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Vol XXXVIII
No. 3

ISSN 0019-5014

CONFERENCE
NUMBER

JULY-
SEPTEMBER
1983

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS



INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

forestry to a significant extent. Moreover, the nature of the forestry is such that there is sufficient time lag between the investment and commercial return from that investment. The country is faced with a dilemma. If production is increased to meet the expanding needs and demands of growing population and increasing incomes, ecological balance is disturbed resulting in atmospheric pollution. If ecological balance is maintained, production suffers resulting in increase in the prices of forestry products, necessitating imports of such products which the country can ill-afford. The solution lies in maintaining proper balance between the conflicting interests of ecological balance and production of forestry products.

A STUDY OF REGIONAL DISTRIBUTION AND TRENDS IN AREA, PRODUCTION AND YIELD OF FORESTS IN BIHAR (1957-58 TO 1976-77)

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Forests have a very important role to play in agriculture, environment, employment and rural development. As against the norm of 33 per cent of the geographical area required to be covered with forests, only 23 per cent is covered under forests in India. Not only that, there has been a continuous decline in the area under forests in India. Further, there is an intense disparity in the regional distribution of forests.

An attempt has been made in this paper to give a brief account of inter-State disparity as well as inter-district disparity in the distribution of forests in Bihar. An attempt has also been made to investigate into the trends in the area, production and productivity of forests in the State of Bihar for the period 1957-58 to 1976-77.

Data

The study is based purely on secondary data. The data on inter-State and inter-district distribution of forests have been taken from the Selected Plan Statistics (1976), published by Bihar State Planning Board. Time-series data on the forest area, revenue received from and expenditure incurred on forests have been taken from the various issues of the Bihar Through Figures. Revenue and expenditure data have been deflated on 1957-58 prices. Time-series data on physical output of forests not being available, the production of forests have been taken as the revenue received from the sale of different forest products. Similarly, yield of forests has been taken as the gross revenue productivity and net revenue productivity.

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Methodology

The inter-State and inter-district disparities in the distribution of forest resource have been studied with the help of coefficient of variation. Further, both linear and exponential trend equations have been fitted to the time-series data on forest area, revenue, gross revenue and net revenue productivity. Thus, the linear and exponential growth rates have been estimated along with their respective standard errors. The formulae used for the purpose are:—

(i) Linear growth trend equation: $Y = a + bX$

(ii) Compound growth trend equation: $Y = ab^X$
where in both (i) and (ii)

Y = forest area/revenue/gross revenue productivity/net revenue productivity,

X = number of years,

a = intercept (constant),

b = regression coefficient or trend value.

Further, linear growth rate has been defined as:

(iii) $GR = \frac{b}{\bar{Y}} \times 100$

where GR = growth rate (linear),

\bar{Y} = mean value of forest area/revenue/gross revenue productivity/
net revenue productivity.

Similarly, compound growth rate has been defined as:

(iv) $GR = (b-1) \times 100$

(v) Standard error of linear growth rate:

$$S_b = \frac{\sum Y^2 - a\sum Y - b\sum XY}{(N-2) \sum X^2}$$

(vi) Standard error of compound growth rate:

$$S_b = \frac{\sum \log Y^2 - \log a \sum \log Y - \log b \sum X \log Y}{(N-2) \sum X^2}$$

The present study covers the period of 20 years from 1957-58 to 1976-77. The 20-year period has been divided into two sub-periods, namely, period I (1957-58 to 1966-67) and period II (1967-68 to 1976-77). The period from 1957-58 to 1976-77 has been termed as period III.

Inter-State Disparity

Only 22.9 per cent of geographical area is covered with forests in India. As regards different States, the maximum percentage coverage under forests

has been observed in Assam (58.4 per cent), followed by Orissa (43.2 per cent), Himachal Pradesh and Madhya Pradesh (38.8 per cent each). In the rest of the States, the forest coverage has been observed to be less than the required area of 33 per cent. The position of Haryana, Gujarat and Jammu & Kashmir has been quite unsatisfactory (less than even 10 per cent of geographical area being covered with forests).

The coefficients of variation for the total geographical area of the States, total forest area, forest area as per cent of geographical area and per capita forest area have been found to be 61.91, 94.59, 61.2, and 97.08 respectively, showing the intense disparity in the distribution of forest resources among the different States.

Inter-District Disparity

As has been stated above, only 4 States, namely, Assam, Himachal Pradesh, Madhya Pradesh and Orissa have sufficient area covered with forests. The rest of the States are forest deficient. Only 17 per cent of the geographical area of Bihar is covered under forests. The geographical territory of Bihar may be divided into three regions—North Bihar, South Bihar and Chhotanagpur. Out of the three regions, the position of North Bihar region is very much deplorable from the point of view of coverage of forest area, as only 1.9 per cent of the geographical area is covered under forests. The per capita availability of forest area comes to 0.004 hectare only on the basis of 1971 population data. Similarly, the forest area per head of livestock comes to 0.001 hectare (Table I).

The position of South Bihar is slightly better than that of North Bihar with 11.52 per cent of the geographical area covered with forests, per capita forest area being 0.029 hectare, and the forest area per head of livestock being 0.071 hectare.

Chhotanagpur region shows a better position as compared to North Bihar and South Bihar. In this region 29.03 per cent of the geographical area is covered with forests, forest area per capita is 0.162 hectare and area per head of livestock is 0.212 hectare.

Taking the whole State, it is observed that 16.83 per cent of the total geographical area is covered with forests, 0.052 hectare of forest area is available per capita and the forest area per head of livestock is 0.105 hectare. The coefficients of variation of inter-district distribution of forest area, percentage distribution of forest area, distribution of forest area per capita and forest area per head of livestock have been found to be 126.83, 106.81, 148.28 and 119.63 respectively. The above description shows the intensity of disparity in the distribution of forest resources among the different districts of the State.

Trends in Forest Area and Revenue

There has been a decreasing trend in the area under forests in Bihar during the period under study. As revealed from Table II, the mean values of the area of forests were 31,837.8, 29,260 and 30,543.9 sq. km. for

TABLE I—REGIONAL DISTRIBUTION OF FORESTS IN BIHAR (1971-72)

Sr. No.	District	Geographical area (sq. km.)	Forest area (sq. km.)	Forest area as per cent of geographical area	Forest area per capita (hectare)	Live-stock (lakh)	Forest area per head of live-stock
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Sarang	6,913	—	—	—	13.48	—
2.	Champan	9,202	918	9.97	0.026	17.64	0.052
3.	Muzaffarpur	9,817	—	—	—	16.43	—
4.	Darbhanga	8,664	—	—	—	16.69	—
5.	Saharsha	5,421	—	—	—	11.36	—
6.	Purnea	11,030	13	—	—	21.98	—
	North Bihar	49,047	931	1.90	0.004	97.58	0.001
7.	Patna	5,605	46	0.82	0.002	9.59	0.004
8.	Gaya	12,344	1,561	12.64	0.035	21.77	0.072
9.	Shahabad	11,417	1,803	15.79	0.046	16.25	0.111
10.	Monghyr	10,295	1,291	12.54	0.033	15.21	0.085
11.	Bhagalpur	5,654	518	9.16	0.025	10.33	0.050
	South Bihar	45,315	5,219	11.52	0.029	73.15	0.071
12.	Santhal Pargana	14,167	1,916	13.52	0.061	28.59	0.067
13.	Hazaribagh	18,171	7,539	41.49	0.250	21.35	0.353
14.	Ranchi	18,252	3,327	17.48	0.122	22.39	0.149
15.	Palamu	12,756	5,580	43.74	0.372	14.00	0.399
16.	Dhanbad	2,883	261	8.92	0.018	0.15	0.424
17.	Singhbhum	13,445	4,506	33.51	0.185	16.25	0.279
	Chhotanagpur	79,674	23,129	29.03	0.162	108.73	0.212
	Bihar	1,74,036	29,279	16.83	0.052	279.46	0.105
	Coefficient of variation..	41.43	126.83	106.81	148.28	32.99	119.63

Source: Selected Plan Statistics (Bihar), Bihar State Planning Board, 1976.

period I (1957-58 to 1966-67), period II (1967-68 to 1976-77) and period III (1957-58 to 1976-77) respectively. Both the linear and compound growth rates have been found to be negative during the period under consideration. The linear growth rate per annum for periods I, II and III has been found to be -0.89 , -0.78 and -0.85 per cent respectively. Similarly, the compound growth rate for the respective periods has been observed to be -0.88 , -0.77 and -0.83 per cent per annum.

As regards the accuracy of the two types of growth rates, the compound growth rates appear to show more accuracy as the standard errors in their cases have been found to be very much less than those of the linear growth rates in all the three periods.

The revenue received from the sale of the various forest products has shown an increasing trend in all the three periods as judged from the mean values of the revenue at 1957-58 prices. The growth rates have also shown an increasing trend (Table II). The linear growth rates for the three respective periods were 4.27, 1.75 and 1.97 per cent per annum. Similarly, the compound growth rates were 4.86, 1.71 and 2.18 for the periods under study with lower standard errors.

TABLE II—TRENDS IN FOREST AREA AND REVENUE

	<i>(growth rate per cent per annum)</i>					
	Period I (1957-58 to 1966-67)		Period II (1967-68 to 1976-77)		Period III (1957-58 to 1976-77)	
	Mean value	Linear growth rate	Compound growth rate	Mean value	Linear growth rate	Compound growth rate
Area 31,837.8 sq. km.	-0.89 (5.6177)	-0.88 (0.0000023)	29,260.0 sq. km.	-0.78 (3.0988)	-0.77 (0.00049)
Revenue Rs. 1,81,58,100	4.27 (5.2030)	4.86 (0.5128)	Rs. 2,15,08,900	1.75 (13.2551)	1.71 (0.00048)
Per sq. km. gross revenue	.. Rs. 574.6	7.09 (11.1024)	5.75 (0.00015)	Rs. 737.2 (4.5103)	2.39 (0.00018)	2.91 (0.00018)
Per sq. km. net revenue	.. Rs. 163.0	8.63 (12.2803)	11.25 (0.00035)	Rs. 162.0	-16.99 (2.5866)	-10.37 (0.0008)
				Mean value	Linear growth rate	Compound growth rate
				Sq. m.		
				Rs. 19,83,300	1.97 (3.7600)	2.18 (0.00026)
				Rs. 655.9	2.74 (1.5450)	2.54 (0.99912)
				Rs. 162.8	-2.91 (3.9199)	-1.71 (0.00023)

Note.— Figures in parentheses show standard errors of the estimates.

As regards gross revenue productivity per sq. km., a positive trend has been noted in all the three periods under consideration. The mean value of gross revenue productivity per sq. km. at 1957-58 prices was Rs. 574.6, Rs. 737.2 and Rs. 655.9 for the three respective periods. Further, both the linear and compound growth rates have also shown an increasing trend (Table II).

But the case is quite different as regards per sq. km. net revenue productivity, which has shown an increasing trend in period I and a decreasing trend in periods II and III (Table II). Similarly, both the linear and compound growth rates were positive (8.63 and 11.25 per cent per annum respectively) in period I. But the linear growth rate was -16.99 and -2.91 for periods II and III, and the compound growth rate was -10.37 and -1.71 for periods II and III respectively.

From the above analysis it is evident that there has been a continuous decline in the area under forests in Bihar. A number of factors may be held responsible for this phenomenon. One of the major factors responsible for the continuous decline in the forest area is the unscientific and over-exploitation of forests. The private contractors with the connivance of the Government officials have been engaged in indiscriminate felling of trees to get the maximum gain. Lack of a cheap alternative fuel resource is also responsible for the fall in forest areas.

Another factor which has caused a fall in the forest area is the conversion of forest area into cultivable area and its distribution among the *adivasis* and other tribes. This is evident from the fact that there has been a slow but continuous increase in the net sown area in the State.

Prior to 1946, the forests in Bihar were managed and controlled under the Indian Forests Act, 1878. The Government had the control over the Government forests only, and the private forests were left in the private hands. The forests in the private hands were facing destruction. With a view to protect the private forests from destruction, the Bihar Private Forests Act was passed in 1946. This Act brought the private forests under the control of the Government. Further, after the passing of the Bihar Land Reforms Act (Abolition of Zamindari), the total forest area of the State came under the control of the Government. In spite of these Acts, the Government did not take measures to protect the forest and/or to extend the forest area. Thus, the indifferent forest policy and the lack of forest protection measures have played a significant role in bringing down the forest area in Bihar.

Of late, the Government of India has recognized the importance of forests. Social forestry and alternative energy resources programme has been included in the New 20-Point Programme under which the Government of Bihar has targeted to install 6,000 bio-gas units and to plant nine crores of trees. In the year 1982-83, the Government of Bihar had allocated Rs. 14 crores for tree plantation. Further, the Government of Bihar is running a Scheme known as "Roadside Tree Plantation Programme" (*Path-Tat Briksha Ropan Karyakrama*) and the slogan is *Briksha Lagao, Briksha Bachao*.

The social forestry programme should be taken as the people's programme and the people should be invited to participate with zeal and zest in the programme. Industrial units should also participate in this programme and they should adopt at least one village each for implementing the social forestry programme.

DEMAND-SUPPLY MANAGEMENT AND PRICING POLICY OF FOREST BASED RAW MATERIALS FOR THE PAPER INDUSTRY IN INDIA: SOME ISSUES

Tirath Gupta*

The significance of an activity in a nation's economy can be assessed through its backward and forward linkages. Numerical values of input and output coefficients are generally used to measure the relative importance of an activity but they cannot bring out its real or potential worth in a dynamic situation. This is more true for land based activities where the potential for technological improvements at primary production and product processing stages could be visible, and policy interventions can be used to enhance efficiency of the natural resource system.

This paper is an attempt to deal with the problems and prospects of demand for and supplies of forest based raw materials for the paper industry. The choice was made for a number of reasons. First, per capita consumption of paper is considered as one of the indices of the level of economic development of a country. Availability of paper in India (including imports) is around 2 kg. per person per annum as against 289 kg. in U.S.A. and 13 kg. for Asia. It can be argued that to plan for a very high level of paper consumption would not be desirable and the principles of 'demand management' must be invoked for a number of reasons including the necessity to (i) meet the demand for forest produce from other industries and sectors, and (ii) control environmental pollution caused not only by the production process but also by garbage disposal. At the same time, it can be argued that the nation must plan for enhancing paper consumption at least to match with the annual growth in per capita income at constant prices.¹ This is an enormous task.

Second, the paper-making units are currently competing for too little raw materials (10, p. 20).[†] This means that serious thought must be given on the sources and methods to meet the requirements for additional production capacity. Third, not only must the raw materials be available but their price must be such that the industry and society can afford. This encompasses

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1. Engel's Law of consumption states that proportionate expenditure on certain goods and services of social and cultural significance would normally rise faster than the rise in family income.

† The figure in brackets refers to the study in the list of references cited at the end.