

Assessment of the contribution of forests to the economy of the northeastern states of India

S.K. BARIK¹ and S.K. MISHRA²

¹ Department of Botany, Northeastern Hill University, Shillong – 793022, India

² Department of Economics, Northeastern Hill University, Shillong – 793022, India

E-mail: sarojkbarik@yahoo.com

SUMMARY

The economic and environmental benefits of the extensive biodiversity-rich forest areas of Northeast India are immense and are depended upon by the people for their livelihoods. However, for historical, topographical, logistic and complex sociological reasons, quantitative data on most of the economic and environmental components of forests are lacking. Quantification of both tangible and intangible forest benefits remains a neglected research area. The paper provides some available data on the forest contribution and models this based on the current rate of forest revenue generation. Considering the ample opportunities of the forestry sector, the need for strategic planning to enhance the contribution of forests to the overall economy of the region is emphasised. The paper identifies various system components and forcing functions impacting forest benefits and suggests what issues need to be addressed to enhance them.

Keywords: forest revenue model, tangible and intangible forest benefits, shifting cultivation, strategic planning

Evaluation de la contribution des forêts à l'économie des états de l'Inde du Nord-Est

S.K. BARIK ET S.K. MISHRA

Les bénéfices économiques et environnementaux des zones de forêts étendues riches en bio-diversité du Nord-Est de l'Inde sont immenses, et les habitants locaux en dépendent pour leur revenu. Cependant, pour des raisons historiques, topographiques, logiques et complexes sociologiquement, des données quantitatives sur le plus gros des composés économiques et environnementaux sont absents. La quantification des bénéfices tangibles et impondérables des forêts demeure un secteur de recherche négligé. L'article fournit certaines des données disponibles sur la contribution forestière, et en fait un modèle basé sur le taux courant de la génération de revenu forestier. Etant donné les opportunités amples du secteur de la foresterie, le besoin d'une planification stratégique pour aggrandir la contribution des forêts à l'économie totale de la région est souligné. Cet article identifie divers composites de systèmes et des fonctions appliquées avec force pour obtenir un impact sur les bénéfices de la forêt, et suggère quelles questions doivent être soulevées pour les fortifier.

Evaluación de la contribución de los bosques a la economía de los estados del nordeste de la India

S.K. BARIK Y S.K. MISHRA

Los enormes beneficios económicos y ambientales de los extensos bosques del nordeste de la India, ricos en biodiversidad, son fundamentales para el sustento de las comunidades locales. Por motivos complejos de carácter histórico, topográfico, logístico y sociológico, sin embargo, faltan datos cuantitativos sobre la mayor parte de los componentes económicos y ambientales de los bosques. La cuantificación de beneficios forestales tangibles e intangibles sigue siendo un área de investigación poco estudiada. Este estudio presenta algunos datos disponibles sobre la aportación de los bosques y crea un modelo basado en el ritmo actual de generación de ingresos forestales. Teniendo en cuenta las muchas oportunidades en el sector forestal, se resalta la necesidad de planificación estratégica para potenciar la contribución de los bosques a la economía global de la región. El estudio identifica varios componentes del sistema y las funciones que tienen un impacto sobre los beneficios forestales, y señala las cuestiones que deben ser tratadas para potenciar el aporte de los bosques a la economía.

INTRODUCTION

The economy of any state or region consists of 13 important sectors, namely, agriculture, forestry, fishing, mining and quarrying, manufacturing, construction, water supply and

production of electricity, gas and other energy resources, transport, storage and communication, trade, hotel and restaurant, banking and insurance, real estate, ownership of dwellings and business services, and public administration and other services. However, for historical and geographical

reasons, forestry is the only sector that has been able to contribute significantly to the economy of the northeastern region of India. The societal, economic and environmental benefits of forests in the northeast that have been realised are perhaps the highest in the country because of the region's high dependency on forest resources for the livelihood of its people, a dependency that sometimes approaches 100 percent (Barik and Darlong 2007). The dependency on the forests of the people in the region is not only for subsistence purposes, like in the rest of the country, but also for commercial purposes, as there is a large chunk of the population that owns forest land and resources. Therefore, the entire 32 million population of the northeastern states are directly or indirectly dependent on the forests for their livelihoods.

The societal and economic benefits in absolute terms are quite high, considering the high proportion of forest-dependent population, high forest cover, rich biodiversity, and thus the wide range of forest products, and the better equitability in accessing the resources. The most important environmental benefits that the forests of the northeast provide include protection of fragile ecosystems, habitats for biodiversity, protection of the major water sources of the country and maintenance of water quality as well as the sequestering of atmospheric carbon. Unfortunately, for historical, logistical and complex sociological reasons, quantitative data on most of the above aspects are lacking. The quantification of both tangible and intangible forest benefits in the northeast have, to date, remained a neglected area of research. The present paper identifies various system components and forcing functions impacting the forest benefits in the Northeast India context. The need to develop a robust method to quantify and estimate the benefits as accurately as possible has been emphasized (Mathur and Sachdeva 2003). Based on the information, quantitative models for each system component can be developed that would ultimately provide the capacity to model the entire forest benefits accrued to the region. The models would also help in future projections for use as the basis for appropriate policy decisions and for strategic planning to enhance the forest benefits.

FORESTS OF NORTHEAST INDIA

Forest area

The forest cover of the northeastern region, as assessed by Forest Survey of India (FSI) every two years since 1991 fluctuates between 1 66 917 and 1 72 847 km² (Table 1). Except in Arunachal Pradesh, the forest cover in all the states has increased during the last assessment of 2003. The region is forest-rich, with a high forest: man ratio (Table 2). The forest cover in all states of the region is much higher than the recorded forest area, except in Assam and Tripura (Table 3). This is because of the non-inclusion in the records of some of the autonomous district council, community, clan and private forests, most of which are not surveyed, demarcated and settled. In Assam, Arunachal Pradesh and Tripura, substantial recorded forest areas are encroached degraded and diverted for non-forestry purposes; hence, the actual forest cover is significantly less than the recorded forest area.

Forest ownership

In most northeastern states, substantial forest areas come under the unclassified category, and are owned by private individuals, clans, village councils, district councils and other traditional community institutions (Table 3). In some states like Arunachal Pradesh, the ownership of such forests is not clear; the people enjoy traditional usage rights and the government has adequate control over the land and trees. On the other hand in states like Meghalaya, Nagaland and Manipur, the state forest departments have very little say in the management of private/communal forests.

About 54 percent of the total forest area of the region are unclassified and are not covered by any scientific management plan (Tripathi and Barik 2002). In Assam, of a total of 30 707.57 km² of forest area, 3 589 km² of reserved forest and proposed reserved forest are managed by two district councils and the rest are managed by the state forest department. In Tripura, the Tripura tribal area autonomous district council controls 143.17 km² of forests (2.27 percent) and the rest are managed by the state forest department. In Mizoram, 1 776 km² of forest (11.14 percent) is under the control of three district councils and the state forest department manages the remaining areas. In Meghalaya, the three autonomous

TABLE 1 Forest cover (in km²) in northeastern states since the 1991 FSI assessment

State	1991	1993	1995	1997	1999	2001	2003
Arunachal Pradesh	68 757	68 661	68 621	68 602	68 847	68 045	68 019
Assam	24 751	24 508	24 061	23 824	23 688	27 714	27 826
Manipur	17 685	17 621	17 558	17 418	17 384	16 926	17 219
Meghalaya	15 875	15 769	15 714	15 657	15 633	15 584	16 389
Mizoram	18 153	18 697	18 576	18 775	18 338	17 494	18 430
Nagaland	14 321	14 348	14 291	14 221	14 164	13 345	13 609
Sikkim	3 041	3 119	3 127	3 129	3 118	3 193	3 262
Tripura	5 535	5 538	5 538	5 546	5 745	7 065	8 093
Total	168 118	168 261	167 486	167 172	166 917	169 366	172 847

TABLE 2 Status of forests and forest: man ratio in northeastern states. Figures in parentheses represent the forest area as percentage of the total geographical area (after Barik and Tripathi 2004)

State	Population	Geo-graphical area '000 ha)	Total forest cover ('000 ha)		Dense forest (>40% canopy cover) ('000 ha)	Open forest (10–40% canopy cover) ('000 ha)	Per capita forest cover in ha
			Recorded cover	Actual cover			
Arunachal Pradesh	864 558	8 374	5 154.0 (61.54)	6 885 (82.21)	5 776	1 109	7.96
Assam	22 414 322	7 844	3 070.0 (39.15)	2 369 (30.20)	1 452	917	0.11
Manipur	1 837 149	2 233	1 515.4 (67.87)	1 738 (77.86)	593	1 145	0.95
Meghalaya	1 774 778	2 243	949.6 (42.34)	1 563 (69.70)	592	971	0.88
Mizoram	689 756	2 108	1 593.5 (75.59)	1 834 (86.99)	379	1 455	2.72
Nagaland	1 209 546	1 658	862.9 (52.04)	1 416 (85.43)	514	902	1.17
Sikkim	406 457	730					
Tripura	2 757 205	1 049	630.9 (60.01)	575 (54.79)	223	352	0.21
Northeast states	31 953 771	26 239	13 776.3 (54.00)	16 380 (64.00)	9 529	6 851	0.52
India	838 583 988	328 726	765 210.0 (23.28)	63 729 (19.39)	37 736	25 506	0.076

TABLE 3 Classification of forest areas (km²) in northeastern states based on legal status. Figures in parentheses represent the percentage of the total recorded forest area (after Tripathi and Barik 2004)

States	Geographical area (km ²)	Reserved	Proposed reserve	Protected	Unclassed	Total recorded forest
Arunachal Pradesh	83 743	19 673.52	-	-	31 866.48	51 540.00
Assam	78 438	17 588.85	3 933.63	-	9 185.09	30 707.57
Manipur	22 327	1 463.00	-	4 171.00	9 520.00	15 154.00
Meghalaya	22 429	981.00	-	12.00	8 503.00	9 496.00
Mizoram	21 081	7 127.00	-	3 568.00	5 240.00	15 935.00
Nagaland	16 579	86.00	-	507.00	8 036.00	8629.00
Tripura	10 486	3 588.18	509.03	-	2 195.47	6 292.68
Total	255 083	50 507 (37%)	4 443 (3%)	8 258 (6%)	74 546 (54%)	137 754 (100%)

district councils control the unclassified forests which cover 8 503 km² (96 percent) area. In Nagaland, the unclassified forests (93 percent) are owned by the clans, village councils and individual families. In Manipur, all unclassified forest land of 9 520 km² is under the control of hill area councils. The region has 5.71 percent of its geographical area under protected area network (Table 4).

Forest resources

The forests are extremely rich in ecosystem, species and genetic diversity, and more than 33 percent of the region's

forest biodiversity is endemic. The region is a centre of origin for several crop plants and home to many crop wild relatives (Tripathi and Barik 2004). Besides timber, a number of non-timber forest products such as cane, bamboos, broom grass, lichens, mushrooms, orchids, commercially important grass species, oil yielding trees, honey, dye-yielding plants and wax are extracted from the forests every year in large quantities. The northeast region contains about 46 percent of bamboo and 33 percent of rattan species found in India. Important medicinal plants such as *Taxus baccata*, *Tinospora cordifolia*, *Vinca rosea*, *Strychnos nux-vomica*, *Dichora*

TABLE 4 Area (km²) under national parks and wildlife sanctuaries in Northeast India. Figures in parentheses represent the area as percentage of the total geographical area (after Tripathi and Barik, 2004)

State	Area under national park	Area under wildlife sanctuary	Total
Arunachal Pradesh	2 468.23	7 114.45	9 582.68
Assam	1 173.71	939.88	2 113.59
Manipur	81.80	184.85	266.65
Meghalaya	267.48	34.20	301.68
Mizoram	250.00	634.00	884.00
Nagaland	202.02	24.41	226.43
Sikkim	850.00	161.1	1011.1
Tripura	0	603.62	603.62
Total	5 293.24 (2.02%)	9 696.51 (3.70%)	14 989.75 (5.71%)

febrifuga, *Hodgsonia hiteroclita*, *Scutellaria discolor*, *Smilax* sp., *Solanum khasianum*, *Dioscorea deltoides*, *Dioscorea prazera*, *Dioscorea bulbifera*, *Holarrhena antidysenterica* are found in these forests. Gums, resins, edible wild fruits and tubers and a number of spices such as cinnamomum, lichi (*Illicium griffithii*), and large cardamom are other important non-timber forest resources of the region that provide livelihood to the people and contribute substantially to the economy of the region.

Forest governance structure

The governance of forest resources in Northeast India may be divided into the following four categories: (a) governance by state, (b) joint governance by state and communities, (c) governance by communities and private individuals, and (d) governance by district councils.

(a) Governance by state

The forest resources of northeastern India are governed by the Ministry of Environment and Forests at the national level and by the state forest departments at the state level.

(b) Joint governance by states and communities

Joint governance by the state and communities in Northeast India is represented by various models of joint forest management throughout the region, and Anchal and village forest reserves of Arunachal Pradesh.

(c) Governance by communities and private individuals

Most of the forests in Arunachal Pradesh, Manipur, Meghalaya, Mizoram and Nagaland are owned by private individuals, communities and clans. The ownership rights over land and resources are further protected by the sixth schedule to the Indian Constitution in many states (Table 5).

(d) Governance by autonomous district councils

The forests under governance category (c) are supposed to be registered under autonomous district councils (Table 5), and the district councils are supposed to ensure their sustainable management. The acts and rules framed by the state and national governments for forest management are therefore not applicable to such forests. Although the autonomous district councils do have separate acts, rules and regulations to ensure their management, the acts are too weakly enforced,

TABLE 5 Administrative structure and special constitutional provision for tribal areas of northeast India (Tripathi and Barik 2004)

State	Special constitutional provision	Autonomous (district) councils
Arunachal Pradesh	Article 371 H	No autonomous councils but the state has elective village councils and <i>Anchal Samitis (Panchayats)</i>
Assam	Sixth schedule read with Article 371 B (for scheduled areas only)	Karbi-Anglong, North Cachar Hills, Bodoland, Rabha-Hasong, Tiwa, Mishing
Manipur	Article 371C	Ukhrul, Tamenglong-Senapati, Sadar Hills
Meghalaya	Sixth schedule	Khasi Hills, Jaintia Hills and Garo Hills
Mizoram	Sixth schedule Read with Article 371G	Mara, Lai, Chakma
Nagaland	Article 371A	No autonomous councils but each village has a village council
Tripura	Sixth schedule	Tripura tribal area autonomous district council, Khumulwang

as there are not enough forest personnel in the district council to enforce them. Hence, most community forests in the northeast are virtually under no management and do not come under the effective enforcement of any of the forest laws. The Supreme Court directives of 1996 have addressed this issue to a great extent. Besides having indirect control over communal and private forests under their jurisdiction, the district councils have their own reserved, protected and proposed reserved forests, which they manage directly.

FOREST CONTRIBUTION

The contribution of forests to the gross domestic product (GDP) of India was only 1 per cent in 1996–1997 (measured at constant price of 1980–1981). The contribution increased to 2.37 percent, when the gross value of goods and services provided by the forestry sector was taken into account (GoI 2007). The parameters, methods of data collection, estimation and statistics pertaining to forest contributions in Northeast India vary from one state to the other and most data are fragmented (Table 6). In most northeastern states, the contribution of forests to net state domestic product (NSDP) is higher than the national average (Tables 7–9). For instance, in Arunachal Pradesh the contribution of forests to NSDP was in the range of 10–20 percent before 1996 and between 4 and 5 percent during the post–Supreme Court intervention period (i.e., 1997 to 2004 when the Supreme Court placed restrictions on the felling of trees) (Table 8). Although in the post–Supreme Court intervention period, the contribution of the forestry sector to concerned states’

total economy significantly declined, it remains critical to the prosperity of rural communities in Northeast India.

The range of benefits that the rural populations derive from the forests is largely unaccounted for: they include: forest daily wage earners during the plantation programme, tourist operators, forest industries, gatherers of non-timber forest products (NTFP), forest cultivators and shifting cultivators. The types of activities include wood industries, direct and indirect jobs, tourism, charcoal making, forest product collection, forest farming, plantation activities including nursery, and shifting cultivation. Biomass extraction by communities for domestic consumption is not accounted for (Tables 10 and 11). Similarly, data from autonomous district council areas are often underestimated. Record keeping is generally poor, and porous international boundaries result in the forest product quantity and value being underestimated. The values and income from several NTFP species, including medicinal plants, are not currently being included in forest income accounting. Attempts have not been made to account for the whole range of ecosystem services being provided by the forests of the region.

Even the estimates available on forest revenue are based on indirect methods. During indirect estimations, too much extrapolation is done. For example, for estimating the quantity of a product, the whole recorded forest area is multiplied by the sample data, irrespective of the species’ growing area, which results in an overestimation of the forest products. A rapid land use change, which is so common in the region, is not often taken into account when the estimates are being made.

TABLE 6 Revenue (million INR)* earned by the forest departments in northeastern states

Year	Tripura	Nagaland	Meghalaya	Manipur	Arunachal Pradesh	Mizoram	Assam
1993	-	3 510.0	-	-	28 480.0	-	-
1994	-	3 063.8	21 750.0	-	39 650.0	-	-
1995	-	2 207.5	30 500.0	-	34 890.0	-	-
1996	-	2 751.0	35 980.0	-	49 040.0	-	-
1997	-	1 525.3	35 210.0	-	25 240.0	-	-
1998	-	1 230.2	33 540.0	-	7 530.0	-	7 798.6
1999	-	2 918.3	35 150.0	-	12 430.0	1 090.0	9 594.7
2000	-	1 662.8	35 100.0	-	15 440.0	3 990.0	14 728.3
2001	-	2 576.7	-	-	13 000.0	1 860.0	14 765.0
2002	-	2 000.5	-	730.0	25 240.0	1 630.0	12 077.7
2003	4 361.2	2 630.0	-	780.0	15 610.0	380.0	18 540.0
2004	14 617.4	2 690.0	-	950.0	9 630.0	-	19 296.6
2005	5 847.5	3 725.6	-	690.0	5 800.0	52 000.0	23 778.4
2006	4 945.7	4 827.1	-	1 450.0	-	-	43 382.6
2007	4 552.1	-	-	-	-	-	-
2008	3 121.2	-	-	-	-	-	-

*INR40 = ~US\$1

- indicates data not available

TABLE 7 *Forestry and logging (gross value added) as percentage of gross domestic product at current prices (million INR*) in Meghalaya (after Government of Meghalaya 2003)*

Year	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	1999–2000
Forestry and logging	217.50	305.00	359.80	352.10	335.40	351.50	351.00
Total GDP	15 110.50	16 649.00	19 952.90	21 985.80	24 980.50	29 402.70	32 913.60
% of GDP	1.44	1.83	1.80	1.60	1.34	1.20	1.07

*INR40 = ~UD\$1

TABLE 8 *Contribution of forestry sector to the state economy of Arunachal Pradesh at current prices*

Year	Net state domestic product (million INR*)	Forest contribution (million INR*)	Forest contribution (%)
1970–71	213.4	44.2	20.7
1980–81	977.0	99.9	10.2
1990–91	2 311.1	221.2	9.6
1991–92	2 642.4	223.9	8.5
1992–93	2 710.7	307.3	11.3
1993–94	8 121.3	932.4	11.5
1994–95	8 726.8	1 198.2	13.7
1995–96	10 714.5	1 165.5	10.9
1996–97	10 827.1	1 168.7	10.8
1997–98	11 921.8	536.8	4.5
1998–99	13 538.2	709.7	5.2
1999–2000	14 570.8	729.9	5.0
2000–01	15 948.6	712.8	4.5
2001–02	17 302.1	771.3	4.5
2002–03	17 443.6	759.2	4.4
2003–04	19 706.6	767.5	3.9

*INR40 = ~UD\$1

TABLE 9 *Contribution of forestry sector to the total state revenue (million INR*) in Manipur. The data are based on the royalties on forest products collected at the forest check gates and sale of Mahals (Forest Department, Manipur)*

Year	1990s	2001–02	2002–03	2003–04	2004–05	2005–06
Tax revenue		1 931.50	2 532.80	3 091.20	3 684.10	
Non-tax revenue		277.30	564.90	498.80	697.50	
Forestry sector revenue	30.00	7.30	7.80	9.50	6.90	14.50
% of non-tax revenue		2.54	1.38	1.93	0.99	
% of total revenue		0.33	0.25	0.27	0.16	

*INR40 = ~UD\$1

TABLE 10 *Quantum of forest products from forests of Meghalaya (Government of Meghalaya 2003)*

Year	Industrial wood (× 1 000 m ³)	Fuelwood (× 1 000 tonnes)	Bamboo (× 1 000 no.)	Broom grass (tonnes)	Bay leaf (tonnes)
1979–80 to 1981–82	47.029	1 284.7	182	194	
1982–83 to 1984–85	19.657	2 069.3	554	453	
1985–86 to 1987–88	4.855	2 248.4	865	830	
1988–89 to 1990–91	11.576	2 453.9	1 200	1 521	
1991–92 to 1993–94	90.685	2 652.9	1 540	2 790	
1994–95 to 1996–97	513.731	2 894.3	4 154	6 252	2 326
1997–98 to 1999–2000	155.141	3 475.7	5 682	10 189	3 426

TABLE 11 *Estimated value of forest products at current prices, 2004–2005*

State	Total value (million INR)*				% of total value		
	Industrial wood	Fuelwood	NTFPs	Total	Industrial wood	Fuelwood	NTFPs
Arunachal Pradesh	100.0	360.0	130.0	590.0	16.4	61.9	21.7
Assam	110.0	5 560.0	70.0	5 740.0	2.0	96.8	1.2
Manipur	20.0	550.0	30.0	600.0	2.6	91.7	5.7
Meghalaya	30.0	470.0	230.0	730.0	4.0	64.2	31.8
Mizoram	10.0	470.0	50.0	520.0	1.8	89.3	8.8
Nagaland	60.0	1 980.0	0.0	2 030.0	2.8	97.2	0.0
Sikkim	10.0	150.0	20.0	180.0	1.2	85.2	13.6
Tripura	20.0	890.0	30.0	930.0	1.6	95.7	2.7
Total	360.0	10 430.0	600.0	11 390.0	3.1	91.6	5.3
All India	22 320.0	211 340.0	20 290.0	25 3950.0	8.8	83.2	8.0
%	1.61	4.94	2.96	4.49			

*INR40 = ~US\$1

MODELLING FOREST CONTRIBUTION BASED ON REVENUE COLLECTION

Data available on the determinants of revenue from forests are deficient and often fluctuate, making it difficult to discern stable trends. As a result the available data on open and closed forests are used. In some cases, minor adjustments have been made to fill in the gaps in data and then the series has been used to fit a nonlinear regression model, specified below.

$$\text{Log}(\text{revenue}) = a_1 * \log(\text{o_forest}) + a_2 * \log(\text{c_forest}) + (b_1 * d_1 + b_2 * d_2 + b_3 * d_3 + b_4 * d_4 + b_5 * d_5 + b_6 * d_6 + b_7 * d_7) + (\text{o_forest} + \text{c_forest})^p + c_1 * \log(\text{year}-1992) + g * v$$

Here “o_forest” refers to the area under open forest and “c_forest”, likewise, is the area under closed forests. d_1 through d_7 are the binary dummy variables standing for the states Tripura, Nagaland, Meghalaya, Manipur, Arunachal Pradesh, Mizoram and Assam, respectively. If the data pertain to a particular state, the dummy for it is unity (1), otherwise zero (0). The dummy variable “v” captures the

effects of other variables, presently not included in the model. The data series begins from the year 1993.

The estimated model fits quite well to the data, explaining over 91 percent of variation ($R^2 = 0.914$), and the coefficient of correlation between the observed and the expected values of revenue is 0.96.

As the estimated parameters indicate, the revenue-earning effect of closed forests is about 2.78 times that of the open forests. The coefficient associated with state dummies (d_1 through d_7) is the smallest for Arunachal Pradesh and the largest for Meghalaya. The time trend is positive.

Using the estimated parameters of the model, the likely values of revenue for the years 2009 through 2021 have been projected. These figures, along with the base figures used for estimating the model for years 1993 through 2008, are presented (Table 12).

FORESTRY SECTOR FORCING FUNCTIONS

Supreme Court intervention

Although the Supreme Court intervention was successful in

TABLE 12 *The estimated and predicted revenue from forests of Northeast India based on current level of revenue generation.*

Year	Revenue (million INR*)	Area under open forest (km ²)	Area under closed forest (km ²)
1993	530.90	76 423.00	88 664.00
1994	712.46	75 985.50	88 742.00
1995	760.61	75 548.00	88 820.00
1996	979.17	73 840.91	90 840.84
1997	738.03	72 025.08	92 814.93
1998	558.18	69 544.10	95 672.65
1999	651.86	68 465.00	95 285.00
2000	752.08	67 788.30	97 115.00
2001	734.85	67 200.45	98 945.00
2002	841.28	66 596.93	101 176.73
2003	822.39	72 212.00	97 823.00
2004	1 049.24	64 711.86	106 213.78
2005	1 872.04	64 281.42	109 590.55
2006	1 727.87	63 057.13	111 245.18
2007	1 838.43	62 212.99	113 691.67
2008	2 022.40	62 064.00	118 553.00
2009	1 934.77	61 174.49	120 818.13
2010	2 025.01	60 284.97	123 083.26
2011	2 115.18	59 395.42	125 348.43
2012	2 205.07	58 505.88	127 613.57
2013	2 294.47	57 616.34	129 878.74
2014	2 383.14	56 726.82	132 143.88
2015	2 470.81	55 837.25	134 409.05
2016	2 557.22	54 947.73	136 674.19
2017	2 642.08	54 058.19	138 939.36
2018	2 725.07	53 168.65	141 204.50
2019	2 805.87	52 279.10	143 469.67
2020	2 884.10	51 389.58	145 734.80
2021	2 959.37	50 500.00	148 000.00

*INR40 = ~US\$1

controlling large-scale deforestation in the region, lack of alternate livelihoods for the people often adversely affected forest conservation. Lack of awareness and incorrect interpretation of the Supreme Court orders (1996–2002) by the people also adversely affected forest resources in many areas. For instance, almost all forest land owners have leased their land for limestone mining in Lumshnong village of Jaintia Hills of Meghalaya through fear of not getting any benefit from the forest because of the Court's restriction. However, in reality all these forests could have been harvested in a sustainable way through an approved working scheme, but people were not aware of this. In the process, the forests have become the victim of mining. Similarly, about 50 percent of the forest-dependent population in Diskiang village of West Khasi Hills district have turned to charcoal making (Barik and Darlong 2007). Following the

Supreme Court intervention, rattans were the worst victim in Arunachal Pradesh. Forest-based industries have shifted to cement (using limestone as raw material) and ferro-alloy complex industries (using charcoal as raw material), which has impacted forestry sector economics. The Supreme Court intervention which was intended to help forest conservation has therefore become an important determinant for the reduced flow of forest benefits in these areas.

Shifting cultivation

Shifting cultivation is viewed as a part of forest cycle in Northeast India. Depending upon the cultivation cycle, the products vary at different stages of forest growth cycle. The highly variable shifting cultivation systems as practised by different tribes have a wide range of products and the plots vary widely in productivity from one state to the other, even

within the state (Barik 2007). When developing a forest benefits model, all these variations need to be incorporated within a shifting cultivation system. The trend of shifting cultivation, which is also decreasing, needs to be incorporated into the model (Table 13). All these variations make accurate data collection difficult and pose big challenges to the modellers.

The State of Forest Report, 1999 contains the latest available statistics on shifting cultivation in Northeast India. In spite of their methodological and technological limitations, the data presented in the report can be considered as most reliable in comparison to earlier estimates. The states of Nagaland, Mizoram and Manipur have substantial areas under shifting cultivation (Table 14). However, shifting cultivation, being a dynamic land use activity needs regular monitoring so that reliable data on area, productivity and annual economics (Table 15) can be obtained for better projections and planning.

Transition in forest management structure

According to the Supreme Court orders, all the forests under community, village council and individual ownership need to be covered under working schemes to be prepared jointly by

the forest personnel as well as landowning communities, for approval by the central government. Although the progress in this regard has hitherto been far from satisfactory, as time passes, the working schemes, which are prepared based on the sustained yield principle, would certainly contribute towards improved economic benefits from the large tract of communal forests of Northeast India, which to date, have not been covered under any scientific plans. The spread of joint forest management to new forest areas would also enhance forest productivity, particularly with better management of NTFPs. Thus, such changes in the management approach would have long-term impacts on forest benefits and need to be incorporated into strategic planning.

IMPROVING ESTIMATION OF THE FOREST CONTRIBUTION

For a better and more reliable estimate of contribution of forests in the northeast, the following components need to be estimated using appropriate methods.

TABLE 13 Area under shifting cultivation in Northeast India as estimated by different agencies

Agency	Year	Area (million ha)
Northeastern council	1975	2.80
FAO	1975	7.40
Task force on shifting cultivation, Ministry of Agriculture	1983	3.81
Forest Survey of India	1999	1.73

TABLE 14 Total area affected by shifting cultivation in different northeastern states during 1987–1997 (after SFR 1999)

State	Area under shifting cultivation (million ha)
Nagaland	0.39
Mizoram	0.38
Manipur	0.36
Arunachal Pradesh	0.23
Meghalaya	0.18
Assam	0.13
Tripura	0.06
Total	1.73

TABLE 15 Economics of shifting cultivation in Julie village in Arunachal Pradesh (Rs)*

Year	Gross income	Expenditure	Net income
1997	14 950	11 244	+ 3 706
1998	11 230	8 800	+ 2 430
1999	8 940	9 363	- 423
3-year total	35 120	29 407	+ 5 713

*INR40 = ~US\$1.

Estimation of total economic value of forests

The valuation of forest products can be made using the following approaches singly or in combination:

- Forest values (forest-related economic activity—e.g., employment and outputs)
 - Shadow values (economic activities resulting from forestry—e.g., tourism)
 - Non-market values (external effects of forestry—e.g., informal recreation, health)
 - Social values (values arising from identity, belonging attributable to trees and forestry—e.g., social capital)
- The four subjective groups of forest values could be:
- Use values (market values—e.g., price of wood and non-wood products)
 - Non-use values (existence, altruistic values etc.,—e.g., subscription by some organisation)
 - Held values (aesthetic, moral, spiritual values etc.,—e.g., a beautiful view, sacred forest)
 - Non-preference values (functional values—e.g., water, carbon sequestration, land fertility)

However, the most widely used method for valuation of natural resources including all the goods and services is total economic value (Gregersen *et al.* 1995, Mathur and Sachdeva 2003). The total economic value is the sum of use values and non use values. The use values are the sum of direct use value, indirect use value and option value, while non-use values are the sum of bequest value and existence value. For valuation of all goods and services, the total economic value of northeastern forests needs to be calculated.

Non-timber forest products (NTFP) and medicinal plant species

At least 20 NTFP species such as *Phrynium pubenerve*, lichens, *Livistonia jenkinsiana* and a large number of leafy vegetables are widely traded in the northeast and are also exported outside the region. Products from forest farming such as beetle leaf, beetle nut, honey and fruits have also not been accounted for. Of these, only three to four NTFP species namely, bamboo, cane, broom stick and bay leaf have so far been included in the state estimates. A good number of medicinal plant species such as *Taxus baccata*, *Illicium griffithii*, *Coptis teeta*, *Terminalia* spp., *Piper longum*, *Swertia chirayita*, *Panax pseudoginseng*, *Acorus calamus* etc., are collected from the forest, and some have a very high market value (Barik *et al.* 2007). Because of the lack of quantitative data for most NTFP, income from NTFP and medicinal plants has not been included when accounting for forest benefits. Estimation of income from NTFP should thus be undertaken on a priority basis.

Income from shifting cultivation

Shifting cultivation is practised on forest land and the income from shifting cultivation plots, both during cropping and in the fallow phases; they thus need to be included when forest contribution is estimated. Given the dynamic nature of forest recovery during the fallow phase and the extremely variable fallow period in the region, a precise estimation of benefits during the fallow phase is difficult. For the cropping

phase, even if the conservative shifting cultivation area is taken into account (i.e., 1.73 million ha), the gross income from shifting cultivation would be INR 6 411 million (or US\$160 billion) annually. The estimation is based on data on economics of shifting cultivation in Arunachal Pradesh (Barik 2007).

Effective utilisation of bamboo

The northeast region has abundant bamboo resources. About 65 percent of bamboo in India and 20 percent in the world are found in the region. Of the world total of 1 250 species in 75 genera, India has the second richest bamboo genetic resources (after China) with 136 species, including 11 exotic species. Fifty-eight species belonging to 10 genera are found in the northeast. The distribution of species and the quantity of bamboos is uneven and more than 50 percent of the bamboo species and 66 percent of growing stock out of about 80.42 million tonnes (GOI, 2001) occurs in Northeast India. About 28 percent of the total bamboo area of the country is located in Northeast India. The principal bamboo genera occurring in Northeast India include, *Arundinaria*, *Bambusa*, *Chimonobambusa*, *Dendrocalamus*, *Dinochloa*, *Gigantochloa*, *Melocanna*, *Indocalamus*, *Ochlandra*, *Drepanostachyum*, *Phyllostachys*, *Pleioblastus*, *Pseudoxytenanthera*, *Schizostachyum* and *Thamnocalamus*. There are about 1 500 documented applications of bamboos that include use in building materials, agricultural implements, furniture, packaging, musical instruments, food items, handicrafts, as well as large bamboo-based industries (e.g., paper pulp, rayon etc.).

According to the United Nation's Industrial Development Organization (UNIDO), the bamboo business in the northeast region would be worth INR 50 million (or US\$ 12.5 billion) in the next 10 years. However, until now the potential of the bamboo sector in Northeast India has remained largely untapped, although considerable efforts have been made by the National Bamboo Mission as well as the National Mission on Bamboo Applications through the concerned state governments to give the bamboo economy a major boost. The National Mission on Bamboo Technology and Trade Development envisages the expansion of India's bamboo market to US \$5.5 billion by 2015. This is an achievable objective, as the bamboo economy is largely unorganised and is therefore expected to respond quickly to systematic improvement, as envisaged. This will create economy growth with a stronger thrust on employment generation through bamboo-based industrial development, including handicrafts.

Improving forest-based employment

The contribution of forests to employment generation is well recognised (Okafor 1979). The employment opportunities in the forestry sector in the post-Supreme Court period is more oriented towards plantation-related activities than logging, harvesting and wood-based industries (Table 16).

It is estimated that about 15 200 members of the population are employed directly or indirectly in the forestry sector. The estimated employment is nearly 24 million man

TABLE 16 *Employment generation in afforestation activities per hectare in Northeast India as per Government of India guidelines (NAEB 2002)*

Activity	Man days of employment created
Artificial regeneration	237
Medicinal and NTFP plantation	256
Bamboo plantation	109

TABLE 17 *Estimated employment (million man days) supported by forests*

Year	Tripura	Nagaland	Meghalaya	Manipur	Arunachal	Mizoram	Assam
1993	0.92	2.27	2.43	2.89	7.40	2.92	4.92
1994	0.92	2.26	2.47	2.89	7.39	2.92	4.88
1995	0.92	2.26	2.51	2.88	7.38	2.91	4.83
1996	0.93	2.30	2.56	2.85	7.43	2.94	4.89
1997	0.93	2.34	2.59	2.83	7.48	2.98	4.94
1998	0.96	2.38	2.64	2.88	7.52	3.02	5.00
1999	0.99	2.41	2.69	2.93	7.58	2.83	4.66
2000	1.15	2.37	2.67	2.88	7.46	3.04	4.99
2001	1.30	2.33	2.66	2.84	7.33	3.25	5.33
2002	1.45	2.37	2.65	2.90	7.38	3.31	5.38
2003	1.60	2.40	2.91	2.97	7.31	3.23	5.05
2004	1.57	2.45	2.90	2.98	7.48	3.42	5.49
2005	2.02	2.50	2.91	3.00	7.53	3.48	5.54
2006	1.74	2.55	2.93	3.02	7.69	3.54	5.60
2007	1.62	2.60	2.95	3.06	7.87	3.59	5.65
2008	2.22	2.65	2.96	3.10	8.03	3.65	5.70
2009	2.23	2.68	3.00	3.14	8.14	3.68	5.76
2010	2.24	2.71	3.05	3.17	8.24	3.71	5.82
2011	2.26	2.74	3.10	3.21	8.35	3.74	5.87
2012	2.27	2.77	3.15	3.24	8.45	3.76	5.93
2013	2.29	2.79	3.20	3.28	8.55	3.79	5.99
2014	2.30	2.82	3.24	3.31	8.66	3.82	6.04
2015	2.31	2.85	3.29	3.35	8.76	3.85	6.10
2016	2.33	2.88	3.34	3.39	8.87	3.87	6.16
2017	2.34	2.91	3.39	3.42	8.97	3.90	6.21
2018	2.36	2.94	3.43	3.46	9.07	3.93	6.27
2019	2.37	2.97	3.48	3.49	9.18	3.96	6.32
2020	2.39	3.00	3.53	3.53	9.28	3.98	6.38
2021	2.40	3.03	3.58	3.56	9.39	4.01	6.44

days per year and varies from year to year (Table 17). Even with a conservative wage rate of INR 100 (US\$2.5) per day, the forests contribute INR 2 380 million (or US\$ 60 billion) per year as employment in the forestry sector. There is a need to improve the forestry sector employment scenario through the establishment of more forest product-based industries and through the introduction of qualitative improvements by the adoption of advanced technologies.

INFORMATION NEEDS FOR STRATEGIC PLANNING

As well as the state, a complex mix of forest landowners, NTFP-gathering communities, traditional community bodies such as *Syiemships* (an administrative unit under traditional governance system equivalent to a kingdom or *Elaka* which controls several village councils in Khasi hills of Meghalaya), *Dolois* (an equivalent terminology for Jaintia hills of Meghalaya), *Nokmas* (a more or less equivalent

administrative unit in Garo hills of Meghalaya), *Anchal Samitis* (Anchal Samitis are democratically elected second-tier administrative units comprising several village councils existing in Arunachal Pradesh long before the Panchayati Raj Act came into effect in India; they are equivalent to the present day *Panchayats*, village councils, autonomous district councils, shifting cultivators and the forest products industry, which have always been stakeholders of forest products and important contributors to the forest economy. The role of the forest sector in the state economy can be captured in several ways: (i) by analysing the changing business level, (ii) by statistics (after introducing the necessary correction factors), and (iii) by understanding the linkages between the forest sector and the other sectors, including the total state economy, which is best characterised by input/output and econometric models. To prepare a strategic plan to enhance the contribution of forests to the region's economy, studies on the following need to be undertaken:

- Pilot studies for quantity and price inventories of NTFP species, developing a robust and reliable method of estimation for all the benefits, including intangible ones.
- Description of the role of the forestry and identification of forest products sector such as forest industries, plantation sector, forest tourism, sacred forests, etc.
- Analysis of the economic contribution of the forest products industry on a regional basis.
- Description of changes over time for key drivers at both the state and regional levels.
- Projection of the contribution of forestry and logging, primary manufacturing, and secondary manufacturing into the near future.
- Analysis of regional economic and productivity trends, such as wage costs and productivity across stages of forest product processing.
- Economic impact analysis: gross product, income, direct and indirect jobs, and taxes related to forest sector activity levels.
- Policy interventions: identifying those factors and policies that constrain investment in the forest industry, with a view to obtaining policy amendments and facilitating investment through the development of appropriate policies.

FACTORS NEEDING TO BE ADDRESSED FOR STRATEGIC PLANNING

Although the productivity of northeastern forests has been estimated to be around 6 m³ per year, the productivity rate of the forests and improved estimation of growing stock according to a rigorous scientific method for different forest types would improve planning. Several strategies need to be introduced to enhance the contribution of forests in the region. Some of the priority actions required are: (i) enhancing forest productivity through quality planting material; (ii) management of community forests for timber and NTFP based on the sustained-yield principle; (iii) focused approach to better management of NTFP and their value addition to

make NTFP a mainstay of forest economy; (iv) creation of alternative income-generating opportunities for forest dependents; (v) facilitation of the market environment for forest products so that higher benefits can be obtained; (vi) creation of a favourable policy environment for the growth of the forestry sector; (vii) reducing shifting cultivation by introducing more productive land use options to enhance the contribution from forest farming; (viii) inclusion of all tangible and non-tangible forest benefits in accounting for the benefits; (ix) enhancing technology input into forest product utilisation; (x) making eco-tourism a major forest-based livelihood option; and (xi) increased investment in the forestry sector by both government and industries. An appropriate regional forest policy needs to be formulated which stresses the development paradigm; the goal of achieving greater productivity and an increased overall contribution of the forest sector, without compromising biodiversity conservation and its effective implementation, is an area of great concern.

CONCLUSION

To enhance the forest investment in India in general and in northeastern states in particular, the actual value of forests, including all the goods and services, needs to be calculated. The standard total economic valuation must be carried out for northeastern forests to demonstrate their potential value, which could be much higher than those reported earlier for the forests located in the other parts of the country (Chopra 2002, Chopra *et al.* 2002, Kadekodi 2002, Verma 2000). The higher economic value of northeastern forests could be attributed to high growing stock, density, annual increment, and diverse ecosystem services in fragile ecosystems. Even if the values as computed by Manoharan (2000) and Haripriya (2001) are taken into account, the forest benefits of the northeast would be many times higher than the present level of estimates. Therefore, it is suggested that the valuation of forest goods and services should be undertaken on a priority basis to attract forestry sector investment to the region, which is so crucial for multiplying the forest benefits, while ensuring the conservation of rich forest biodiversity and resources of the region.

REFERENCES

- BARIK, S.K. 2007. Spatial and temporal variations in shifting cultivation in northeast India: is sustainable land use possible with *jhum* around? In K. G. Saxena, M. Pal and B.P. Singh (eds.). *Shifting cultivation in south-east Asia*, Mahendra Pal Bishen Pal Singh, Dehradun, India.
- BARIK, S.K. and DARLONG, V.T. 2007. *NRM policy environment in Meghalaya impacting the livelihood of rural poor*. Centre for International Forestry Research, Bogor, Indonesia.
- BARIK, S.K., HARIDASAN, K., SANGMA, D.M., LAKADONG, J.N. and MANNERS, V. 2007. *Developing*

- medicinal plant sector in Meghalaya: an action plan.* State Medicinal Plant Board, Shillong, India.
- BHATTACHARJEE, R.P. 2005. Forest economics in Arunachal Pradesh and its impact on state economy. *Arunachal Review*. Information and Public Relations Department, Government of Arunachal Pradesh, Itanagar.
- CHOPRA, K., BHATTACHARYA, B.B., KUMAR P. 2002. *Contribution of forestry sector to gross domestic product (GDP) in India* (mimeo). Institute of Economic Growth, New Delhi, India.
- CHOPRA, K. 2002. Economic valuation of biodiversity: the case of Keoladeo National Park. In G.K. Kadekodi (ed.) *Environmental economics in practice: selected case studies from India* (mimeo), Centre for Multi-Disciplinary Development Research, Dharwad, India.
- GOVERNMENT OF MEGHALAYA 2003. *Socio-economic review of Meghalaya, 2003*. Government of Meghalaya, Shillong, India.
- GOI 2007. *Central Statistical Organization report, 2007*, Government of India, New Delhi, India.
- GREGERSEN, H.M., ARNOLD, J.E.M., LUNDGREN, A.L. and CONTRERAS-HERMOSILLA, A. 1995. *Valuing forests: context, issues and guidelines*, FAO Forestry Paper 127, Food and Agriculture Organization, Rome, Italy.
- HARIPRIYA, G.S. 2001. *Carbon budget of Indian forest ecosystem*. Indira Gandhi Institute of Development Research, Mumbai, India.
- KADEKODI, G.K. 2002. *Environmental economics in practice: selected case studies from India*, (mimeo), Centre for Multi-Disciplinary Development Research, Dharwad, India.
- MANOHARAN, T.R. 2000. Natural resource accounting: economic valuation of intangible benefits of forests, RIS Discussion paper #04/2000, *Research and information system for the non-aligned and other developing countries*, New Delhi, India.
- MATHUR A.S., and SACHDEVA, A.S. 2003. *Towards an economic approach to sustainable forest development*. Working Paper 2/2003. Perspective planning division, Planning Commission, New Delhi.
- NAEB 2002. National Afforestation Programme Guidelines, National Afforestation and Ecodevelopment Board (NAEB), Ministry of Environment and Forests, Government of India, New Delhi, India.
- OKAFOR, J.C. 1979. *Edible indigenous rural plants in the rural economy of the Nigerian rainforest ecosystem*. University of Ibadan, Nigeria, pp 262–299.
- SFR 1999. *State of forest report, 1999*. Forest Survey of India, Dehradun, India.
- TRIPATHI, R.S. and BARIK, S.K. 2004. *Northeast ecoregion biodiversity strategy and action plan*. Ministry of Environment and Forests, Government of India, New Delhi, India.
- VERMA, M. 2000. *Economic valuation of forests of Himanchal Pradesh* (mimeo). Indian Institute of Forest Management, Bhopal, India.