Forestry Development Strategy for India for 1985 and Formulation of Regions Based on a Study of the Present and Potential Role of Forests and Forest Industries in the National Economy

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India has a rich forestry tradition more than hundred years old, in which the foresters' bias was towards conservation and growing large-sized trees. There is now a need for drastic change in order to enable to forestry sector to play a more dominant role in the industrial revolution that is taking place in the country. It is time the conventional forestry practices gave place to a more dynamic approach to forest planning aimed at the augmentation of yields of industrial wood.

The three major-constraints of the forestry sector are (a) lack of capital, (b) lack of demand of industrial wood and (c) lack of reliable data to form a basis for realistic planning. In recent years earnest efforts have been made by Government, planners and industrialists to overcome these constraints. In this connection mention may be made of the useful work done by the Pre-Investment Survey of Forest Resources Organization.

The paper sets out to tackle the problems of forestry development during the next 15 years, based on a critical analysis of the projections of present and future production and demands of industrial wood and the scales of present and future inputs.

The forest area of India constitutes 23% of the total geographical area, and nearly 50% of the area under agriculture. The average annual increment per hectare is extremely low and the present extent of removal of industrial wood from the forests is much below their potential productive capacity. The contribution of the forestry sector to the gross national product and to the working force is also negligible. Likewise, even though this sector is getting an increasing allocation of funds under the Five Year Development Plans, the overall picture remains relatively static. The share of the developmental allocations in the forestry sector remains almost 0.7% of the total plan outlays under the different Five Year Plans.

The population of the country is expected to become 750 million in the year 1985 and the demand of industrial wood is expected to soar from the present figure of 14 million m^3 to 50 million m^3 in the same period. Thus the task before the forester is to strive to meet spiralling needs of industries for industrial wood. The requirements of industrial wood would be even higher than the figure mentioned above if extra allowance is to be made for the possibilities of exports of wood and wood products to the extent of 7% of the production targets.

During the period from now till 1985, it is estimated that an investment of nearly Rs. 1,500 crores will be made in the expansion of existing wood-based industries or setting up new ones and for this to be meaningful and practical, it would be necessary to have a proper plan based on the resource situation and a thorough study of forestry regions. Moreover, for a proper planning of forestry development during the next fifteen years, it would be worthwhile dividing the forest areas into regions based on parameters such as productivity, terrain, climate, demand and location of wood-based industries, etc. Such a study was carried out in 1964 by the Planning Commission for the formation of regions for general development. In this paper ten regions have been formulated for the country,

Land, labour, capital and organization are the four well-recognised economic factors of production whose full employment is considered necessary for the maximization of national wealth and prosperity. The general welfare of a nation depends on the degree of sound and planned exploitation of available resources. Forestry represents a significant element in World economy. However, its state in the different regions of the world presents a wide range of a spectrum. It is interesting to note that in the different countries it is directly linked with the standard of industrial development. In Europe, and U.S.A. which have reaped the fruits of the Industrial Revolution, the status of forestry is well recognized. But not so is the case with the less developed countries.

In the developing countries, forestry and timber industries generally find themselves between two poles of agriculture and industry. On the one hand, forestry is linked most intimately with agriculture, and on the other hand, wood is an industrial raw material which is processed by a great variety of industries. This dual role has often led to a neglect of forestry from both side, thus preventing it from making its proper contribution to economic growth. There are, however, glimmerings that forest development, integrated with agricultural and industrial progress, will come to be used deliberately as an essential part of measures to promote a self-sustaining economic growth and often as a useful form of public works capable of absorbing unemployed and under-employed rural manpower.

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India has a glorious forestry tradition of more than hundred years which, however, would call for a drastic chan ge in order to enable this sector to play a more dominant role in the industrial revolution that is taking place in the country. Hitherto, the bias of the forestry man was towards conservation and growing a "forest beautiful" containing large-sized timber trees grown on long rotations of a hundred years or more. In view of the new unprecedented demands that would be placed on the forest for supplying the requirements of industrial wood, the conventional forestry practices may not be enough and these may have to give place to a more dynamic approach to forest planning aimed at the augmentation of yields of industrial wood per hectare. The answer would lie in treating forestry as an economic activity and integrating forestry development plans with the over all development of all other sectors of the economy, and particularly those relating to industrial growth. When this happens, the contribution of forestry to national income will increase appreciably.

The three major constraints of the forestry sector are (a) lack of capital, (b) lack of demand of industrial wood and (c) lack of reliable data to form a basis for realistic planning. With lack of capital, lack of demand is also a most important obstacle to development. Likewise, planned development of forest resources to meet the growing demands of industries for raw material cannot be undertaken without a comprehensive survey of the forest resources throughout the country. Moreover. for a systematic and scientific expansion of wood-based industries, it is necessary as a first step to have adequate and continuing inventories of the renewable natural resources to determine their condition, productivity and potential use in relation to human needs and to support these as a guide to the proper utilization and treatment of these resources. It cannot be emphasized too much that, in a rapidly developing country, an organization must be in a condition of growth; it must recognize the necessity for constant reappraisal of its status, carry out continuous planning for future development and be aware of the possibility of acquiring or disposing of resources.

barring the islands of Andamans and Nicobar and Laccadive and Minicoy, and indications are given of their potential productivity and the role they could play in the development of wood-based industries.

The achievements in the agricultural sector have been discussed at some length in the paper and the factors that have contributed to a marked increase in crop yields have been highlighted. The green revolution in the agricultural sector has been achieved largely through heavy inputs, introduction of modern and scientific ideas and by organizational and institutional innovations. The lessons learnt in that sector could be applied to the forestry sector and a tremendous improvement could be brought about. The man-made forests which could be created on the basis of ideas put forward in the paper along with the development of the untapped resources in the remote and unopened tracts of the country could make the raw material prospects for the future quite promising and give a lie to the gloomy prognoses of experts of an impending wood famine in the country. For this purpose an investment of nearly Rs. 1,500 crores over and above the normal budgetary inputs would be required to be made. This means that the present annual plan allocation of Rs. 3 per hectare of commercial forest area will have to be raised to at least Rs. 20.

The question of forestry development has been engaging to the attention of Government and planners. In fact, the Planning Commission had desired a ten year development programme to be prepared and to dovetail it into the remaining part of the Fourth Plan. The National Commission on Agriculture has also got as one of the terms of reference the question of the development of forestry including farm forestry as a factor in agricultural progress and the establishment of wood-based industries to meet the demands within the country and the requirements of export and to generate employment opportunities. International bodies are also showing an interest in extending assistance for the development of forestry and creation of man-made forests in the country. Any attempts to reduce waste, earn and save foreign exchange, and utilize human resources would arouse a positive response from international bodies and all such help that could be forthcoming, could be pooled with the national effort in order to achieve the stupendous task which faces the country. Granting that the forestry blueprint presented in this paper is adopted, the contribution of the forestry sector to the gross national product in 1985 would be nearly Rs. 2,500 crores (as against the 1969-70 figure of Rs. 513 crores) and the working force in the forestry and forest industries sector would be nearly 30 million as against the 1969-70 figure of 3 million

In recent years earnest efforts have been made by Government, planners and industrialists to overcome the above three constraints. The forestry sector has been getting increasing allocations of resources under the Five Year Development Plans. So also the demand for industrial wood is rising steadily and industrialists are showing a keenness for expanding existing units and setting up new industries. As for the question of forest resources surveys, the Government of India have set up a Pre-Investment Survey of Forest Resources Organization which has done useful work in assessing reasonably accurately in selected forest areas the volume of the existing growing stock and other connected indices such as increment, drain, accessibility, etc. At best, these efforts could be regarded as useful activities, but it requires to be realized that much more effort would be required in the future to formulate a national picture of the resource base and to plan an investment programme for expanding it so that the supply of wood and wood products is able to keep pace with long-range demands.

This paper sets out to tackle the problems of forestry development during the next fifteen years based on a critical analysis of the projections of present and future production and demands of industrial wood and the scales of present and future inputs. Comparisons have been made with the developments in the agricultural sector inasmuch as, useful lessons could be learnt from the achievements recorded in it. The green revolution in agriculture has been brou-

ght about by concentrated efforts, heavy inputs, introduction of scientific ideas and intensive organizational support. Similar efforts will also have to be made in the forestry sector if it is to occupy its rightful place as an effective contributor to national welfare and a generator of rural and industrial employment.

These matters have been engaging the attention of planners in the country and other international bodies Actually, the Planning Commission had desired a ten year perspective plan of forestry development to be prepared and closely dovetailed into the remaining period of the Fourth Plan. The National Commission on Agriculture which has recently been set up by the Government of India has also been asked to investigate and report on forestry development. The specific term of reference in this respect reads —

"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". International bodies are showing an interest in extending assistance for the development of forestry and creation of man-made forests in the country. Any attempts made by the Indian Government to reduce waste, earn and save foreign exchange, and utilize human resources would certainly arouse a positive response from international bodies and all such help that could be forthcoming could be pooled with the national effort in order to achieve the stupendous task which faces the country. This study which deals with the patterns, problems and promise of forestry development in India would have served its purpose if it could succeed in creating an abiding interest in the matter and stimulate further thinking. The basis for any effective planning of forestry development in India for the future would be the formulation of regions; and this is what the paper sets out to present.

FORESTRY SITUATION, POPULATION TRENDS AND APPRAISAL OF DEMAND OF WOOD

According to an estimate of the Ministry of Food and Agriculture[1], the total growing stock in all the forests of India is estimated at nearly 2128 million m^3, of which broad-leaved species account for 1820 m^3 (86% of total) and conifers for 308 million m^3 (14% of the total). The stocking per hectare works out to about 24 m^3 for broad-leaved species (against 90 m^3 for Asia-Pacific region) and 118 m^3 for conifers. The estimates for increment are only tentative and work out to 0.53 m^3 per hectare per annum against 2 m^3 per hectare for conifers and 0.8 m^3 per hectare for broad-leaved species in the Asia-Pacific region.

The first and most striking feature of the forestry situation in India is the very unbalanced geographical distribution of the forest resources and the general paucity of resources, though not in extent of forests but in growing stock and increment. The next point is the extraordinary diversity of the regions' forests, ranging from wet evergreen with its enormous wealth of species, to monoculture of pine and deodar. Methods of management, exploitation and regeneration differ equally widely, ranging virtually from no management at all to intensive plantation forestry. The increment varies from 0.175 m^3 per hectare for scrub forests to over 35 m^3 per hectare in Eucalyptus globulus plantations in the Nilgiris. But nearly always, the increment is very much below the potential that can be achieved. There is thus a great possibility of increasing the rate of growth and hence the production potential. Often what is grown and felled is not fully used; logging is often limited to a few valuable species and much material suited for general utility work or pulp is wasted in the absence of forest industries or suitable markets or because transport costs are too high.

Population Trend :— The projection of mid-year population in millions which has been made by the Planning Commission is 527 in 1968-69; 596 in 1973-74; 666 in 1978-79; 690 in 1980-81 and 750 in 1985-86.

Population growth is an important variable determining the rate of improvement in per capita income. The above projections of population growth are based on the recommended projections of the Registrar General. According to these the population would increase at the rate of around 2.5 per cent during the Fourth Plan. This rate would fall thereafter, reaching 1.7% a year by 1980-81. Implicit in these projections is the assumption that there will be a decrease in birth rate from 39 per thousand of population in 1968 to 25 in 1980-81 on the basis of an active family planning programme and a decline in the death rate from 14 per thousand of population to less than 9 over the same period. If population growth is brought down to 1.7 per cent by 1980-81 and further to 1 per cent by the end of this century, the population in 2000 would be around 890 million. Population growth on this scale can be a crippling handicap since the population of the country in relation to resources is already large, incomes are low and economic development is a desperate need. The speed at which a country develops depends largely upon its ability to direct a larger part of its growing resources to investment rather than current consumption.

Projections of Demand For Wood :— Of the many projections made of the demand for forest produce in the ensuing years, the one which has been chosen for reproduction in this paper is the estimate prepared by the Working Group, Forestry Sector, Fourth Plan Proposals, 1968. The projections are given below :—

TABLE NO. 1

A. INDUSTRIAL WOOD

In Million m^3 Round Wood Equivalent

		1970	1975	1980	1985
Timber	...	11.65	15.75	22.90	33.21
Roundwood	...	1.99	2.75	3.99	5.78
Pulpwood	...	0.42	2.66	4.80	9.94
Matchwood	...	0.33	0.40	0.49	0.57
Total	...	14.39	21.54	32.17	49.50
or in round figures	...	14	22	32	50

B FUELWOOD

(Million tonnes)

		1970	1975	1980	1985
Fuelwood	...	121	130	131	126

These projections are based on the following assumptions :—

1. Timber and roundwood — rise of 2% per annum due to increase in population, of 5% upto 1975 and thereafter of 7% per annum due to economic development.
2. Pulpwood — according to anticipated per capita consumption of paper and paper products and availability of raw materials other than pulpwood.
3. Matchwood — according to anticipated future demands.
4. Fuelwood — will steadily rise upto 1980 and thereafter decrease due to substitution.

Projections of Supply Situation :— Taking the actual supply of industrial wood in 1960 as 7.7 million m^3 the projected demands would be nearly double in 1970, three times in 1975, four times in 1980 and seven times in 1985. As against this demand situation, the Ministry of Agriculture[2] has projected a supply position of 13.3 million m^3 in 1975 and 32 million m^3 in 1985. The annual yield from the industrial plantations has been estimated to be 12 million m^3 annually in the year 1985. It would be seen that there would be a shortfall in the production of industrial wood as compared to the projected demand. This gap according to Seth[3] can be narrowed considerably, among other things, by intensifying forest management for improving the productivity of the forests, paying attention to those extensive forest areas which have remained unexploited and by raising more industrial plantations. At the same time the major wood-using industries will have to get interested in locating new units close to the hitherto untapped raw material resources in the interest of economy and profitability.

The Pre-Investment Survey of Forest Resources Organization which has completed an extensive survey of the forest resources of the Godavary Catchment covering a compact block of forest area in Central India lying in the States of Madhya Pradesh (Bastar district), Maharashtra (Chanda district) and Andhra Pradesh has established that these forests could play a big role in the development of wood-based industries. Further details of this area are given in a later part of this paper dealing with proposed regions. Those who make a gloomy prognosis of an impending wood famine would do well to look at these and similarly rich forests in the north-eastern part of India, and visualize that they could supply a major need of industrial wood.

Seth[4] has pointed out that the level of production of wood from the forests of India is many times less than the potential productivity of the forests, and as such, there would be considerable scope for stepping up the annual production of wood from these forests. The short-term and long-term measures that could bring this about could be briefly stated as :—

a) Considering the present diversity of species as against the contemplated monoculture of a few selected species in areas picked out for intensive development.

b) Developing certain areas which carry a surplus of forest produce due to the fact that lack of population density and lack of infrastructural facilities have precluded this development of the areas. Such areas have been identified in Bastar, Chanda, Andhra Pradesh, Mysore, Kerala, and the north-east part of India. They are also found in inaccessible inner Himalayan forests of fir and spruce. It is of the utmost importance to utilize the surplus raw material here most profitably by creating the necessary network of communications and establishing primary resources of water and power etc., so that the woody material, much of which goes waste at present, is made good use of.

c) In the interest of a larger sustained growth of economy, it will be necessary to identify areas to change over from mixed forests of many secondary species to a restricted range of a very few species which could be used for production of pulp, plywood and boards of various kinds. This will lead, in the long run, to intensive and extensive development of areas which have a high industrial potential where intensification of production can be achieved by proper species selection, improved cultural practices, concentrated harvesting and integrated utilization.

THE FOURTH PLAN AND SECTORAL OUTLAY ON AGRICULTURE

Planning in India was intended in the words of the Government Resolution of March 1950, "to promote a rapid rise in the standard of living of the people by efficient exploitation of the resources of the country, increasing production and offering opportunities to all for employment in the service of the community".[5] For this purpose it would be necessary to organize the efficient exploitation of the resources of the country, increase production and step up the tempo of economic activity in general and industrial development in particular to the maximum possible extent. The basic goal is a rapid increase in the standard of living of the people, through measures which also promote equality and social justice.

In discussing the crucial role of agriculture, the Plan Document states that "growth with stability should remain the obective of the Perspective Plan, as it is of the Fourth Plans Agricultural output over the next decade needs to grow appreciably faster than has been achieved in the past. The strategy for achieving this goal will consist of expansion of cultivated area, intensification of cropping extension of irrigation facilities and measures to accelerate yield improvement. Provisional projections of the area, yield and production of major crops in 1980-81 and comparative figures for 1968-69 are shown in the table No. 2.

Gross cropped area is projected to reach 188 million hectares by 1980-81, compared to 156.6 million hectares in 1966-67. The introduction of improved soil and moisture conservation practices, the spread of irrigation and the increased use of chemical fertilizers can be expected to augment net sown area through the reduction of fallows. The major part of additions to cropped area will, however, have to come from multiple cropping. The increase in croping intensity is largely a function of the expansion and improvement of irrigation combined with development of crop varieties which can be fitted into tight rotations. It is expected that gross irrigated area would reach 58 million hectares by 1980-81.

The pattern of outlay on the agriculture and irrigation sectors is shown in the table No. 3.

TABLE NO. 2

PROJECTION OF AREA AND PRODUCTION OF SELECTED CROPS : 1968-69 & 1980-81

S. No.	Crop	1968-69 Area (mill. ha.)	1968-69 Yield (Kg./ha.)	1968-69 Production (mill. tons)	1980-81 Area (mill. ha.)	1980-81 Yield (Kg./ha.)	1980-81 Production (mill. tons)
1.	Cereals	99.2	843	83.6	107.0	1389	148.6
2.	Pulses	21.3	488	10.4	25.0	744	18.6
3.	Oilseeds	14.6	473	6.9	20.0	760	15.2
4.	Sugarcane	2.46	4878	12.0	3.2	6875	22.0
5.	Cotton (lint)	7.7	124	0.95	11.5	172	1.98

Source : Planning Commission.

TABLE NO. 3

FOURTH PLAN OUTLAY ON AGRICULTURE AND ALLIED SECTORS AND IRRIGATION AND FLOOD CONTROL

Rs. crores

	Public Sector				Private Sector		Public & Private Sectors		
	Total outlay	Current outlay	Investment	% Distribution of total outlay	Investment	% Distribution of Investment	Total investment	Total outlay	% Distribution of total outlay
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Agriculture and Allied Sectors	2728	610	2118	17.1	1600	17.8	3718	4323	17.4
Irrigation and Flood Control	1087	14	1073	6.8	—	—	1073	1087	4.4

Source : Planning Commission

Evolution of Agricultural Strategy :— The first stage of the new strategy pertained to the Intensive Agricultural District Programme. It was started in 1960-61 in three districts and was subsequently extended by stages to another thirteen. This clearly demonstrated both the value of the "package" approach and the advantage of concentrating effort in specific areas. In 1964-65 and subsequent years, a modified version of the same approach was extended to several other parts of the country in the form of the Intensive Agricultural Area Programme. The main concern of the Programme was with specific crops.

While both the above programmes were concerned with the promotion of intensive agriculture, they operated within the limitations set by existing crop varieties which had relatively low response to fertilisers. A major change occured with the introduction of the high-yielding varieties. Hybridization techniques for maize and millets had been initiated as early as 1960. Hybrid seeds began to be widely adopted by 1963. By 1967-68, nearly 6 million hectares were brought within the purview of this programme, and by the end of the Fourth Plan Period, this figure is expected to exceed 9 million hectares.

The high-yielding varieties programme has so far been taken up for five crops, namely, wheat, paddy, bajra, maize and jowar. Among these crops, the most striking success has been achieved in wheat. In some of the dwarf varieties, a yield of 5 to 6 tonnes per hectare has been recorded as against a normal yield of about 2 tonnes in irrigated areas.

The new strategy is concerned not only with higher yield but with greater intensity of cropping. Entirely new crop rotations have been made possible by the development of short duration varieties of crops. The new multi-cropping programme was taken up in 1967-68.

In recent years, new emphasis has come to be attached to the role of agricultural technology as a major input of agricultural production. A number of steps have been taken to facilitate organization and development of agricultural research. The Indian Council of Agricultural Research was reorganized in 1965. Another important step was the establishment of agricultural universities which are conceived as combining the functions of education, research and extension education. Nine agricultural universities have so far been set up. Yet one more development of importance is the organization of all India coordinated research projects. Thirty eight such projects have so far been taken up by the Indian Council of Agricultural Research. They constitute a significant advance towards planning of agricultural research on a national basis.

In view of the importance assumed by inputs and services such as improved seeds, chemical fertilizers, plant protection, implements and machinery, irrigation facilities and agricultural credit, several new public institutions were promoted and provided with funds to lend support to agricultural production programmes. Among these institutions was the National Seeds Corporation which was set up in 1963 with responsibilities in the field of seed production,

particularly the foundation stock of high-yielding varieties. Starting with 1965, fifteen agro-industries corporations have been established in different States. They are joint ventures of the Central and State Governments charged with the primary object of supplying and servicing agricultural machinery. For promoting programmes for production, marketing, processing and storage of agricultural produce through co-operative societies, another public agency, namely, the National Co-operative Development Corporation, was set up on a statutory basis in 1963. In the same year the Agricultural Refinance Corporation was established to provide refinancing facilities to land development banks and commercial banks for financing schemes of agricultural development.

The Rural Electrification Corporation was set up by the Government of India in 1970 with the object of sanctioning project-based loans for schemes of rural electrification sponsored by State Electricity Boards and Rural Electric Co-operatives. The Corporation was expected to pay particular attention to areas backward in electrification or classes backward in economic development.

During the eighteen months of its active life, the Corporation has sanctioned loans for as many as 137 projects spread all over India. The aggregate loan outlay sanctioned for these projects works out to Rs. 88.38 crores. The total number of irrigation pump sets to be energized under these projects is over 200,000. For the backward areas, the Corporation encourages tenable economic programmes based on the utilization of forests and forest produce.

As a result of the various measures taken, there was a significant increase in the use of Agricultural inputs and the volume of co-operative credit. Some of the selected targets of crop production are shown in the table given below :

TABLE NO. 4
SELECTED TARGETS OF CROP PRODUCTION

S. No.	Item	Unit	Base Level	Fourth Plan Target
1.	Foodgrains	Mill. tonnes	98.0	129.0
2.	Jute	Bales	6.2	7.4
3.	Cotton	Bales	6.0	8.0
4.	Oilseeds	Mill. tonnes	8.5	10.5
5.	Sugarcane (gur)	Mill. tonnes	12.0	15.0

Source : Planning Commission.

The rate of increase in production of foodgrains and major commercial crops envisaged is much higher than that accomplished in the past. Hence it is necessary to spell out, in some details, the strategy for realizing the production targets. This strategy places very little reliance on bringing additional land under cultivation. The potentially arable area in the country is estimated at about 175 million hectares. Of this, nearly 85 per cent is under cultivation. Thus there is a virtual exhaustion of uncommitted land resources. In the Fourth Plan, it is anticipated that the addition of the net sown area will be only about one million hectares which is the target of land reclamation. In this context, the strategy of production is primarily dependent on intensive agriculture and consists of the following main elements :

(1) co-ordinated research in respect of all important crops;

(2) continued expansion of irrigation facilities so as to ensure optimum and integrated use of ground and surface water;

(3) improvement in the utilization of existing irrigation potential through special programmes;

(4) expansion in the supply of fertilizers, plant protection material, farm machinery and credit;

(5) full exploitation of the possibilities of raising yields provided by the new seed varieties and the case of cereals;

(6) intensive efforts in selected suitable areas for raising the yield levels of major commercial crops;

(7) meausres to increase intensity of cropping; and

(8) improvement in the agricultural marketing system in the interests of the producer along with assurance of minimum prices for major agricultural commodities.

AREA UNDER FORESTS, AND PLAN INVESTMENTS

Area Information : According to the figures of the Ministry of Agriculture[6], just over one-fifth of the total land area of the country is covered by forests. The present land utilization in India is as shown in the table given below :—

TABLE NO. 5
DISTRIBUTION OF AREA

Category	Area (million ha.)	Percentage
(a) Agriculture	154.34	47.2
(b) Forestry	75.33	23.1
(c) Potentially productive barren land	53.64	16.4
(d) Not available for agriculture or forestry.	43.50	13.3
Total land area	326.81	100.0

The extent of forest area is 23 per cent of the total geographical area, and nearly 50 per cent of the area under agriculture. Coniferous forests constitute nearly 4 per cent of the total forest area, and are found on the Himalayan mountain ranges in the States of Jammu & Kashmir, Uttar Pradesh and Himachal Pradesh and to a lesser extent in Assam, NEFA, West Bengal and Manipur. The broad leaved forests occupy nearly 96 per cent of the total forest area.

Plan Investments in the Forestry Sector: The Five Year Development Plans have been largely responsible for the accelerated pace of forestry development and the expansion of the forestry organization in the country. During the First (1951-52 to 1955-56) and Second (1956-57 to 1960-61) Plans, an expenditure of Rs. 10.6 crores and Rs. 20.1 crores respectively was incurred on the development of forestry. In the Third Plan (1961-62 to 1965-66) about Rs. 46.5 crores were spent.

Seth and Sudhakara Rao[7] have pointed out that inspite of the increasing allo-

cation of funds for forestry development in the successive Plans, the picture remains relatively static, in that a meagre and almost fixed allocation of nearly 0.7 per cent of Plan allotment is made in each Plan for the forestry sector.

The allocation of funds for this sector during the Fourth Plan period is Rs. 89.77 crores (Rs. 85.84 crores in the State Sector and Rs. 3.93 crores under Central and Centrally Sponsored Schemes), which works out to nearly 0.6 per cent of the total Plan allocation. It will not be difficult to visualize that this allocation is quite meagre and is not at all commensurate with the sizeable forest area and the importance of forests in the overall national economy. Distributing the total allocation over the forest area, it would be seen that the per hectare availability of funds comes to a meagre figure of Rs. 3/-.

One significant thing worth mentioning about the Plan activities is that till the year 1969-70 nearly 15.35 lakh hectares of plantations have been created. During the Fourth Plan period an additional area of 8.33 lakh hectares is proposed to be added to the above figure. These man-made forests would play an increasingly important role, in the coming years, in the development of forest industries and supply of raw material to them.

NATIONAL INCOME, WORKING FORCE AND CONTRIBUTION OF FORESTRY

National Income : Samuelson[8] has pointed out that one of the most important concepts in all economics is national income. An analysis of national income. its anatomy and accounting structure can be regarded as the introduction to the study of the physiological forces that determine total employment, production, real income, and the price level. The concept of national income is indispenable preparation for tackling the great issues of employment, inflation and growth.

National income is the loose name given to the money measure of the overall annual flow of goods and services in an economy. Often instead of it, the almost equivalent term "national product" or "net national product" or the slightly different concept of "gross national product" is used. In brief, national income or product is the final figure arrived at when the measuring rod of money is applied to the goods and machines that any society produces with its land, labour and capital resources.

The Central Statistical Organization[9] has pointed out that the provisional estimate of national income at 1960-61 prices for the year 1969-70 shows an increase of 5.3% over the previous year against a rise of 2.4% in 1968-69 over 1967-68. The net output from agriculture in 1969-70 registered a rise of 5.1% over the preceding year. The corresponding increase in the manufacturing sector was 4.9%. Per capita income increased by 2.9% in 1969-70 as against a small rise of 0.2% in 1968-69. The estimates of national and per capita income for the year 1960-61 to 1969-70 at current prices and 1960-61 prices as well as percentage increase in these estimates over the previous year at 1960-61 prices are given in the following table :—

The variations in the rates of growth of the national income as well as per capita income as shown in the table No. 6 are mainly due to fluctuations in the output from agriculture.

According to the Central Statistical Organization[10], the primary sector comprising agriculture, forestry, fishing and mining accounted for nearly 52% of the net domestic product in 1960-61. The percentage declined to 45 in 1969-70. The secondary sector covering manufacturing, construction, electricity, gas and water supply contributed 19% of the NDP in 1960-61. The contribution rose to 22% in 1969-70 . The tertiary sector consisting of the rest of the industries was responsible for 29% of the NDP in 1960-61. The share of this sector increased to 33% in 1969-70.

TABLE NO. 6

NATIONAL INCOME

Year	At Current Prices		At 1960-61 Prices		% Increase over previous year	
	Total Rs. (Crores)	Per capita Rs.	Total Rs. (Crores)	Per capita Rs.	Total	Per capita
1960-61 ...	13294	306.3	13294	306.3	—	—
1961-62 ...	14050	316.4	13763	310.0	3.5	1.2
1962-63 ...	14873	327.6	14045	309.4	2.0	0.2
1963-64 ...	17094	368.4	14845	319.9	5.7	3.4
1964-65 ...	20061	423.2	15917	335.8	7.2	5.0
1965-66 ...	20621	426.1	15021	310.4	5.6	7.6
1966-67* ...	23903	482.9	15243	307.9	1.5	0.8
1967-68* ...	28374	560.8	16660	329.2	9.3	6.9
1968-69* ...	28678	554.7	17057	329.9	2.4	0.2
1969-70* ...	31174	589.3	17955	339.4	5.3	2.9

* Provisional. Source :— Cental Statistical Organization.

The net domestic product at factor cost by agriculture and forestry at current prices is shown in the table given below :—

TABLE NO. 7

NET DOMESTIC PRODUCT AT FACTOR COST BY AGRICULTURE AND FORESTRY AT CURRENT PRICES.

Rs. Crores.

Item	1960-61	61-62	62-63	63-64	64-65	65-66	66-67*	67-68*	68-69*	69-79*
Agriculture	6570	6771	6905	8015	9846	9523	11491	14569	13859	14905
Forestry and Logging	174	198	206	247	260	298	383	417	470	513

Source : Central Statistical Organization.

The contribution of agriculture to the net domestic product in 1960-61 and 1969-70 was 49% and 47% respectively. The corresponding contribution of forestry and logging for the same periods was 1.3 and 1.6% respectively.

For the purpose of calculation of the net domestic product from the forest sector, the Central Statistical Organization considered[11] a) forestry (e.g. planting, replanting and conservation of forests; gathering of uncultivated materials; charcoal (burning) and b) logging.

The conventional estimates of net product from this industry were prepared by following the "value added approach". The various forest products were classified into two heads (i) major forest products and (ii) minor forest products. For estimation of gross value of output, outturn of timber, roundwood and pulpwood were combined and evaluated at timber prices. As regards minor forest produce, the aggregate Government revenue from these products was assumed to represent their value of output. For other products, not covered above, an overall allowance was made at the rate of 5.3% of the total estimated value of major and minor products. The net product was obtained by making a deduction of 5% from the gross value of output to cover the current expenditure on repairs, maintenance and other operational costs and depreciation.

A serious limitation of the outturn data contained in Indian Forest Statistics is that they represent the authorized exploited forest resources only. Thus all unauthorized removals of industrial and fuel wood do not find any place in the official production data. The Central Statistical Organization has assumed that unrecorded and unauthorized removals constitute 10% of recorded production of industrial wood as well as of fuel wood.

The average prices worked out for each State have been deflated at a flat rate of 25% to allow for the trade and transport margins implicit in them The same factor has been applied for fuel wood also.

At present no data are available to permit direct estimate of the income originating from planting and replanting of trees in forests. However, in the case of Government forests, information relating to the expenditure on get documents. Such expenditure has been assumed to represent the gross value of output from new plantations. It has also been assumed that 75% of such plantations is available in the budthe outlay on new plantations is on wages and salaries and the remaining 25% on cost of materials. The net product from new plantations has been taken to be equal to the wages and salaries.

The gross and net product from froestry and logging has been calculated for the year 1960-61 to 1964-65 (at current prices) by the Central Statistical Organization as shown below :—

TABLE NO. 8

GROSS AND NET PRODUCT FROM FORESTRY AND LOGGING FOR THE PERIOD 1960-61 TO 1964-1965 AT CURRENT PRICES

Quantity in '000 m^3 Price in Rs. per m^3 : Value in Rs. Lakhs.

Item	1960-61	1961-62	1962-63	1963-64	1964-65
1. Industrial wood.					
Quantity	6040	6291	6288	6700	7483
Price	167.27	180.77	181.45	198.59	213.60
Value	10076	11343	11361	13429	15913
2 Fuelwood					
Quantity	12693	12739	14705	13641	14165
Price	24.54	27.41	27.35	29.31	30.32
Value	3106	3482	4015	3990	4288
3 Minor Forests Products Value	4144	5340	5266	5937	6112
4 New Plantations	265	283	380	408	511
5 Gross Value of Output	17861	20448	21022	23764	26824
6 Less Repairs, maintenance and other operational costs	770	877	921	1036	1180
7 Gross Product	17091	19571	20101	22728	25644
8 Less allowance for depreciation	176	202	206	234	264
9 Net Products	16915	19369	19895	22494	25381

Source : Central Statistical Organization.

Working Force :— According to the Central Statistical Organization[12], the basic data in connection with the estimation of national product relate to the size of the working force and its distribution by various industries. The estimates of working force have also to be used for the measurement of value of output of those commodities and services for which the physical measurement of output is not possible. The working force represents the number of workers as defined in the 1961 (population) Census Report[13]. The table given below shows the distribution of working force by agriculture, forestry and logging, and fishing for the year 1960-61.

The working force figures, however useful they may be, have a serious limitation in that they are valid for the year 1960-61. At best they highlight the very limited role the forestry and logging activities play in the overall national context (the percentage share for this activity is as low as 0.2% of the total working force). There has undoubtedly taken place some stepping up of activity in the forestry and logging sector during the last decade as a result of more inputs under the Five Year Plans, which must have resulted in an augmentation of the working force. For a better appreciation of the forestry and logging situation, it would be very necessary and highly desirable to have authentic and uptodate figures available. Nevertheless, it is evident that just as in the case of national income, the role of forestry and logging vis-a-vis the working force is very small, and there would be a considerable scope for enlarging it. The Ministry of Food and Agriculture[14] has estimated that the forest activities in India provide (primary, secondary and tertiary) employment of about 969 million man-days which in terms of full year employment would work out to about 30 lakh workers at the rate of 300 man-days a year. About eighty per cent of this forest labour force is estimated to be engaged in primary forestry activities such as plantations, harvesting including handsawing, transport of forest produce, silvicultural operations, road construction, extraction of minor forest produce including resin and other similar activities. In addition, the total number of permanent personnel employed by the State Forest Departments is estimated at about 98,000.

TABLE NO. 9

DISTRIBUTION OF WORKING FORCE BY AGRICULTURE FORESTRY AND LOGGING AND FISHING (1960-61).

Industry		No. of workers (000)	Per cent
1. Agriculture, livestock and ancillary activities including hunting, trapping and game propagation	...	135983	72.71
1.1 Agriculture and ancillary activities	...	132136	70.65
1.2. Livestock and ancillary activities	...	3838	2.05
1.3. Hunting, trapping and game propagation.	...	9	0.01
2. Forestry and Logging	...	372	0.20
3. Fishing	...	571	0.30
Total agricultural activities	...	136926	73.21
Total non-agricultural activities	...	50104	26.79
Grand Total :	...	187030	100.00

Source : Central Statistical Organisation

TABLE NO. 10
SUMMARY BY INDUSTRIES, ALL STATES IN 1965.

No. of factories.	...	13,425
Productive capital employed.	...	Rs. 6,444 Crores.
Working capital.	...	Rs. 1,788 Crores.
No. of persons employed.	...	Rs. 40 Lakhs.
Gross value of output.	...	Rs. 6,492 Crores.
Gross value of input.	...	Rs. 4,792 Crores.
Value added by manufacture.	...	Rs. 1,700 Crores.
Percentage of wages, salaries, etc. to value added.		57.1

INDUSTRIES BASED ON FOREST PRODUCTS

According to a study[15] carried out by the Central Statistical Organization, the particulars of factories in the whole country are as shown in the table No. 10.

The role of industries based on forest products as determined in the same study for the year 1965 is as shown in the table No. 11.

FORESTRY BLUEPRINT FOR 1985

It has been amply brought out in the preceding parts of this paper that the forests of India which constitute a rich renewable source of raw material for industries and human needs have not so far been assigned the role which they can play in promoting national welfare and providing jobs in the rural and industrial sectors. The multifarious influences that the forests exert in regulating stream flows, influencing climate, preventing soil erosion, improving the agrarian microclimate, satisfying human needs for forest products and providing jobs to the needy populace need to be given greater play in the future.

TABLE NO. 11
SUMMARY BY FOREST-BASED INDUSTRIES — 1965

Item	Manufacture of furniture and wooden fixutres	Pulp-wood pulp, mechanical chemical newsprint, paper and paper products — others	Paper-Writing, Printing and Wrapping	Paper board and straw board	Paper for packaging	Hardboard including Particle board and fibre board	Biri	Sawmilling
1. No. of factories in existence	74	25	49	55	31	5	89	143
2. Productive Capital Employed (Rs. Crores)	2.6	15.6	92.1	12.4	4.2	3.5	1.0	8.8
3. Working Capital (Rs. Crores)	1.8	5.6	18.1	3.2	2.2	0.7	0.9	6.8
4. No. of persons employed	8170	5877	38249	11781	3480	1545	7857	7703
5. Gross value of output (Rs. Crores)	3.8	15.7	70.4	16.1	9.9	2.2	5.5	7.4
6. Gross value of input (Rs. Crores)	2.5	11.4	50.2	12.1	8.0	1.6	4.5	6.1
7. Value added by Manufacture (Rs. Crores)	1.2	4.3	20.2	4.0	1.9	0.6	1.0	1.3
8. % of wages, salaries, etc. to value added.	64.4	36.8	53.4	57.0	40.2	57.2	63.2	79.1

Source : Annual Survey of Industries, 1965, by Central Statistical Organization.

There is much talk of a green revolution in the agricultural sector. A similar revolution could be brought about in the forestry sector too, provided matching inputs are forthcoming, and new ideas and institutional arrangements are applied to it. There is scope for raising the productive capacity of the forests at least twenty times the present level of production by adopting measures of better conservation, management, tree improvement, irrigation and fertilization. The area concepts and introduction of high-yielding agricultural varieties which have contributed to a boost in agricultural production, could be applied to the forestry sector too. For this purpose it would be worthwhile forming a suitable number of regions based on a study of vegetation, productivity, terrain, agricultural and industrial development and demand and supply. One weakness of planning in the past has been to distribute funds empirically to the different states without regard to the peculior requirements of the different regions. The best way to get good results would be to evaluate carefully the present locational and other factors and then to prescribe suitable treatments. For instance, in areas which contain untapped forest resources, the solution would lie not in raising industrial plantations of fast-growing species, but in developing the infrastructure and setting up wood-based industries. Similarly, in areas where industrial development is high, the task of augmenting productivity from the forests would have a high priority. Then in areas which are highly productive, but in which the extent of forest area is inadequate, top priority should be given to the creation of man-made forests. Many more such illustrations could be given, but it should suffice to emphasize the need for a rational and pragmatic constitution of regions for development which, in view of their peculiar endowments or deficiencies, would merit special attention or treatment. These ideas have been applied to the formulation of ten regions of the country for developmental planning (The islands of Andamans and Nicobar etc. have been left out from this study). This has been dealt with in a later part of the paper. However, before going on to that part, it would be worthwhile to examine what the demand pattern will be in the year 1985 and what will be the likely investments on development of industries and infrastucture. Lastly, it would also be worthwhile to assess the employment opportunities that all these activities are likely to generate.

Requirement of Industrial Wood and Fuel in 1985 :— It has been shown in an earlier part of the paper that as against to present consumption of 14 million m^3 of industrial wood and 124 million tonnes of fuel-wood, the requirement in 1985 would be 50 million m^3 and 120 million tonnes respectively. The contribution of foresting and logging to the gross national product would, at present value, increase from the figure of Rs. 513 crores in 1969-70 to somewhere near Rs. 2,500 crores in 1985. In case the Government policy of exporting forest produce to the extent of 7 per cent production materialises along

Plywood	Wooden and cane containers	Joinery and other wood working	Manufacture of coak and other wood products	Turpentine and Rosin	Matches	Lac including Shellac	Total
67	21	18	9	4	58	22	670
9.2	0.6	1.2	0.9	1.5	6.5	1.5	161.6
3.9	0.3	0.3	0.2	1.2	3.3	1.2	49.7
13928	1581	2051	1080	728	13587	2251	119868
13.2	1.8	1.4	1.7	2.4	13.5	3.7	168.7
9.6	1.4	0.9	1.2	2.1	7.8	3.2	122.6
3.6	0.4	0.5	0.5	0.3	5.7	0.5	46.0
55.3	64.1	64.9	36.9	51.2	61.4	50.3	—

with the possibility of exporting hard wood chips to Japan, then the contribution of forestry and logging to the gross national product might be even higher (somewhere near Rs. 3,000 crores).

Investments that would be Required for Setting up Wood-based Industries :— It has been estimated by the Planning Commission that the requirement of newsprint, writing and printing paper, wrapping paper, rayon etc. would be nearly 4 million tonnes in 1985. This would mean an increase of nearly 3 million tonnes over the present production capacities. This expansion of capacities would come about partly from expansion of existing units and largely from the setting up of large new units in the potential undeveloped forest areas like those of Bastar, Chanda and the north-eastern region. The approximate investment for the expanded production capacities would be of the order of Rs. 1,400 crores. There would also be an all round expansion of saw milling, plywood, and panel-wood manufacture. The investment for these items could be roughly taken as Rs. 100 crores. Thus, it would be seen that within a period of 15 years from now, an investment of Rs. 1,500 crores will have to be made in wood-based industries.

Employment Opportunities :— The stepping up of activities in the forestry sector on the scale indicated above would throw open wide employment opportunities to rural and urban populations. More intensive management, development of infrastructure and industries and raising of man-made forests would mean more jobs. The working force under forestry and logging and wood-based industries would register at least a tenfold increase to 3 crores over the present figure which would be about 30 lakhs.

Inputs Needed :— For the forestry sector to play an active role in the national economy of a magnitude outlined above, it would be necessary to provide for heavy inputs. Unless this is ensured, it would be futile to plan for the future. It has been amply brought out in this paper that the previous inputs have made only a small dent in the situation and have only brought about an acute awareness of the stupendous task that lies ahead. It would be difficult to deal at length in this paper with an exhaustive list of items of inputs in the forestry sector, but, all the same, a broad sectoral spectrum of inputs could be indicated to form a basis or frame work for future planning. These are indicated in the Table given below :—

TABLE NO. 12

INPUTS REQUIRED IN THE FORESTRY SECTOR FOR A PERIOD OF 15 YEARS

S. No.	Item	Inputs in Rs. Crores
1.	Plantation of quick-growing species	300
2.	Economic Plantations for industrial & commercial use	300
3.	Rehabilitation of degraded forests	100
4.	Bringing remote and untapped forests under exploitation	100
5.	Development of farm-forests and fuelwood plantations in the agrarian sector	150
6.	Extension and Publicity	50
7.	Communications and Buildings	80
8.	Consolidation of forests, including survey and demarcations	50
9.	Forest Resources Surveys, Management Planning, Costs and Market Trends Surveys	60
10.	Forest Protection, Tree improvement, Training and research	80
11.	Timber operations	100
12.	Nature conservation, and development of pastures and grazing	40
13.	Amenities to staff, intensification of management, cultural operations and miscellaneous	90
	Total	1,500

The inputs required for the next fifteen years work out to Rs. 1,500 crores. The average annual rate of input would, therefore. be Rs. 100 crores. If this amount is spread over 50 million hectares of productive forest area, the annual rate of input per hectare of productive forest area would work out to Rs. 20/-.

Closing of the Demand — Supply Gap and Indication of Annual Production of Raw Material in 1985:— Granting that the massive inputs as indicated above would be assured, there would be a tremendous boost in the production of industrial wood and fuel-wood from the forest areas, as well as from the agrarian sector. Ten forestry regions have been proposed later in this paper and the projections of likely annual availability of industrial wood from these regions (for particulars see the map) in the year 1985 would be somewhat as shown in table No. 13.

TABLE NO. 13

Forestry Regions	Potential Annual Availability of of Industrial Wood in 1985 in million m^3	
1. Coniferous forests of Jammu & Kashmir, Himachal and Uttar Pradesh.	5	
2. Intensive agricultural areas of Punjab, Haryana and U.P.	3	(from plantations of quick-growing species).
3. Bhabar-Tarai tract in U.P. and Bihar.	3	—do—
4. North-eastern region of Assam, Meghalaya, NEFA, Nagaland, Tripura and Manipur.	10	
5. Bihar, Bengal and Orissa.	5	
6. Godavary Catchment in Madhya Pradesh, Maharashtra and Andhra Pradesh.	10	
7. Madhya Pradesh, Gujarat and some parts of Maharashtra.	7	
8. Western Ghat Belt of Maharashtra, Mysore, Kerala.	5	
9. Eastern Ghat Belt of Tamil Nadu and Andhra Pradesh.	6	(from forests & industrial plantations).
10. Peninsular hinterland in Maharashtra, Mysore & A.P.	6	—do—
Total	60 mill. m^3	

In addition to the above projection of industrial wood, the anticipated annual availabilty of bamboo would be 4.5 million tonnes and of agricultural residues like bagasse, rubber wood, jute sticks, **Kenaf, Sesbania,** straw etc. 10 million tonnes. Taking all these into consideration, the picture of potential raw material for the future could be considered as quite satisfactory. This would also be of considerable help to planners and industrialists for the planning of new industrial capacities and location of new industries.

Strategy for the Development of Wood-based Industries :— It can be safely assumed that through the crash programme of expansion of capacities of existing pulp and paper mills, their annual production would be raised to the figure of 1 million tonnes, as against the projected demand in 1985 of 4 million tonnes. The planning strategy for the development of new pulp and paper units will have to be governed both by the demand projections and the potential productivity figures for the different regions given earlier. In the interest of equitable and balanced regional development, the distribution of new pulp and paper units could be as shown in table No. 14.

A proper strategy for these industries would be to plan their location after taking into consideration factors like rail and road communications, availability of water and power etc. Once a development blueprint is drawn up, then feasibility reports could be prepared and decisions taken on the location of industrial plantations for supplying raw material at economic costs. These new units would have the advantage of being located near centres of demand as well as sources of raw material supply. This will obviate the need for transporting raw materials and finished products over long distances.

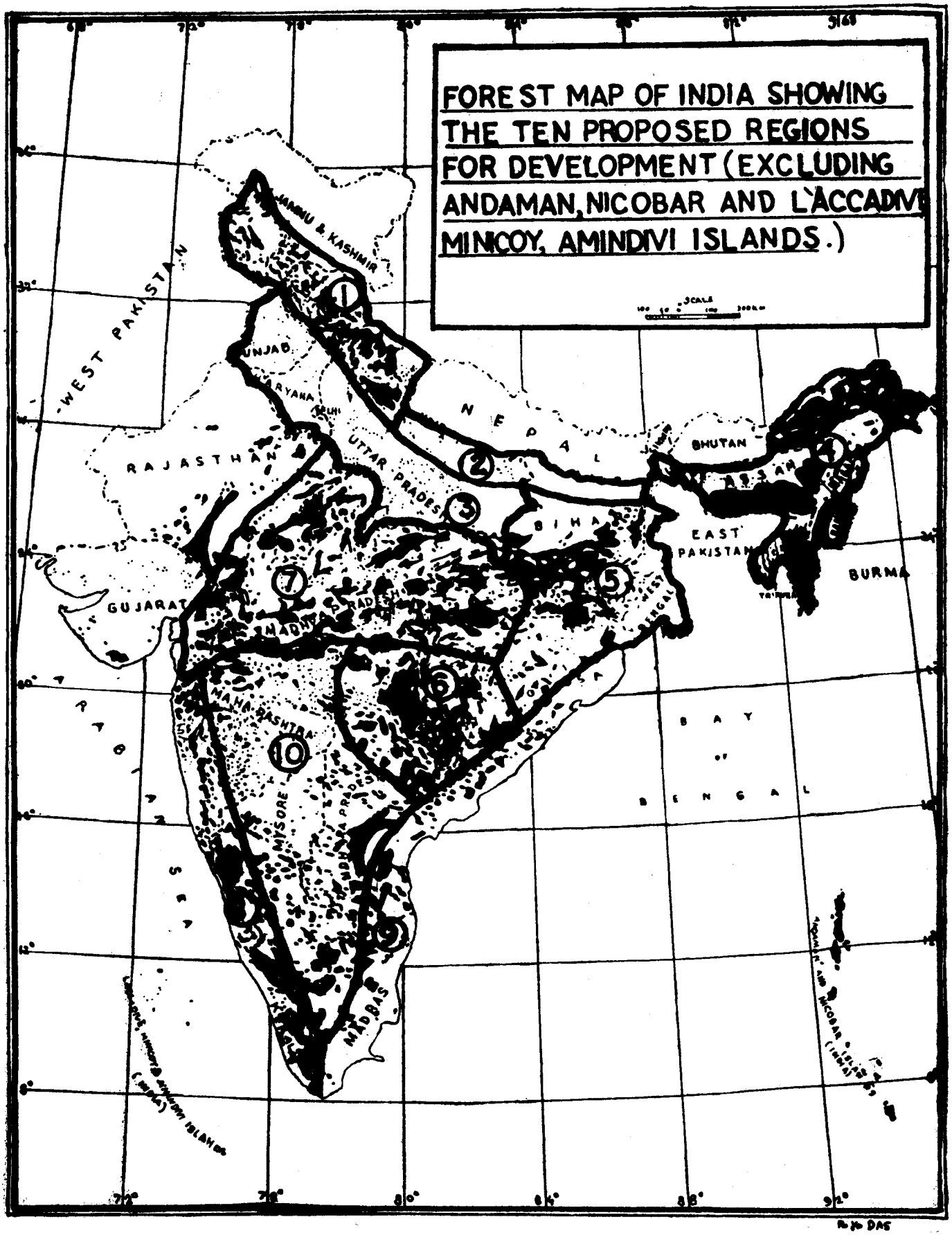
For an expansion of production of 3 million tonnes, it would be reasonable to plan for a capacity of 3.6 million tonnes. The investment required for this purpose would be nearly Rs. 1,400 crores (at Rs. 4,000 per tonne).

As for the plywood and veneering industry, the picture of production and exports could be improved considerably. The country produced 28 million sq. metres of plywood in 1968 from 70 plants as against the installed capacity of 37 million square metres. It may be significant to point out that just one plan in Souh Korea produced more than twice the quantity in 1968. There is considerable scope for the expansion of this industry in India and for gearing it to meet the export requirements. Regions 1, 4, 6, 7 and 8 offer excellent opportunities for this purpose.

The hardboard and particle board industries also have a great scope for expansion. Their problem is not of raw material supply, but of the high excise duty and price of urea formaldehyde and glues. If these could be brought down, then units could be spread uniformly over the whole country.

PROPOSED FORESTRY DEVELOPMENT REGIONS FOR FUTURE PLANNING

Perhaps the most vital part of planning a huge development of the forestry sector for the future would be the division of the country into regions on the basis of criteria, such as topography, soils, climate, productivity, demographic pressures, extent of forest area and the existence of forest-based industries. India is a vast country in which effective perspective planning cannot be made effective without dividing the country into regions.


FOREST MAP OF INDIA SHOWING
THE TEN PROPOSED REGIONS
FOR DEVELOPMENT (EXCLUDING
ANDAMAN, NICOBAR AND L'ACCADIVE
MINICOY, AMINDIVI ISLANDS.)
SCALE
JAMMU & KASHMIR
WEST PAKISTAN
PUNJAB
HARYANA
DELHI
RAJASTHAN
NEPAL
BHUTAN
ASSAM
UTTAR PRADESH
BIHAR
EAST PAKISTAN
BURMA
GUJARAT
MADHYA PRADESH
WEST BENGAL
ORISSA
MAHARASHTRA
MYSORE
ANDHRA PRADESH
MADRAS
BAY OF BENGAL
ARABIAN SEA
1
2
3
4
5
6
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8
9
10

TABLE NO. 14

Region No.	No. of Pulp and Paper Mills	Annual productive capacity in mill tonnes	Remarks
1.	3	.3	Mainly for production of chemical and rayon grade pulp.
2.	2	.3	Based on plantation and agricultural residues.
3.	2	.3	—do—
4.	4	.6	These could play the role of "Mother Pulp Mills" and could also be utilised for export of pulp and paper.
5.	—	—	There is already a heavy concentration of mills in this region.
6.	4	.6	These mills could also be geared to exports.
7.	2	.3	Geared to exports.
8.	4	.6	—do—
9.	2	.3	—do—
10.	2	.3	Based on plantations and agricultural residues.
Total	25	3.6	

Such regions will necessarily depend on the objective of planning. Thus, regions which may be formed for agricultural development need not be the same as those formed for the development of forestry or, as for that, power or irrigation development. For the purpose of forestry development for the next 15 years, a regional approach to planning has been evolved and is presented briefly below This is based on the distribution of forest area and the state of development of wood-based industries. Ten regions have been proposed for forestry development for the next fifteen years.

It may be worthwhile to mention that a similar regional classification was developed in 1964 by the Planning Commission[16] mainly for the development of agriculture whereby fifteen regions had been formed. In broad details these regions tally, with minor exceptions, with the regions that have been formed for forestry development. In the words of the Planning Commission "there is a need for balanced regional development of the country and for understanding the differences in physical conditions and resources development potential in different parts of the country, which is the first step in balanced development, it is necessary to have a scheme of regions which divides the country into areas having similar conditions and development potentials."

Particulars of the Ten Forestry Regions

1. The Coniferous Forests of Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh :— Barring a very small proportion of area under pines in West Bengal, Meghalaya, NEFA and Manipur, the coniferous forests are located in the temperate north-western belt of the Himalayan range. This region is separated from the north-eastern region by the long stretch of Nepal and has striking differences in rainfall which produce corresponding differences in vegetation, patterns of agriculture, etc. The north-western Himalayan region has generally lower rainfall and excepting the lower slopes, (in the Siwaliks and the outer Himalayan ranges) which have sub-tropical vegetation, has the characteristic deciduous and evergreen coniferous forests and landscapes of the temperate zone. The north-eastern Himalayan region, on the other hand, has a much higher rainfall, and a humid tropical or sub-tropical climate with tropical rain forests as the dominant vegetation.

It is in the north-western Himalayan region that the rich forests of pines, deodar and firs are located. These constitute a rich economic source for industrial development. The forests are, however, located in remote, and comparatively inaccessible areas, and the main problem of the forests could be listed as; (a) very tardy utilization of the forest resources, due to absence of a proper infrastructure, lack of modern tools and difficult terrain. The need in this region is to invest heavily on developing roads, skyline ropeways, river transportation methods, etc., for a fuller and better exploitation of the resources, (b) high cull percentage due to unexploited over mature forests and (c) deficiency or paucity of natural regeneration. There is a heavy annual import bill on the import of long-fibred chemical pulp into the country and with the heavy expansion of wood-based industries during the next fifteen years, this is likely to increase unless the coniferous forests of the north-western Himalayan region are tapped more intensively. They have, therefore, a big role to play in the future, and cannot be neglected any longer. In any forestry development programme for this region, considerations of natural or artificial regeneration, soil protection, tourism and recreation will also play an important part. The activities that would call for attention in the industrial sector would be (i) saw milling, (ii) manufacture of packing cases for the fruit industry and (iii) setting up of pulping plants for the manufacture of chemical pulps and special grade rayon pulp.

The potential annual production of coniferous wood from this region could be raised to 5 million m^3. This could be brought about by intensification of management, reducing the long rotation periods, and resorting to a plantation programme.

2. The Bhabar and Terai Belt on the Foothills of the Himalayas :— It would be seen that a narrow strip of area has been put under this region, which inspite of its diminutive size, would play a big role in the development of forestry in the country. The constitution of this region could be ascribed entirely to the outstanding success of the Forest Department in raising plantations of **Eucalyptus** and, to a very small extent, **Poplars** in the Bhabar and Terai areas of Uttar Pradesh.

The advantages of this region are that (a) it has rich and well-drained soils, (b) it is situated on plains or gently sloping areas, (c) it has a high water

table and (d) it has a fairly high and well distributed annual rainfall. The activities in this region would aim at raising concentrated plantations of fast-growing species for the pulp and paper industries on the lines the Uttar Pradesh Forest Department has done. The existing forests which contain scattered low volume crops of hardwood species would be replaced by man-made forests of high increment, with or without combination with agriculture. In the Haldwani plantations, an average annual increment of 15 m^3 has been obtained in better localities, and there is no doubt that this figure could also be raised if improvements are introduced in choice of proper species and seeds and after care of plantations e.g. soil working, weeding, grass cutting and fertilization. It would be possible to obtain much-needed industrial wood on short rotations of 10 to 15 years and this programme could lead to a rapid development of wood-based industries in the region. The major advantages of this programme would be, (a) the provision of ample employment opportunities in the rural sector, (b) stepping up considerably agricultural and forestry yields, (c) availability of concentrated supplies of homogeneous raw material for the wood-based industries and (d) low transportation costs. All these would bring about an ideal climate for the establishment of new large-capacity pulp and paper industries in the region. The potential annual production of industrial wood in the region would depend on the plantation targets fixed, but taking it that 200,000 hectares could be planted up annually, the expected annual availability could be put at 3 million m^3. If irrigation could be applied to these plantations, then the annual yield could even be doubled.

3. The Wood Deficit States of Haryana, Punjab and Uttar Pradesh : This region could be looked upon as a good example of the green revolution in agriculture, which has brought about a phenomenal increase in the production of food-crops and also a revolution of rising expectations in the agricultural community. The region has a heavy incidence of population and the forestry sector could play a big role in providing jobs to the needy populace. The climate in this region is ripe for the entry of forestry into the agrarian sector in a big way in giving a further boost to the incomes of agriculturists and in ensuring supplies of fuelwood and industrial wood. The example of the intensive **Poplar** programme in the Po valley of Italy could be applied to this region for the general improvement of the environment and agrarian microclimate. The success of road-side and canal-bank plantations of **Eucalyptus** in this region could be taken as a pointer in this direction, and a big effort could be made to establish on sound lines, the practice of forestry in the agrarian sector. Irrigated plantations of **Eucalyptus, Poplars** and high-yielding varieties like **Sesbania** could be grown intensively by agriculturists in order to meet their requirements of fuel and of industries of raw material. There is an excellent infrastructure available in the region for the production of woody raw material for wood-based industries and the setting up of such industries. A ten or fifteen year plantation programme of **Eucalyptus** or **Poplars** with an annual target of 200,000 hectares, could ensure a minimum annual availability of 3 million m^3 of industrial wood. This could also be supplemented with agricultural residues like bagasse as raw material.

An indirect advantage of the afforestation programme in this region would be in arresting the march of the Rajasthan desert by ringing it with a green belt.

4. The North-Eastern Region :— One striking feature of the region is its heavy rainfall. As a result of the heavy rainfall and juxtaposition of high mountain ranges with flat plains, floods are a major problem in the plains of this region. Difficulties of communication arising from the rugged terrain are aggravated by the heavy rainfall and dense tropical forests. The area has a sparse population made up largely of tribal people. The region is generally at a low level of development except for the southern portion which has also extensive tea plantations.

The forests of the region are luxuriant and bamboo growth is plentiful. The present tempo of exploitation is very much limited on account of the absence of major wood-based industries, which along with the difficult nature of terrain and absence of a proper infrastructure, have contributed to the extremely limited development of forestry in it. There is however, a heavy concentration of plywood industries, both of commercial as well as decorative plywood, but these factories too are facing acute problems of supply of ply logs.

This region is extremely rich in forest resources and there is not the least doubt that these could play an important role in its development. The rich bamboo, hardwood and coniferous resources could be utilized for the setting up of large-sized pulp and paper units in the region. There is also ample scope for the expansion of the plywood industry for feeding the markets in the country and for export. Of late attention is being paid to the untapped forest resources of the region and there are sevaral schemes in it for the setting up of pulp and paper units (e.g. the proposed plants at Hojai, Silchar, Tuli etc.). On a modest scale the annual potential availability of raw material from the region could be placed at 2.5 million tonnes of bamboos and 10 million m^3 of hardwoods. The region deserves to get much more attention in future than it has had in the past.

5. Bihar, Bengal and Orissa Region :— In this region the population is quite heavy and the extent of forest area inadequate. The situation is further aggravated by the influx of displaced persons from East Bengal. On the other hand, there is perhaps the heaviest concentration of pulp and paper mills in it. Most of the forest areas have been almost completely committed for meeting the raw material demands of the existing units. Thus the future strategy for the forestry sector in this region should aim at keeping the existing units going and to be able to meet their expanded requirements. The question of setting up large-sized new units in the region cannot arise in future. The forestry management will have to be intensified and efforts will have to be made to augment the yields from the forests. The future annual potential availability of industrial wood from the region could be put at 5 million m^3. In addition, about .3 million tonnes of bamboo could also be expected.

6 Godavary Catchment in Madhya Pradesh, Maharashtra, Andhra Pradesh and Orissa :— This is a compact and rich forest region almost in the heart of the country which has remained comparatively undeveloped. The forest resources are known to be extremely valuable, but the factors that have contributed to their neglect, could be described as absence of a proper infrastruc-

ture and also absence of large-sized wood-based industries. The region has a low population density and the predominently tribal population living in it is very backward. It is a strange irony that a region which is very rich in minerals and forest resources (perhaps one of the richest and most strategically situated), should be among the most backward parts of the country. It is only recently that some attention is being paid to it. The famous iron ore deposits of Bailadila range in Bastar district of Madhya Pradesh are now being tapped for supply of Japan, and this export item alone is bringing to the country a foreign exchange of Rs. 80 crores annually. There is no doubt that, with wise attention and investment, this region could become among the most strategic raw material suppliers to new large-sized wood-based industries.

Seth[17] has pointed out that the Pre-Investment Survey of Forest Resources Organization has completed an extensive survey of the forest resources of the Godavary Catchment and has established that these forests could play a big role in the developement of wood-based industries. The extent of the forest area would be nearly 50,000 sq. km. and the growing stock on it would be nearly 300 million m^3. The potential annual cut could be 10 million m^3. There is very little existing demand for pulp wood and fuel wood from these forests and vast areas are lying untapped. The potential annual availability of bamboo from the region would be .6 million tonnes.

8. The Western Pennisular Strip in Maharashtra, Mysore and Kerala :— This region is confined to the western coastal part of the Indian pennisula which has rich moist deciduous and evergreen forests. These could play a big role in the development of wood-based industries. There is ample scope for raising plantations of teak, fast-growing **Eucalyptus,** bamboos and also tropical pines. The annual potential availability of industrial wood from this region could be put at 5 million m^3 and of bomboo at .5 million tonnes.

9. The Eastern Penninsular Strip in Tamil Nadu, Andhra Pradesh and Orissa:— This is a wood-deficit region and, apart from intensively managing the existing hardwood forests, efforts will have to be concentrated on raising new resources of fast-growing **Eucalyptus, Casuarina,** and tropical pines. The annual potential availability of hardwood resources from the region could be put at 6 million m^3.

10. The Peninsular Hinterland in Maharashtra, Mysore, Andhra Pradesh and Tamil Nadu :— This is a wood-deficit region in which also, apart from intensifying management, efforts will have to be concentrated on raising new resources of fast-growing **Eucalyptus** etc. The region has had several major river-valley projects executed for the development of agriculture, and there would be a considerable scope for raising irrigated plantations of fast-growing tree species and the creation of farm forests. These resources along with agricultural residues could provide a sizeable supply of raw material for new pulp and paper industries. The potential annual availabilty of hardwood resources from the region could be put at 6 million m^2

General :— Whatever may be the inputs assigned to the forestry development of the regions, their distribution internally will vary according to the technical condition and the economic significance of forest stands. The intensity of treatment may range all the way from minimum protection against destructive agencies, notably fire, in remote areas, to the most intensive management and silvicultural treatment in the neighbourhood of wood-using industries. In some cases, exploitation may be carried into virgin forest areas. In principle, the working of such areas is desirable,since it means mobilizing new resources and creating settlements of forest workers.

CONCLUSION

An endeavour has been made in this paper to appraise the demand of industrial wood and fuel wood in India for the next fifteen years and to lay down production goals to ensure matching supplies. A new approach to regional planning for production of wood and the development of wood-based industries has been outlined. This should help in putting the problems of forestry development and the spread of industries in a proper perspective or focus. Of the ten regions proposed in this paper, two regions, i.e. Nos. 4 and 6 could be regarded as vast and untapped storehouses of industrial wood which offer a promise of sustained growth of wood-based industries in the years to come. The hardwood and bamboo resources in them are truly stupendous and any investment made in these areas for the development of an infrastructure, would give a high ratio of benefit/cost.

Regions No. 3 and 10 are wood-deficit areas, but the green revolution in the agricultural field has occured in them. These regions have attained a high state of development of agriculture and they offer an ideal climate for the entry of forestry into the agrarian sector. Here is an opportunity for the creation of new resources for wood-based industries and also for meeting the heavy demand of agriculturists for fuel. In the fuel-hungry countryside where dung is burned instead of being returned to the soil, village fuel wood plantations may be the key to a rise in agricultural productivity.

Region No. 2 could well become an outstanding example of the dynamic role that forestry can play in the future economy of the nation. The man-made forests of fast-growing species are bound to lead to the establishment of new industries and the generation of employment.

Region No. 1 occupies a unique position in that it contains a bulk of the coniferous resources of the country. In view of the importance of long-fibred raw material in the pulp and paper industry, it would be necessary and desirable to use these resources rationally and judiciously.

The remaining four regions contain forests in varying proportion and the strategy for their future use would be to intensify their management and augment production of wood and bamboo in them. It should be possible to raise plantations of teak, **Eucalyptus**, and tropical pines in the coastal belts on the Western and Eastern Ghats. So also **Casuarina** plantations could be raised in the coastal region.

Writing about plantation forestry, Westoby[19] has stated that it has made spectacular advances in recent decades. Forestry genetics can assure high quality breeding material. With the use of selected seedlings, by tilling and fertilizing the soil, plantations can produce as much as ten times the growth of the natural forest. The shift to what are essentially agrotechnical methods presents many advantages; convenient selec-

tion of species and rotation period; a more homogeneous crop, lending itslf to mass production, removal and processing techniques; co-use of the land with agricultural crops in the first few years after establishment; reduction of supervision and transport costs by concentration; and freedom to plan the sequence of age groups for orderly harvesting. An adaptation of plantation forestry — now commonly called linear forestry — has evolved in a number of countries, usually those with much land in agricultural use. Experience has shown that, even in countries with little natural forest of value, plantation and linear forestry can transform the situation speedily, opening up entirely new perspectives.

There is an intimate inter-relation between the forestry and forest industry sectors. A coherent forestry plan is a pre-requisite for the sound long-term development of forest industries. Planning forestry with regard to the other economic sectors involves :

a) estimating the future demand for wood and for the non-crop utilities that the forests can provide : this refers both to the forest already in existence and to those that may have to be created;

b) estimating the size and the nature of the forest resource, and appraising the extent to which essential production factors might be available for forestry;

c) determining the plan within the context of the economic needs of the country as also the measures for the execution of the plan.

The installation of forest industries is of a dynamic character. These industries could be regarded as a propulsive sector, that is, a sector the expansion of which is liable to induce spontaneous investment in other branches of production. This is due to the fact that the forest industries have a very strong forward linkage with other sectors. A high degree of linkage makes a sector a good starting point for industrial growth. Investment there, by including demand and providing supplies for other sectors, widens investment opportunities in the economy as a whole and has a multiplier effect.

A massive effort will have to be launched in the coming years for strengthening and consolidating the base of forestry in India. The essential prerequisites for the success of the programme would be assured inputs of the magnitude indicated in the paper and drastic changes in the organizational and institutional structure of the forestry sector. For the sake of insuring sufficient and timely inputs, it may be necessary to introduce a large measure of autonomy in the sector and to set apart exclusively funds for forestry development. It would also be a worthwhile idea to pool up the resources of the country along with financial aid and loans from international bodies like the World Food Programme of F.A.O., World Bank assistance, UNDP collaboration and bilaterial assistance programmes like those of SIDA (Swedish International Development Aid).

Lastly it would not be out of place to say a word about the organisational and forestry service matters. Both these are vital matters and giving them their proper place in the planning programme would make all the difference between success and a tardy performance of the forestry sector. It is improved organization which guarantees new breakthroughs. Besides, the challenges that foresters will have to face in the coming years in the direction of augmenting production from the forest and meeting the spiralling needs of wood-based industries are such as would call for the highest calibre and sense of dedication in the forestry personnel. This can only be ensured by providing within the framework of development plans for the creation of trained cadres and for the guaranteed career prospects for forestry personnel. The top positions should be available to foresters in the forestry, administrative, planning and industrial sectors.

It is often not realized in underdeveloped economies that their forests, which the very lack of development has in many cases helped to preserve, are an important source of natural wealth, which if properly exploited, would represent a most important incentive to the beginning of industrialization. Indeed, forests have a great potential as a source of human welfare, and industrialization based on the forests can both-contribute to and promote the general economic development process.

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