,000	4,000	0.160	6,000	0.240	2,000	0.080	0.880
1st Year	.	16,000	8,000	0.320	12,000	0.480	4,000	0.080	1.520
2nd Year	.	24,000	12,000	0.480	18,000	0.720	6,000	0.080	2.240
3rd Year	.	32,000	16,000	0.640	24,000	0.960	8,000	0.080	2.960
4th Year	.	40,000	20,000	0.800	30,000	1.200	10,000	0.080	3.680
5th Year	.	48,000	24,000	0.960	36,000	1.440	12,000	0.080	4.400
6th Year	.	56,000	28,000	1.120	42,000	1.680	14,000	0.080	5.120
7th Year	.	64,000	32,000	1.280	48,000	1.920	16,000	0.080	5.840
8th Year	.	72,000	36,000	1.440	54,000	2.160	18,000	0.080	6.560
9th Year	.	80,000	40,000	1.600	60,000	2.400	20,000	0.080	7.280

The annual staffing requirements have been worked out as under :—

1. For bamboo : The staff is charged only for the year of planting, thereafter a protection staff is maintained.
2. For pine, teak & eucalyptus : The plantations are regarded as a growing concern, i.e., each year a new staff ex-
pense is added besides maintaining the old staff.

8.7 *Statement on Annual Contingency — expenses are calculated on the basis of 20,000 hectares forest area being regarded as a growing concern includes Contingencies & Fire Protection and Protection Staff on Bamboo*

Year	(Area in hectares) (Cost Rs. in million)									
	1	2	3	4	5	6	7	8	9	Total Expenses (Col. 3+ 5+7+9)
0 Year	.	8,000	0.216	4,000	0.108	6,000	0.162	2,000	0.024	0.510
1st Year	.	16,000	0.432	8,000	0.216	12,000	0.324	4,000	0.048	1.020
2nd Year	.	24,000	0.648	12,000	0.324	18,000	0.486	6,000	0.072	1.530
3rd Year	.	32,000	0.864	16,000	0.432	24,000	0.648	8,000	0.096	2.040
4th Year	.	40,000	1.080	20,000	0.540	30,000	0.810	10,000	0.120	2.550
5th Year	.	48,000	1.296	24,000	0.648	36,000	0.972	12,000	0.144	3.060
6th Year	.	56,000	1.512	28,000	0.756	42,000	1.134	14,000	0.168	3.570
7th Year	.	64,000	1.728	32,000	0.864	48,000	1.296	16,000	0.192	4.080
8th Year	.	72,000	1.944	36,000	0.972	54,000	1.458	18,000	0.216	4.590
9th Year	.	80,000	2.160	40,000	1.080	60,000	1.620	20,000	0.240	5.100

I Establishment Costs : *Eucalyptus* & *Pine* (per hectare)

Details	Rs. per ha.
1. Plot survey and demarcation	2
2. Site clearance	3
3. Soil working by departmental tractors:—	
(a) DPOL	
Ploughing	35
harrowing	11
ridging	9
(b) Labour	4
4. Cost of seed	4
5. Nursery cost	200
6. Insecticide	9
7. Fencing : (a) Material	75
(b) Labour	14
8. Transport	45
9. Planting and Replacement	70
10. Harrowing	30
11. Seasonal staff watchers	5
12. Tractors and implements—	153
New purchase, purchase of spare parts, cost of repairs	
13. Huts for labourers	15
14. Roads maintenance	3
15. Water arrangements and other labour amenities	10
16. Fertiliser	100
	797
	or Rs. 800 per ha.

P. T. O.

2. Annual Expenditure (Staff)

Staff requirements for unit of 2,000 hectares is proposed as under :—

Staff	Nos.	Emoluments	Total for the year
D. F. O.	1	1,000	12,000
Ranger	2	350	8,400
Forester	4	180	8,640
Forest Guard	10	140	16,800
Driver	10	150	18,000
Cleaner	10	110	13,200
Clerk	2	130	3,120
Typist	1	150	1,800
			<u>Rs. 821,960</u>
	82,000		
	2,000	= 41 or Rs. 40/ha	

The staff suggested may not be with the Forest Department staffing pattern. Normally for drawing up a commercial project overhead on staff should be kept as low as possible. Hence the proposed staffing pattern. This is only suggestive. There should be no difficulty in changing this pattern. The high establishment cost proposed will allow this adjustment.

3. Annual Contingencies for 2,000 hectares

Building rent	6,000
Postage and Telephone	5,000
Running of vehicles	15,000
Contingencies	5,000
	<u>Rs. 31,000</u>

31000
2000 ——— = Rs. 15 per ha. (Approx.)

4. Harrowing

Rs. 35 per ha.
based on operational costs
@ Rs. 17.50/hour

} For Eucalyptus and Pine

5. Fertiliser

1000 plants @ 200 gms of Calcium Ammonium Nitrate per plant based on 1000 plants per hectare and Rs. 515 per tonne of fertiliser the cost per hectare works out to Rs. 100/- per hectare.

6. *Protection—Fire Protection*

One Fire Watcher for 2000 hectares

10 Fire Watchers @ Rs. 100/- = 12000

$$\frac{12000}{200} = \text{Rs } 6 \text{ per hectare}$$

Roads & Fire Lorries—Maintenance

and cutting of fire lines = Rs. 6 per hectare

Total Rs. 12 per hectare

II. First year maintenance		Eucalyptus	Pine							
		Rs.	Rs.							
Beating up of Failures		25	50							
Grass cutting around Plants		25								
		50	50							
III. Second year maintenance										
		Rs.	Rs.							
Grass cutting around plants		25	25							
IV. Costs in Subsequent years (in Rs.) per hectare										
		Eucalyptus				Pine				
Year		3	4	5	10	3	4	5	6	10
Item										
Harrowing		35	35	35	..	35	35	35
Fertiliser		100	..

*Assumptions***Bamboo**

I. Establishment costs Rs. 500 Par ha.

1st year Rs. 50

2nd year nil

3rd year to 10th year and thereafter No costs have been assumed as the cleaning operation will take care of the costs involved.

II. For Bamboo are of 2,000 hectares staffing have been adopted as per other Plantations.

III. Immediately after planting—1 Forest Guard for 100 hectares will be employed to look after. Annual cost is Rs.8/hectare.

IV. Building rentals and contingencies charged without the building (It is expected that the existing building will cater the demand).

Annual Cost is Rs. 4/ ha.

Yield : 4 Tonnes at 10th year and thereafter

4 Tonnes/ha/every 4 years.

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1. Establishment . . . Rs. 800 per ha.
2. Staff . . . Rs. 40/ha.
3. Annual contingency . . Rs. 15/ha.
4. Harrowing . . . Rs. 35/ha—third year
5. Fertiliser . . . Rs. 100/- ha—fourth year
6. Protection . . . Rs. 12/ha.
7. Ist year maintenance . Rs. 50/ha.
8. 2nd year weeding around plants . . . Rs. 25/ha.

8.8. Statement on Provision for Capital Expenditure in Plantation Project (Rs. in million)

Year	Costs
0 Year	20.55
Ist Year	3.62
2nd Year	2.03
3rd Year	2.10
4th Year	1.75
5th Year . . . . .	..
6th Year . . . . .	..
7th Year . . . . .	..
8th Year . . . . .	..
9th Year . . . . .	..
Total	30.05

Explanatory note to Statement 8.8

Machinery Requirements*

On the basis of Experience of U. P. the requirements of machineries for an annual planting area of 2000 hectares has been adopted. The assumption is that these machines have a life of 10 years and the bulk of the machineries will be purchased in the first year.

The requirements of the machineries will be as under :

Annual unit of 2000 hectares.

Tractors

Year of planting	Ploughing Crawler 55-65 HP	Wheel - ed Type 40-45 HP for Trans- porta- tion	Harrow- ing Wheel- ed type 40-45 HP	Reserve		Total
				Crawler	Wheel- ed	
1st	9	5	5	2	2	23
2nd . . . . .	..	5	..	..	..	5
3rd . . . . .	..	5	..	..	..	5
4th . . . . .	..	5	..	..	..	5
5th . . . . .	..	5	..	..	..	5
Total	9	25	5	2	2	43

Requirements of other implements :

(i) Trailing type 5-6 Disc Plough . . . . .	..	16
(ii) Trailing type 4 Disc Plough . . . . .	..	24
(iii) 18 Disc offset Harrows . . . . .	..	35
(iv) Ridger . . . . .	..	8
(v) Trailer . . . . .	..	40

Year of Planting	Trailing type 5-6 Disc	Trailing, type 4 Disc plough	18 Disc offset Harrows	Ridger	Trailer
1st	9	12	7	8	40
2nd	7	12	10	..	..
3rd . . . . .	..	..	8	..	..
4th . . . . .	..	..	10	..	..
5th . . . . .	..	..	..	..	..
Total	16	24	35	8	40

*While apportioning the cost of machinery to the project incalculating rate of return, the entire cost has not been included and scrap value and part utilisation of the machines and other works have been assumed.

Capital Requirements for Machineries for 20,000 Hectares

Particulars	No. of Units	Price per Unit in Rs.	Require- ments Rs. in million
1st year			
Trailer Ploughing Crawler	110	75,000	8.25
Harrowing & transport wheeled type	120	35,000	4.20
Machinery of ploughs	210	8,000	1.68
Harrows	70	3,700	0.26
Ridger	80	2,000	0.16
Trailer	400	15,000	6.00
			<hr/> 20.55 <hr/>
2nd Year			
Tractors	50	35,000	1.75
Ploughs	190	8,000	1.52
Harrows	100	3,500	0.35
			<hr/> 3.62 <hr/>
3rd Year			
Tractors	50	35,000	1.75
Harrows	80	3,500	0.28
			<hr/> 2.03 <hr/>
4th Year			
Tractors	50	35,000	1.75
Harrows	100	3,500	0.35
			<hr/> 2.10 <hr/>
5th Year	50	35,000	1.75

Assumptions on Revenue prior to Planting

Rent for Agriculture cultivation . . . Rs. 100/ha

Revenue from clearfelling
after deducting normal revenue . . . Rs. 400/ha

8.9 Statement on Estimate of Loan Requirement based on Expenditure and Yield from Clearfelling and Lease Rent
(Rs. in million)

Year	Total Expendi- ture	Interest on cumu- lative loan at 7%	Revenue		Loan Require- ment (Col. 2-6)	Cumulative Loan
			Lease Rent@ Rs. 100 per ha.	Yield from clearfell- ing @ Rs. 400		
1	2	3	4	5	6	7
0 Year	.	.	.	.	.	.
1st Year	39.660	2.076	2.000	8.000	10.000	29.660
2nd Year	24.960	2.983	4.000	8.000	12.000	42.620
3rd Year	25.050	3.757	6.000	8.000	14.000	53.670
4th Year	26.980	4.665	6.000	8.000	14.000	66.650
5th Year	28.880	5.707	6.000	8.000	14.000	81.530
6th Year	28.780	6.742	6.000	8.000	14.000	96.310
7th Year	30.410	9.890	6.000	8.000	14.000	112.720
8th Year	31.640	9.125	6.000	8.000	14.000	130.360
9th Year	32.870	10.446	6.000	8.000	14.000	149.230
	34.100	11.853	6.000	8.000	14.000	169.330
TOTAL	303.330					169.330

8.10 Statement on Surplus Revenue from 10th Year

Year	(Rs. in million)									
	1	2	3	4	Yield from Thinning			Yield from final Harvest		
					Yield from Eucalyptus	Yield from Bamboo	Pine	Teak	Pine	Total (Col. 2 to 8)
10	.	4,000	24,000	0,640	4,800			0,960		34,400
11	.	2,000	24,000	0,640	4,800			0,960		32,400
12	.	.	24,000	0,640	4,800			0,960		30,400
13	.	.	24,000	0,640	4,800			0,960		30,400
14	.	.	24,000	1,280	4,800			0,960		31,040
15	.	.	24,000	1,280	4,800			0,960		31,040
16	.	.	24,000	1,280	4,800			0,960		31,040
17	.	.	24,000	1,280	4,800			0,960		31,040
18	.	.	24,000	1,920	4,800			0,960		31,680
19	.	.	24,000	1,920	4,800			0,960		31,680
20	.	.	24,000	1,280						25,280
21	.	.	24,000	1,280						25,280
22	.	.	24,000	1,920						25,920
23	.	.	24,000	1,920						25,920
24	.	.	24,000	1,280						25,280
25	.	.	24,000	1,280				16,080		41,360
26	.	.	24,000	1,920				16,080		42,000

27	..	24,000	1,920	..	16,080	..	..	42,000
28	..	24,000	1,280	..	16,080	..	..	41,360
29	..	24,000	1,280	..	16,080	..	..	41,360
30	..	..	..	..	16,000	48,000	..	64,080
31	..	..	..	..	16,080	48,000	..	64,080
32	..	..	..	..	16,080	48,000	..	64,080
33	..	..	..	..	16,080	48,000	..	64,080
34	..	..	..	..	16,080	48,000	..	64,080
35	..	..	..	..	..	48,000	..	48,000
36	..	..	..	..	..	48,000	..	48,000
37	..	..	..	..	..	48,000	..	48,000
38	..	..	..	..	..	48,000	..	48,000
39	..	..	..	..	..	48,000	..	48,000
40	..	..	..	..	36,000	..	..	36,000
41	..	..	..	..	36,000	..	..	36,000
42	..	..	..	..	36,000	..	..	36,000
43	..	..	..	..	36,000	..	..	36,000
44	..	..	..	..	36,000	..	..	36,000
45	..	..	..	..	36,000	..	..	36,000
46	..	..	..	..	36,000	..	..	36,000
47	36,000	36,000
48	36,000	36,000
49	36,000	36,000
60	480,000	480,000
to	480,000	480,000
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Explanatory Nott to Statement 8.9 and 8.10

Assumption on Yield and Prices (Plantation Crop.) per hectare

	Price
Eucalyptus (10m ³ /ha/year M. A. I.)	Rs. 30 per m ³
Pine (15m ³ /ha/year M. A. I.)	Rs. 30 per m ³
	Rs. 40 per m ³
Bamboo	Rs. 80/tonne
Yield at the end of Rotation of 10 years per m ³ and subsequent coppice Rotation 100 m ³ per hectare.	
40 m ³ at tenth year Thinning for Pulpwood	
(300 m ³ /ha at 30th year 60% Sawn wood 40% Pulp wood)	
4 tonne/hectare at tenth year and 1 Tonne/hectare/year M. A. I.	
4 Tonnes every 4th year thereafter.	
Quality I/II to II/III	

Year	Thinning Yield		Price	Total		Final Yield		Price @ Rs. 400/ m ³ (Ti- mber) Rs. 4/m ³ (small wood)
	Small wood (m ³)	Timber (m ³)		Small wood Rs. 4 m ³	Timber Rs. 200/ m ³	Small wood (in m ³)	Timber (in m ³)	
10	.	.	.	160	nil	..	..	..
25	.	.	.	13	2,600	..	..	..
40	.	.	.	30	6,000	..	..	..
					or 6,000			
60	16	200	80,064 or Rs. 80,000

8.11 Statement on Disbursement and Payment Schedule

Year	(Rs. in million)						
	1	2	3	4	5	6	7
0 Year	.	29,600	29,600	..	2,076	..	..
1st Year	.	12,960	42,620	..	2,983	..	..
2nd Year	.	11,050	53,670	..	3,757	..	..
3rd Year	.	12,980	66,650	..	4,665	..	..
4th Year	.	14,880	81,530	..	5,707	..	..
5th Year	.	14,780	96,310	..	6,742	..	..
6th Year	.	16,410	112,720	..	7,890	..	..
7th Year	.	17,640	130,360	..	9,125	..	..
8th Year	.	18,870	149,230	..	10,446	..	..
9th Year	.	20,100	169,330	..	11,853	..	..
10th Year	.	..	169,330	34,400	11,853	9,000	13,547
11th Year	.	..	160,330	32,400	11,223	9,000	12,177
12th Year	.	..	151,330	30,400	10,593	9,000	10,807
13th Year	.	..	142,330	30,400	9,963	9,000	11,437
14th Year	.	..	133,330	31,040	9,333	9,000	12,707
15th Year	.	..	124,330	31,040	8,703	9,000	13,337

1	2	3	4	5	6	7
16th Year	..	115,330	31,040	8,073	9,000	13,967
17th Year	..	106,330	31,040	7,443	9,000	14,597
18th Year	..	97,330	31,680	6,813	9,000	15,867
19th Year	..	88,330	31,680	6,183	9,000	16,497
20th Year	..	79,330	25,280	5,553	9,000	10,727
21st Year	..	70,330	25,280	4,923	9,000	11,357
22nd Year	..	61,330	25,920	4,293	9,000	12,627
23rd Year	..	52,330	25,920	3,663	9,000	13,257
24th Year	..	43,330	25,280	3,033	9,000	13,247
25th Year	..	34,330	41,360	2,403	9,000	29,957
26th Year	..	25,330	42,000	1,773	9,000	31,227
27th Year	..	16,330	42,000	1,143	9,000	31,857
28th Year	..	7,330	41,360	0,513	7,330	33,517
29th Year	41,360
30th Year to 34th Year	64,080
35th Year to 39th Year	48,000
40th Year to 49th Year	36,000
60th Year to 69th Year	480,000
69th Year	480,000