Development of Indian Forestry and Tasks Ahead[1]

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1. Introduction

I feel greatly honoured to have been elected as Sessional President of the 57th Annual Conference of the Indian Society of Agricultural Statistics and invited to deliver the Technical Address. I consider it a great privilege to be able to address this august gathering of distinguished members of the Society and Agricultural Scientists many of whom have taken up a leadership role and contributed significantly to the growth of the Agriculture Sector in the country. After some thought, I have chosen this topic for my address. The problems suggested are likely to be challenging for Research Statisticians.

Forests perform a number of productive, protective and regulative functions. They are important components of the economic and ecological systems. The role of forestry is to regulate the hydrological and atmospheric cycles, to provide a habitat for biodiversity and to prevent soil erosion, siltation and flooding. The economic returns are derived from the large variety of forest products. Forests also provide recreational, aesthetic and cultural functions and are an important source of livelihood for local communities. They provide a sanctuary that is essential for the incubation and maintenance of terrestrial life.

2. Preamble

In India, forestry is a major land use next to agriculture. However, it is almost a neglected sector in the structure of Indian economy. It is consistently and seriously under-valued in economic and social terms. For example, the contribution of the forestry sector to gross domestic product (GDP) was only 1.1 per cent in 1999-2000 (measured at constant prices of 1993-94). Forestry has to be treated as one of the few core sectors of Indian economy. Of late, the Government of India have recognized the importance of forest resources to complement and sustain the growth of agriculture and industrial sector; to

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provide gainful employment to a large number of people, particularly in remote rural areas; to enhance foreign exchange earnings; to sustain an ecological balance and to enhance the quality of the bio-physical environment.

The Standing Committee on Improvement of Agricultural Statistics, in consultation with the Inspector General of Forests, recommended the revised definition of "area under forestry" for adoption in both the Revenue and Private Departments of States.

"Area under forests includes all lands classed and/or administered as forests under any legal enactment dealing with forests, whether State owned or private and whether wooded or maintained as potential forest land".

Under the Constitution, forestry is a State subject and the Central Government is chiefly concerned with the implementation of National Forest Policy, coordination, forest education at professional and sub-professional levels, research and training.

3. Method of Forest Data Collection & Statistical Research

Reliable forestry statistics are required for planning, policy and decision making on forestry development programmes. These statistics were collected earlier mainly as a by-product of State Forest Administration.

On the recommendations of the National Commission on Agriculture (1976), the Forest Survey of India (FSI) was created in 1981 with the objective of monitoring the forest resources at a micro level; collecting, storing and retrieving forestry related data; designing methodologies related to forest surveys; imparting training in modern survey techniques to forestry personnel, and undertaking special studies and consultancies. Besides the FSI, the Indian Council of Forestry Research and Education (ICFRE) established in 1986 is mandated to collect, collate and compile primary and secondary data generated by the State Forest Departments and various Central Ministries. A comprehensive national forest research plan has been developed by ICFRE after working out due priorities.

Since 1987, Remote Sensing Technology is being used by FSI, for collection of data on forest cover on a country-wide scale through biennial surveys. Digital Image Processing (DIP) using satellite data provided by the National Remote Sensing Agency (NRSA), is used in all States now. It is reported that the estimates of forest cover has been arrived at by using the digital image processing techniques using 1:50,000 scale against the 1:2,50,000 scale used earlier. Introduction of digital interpretation has helped in obtaining more accurate figures and in reducing the time lag in the availability of the area estimates.

The thrust of statistical application in forestry was for enumeration of species especially to determine timber and bamboo resources. A notable

beginning in the development of suitable sampling methods in forest surveys for estimation of timber volume was made by Griffith (1945) who examined many complete and partial enumeration records from different parts of India and discussed the efficiency of sampling methods. Finney (1947) studied the principle of different types of strip sampling in estimation of timber volume. In 1948, he studied the data used by Griffith in a greater detail and examined the efficiency of systematic strip sampling in relation to stratified random sampling.

The 8th Silvicultural Conference held at Dehradun in 1951 emphasised the need for development of proper sampling methods under Indian conditions. Thereafter a series of studies was made by Nair (1956), Nair and Bharagava (1951), Seth (1951, 1955), Finney (1953, 1958), Mukashi (1954) and Rao (1957). A manual on sampling techniques for forest surveys was prepared by Chacko (1965). Feasibility of sequential sampling in forest surveys was attempted by Shukla (1973). A series of volume tables for different species based on statistical analysis of available data was prepared by A.N. Chaturvedi during 1970-80. One of the earliest publications dealing with design and analysis of experiments in respect of forestry is the Silvicultural Research Code by Griffith and Bakshi (1947).

The scope for application of statistical methodology in forestry has been enlarged. Sampling techniques are being used for estimation of natural population, species and size class distribution of growing stock, increment, yield and volume, pattern on natural regeneration etc. Sampling types that are generally applied in forest surveys are stratified random sampling, strip sampling, systematic sampling, 3-P sampling, point sampling. The choice of sampling design depends on objectives, availability of sampling frame, topography, items on which data need to be collected and organizational set up.

Design and analysis of field forestry experiments are widely in use to determine species-site matching, treatment against pests and diseases, spacing, tending, thinning, growth and increment in height, diameter and volume. Various useful designs developed and being used are block designs (RBD, IBD, BIBD, PBIBD, Lattice design, Augmented block designs etc.) requiring one-way elimination of heterogeneity; row column designs (Latin square, Youden square etc.) requiring two-way elimination of heterogeneity and designs involving several factors (split plot design, strip plot design, response surface design, other designs for factorial experiments etc.). The most common experiments with single factor are provenancial trials. Very often repeated/multiple measurements, both spatial and temporal, are made in Silvicultural trials. Since last few years agro-forestry has become very popular and gained importance. Experimental designs are successfully used in agro-forestry to study the management practices, collection and evaluation of promising species etc.

In addition to using different sampling types and advanced designs for experiments, other statistical methodologies are being applied in forest research

viz. Markovian Stochastic approach to study population and growth dynamics of forest stand (Seth and Shukla (1972), Satyamurthy (1979)); Multiple Regression Models to establish relationship of basal area, volume and height with d.b.h. (diameter at breast height) as well as to study and forecast growth and yield both for short and long term planning.

Methodologies have been developed for comprehensive assessment of forest resources *inside* and *outside* forest areas at national level. In order to assess the inventory inside forest area, the country is stratified into 14 physiographic zones according to tree species composition and ecological parameters. In a strata, districts are being considered as first stage sampling units and grids of size 1¼" × 1¼" as second stage sampling units. Ten per cent of districts are inventoried in every cycle of two years. Together with forest inventory, efforts are being made to assess non-wood forest produce, regenerous forest status etc. The approach is different for assessment of trees outside forests in rural and urban areas. For assessment of trees in rural areas, Remote Sensing data is used to stratify the area on the basis of geometrical formation of tree resources viz. linear, block and scattered trees. Optimum number of random points for the three strata is fed into the computer for randomly marking of all sample points on the maps. The generated maps are taken to the field for carrying out field survey. After the plots are laid out (plot sizes different in different strata) for all strata, data are collected on various parameters like d.b.t., crown diameter, name of species, category of plantation etc. In order to assess the trees outside forest (urban) area, the district is divided into five categories of town as strata based on population size. Urban Frame Survey Blocks, as sampling units, in each district are obtained from the National Sample Survey Organization. Based on a pilot survey, the number of sample blocks to be surveyed in a district is decided. A town class wise sample of randomly selected blocks in each district is completely enumerated for securing data on various parameters as for rural inventory.

There is wide scope for application of statistical techniques in estimation of minor forest products which contribute significantly to the national income. Application of statistics in forestry research is still at its infancy. Considering the diversity of the problems, the scope for use of statistical tools is enormous. New techniques and designs need to be developed to tackle the problems which are specific to forestry.

4. Present Status

4.1 Forest Area

Total land area of the world is 13,077 million hectares of which 32 per cent is covered under forests. India occupies about 2.5 per cent of world's land area and only 1.8 per cent of its forest covers. Regions having forest cover more than World average (32%) are Latin America (46%), former USSR (41%), North America (37%) and Europe (37%) (Table 1).

Table 1. Distribution of the world's forest land (in million hectares)

Region	Total land		Total forest		Closed forest			Open forest	% age of land area forested
	Area	%	Area	%	Broad leaved	Conifer-ous	Total		
North America	1,835	14.0	684	16.5	168	301	469 (68.6)	215 (31.4)	37
Europe	472	3.6	174	4.2	65	88	153 (87.9)	21 (12.1)	37
Former USSR	2,227	17.0	920	22.2	147	645	792 (86.1)	128 (13.9)	41
Africa	2,966	22.7	718	17.3	216	2	218 (30.4)	500 (69.6)	24
·Latin America	2,054	15.7	942	22.7	666	26	692 (73.5)	250 (26.5)	46
Asia	2,573	19.7	567	13.7	414	55	469 (82.7)	98 (17.3)	22
Pacific Area	950	7.3	142	3.4	50	22	72 (50.7)	70 (49.3)	15
World Totals	13,077	100.0	4,147	100.0	1,726	1,139	2865 (69.1)	1,282 (30.9)	32

Source : Encyclopaedia Britannica

NB : Figures in brackets are the percentages of closed and open forest area in the region.

Statistics of area under forests, published in Indian Agricultural Statistics are based on land-use data received from the State Department of Agriculture or Revenue or State Bureau of Economics & Statistics. Area figures received from the State Forest Departments are also published separately. As mentioned earlier, FSI assesses the forest cover of the country biennially. Figures published by different agencies differ from one another.

Of the total area of 3,287,263 sq. km. (i.e. 328.73 mill. hectare), forest area in India, as per land use data, is 768,436 sq. km. which is about 23.38 per cent of the total geographical area. This is far less than the 33 per cent considered necessary, on socio-ecological and economic grounds stipulated in the National Forest Policy Resolution of 1952 and emphasized in the 1988 Policy statement. It is also stated that there should be 60 per cent coverage in hilly tracts and 20 per cent in plains.

Although forest coverage is about 23.4% at National level, the proportion varies widely among States (Table 2), minimum being 3.5% in Haryana and maximum 81.2% in Sikkim. This variation is expected due to location of States in different climatic zones and their topography. Of the total forest area, Madhya Pradesh accounts for 12.4%, Andhra Pradesh 8.3%, Maharashtra 8.1%, Chhattisgarh 7.7%, Orissa 7.6% and Arunachal Pradesh 6.7%. About 53 per cent of the geographical area of seven North Eastern States is covered under forests,

although it accounts for 18% of the total forest area in the country. Forest cover in the seven Union Territories is about 68% of their total geographical area, but accounts for less than one per cent of the total forest area in the country.

Table 2. Forest cover

State/Union Territories	% age of total geographical area	% age of total forest area	% age of forest area to geographical area
Andhra Pradesh	8.37	8.30	23.20
Arunachal Pradesh	2.55	6.71	61.54
Assam	2.39	3.52	34.44
Bihar	2.86	0.79	6.45
Chhattisgarh	4.11	7.72	43.85
Goa	0.11	0.16	33.06
Gujarat	5.96	2.47	9.69
Haryana	1.34	0.20	3.51
Himachal Pradesh	1.69	4.82	66.52
Jammu & Kashmir	6.76	2.63	9.10
Jharkhand	2.42	3.07	29.61
Karnataka	5.83	5.04	20.19
Kerala	1.18	1.46	28.87
Madhya Pradesh	9.38	12.39	30.89
Maharashtra	9.36	8.06	20.13
Manipur	0.68	2.27	78.01
Meghalaya	0.68	1.24	42.34
Mizoram	0.64	2.07	75.59
Nagaland	0.50	1.12	52.05
Orissa	4.74	7.57	37.34
Punjab	1.53	0.40	6.07
Rajasthan	10.41	4.23	9.49
Sikkim	0.22	0.75	81.24
Tamil Nadu	3.96	2.98	17.58
Tripura	0.32	0.82	60.01
Uttaranchal	1.63	4.51	64.81
Uttar Pradesh	7.33	2.19	6.98
West Bengal	2.70	1.55	13.38
Union Territories*	0.33	0.97	68.26
All India	100@	100**	23.38

* A & N Islands, Chandigarh, D & N Haveli, Daman & Diu, Delhi, Lakshadweep, Pondicherry
@ Total Geographical Area 32,87,263 square km.
** Total Forest Area 7,68,436 square km.

Data on area under forests are collected according to various ownership categories viz. (i) State, (ii) Corporate Bodies, and (iii) Private Individuals. About 96 per cent of the country's forest area is State-owned and only 4 per cent under other two categories. The forests are further sub-classified under

'reserved', 'protected' and 'unclassified' areas. These account for about 55.1%, 28.3% and 16.6% of the total forest area respectively. Forest cover by density classes such as 'dense forest' (61.7%), and 'open forest' (38.3%) are also recorded. Technically, areas with tree cover of canopy density of 40 per cent and above are identified as dense forests while those with canopy density of 10-40 per cent are taken as open forests. The proportion of dense forest and open forest varies considerably among states. More than 70 per cent of forest area is dense forest in the States, Arunachal Pradesh, Goa, Himachal Pradesh, Karnataka, Kerala and Sikkim. The extent is 50 per cent or less in Manipur, Meghalaya, Mizoram, Nagaland and Rajasthan.

The proportion of 'closed forest' and 'open forest' in the world is 69:31. The coverage under 'closed forest' is much higher than that under 'open forest' in all the regions excepting in Africa where 'open forest' accounts for about 70 per cent (Table 1).

4.2 Waste Lands

Of the total, 1295.8 lakh hectares of degraded area, forest-degraded area accounts for 27.7% (358.9 lakh hectares) and non-forest degraded area 72.3% (936.9 lakh hectares). The non-forest-degraded area includes saline and alkaline lands (71.6 lakh hectares), wind eroded area (129.3 lakh hectares) and water-eroded area (736.0 lakh hectares). Of the total waste land, Madhya Pradesh accounts for 15.5%, Rajasthan 15.4%, Maharashtra 11.1%, Andhra Pradesh 8.8%, Karnataka 7.1%, Uttar Pradesh 6.2%, Orissa 4.9% and Bihar 4.2%. About one-fifth of the total forest degraded area is in Madhya Pradesh, 10.4% in Andhra Pradesh, 9.0% in Orissa, 7.9% in Maharashtra, 5.7% in Karnataka, 5.4% in Rajasthan, 4.4% in Bihar and 4.0% in Uttar Pradesh. About one-third of the water-eroded area is in Madhya Pradesh and Maharashtra.

Much of the degraded land can be improved through afforestation, which is very labour intensive and extremely rewarding. The conversion of these idle and degraded lands can become productive assets and thereby bring about a reduction in the present migration of the rural people to the urban areas. If our Agricultural Scientists can evolve plants, which can thrive in saline and alkaline conditions and stand against wind and floodwater then forest cover can be enhanced considerably in addition to providing employment to the rural labour force.

4.3 Outturn of Forest Produce

Forests generate a variety of goods both major and minor products. These include timber and fuelwood; fibres and flosses; grasses used for fodder and thatching; bamboo and canes; non-edible and edible oils of grass, wood, leaf, root, flower and fruit origin; tans and dyes; gums and resins; drugs; spices; insecticides; lac & tasar silk; commercial leaves; ivory; honey etc. Statistics of outturn of major forest produce are available both in terms of quantity and value.

Volume of wood is recorded under 'coniferous' or soft-wood species which include Deodar, Chir, Kail, Fir and others; and 'non-coniferous' i.e. broad leaved species like Sal, Teak, Sisso, Simul and others. Among the minor products both quantity and value are reported for bamboo, canes, resin, gums and tendu/kendu/bidi leaves and for the remaining products only the values are available. Even for some products, the volume is reported in different units. For example, bamboo and canes are reported in number by some states and in tonnes or meter by other states. The production of tendu/bidi leaves (Diospyros melanoxylon) is recorded either in tonnes or in standard bags. The estimates of production of timber during 1999-2000 was about 10 lakh cu. metres of which Madhya Pradesh, Jammu & Kashmir and Punjab each accounted for 17%, Maharashtra and West Bengal each accounted for 8% and Karnataka 6%. Of the 40 lakh tonnes of fuelwood production in 1999-2000, Karnataka accounted for 32%, West Bengal 22%, Maharashtra 19%, Bihar 10% and Madhya Pradesh 8%. Major bamboo producing states were Tripura, Mizoram, Manipur, Madhya Pradesh, Karnataka, Rajasthan and Gujarat. Tendu leave is one of the important minor forest produce in some states. Orissa produces about 15% of the total kendu leaf production in the country and accounts for over 70% of the total revenue accruing to the state exchequer from forest produce in a year. Other tendu/kendu leave producing states are M.P., Maharashtra, A.P., Bihar and Rajasthan where the production is reported in standard bags or in tonnes. Efforts need to be made to get information on minor products in quantitative terms and also in standard units. It is observed that information furnished by Corporate Bodies and Private Individuals is either incomplete or do not possess the same degree of accuracy as compared to those from State Forest Departments.

Almost 99 per cent of the forests in India depend on natural regeneration. The growing stock in India's forests is estimated at 74 cu.m. per hectare against the world average of 110 cu.m. The growing stock is about 100 cu.m. in 'dense forests' and 37 cu.m. in 'open forests'. The estimates of growing stock vary considerably between states. More than 100 cu.m. per hectare is estimated in the North-Eastern States, Himachal Pradesh, J & K and Island states; but less than 50 cu.m. per hectare in Punjab, Haryana, Rajasthan and Tamil Nadu.

The average production is less than 1 cu.m. per hectare per year in India against the world average of 2.1 cu.m. The average production is 2.5 cu.m. per hectare in Japan, 3 cu.m. in the USA and 3.5 cu.m. in U.K. There is enough scope for improvement in management to enhance the production.

Considering the varying situations, the current productivity potential has been estimated for different regions in the country (Govt. of India (1988)). These (in cu.m.) are 2.21 in the Western Himalayas, 2.03 in Eastern Himalayas, 1.66 in North-Eastern region, 3.85 in Western coast and Andaman & Nicobar Islands, 1.35 in Decan region, 1.05 in Central India, 0.80 in Gangetic Plain and 0.41 in Dry Forests of Rajasthan and Gujarat. A satisfactory National average is yet to be obtained. It is said that the low productivity of Indian forests has not been a cause but consequence of low investment.

4.4 Gross/Net Domestic Product

The contribution of forestry and logging to the Gross Domestic Product (GDP) at factor cost at constant (1993-94) prices was only 1.1 per cent in 1999-2000. At current prices, the contribution was also 1.1 per cent during the year. The comparable figures for agriculture worked out at 23.2 per cent and 24.8 per cent (Table 3). The contribution to Net Domestic Product at factor cost was 1.2 per cent both at constant and current prices. The real value of GDP increased steadily during seven years (1993-94 to 1999-2000) but percentage contribution decreased. Similar was the trend for agriculture.

Table 3. (a) Gross Domestic Product (GDP) at factor cost (Rs. Crore)

Activity	At current prices			At 1993-94 prices	
	1993-94	1996-97	1999-2K	1996-97	1999-2K
Total	7,81,345	12,43,546	17,86,459	9,70,083	11,51,991
Agriculture	2,21,834	3,34,029	4,43,923	2,53,750	2,66,848
	(28.4)	(26.9)	(24.8)	(26.2)	(23.2)
Forestry & Logging	11,454	14,493	19,916	11,865	12,542
	(1.5)	(1.2)	(1.1)	(1.2)	(1.1)

(b) Net Domestic Product (NDP) at Factor Cost (Rs. Crore)

Activity	At current prices			At 1993-94 prices	
	1993-94	1996-97	1999-2K	1996-97	1999-2K
Total	6,97,992	11,07,043	16,05,732	8,62,808	10,22,826
Agriculture	2,10,919	3,17,899	4,22,703	2,41,793	2,53,458
	(30.2)	(28.7)	(26.3)	(28.0)	(24.8)
Forestry & Logging	11,166	14,042	19,278	11,546	12,188
	(1.6)	(1.3)	(1.2)	(1.3)	(1.2)

NB : Figures in brackets are the percentage of the total.
Source : National Accounts Statistics (2001), CSO.

Value of the output from forestry and logging was broken up into three components viz. industrial wood, fire-wood and minor forest products. The share of fire-wood was almost three-fourths of the total value. The value of each component increased during 1993-94 to 1999-2000 but the percentage contribution declined for both industrial wood and minor products although it increased for firewood (Table 4).

Table 4. Domestic products from forestry and logging (Rs. Crore)

Product	At current prices			At 1993-94 prices	
	1993-94	1996-97	1999-2K	1996-97	1999-2K
Value of output	12,727	16,103	22,129	13,183	13,936
Industrial wood	1,928	2,210	2,879	1,877	1,882
	(15.1)	(13.7)	(13.0)	(14.2)	(13.5)
Fire wood	9,312	12,198	17,194	9,886	10,699
	(73.2)	(75.7)	(77.7)	(75.0)	(76.8)
Minor forest products	1,487	1,695	2,056	1,420	1,355
	(11.7)	(10.5)	(9.3)	(10.8)	(9.7)
Less (-) Repair, maintenance & other operational costs	1,273	1,610	2,213	1,318	1,394
Gross Domestic Product	11,454	14,493	19,916	11,865	12,542
Less (-) Consumption of fixed capital	288	451	638	319	354
Net Domestic Product	11,166	14,042	19,278	11,546	12,188

NB : Figures in brackets indicate the percentage of output value.
Source : National Accounts Statistics (2001), CSO.

4.5 Revenue and Expenditure

Revenue realized and expenditure incurred in forest sector are reported by each State Government. At national level, the total revenue realized was much less than the expenditure in each year during 1990-91 to 1999-2000 as clearly depicted in the *diagram*. Both expenditure and revenue increased steadily but the latter at a slower rate resulting in widening the deficit gap excepting in the last year when the gap was reduced (Table 5).

Table 5. Revenue and expenditure from/on forests (Rs. Crore)

Year	Revenue	Expenditure	Net revenue/deficit
1990-91	1118.00	1205.83	-87.83
1991-92	1246.81	1320.81	-74.00
1992-93	1235.18	1407.28	-172.10
1993-94	1486.76	2304.52	-817.76
1994-95	1441.54	1730.91	-289.37
1995-96	1690.28	1993.41	-303.13
1996-97	1622.46	2194.66	-572.00
1997-98	1486.76	2304.52	-817.76
1998-99	1179.98	2362.50	-1182.52
1999-2K	1771.80	2485.30	-713.50

Source : Statistical Abstract, India, 2002; CSO.

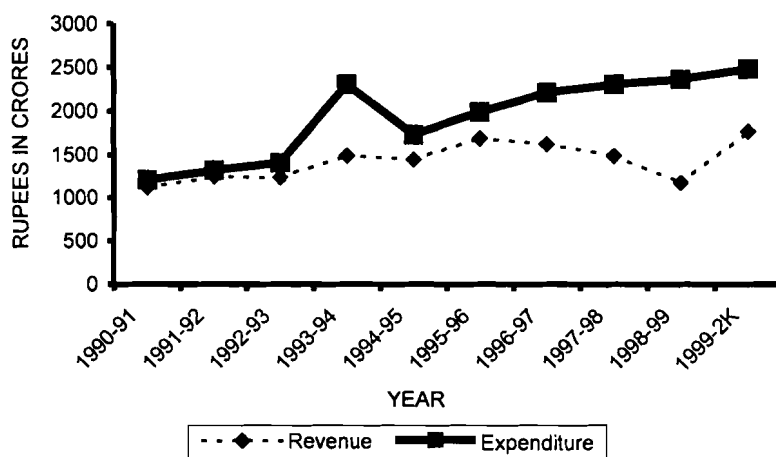## REVENUE AND EXPENDITURE FROM/ON FORESTS

Table 6. Statewise revenue and expenditure per hectare

State/Union Territories	Revenue Rs./hect. 1997-98	Revenue Rs./hect. 1999-2000	Expenditure Rs./hect. 1997-98	Expenditure Rs./hect. 1999-2000	Net revenue/deficit Rs./hect. 1997-98	Net revenue/deficit Rs./hect. 1999-2000
Andhra Pradesh	168	132	130	307	38	-175
Arunachal Pradesh	15	30	57	59	-42	-29
Bihar	83	121	200	313	-117	-192
Goa	54	74	210	798	-156	-724
Gujarat	148	150	1196	1570	-1048	-1420
Haryana	1113	1361	3268	4023	-2155	-2662
Himachal Pradesh	116	1807	327	557	-211	1250
Jammu & Kashmir	100	224	320	386	-220	-162
Karnataka	293	243	527	777	-234	-534
Kerala	1291	1010	756	1137	535	-127
Madhya Pradesh	397	249	264	324	133	-75
Maharashtra	224	–	419	–	-195	–
Meghalaya	39	65	170	72	-131	-7
Nagaland	14	19	103	127	-89	-108
Orissa	–	164	–	160	–	4
Punjab	249	–	756	–	-507	–
Rajasthan	57	70	572	208	-515	-138
Sikkim	35	–	412	–	-377	–
Tamil Nadu	193	465	539	866	-346	-401
Tripura	36	–	255	–	-219	–
Uttar Pradesh	220	–	427	–	-207	–
West Bengal	277	201	839	1139	-562	-938
Union Territories	446	–	8915	–	–	–
Overall	194	230	301	323	-107	-93

Examining statewise revenue and expenditure for the year 1999-2000, it was observed that of the total revenue realized (Rs. 1771.8 crore) Himachal Pradesh, Madhya Pradesh, Kerala and Tamil Nadu accounted for 37.8%, 21.7%, 6.4% and 6.0% respectively. Of the total expenditure of Rs. 2485.30 crore, 20.1% was spent in Madhya Pradesh, 12% each in Karnataka and Gujarat, 8% each for Tamil Nadu and Andhra Pradesh, 5.4% for West Bengal and 5.1% for Kerala. The expenditure per hectare was higher in Haryana as compared to other states.

During 1999-2000, both for Himachal Pradesh and Orissa, revenue exceeded the expenditure. Against the expenditure of Rs. 557 per hectare in Himachal Pradeah, its revenue was Rs. 1807 resulting a net revenue of Rs. 1250 per hectare. The net revenue was marginal in Orissa during the year. However, other states showed deficit (Table 6). In the year 1997-98, Kerala, Madhya Pradesh and Andhra Pradesh realized net revenue amounting to Rs. 535, Rs. 133 and Rs. 38 per hectare respectively. All other states showed deficit. With the efficient management of forestry, the revenue would be much higher than realized at present.

5. Deforestation/Afforestation

Despite laws to protect forests, more and more areas are lost every year. Forest cover is dwindling at a fast pace due to several factors such as rising population, intensified shifting cultivation, indiscriminate removal of timber, fuel wood and fodder, forest fire, increasing industrialization and urbanization. There are many other reasons for decrease in forest coverage. Fuel wood, upon which millions of people depend, is being taken out of the forest at the rate of about 270 million tonnes a year. As grazing lands shrink, domestic animals increasingly move into the forests causing damage. Young trees can hardly coexist with open grazing by cattle and goats in the forest areas. Smuggling is another problem in some areas; the Western Ghats are regularly plundered for valuable sandal wood and rose wood. Forest rangers are ill-equipped to deal with tree poachers. Natural disasters (like land slides) also contribute to deforestation. It has been realized that environmental degradation is mainly because of large scale deforestation.

Besides encroachment, over 4.3 million hectares have officially been lost to residential, industrial, transport and river valley projects since Independence (Govt. of India (1988)). The rate of deforestation, as per one estimate, is over one million hectares every year (Centre for Science and Environment (1982)). Another estimate has been that 9.2 million hectares were deforested during 1975 to 1982 (Govt. of India (1988)).

The Forest Survey of India in collaboration with the Indian Bureau of Mines undertook a study in 1998 to assess the forest cover in areas leased for mining of five important metallic minerals (Bauxite, Copper, Iron, Chromite and

Manganese) in the states Bihar, Madhya Pradesh and Orissa. It has been found that out of 90,695 hectare of leased area, 53,219 hectare is under forest cover of which 71 per cent is under dense forest and 29 per cent under open forest.

The seven North-Eastern States where major portion of land area is under forests are steadily loosing their forest cover. The decrease in forest cover was about 198 thousand hectares during 1991-1999.

Till 1960 a major portion of coastal region in the East was covered with mangroves, serving as the natural barrier against storm, cyclone and other natural disasters. Due to depletion of mangroves soil erosion started and severe cyclonic effect was felt. Meanwhile, when prawn farming emerged as a lucrative business, the onslaught on the mangroves was substantially increased. As a result, a major portion along the coast denuded. It is reported that refugees, settled in the region, illegally started removing the mangroves and acquiring forest land and converting them into agricultural land. Steps need to be taken to protect the mangroves in the coastal region.

Fuelwood prices are rising very fast and the sources of supply dwindling. Some people think that time may come soon when the country might have enough food but no fuel to cook. (Govt. of India (1982), Thapar (1975)).

Upto late seventies, forest land was prime target for its diversion for resettlement, agriculture and industrialization and this trend was contained only by the Forest Conservation Act (1980).

The Act stipulated that no forest land can be diverted for non-forest use. If it is done in the interest of the State or the country, equivalent area of land has to be allocated by the Government, where afforestation can be undertaken to compensate for the loss of cover. The compensatory afforestation norms also lay down that user agencies, the ones which use the forest land for industrial, irrigation, railway or other such projects, have to deposit a certain amount of money with the State Government so that afforestation can be undertaken. These rules have not been strictly followed. Even in some cases, the amount deposited under compensatory afforestation programme has not been used fully for the purpose.

The Government of India has relaxed the provisions of the Forest (conservation) Rules (2003) by delegating more powers to the regional offices of the Union Ministry of Forests and Environment. At present they are empowered to process proposals involving diversion of forest land upto 40 hectares from the earlier limit of five hectares. It is feared that this decision of enhanced power may render larger chauks of forest land vulnerable to decimation.

Some studies have been carried out on deforestation at international level. Stuart L. Pimm and Thomas M. Brooks, ecologists at the University of Tennessee, utilizing some published data and field data collected, concluded that 50 per cent of the world's forest-bird species will be doomed to extinction by deforestation occurring over the next half century.

According to the United Nations Food and Agriculture Organization (FAO), the rate of deforestation in tropical countries has increased and during 1980's the rate reached 15.4 million hectares annually. South America was losing 6.2 million hectares a year. South East Asia was losing less in area but more proportionally : 1.6 per cent of its forests yearly. In terms of cumulative loss, the Atlantic coastal forest of Brazil is at least 95 per cent gone. The Philippines, once nearly covered with rain forest, has lost 92%. The richest of old-growth lowland forests in West Africa, India, Madagascar and elsewhere have been reduced to less than a tenth of their original areas. By the middle of this century, if these trends continue, tropical forests will exist virtually nowhere outside of protected areas – that is national parks, wildlife refuges and other official reserves. W.V. Reid of the World Resources Institute, based on available data on deforestation from 63 tropical countries during 1980, fitted a simple mathematical model and estimated that by the year 2040 between 17 and 35 per cent of tropical forest species will be extinct or doomed to be. The population expert Paul Harrison calculated that population growth accounted for 79 per cent of the deforestation in less developed countries between 1973 and 1988.

According to U.N.'s estimate, human population will rise from the present 5.9 billion to 9.4 billion by 2050, then to 10.8 billion by 2150, before leveling off there at the end of the 22nd century. If it happens, about 9.7 billion people will inhabit the countries included within Africa, Latin America, Caribbean and Asia, many of which are less developed and which together encompass a large portion of tropical forests. As per Harrison's estimate, the minimum land necessary for growing food and other human needs (such as water supply and waste dumping) amounts to one-fifth of a hectare per person. U.N.'s projected increase of 4.9 billion souls would require another billion hectares of human-claimed landscape resulting a billion hectares less forest i.e. more than half the remaining forest area of Africa, Latin America and Asia.

In India, there is evidence of people's protest against deforestation. In the 18th century, hundreds of women and men from Bishnoi Jain Sect in Rajasthan laid down their lives to save the sacred Khejri trees, which the authorities wanted for burning lime. A temple at Khejarli still commemorates their sacrifice, which resulted in a royal ban on cutting any tree near Bishnoi village. In mid 1970's, the Chipko Movement took place in Northern India and women played a major role. They did not allow any timber to be cut and taken. They fought to save the forest.

Afforestation is going on in each year either within forest area or in diverted-land. About 258 lakh hectares have been afforested upto 1998. Some states such as Gujarat, Haryana, Punjab, West Bengal and Delhi have shown an increase – both in dense and open forests. Madhya Pradesh has lost nearly 1000 sq. km. of dense forest while gaining about 1700 sq. km. of open forests. On the other hand, Maharashtra has gained 3000 sq. km. of dense forests while losing 2000 sq. km. of open forests. Some other states although have lost their

dense forests have registered an increase in their open forests. According to the Forest Survey of India, the net increase in forest cover in the country is 3896 sq. km. in 1999 over the previous assessment of 1997. The dense forest has increased by 10,098 sq. km. and mangrove by 44 sq. km. whereas open forest has decreased by 6,246 sq. km. during this period. Experts cite three reasons for the increase in the forest cover : success of the Joint Forest Management programme which has been implemented in 22 states, natural regeneration of mangroves and large block plantations. However, scientists warn the increase may also partially be because of greater accuracy in the method of measuring forest cover.

While the plantation forest has increased in relative terms, critics point out that Eucalyptus and other similarly exotic stands are no substitute for native forest. Under afforestation programme, considerable areas were covered by planting Eucalyptus. It is reported that Eucalyptus lead to an increase in water run-off and soil loss, make the soil acidic, lower water table, prevent under growth, consume water conspicuously, spread out roots which do not decay and thereby prevent the growth of other species even after these trees are fallen. It appears that such findings are not based on adequate and proper research. Elsewhere it is reported that Eucalyptus enrich the soil in the case of marginal agricultural land or unwooded or degraded areas. If it is planted in low densities, there is no evidence that Eucalyptus depletes soil. Regarding the acidic effect, this may be used as a blessing for alkaline soils. Agricultural Scientists in collaboration with Statisticians need to provide guidelines after undertaking research in finding suitable species for various agro-climatic zones. Data on the impact of different forest covering soil and water regime are being collected at various environmental research stations of FRI. The results should be disseminated quickly to user agencies and to the policy makers. Of late, the concept of forestry has taken a new turn by the introduction of social forestry. This refers to large scale afforestation activities with the public involvement in the community lands, in the vacant strips along roads, canals and rail track to meet the day-to-day demands of villagers in respect of firewood, leaf fodder, grass, small timber etc.

There are a number of externally aided projects operating in various states for afforestation or other forest development projects. These aid agencies are World Bank, OECF (Japan), DFID (U.K.), SIDA (Sweden), JBIC (Japan), UNDP, FRG and EEC.

In 1999 the Food and Agriculture Organization's World Forest Report had acknowledged that India was the only developing country where the forest cover was actually increasing.

A two pronged strategy to increase forest cover is necessary and i.e. (i) improvement of canopy cover in the forest land and (ii) undertaking afforestation in non-forest and degraded lands preferably contiguous to forest blocks.

6. Evaluation of Intangible Benefits

The forest wealth may be viewed as the present worth of the sustainable yield of products and services that the forest will provide over its lifetime. Forests perform a range of economic, social and ecological functions, which are the intrinsic component of the forest wealth and the national wealth of a country. The entire services both tangible and intangible, provided by forests should be a part of the national income. It is, therefore, desirable to evolve methodology to estimate the volume and value of forest assets and the income derived from it.

The protective role of forests far exceed their productive functions. They convert carbon-dioxide to oxygen, they work as store houses for water and as absorbants of air and water pollution. They act as sinks for particulate matter in the atmosphere. How can statistics be used for quantifying these benefits? What methodology could be adopted for assessing these vital functions of the forests?

Das (1980) estimated (using Surrogate market valuation method) the ecological services (in terms of production of oxygen, conversion to animal protein, soil conservation and maintenance of soil fertility, recycling of water and control of humidity, sheltering of birds, squirrels, insects and plants and control of air pollution) provided by a medium sized tree which yields a biomass of 50 tonnes over a period of 50 years at Rs. 15,70,000 at 1980-81 prices.

A few more studies have been made (Annexure 1) attempting estimation of some intangible benefits provided by the forests, using the contingent valuation and/or travel cost methods. The results of such studies are location sensitive and would be inappropriate to apply for other areas. Though it may not be feasible to undertake location-specific studies for all parts of the country, it would be necessary to identify/undertake a set up typical case study, the results of which could then be applied to similar situations elsewhere.

7. Employment of Labour in Forestry

Data on number of persons employed annually in management (sericulture), extraction and other labour force in forest based industries are collected and published.

It has been estimated that the labour components per unit of output at producers' prices were as high as 66 per cent, 60 per cent and 59 per cent respectively for wood products, timber and other forestry products (Chatterjee (1978)). Additional labour absorption potential in forestry and allied activities is likely to increase in various operations like nursery, plantation, harvesting, and logging stages. There is a large variety of non-wood forest products which can be collected without damage to the standing trees. It would benefit the seasonally unemployment labour force near the forests. Gupta and Guleria (1982) estimated that only in gathering such products employment can be enhanced from 1.5 million man-years to 3.2 million man-years.

Integrated development of forests and forest-based industries in remote regions can lead to a better use of land as well as enhance employment potential. An exercise for a 250 tonnes a day pulp and paper mill in Tripura indicated that 32,000 hectares under bamboo could feed it. Employment potential in bamboo planting and harvesting was estimated at 7000 man-years in the fifth year and was expected to stabilize at 500 man-years in the ninth year. Nearly 90 per cent of the total cost of raising and harvesting bamboo would flow as cash income to the local people.

Plucking of kendu leaf is highly labour intensive activity. It creates employment opportunity for the rural poor in most interior areas. For example, in Orissa, plucking of kendu leaf is a major source of employment in most interior areas. The Orissa Forest Development Corporation (OFDC) which is responsible for marketing of kendu leaf, provides incentives to the rural poor who are employed for plucking kendu leaves. The trade provides nearly 2.5 crore man-days of gainful seasonal employment in lean summer months to around 20 lakh people in 19 forest divisions spread over 23 districts in the State.

8. Natural Resource Accounting

Both physical accounting and monetary valuation are necessary in order to indicate the maximum amount a country can consume without running down its forest-wealth which is a renewable natural resource. Physical accounting is a pre-requisite to monetary valuation in most cases. It indicates the changes in the *forest stock due to additions* (from growth/regeneration and reforestation/ afforestation) and reductions (due to harvesting, deforestation and natural degradation from fires or insect infestation) to the forest stock. Physical accounting of forests is done by a few states following the opening stock – closing stock approach mostly for timber and fuelwood. As an example, the accounting system in Goa is given in Annexure 2. Such accounting needs to be done for each type of forest, species and density class to reflect the changes in the quality and diversity of forests. However, lack of data, prohibits such accounting.

Forest sector accounting at various levels is based on certain assumptions mainly because of non-availability of data on most minor forest products, from privately owned forests etc. The Government is aware of such limitations. Certain conventional accounting system is followed as suggested by CSO and given in brief, in Annexure 3. This needs to be examined and improved.

9. Steps Taken for Improvement

Realizing the need and great scope for improvement in forestry sector, the Ministry of Environment and Forests which is the nodal agency for planning, processing and coordination has implemented various related programmes in the

country. Some of the development programmes are in operation and a number of new ones are contemplated. Some important steps being taken are as follows :

(i) The steady depletion of forest resources and increasing deforestation led to the realization that the active and willing participation of rural people particularly women and tribal community residing in the fringe areas of the forest, is necessary for the success of any forest development programme, because they have an intimate knowledge of species, their growth characteristics, utility, medicinal value etc. It was also realized that village communities would have little incentive to participate unless they benefit directly. Therefore, a new strategy – Joint Forest Management (JFM) – was adopted to protect and regenerate degraded forests. Women's participation has been in-built in the JFM committees. The JFM programme is in operation in most of the states.

(ii) The National Afforestation and Eco-Development Board (NAEB) was set up in 1992 for promoting afforestation, tree planting, ecological restoration and eco-development activities in the country. Special attention is being given to the regeneration of degraded forest areas and lands adjoining forest areas, national parks, sanctuaries and other protected areas as well as the ecologically fragile areas. Two hundred twenty seven projects in 23 states have been operationalized for the Tenth Five Year Plan. Of this 37 projects are solely for North-Eastern States.

(iii) Agro-forestry, farm-forestry, social-forestry and other plantation programmes are in progress in various states. However, in recent years, agro-forestry has gained importance and received special attention. Its objective is for multiple land use to obtain maximum yield per unit of farming land keeping in view the carrying capacity of land. It will complement agriculture and meet the basic needs of people. Agro-forestry covers four systems viz.

- Agri-silviculture : (agri. crops + forest tree/crops)

- Sylvopastoral system : (forest tree/crops + livestock)

- Agro-sylvopastoral system :

  (agri. crops + livestock + forest tree/crops)

- Multipurpose forest tree production system : (forest trees for wood as well as for leaves and/or fruits suitable for food and/or fodder)

The success of this multi-disciplinary system will depend on the active cooperation of scientists and technical personnel. Statisticians in particular will have a great role to play in developing elite clones (high yielding and disease resistant) of important agro-forestry species suitable for different climatic conditions.

(iv) Out of 5.87 lakh villages in the country, 1.70 lakh have forests as land use. The forest areas near these villages have degraded faster due to over exploitation. It is proposed to cover all 1.70 lakh forest fringe villages under JFM through the Forest Development Agencies (FDA). All afforestation programmes and Eco-development Board are proposed to be merged into a single scheme called "National Afforestation Programme".

(v) A National Forest Commission has been established in 2003 to look into re-structuring, reform and strengthening the entire forest set up and affiliated institutions in the country. As per the Resolution forests have a direct role in poverty eradication and sustainable development, which have a bearing on the economic and social development, protection of environment and conservation of biological resources. There is a need for sound and efficient management of forests on a long term basis and at the same time, the demand of wood for commercial and industrial purposes through agro-forestry and plantation has to be met. In addition thereto, there is an increase in demand for medicinal plants. The fringe areas of national parks and wildlife sanctuaries harbor many people whose participation and involvement in the management of such areas may be indispensable and the communities/people with gender equity is vital for the sustenance and conservation of forests. There are also a very large number of people who are partly or wholly dependent on forests. Keeping also in mind the desire of the Central Government that there should be an increase in the forest and tree cover to 25 per cent by 2007 and 33 per cent by 2012, five Terms of Reference have been made to the Commission.

- Review and assess the existing policy and legal framework and their impact in a holistic manner from the ecological, economic, social and cultural view point

- Examine the current status of forest administration and the forestry institutions both at all India and state levels to meet the emerging needs of the civil society

- Make recommendations indicating specific policy options for achieving sustainable forest and wild life management and ecological security

- Suggest ways and means to make forest administration more effective with a view to help to achieve the above policy options

- Establish meaningful partnership and interface between forestry management and local communities including tribal.

The Commission has issued general notice to all, whether they are governments or their functionaries, public representatives, corporations, education and research institutes, non-governmental organizations, representatives of industries or of village level organizations, any expert researcher, academician, foresters, interested citizens, tribal or a forest

dweller to send communication indicating its interest or desire to interact with the Commission and to offer views or comments on the five terms of reference.

(vi) National Medicinal Plant Board is making efforts to conserve various herbal and medicinal plants grown in different forests particularly in Reserved Forests as some important medicinal plants are reported to be facing extinction. There is a growing demand for medicinal plants as crude drugs, food supplements, pharmaceuticals, cosmetic and perfumery products in the national and global market. Medicinal plants being natural, non narcotic without side effects and easily available, can ensure affordable health care and employment generation.

(vii) The forest sector objective in the Tenth Plan period is to promote sustainable forest management in the states with a larger goal of supporting the rural livelihoods. The development programme would adopt an approach combining elements of asset creation, institutional and social development. The Plan would focus on (i) conserving, protecting and developing dense forests, (ii) regeneration and developing open forests, (iii) afforesting and reforesting scrub forests, (iv) promoting eco-tourism and eco-development in protected areas and (v) building capacity of forest development and village level institutions to take up protection and management of the assigned forests.

Keeping these programmes in view the Tenth Plan allocation have been increased to Rs. 1600 crore from Rs. 900 crore in the previous Plan.

10. World's Forests

1992 marked a turning point for the world's forests. In June, 1992, representatives from 178 countries nearly every nation in the world, assembled in Rio de Janeiro, Brazil for the United Nations Conference on Environment and Development (UNCED). The discussions held and the agreements reached at Rio have immeasurably influenced how the world's natural resources are managed. For the forest sector, the impact has been tremendous. UNCED or the Rio Earth Summit was the first global attempt to deal with forest issues. According to UNCED Forest Principle : Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. These needs are for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelters, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs and for other forest products. Even though world leaders reached agreement on an international framework of sustainable forest management, UNCED countries were still strongly divided on many forest issues, largely because of the differing priorities of developing and industrialized nations. Since Rio summit, there has been a greater realization of

common responsibility towards the world's forests. There is today an increasing consensus among both developed and developing countries on the scope and scale of a large number of forest related issues. There is greater recognition of forests multiple benefits. In order to maintain these benefits and services, individual nations must implement sound forest programs. Sustainable forestry benefits the world, but it must start at home. States have the right to utilize, manage and develop their forests in accordance with their development needs and on the basis of national policies consistent with substantial development.

The XII World Forestry Congress was organized in Quebec City (Canada) from September 21 to 28, 2003. The first Congress took place in Rome in 1926. Since 1949, the event has been held approximately every six years under the auspices of the Food and Agriculture Organization of the United Nations (FAO). The World Forestry Congress is the largest and most important international meeting of the world's forestry sector.

A wide spectrum of issues was considered in the context of the Congress 2003 theme, **Forests, Source of Life,** and under the Program Areas

A. Forests for People : Human needs and demands; Economic aspects; Social, cultural and spiritual values; Development of the human potential; Role and responsibilities

B. Forests for the Planet : Status and trends of forests and trees; Environmental functions; Conservation, protection and restoration; Management and development of forest lands; Agroforestry, trees outside forests, low forest cover

C. People and Forests in Harmony : Sustainable management models; Forest related policies and institutions; Cross-sectorial policies; Research, technology and education; Global thinking in action.

The Congress being a global forum has served in training together the forest community and all the geographical regions to exchange views and experience and provided the forestry sector opportunity to produce a periodical overview of the state of forests and forestry, discern trends, policies and raise awareness with decision makers, the public and all concerned parties. The role of Congress is advisory, not executive. Implementation of its recommendations is incumbent upon those whom they are addressed – governments, international organizations, scientific bodies and forest owners.

The Congress envision a future with

• Social justice, where livelihoods sustained, food and fuelwood secured, rights and benefits for forest workers are enhanced, gender equity is attained and traditional knowledge is respected.

• Economic benefits, where the full value of renewable and environmentally friendly forest products and services is recognized, sustainable forest management is profitable, compensation mechanisms are established and the forest products industry operates competitively.

- Healthy forests, which supply the full spectrum of products and services whilst conserving soils, maintaining biodiversity, regulating climate, sequestering carbon; where forest fragmentation is decreasing, deforestation is reduced, degradataion is halted and forest cover is increasing, and where

- Research, education and capacity building foster better understanding of forest benefits and dynamics, of the complex relationship between ecosystems and human well-being and of the impacts of human activities and management on forests.

Each country including India would be looking forward to get its recommendations and to implement to the extent possible.

Some of the strategies and actions suggested are

- Develop forest policies and implement programmes to reduce deforestation and forest degradation in coherence and synergy with policies of related sectors

- Encourage collaborative partnerships involving women, forest owners, indigeneous peoples, non-governmental organizations, local communities, industry and public agencies

- Reform education curricula to address inter-disciplinary dimensions, as well as global and regional considerations

- Implement comprehensive education and extension programmes designed to promote innovation at all levels and strengthen positive behaviour and attitude towards forests

- Realize the potential synergy between traditional and scientific knowledge

- Increase investment in research, dissemination of information and learning processes that underpin all these strategies

- Develop and disseminate methodologies for assessing, reporting and managing the complete array of forest products

- Promote the reconciliation of uses and activities for adding value to forest goods and services

- Promote planted forests and planting of trees outside forest systems, including in urban areas, which make a contribution to sustainable development

- Develop tools for better monitoring, assessing and reporting on the state of forests and on achieving the balance between the needs of people and the planet.

India can benefit from the experience of other countries, which have developed policies and incentives in accelerating the pace of improvement in forestry. Canada is one such country. Some of its policies and achievements may serve guidelines for other countries particularly developing ones.

Profiles

- Canada occupies 7.05% of total land area
- It covers 10% of the World's forests
- 45% (417.6 million hectares) of Canada's land area is forested

Ownership	71%	Provincial
	23%	Federal and Teritorial
	06%	Private
Forest Type	67%	Soft wood
	18%	Mixed wood
	15%	Hard wood

- 56% (234.5 million hectares) of Canada's forests rre commercial forests i.e. capable of producing forest products; only 28% (119 million hectares) are managed for timber purposes
- Annual allowable cut 225.6 million cubic meters (during 1999)
- Harvest (1999) : 193.2 million cubic meters
- In 1998, it is estimated that 398322 hectares were planted with 563 million seedlings, and 26207 hectares were seeded
- The forest sector's contribution to the Canadian economy (GDP) was 2.3% or $ 20.8 billion in 2000
- Direct employment was 373300 (person-years) in 2000 or 2.5% of total employment in Canada

1,67,700	wood industries
1,16,400	paper and allied industries
58,200	logging
31,000	forestry services

- Canada is the world's largest forest products exporter (19%) particularly for newsprint, softwood lumber and wood pulp

Some Suggestions

1. A comprehensive land-use inventory needs to be conducted in order to examine current land uses such as agriculture, forest conversions, wildlife habitat requirements and soil erosion exigencies and to assess the impact of the current forest harvest.

2. In order to reconcile the differences in forest area statistics generated by two sources i.e. FSI and DES, attempts may be made to have survey at micro level i.e. at village level.

3. Before major forest decisions are made, there should be broad consultations, with non-government organizations, industries, local

communities, academics and others. Public consultations will help in developing a workable, result-based code that reduces costs and administrative burdens, ensures tough penalties for non-compliance and measures performance against legally binding standards.

4. A Statistics Division in the Ministry of Environment and Forests with adequate statistical manpower should be created for rationalization and development of proper database on forestry statistics.

5. It is desirable to set up statistical units in State Departments of Forest and to make use of latest tools of Information and Communication Technology for storage, retrieval and rapid transmission of data.

6. Remote Sensing technologies should be extensively used to improve and develop forestry statistics.

7. Adequate and early steps need to be taken to cover all forest-products so as to improve the GDP estimates of the forest sectors (It is reported that a Working Group has been set up by FSI to examine this problem).

8. More Research Centres need to be established with a view to linking forest research to Agricultural Universities.

9. Estimates of cost per unit of important activities like nursery, planting, harvesting, logging, transportation should be obtained; and species-wise prices at forest depots and wholesale markets etc. be generated by each forest department every year.

10. Statistical techniques should be applied for estimation of minor forest products in addition to developing new techniques and designs to tackle problems, which are specific to forestry. Indian Agricultural Statistics Research Institute can play a major role by undertaking special surveys and case studies to solve specific problems. Even the Research Unit of the Society (ISAS) may also take up some projects and utilize the information that is already available.

11. Every year a few districts may be designated *"forest districts"* for the year and efforts be made by all concerned to make the districts "ideal forest districts". This will steadily improve the forest cover as well as the economy in forest sector. (Canadian Forest Association designated Corner Brook, Newfoundland as 'Forest Capital of Canada for 2002. Each year, a city with a multi-faceted involvement with the forests is honoured by the Association).

Some improvements in the quality and content of forest statistics have already been affected during recent years. Yet it is felt that the presently available data are inadequate for formation of sound plans for forestry development and their implementation and for assessing the contribution of forestry to National Income. The scope of forestry statistics has to be enlarged further to collect data on other aspects in line with the developed countries of the world.

We must try to give to our future generations good air, pure water, nutritious food, healthy environment and greenery around them. Improvement of forest can effectively meet these requirements. Without these, they will face poverty, pollution, poor health and unrest.

We statisticians have a great role to play. We must assess, reassess and review the present and define new line of action with a new vision.

Vision according to the well known writer Joel Barker, I quote

"Vision without action is merely a dream;
Action without vision just passes the time;
Vision with action can change the world".

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Annexure 1

Economic Valuation of Intangible Benefits of Forests : Some Case Studies

Intangible Benefit	Annual Value	Location	Methodology used	Source
1. Recreation/ Ecotourism	Rs. 427.04 per Indian visitor Rs. 432.04 per foreign visitor	Keoladeo National Park, Bharatpur	TCM	Chopra, K. (1997)
2. Recreation / Ecotourism	Rs 519 per Indian visitor Rs. 495 per foreign visitor	Keoladeo National Park, Bharatpur	CVM	Murthy & Menkhuas (1994)
3. Recreation / Ecotourism & other benefits	Rs 90 per household (Rs. 7.5/ month/ household) Rs. 240 million	Boriveli National Park, Mumbai	CVM	Hadker *et al.* (1995)
4. Ecotourism	Rs. 3.38 million	Periyar Tiger Reserve	CVM, TCM	Manoharan (1996)
5. Ecotourism	Rs. 2.95 million (Rs. 34.68 per visitor)	Kalakadu Mundathurai Tiger Reserve	CVM	Manoharan and Dutt (1999)
6. Ecotoursim / Recreation / Pilgrimage	Aggregate WTP –Rs 1.92 million (Per visitor Values): Local Community – Rs. 36 Local Pilgrims – Rs 102 Non-resident visitors – Rs. 295	Recreational value of a sacred lake in Sikkim Himalaya (Khecheopalri Lake)	CVM, TCM	Maharana, Rai and Sharma (2000)
7. Ecological functions (use value) for local residents	Rs 624 per hectare	Yamuna basin	CVM	Chopra and Kadekodi (1997)
8. Carbon store	Rs. 1.292 billion (total forests) & Rs. 20,125 per hectare	Indian forests	Species wise forest inventory data	Haripriya and Parikh (1999)
9. Soil conservation	Cost of soil erosion : Rs 21583 per hectare	Doon valley	Replacement cost approach	Kumar, P. (2000)
10. Watershed values (soil conservation)	Rs. 2.0 lakh per hectare metre of soil	Yamuna basin	Indirect method (Reduced cost of alternative technology)	Chopra & Kadekodi (1997)
11. Environmental services	Value of services provided by medium sized tree over 50 years. Production of Oxygen : Rs. 2,50,000/- Conversion to animal protein : Rs. 20,000/- Soil conservation and maintenance of soil fertility: Rs. 2,50,000/- Recycling of water and control of humidity Rs. 3,00,000/- Sheltering of birds, squirrels, insects and plants: Rs. 2,50,000/- Control of air pollution: Rs.5,00,000/-	–	Surrogati market valuation	Das T.M. (1980) as cited in Lal, J.B. (1992)

Source : Adapted from Manoharan 2000
TCM : Travel Cost Method
CVM : Contingent Valuation Method

Annexure 2

Accounting for Forest Resources

Physical Accounting/Monetary Accounting

1. Opening Stock
    1.1 Total (dense, open and mangrove)
2. Changes due to economic decisions
    2.1 Extraction of timber (legal and illegal)
    2.2 Loss/damage
    2.3 Consumption of fuelwood
    2.4 Total production (2.1+2.2+2.3)
    2.5 Forest conversion to non-forest use
    2.6 Afforestation
    2.7 Net Change (2.6 – 2.5)
3. Other accumulation
    3.1 Additions
        3.1.1 Annual increment/Natural regeneration
    3.2 Reductions
        3.2.1 Insect infestation/fires
    3.3 Net change (3.1.1 – 3.2.1)
4. Total change in stock (3.3 +2.7 – 2.4)
5. Closing Stock (1.1 + 4)
6. Reporting discrepancy

Annexure 3

Conventional Accounting

The estimation of GVA (gross value added) by the forest sector is based on certain assumptions, which need to be examined.

- The value of unrecorded production of industrial wood is taken to be 10% of recorded production.

- Till 1993-94, the value of unrecorded production of firewood was taken as 10 times that of recorded production. The methodology has since been changed and fuel wood consumption is estimated based on three components – households fuel wood consumption; agricultural by-products used as fuel wood; and fuel wood consumed in industries and in funerals. CSO estimates industrial and other uses of fire wood at 6% of household consumption.

- In the case of minor forest products, for which data on quantity and producer prices are not available and royalty values are available, the economic value is taken as 10 times the royalty value.

- If the activities of felling trees, shaping, stacking and their transportation to sale depots are carried out by private contractors/transporters and not by the forest department, a trade and transport margin of 10 per cent of the value of output is adjusted against the output of forestry sector.

- Cost of material inputs such as transportation, water, electricity, fuel, normal repairs and maintenance of fixed assets are assumed at 10 per cent of the value of output.