

Structure and Determinants of Forest Economy in Northeast India

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ABSTRACT The paper seeks to examine the nature, structure and determinants of the forest economy of northeast India using secondary data from various sources. The study employs tools like percentage, compound annual growth rate, per capita availability and multiple regressions to find out the growth trend, structure and determinants of the forest economy of the region. The study finds that the region is experiencing a deteriorating quality of forest as a result of demographic pressure and unscientific agricultural practices like *jhum* cultivation. The study also finds that the contribution of the forest and logging sector to total GDP is increasing and a significant amount of informal employment is generated in the forestry sector. The multiple regression results show that forest cover, literacy rate, rural population and crop diversification are the key factors that are determining the forest economy of the region. The study emphasises the need for strong coordination between community and government so that overexploitation of forest resources from the increasing population is checked and at the same time, new avenues and sustainable livelihoods are generated for communities settling on the forest fringes.

INTRODUCTION

People living in developing regions obtain a sizable part of their earnings from forest-related activities (Angelsen et al. 2014). Income from forests is critical for the rural population in developing countries, due to meeting subsistence needs, providing a safeguard for unforeseen circumstances, and providing a trajectory to break the poverty trap (Angelsen and Wunder 2003). The dependency level on the forest is high for poorer people who have limited access to other means of livelihood (Volker and Waibel 2010; Howell et al. 2010). Distance from the forest also impacts the dependency on the forest for livelihood. Howell et al. (2010) found that seventy-three percent of the families living near the Krau Forest and Wildlife Reserve actively rely on non-timber forest products (NTFPs) for their survival. Sarap (2007) highlighted that factors such as agricultural development, forest quality, exist-

ing policies, and institutional arrangement have an impact on forest dependency. Ghosal (2011) highlighted that the transport system, the distance of the market from the village, and the availability of manufacturing goods have an impact on forest dependency. High dependency on the forest for livelihoods without sustainable extraction, coupled with population growth and the fast pace of development activities in the developed countries has resulted in degenerations of forests (Ahmed et al. 2020; Toledo et al. 2022).

In India, forests account for the largest land use after agriculture, providing livelihood to 200 million people. Half of the incomes of roughly about twenty-five percent of rural workers in India come from small-scale forest-based enterprises (Tewari and Campbell 1995). India is home to nearly 10.4 million tribes, who are linked with forests culturally and traditionally (Tripathi 2016). There is a large gain from the forest in India, which is in the form of socio-economic and environmental aspects, as it is one of the most highly forested regions in the globe. This is even higher in the northeastern part of India due to her richness in forests and heavy reliance on forest-based resources for livelihoods (Nongbri 2001; Barik and Mishra 2008).

Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripu-

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ra form the northeastern states of India. These states are lacking behind in industrial and infrastructure development as compared to the other regions of the country, hampering growth in the region. However, these states are gifted with abundant natural resources and blessed with two biodiversity hotspots out of the 34 global hotspots, namely, the Eastern Himalayas and the Indo-Burma region. As such, agriculture and forestry dominate the primary occupation of the rural and hill people in the region. Collection and selling of forest products and by-products help the majority of the rural dwellers in the region in earning incomes and helping them in sending their wards for education for better livelihoods (Nongbri 2001).

Among the tangible forest resources, NTFPs' contribution to economic wellbeing is high for the northeast region. NTFPs play a crucial part in employing rural skilled and unskilled labourers and improvising in other stagnant rural economies (Tiwari 2000). Various works by many researchers have highlighted the importance of NTFPs in generating sustainable income and livelihoods to the rural communities of the northeastern region even though it varies from state to state (Tiwari 2000; Sahoo et al. 2010; Sharma et al. 2015; Longkumer et al. 2020). Fuelwood, another forest product, is the key source of fuel energy for the tribal communities of the North-eastern Himalayan region for cooking food, water heating, space heating, and animal feed preparation (Bhatt et al. 2016; Upadhaya et al. 2017). Forest gives a varied range of economic goods to the people of developing regions like northeast India. Consumption of fuelwood depends on the accessibility of unconventional sources of energy, season, climate, the distance of forest, and the altitude of the area (Bhatt et al. 1994; Bhatt and Sachan 2004). Fuelwood consumption for rural communities of northeast India is significantly higher than in the Central Himalayas and southern India (Bhatt et al. 2016).

The economic contributions of the forest sector are largely unaccounted for or inadequately measured, especially in the forest area owned by the community, as they do not want to be contested in their use rights (Agrawal et al. 2013). Most of the benefits accrued from the forest are unaccounted for and underestimated, which poorly reflects the economic benefits from the

forestry sector in northeast India (Barik and Mishra 2008). Moreover, the micro and small enterprises of the forest sector in India understate the number of workers to avoid Indian labour law procedures and preferred to remain in the informal economy (Saigal and Bose 2003). Taking into consideration the high dependency on forests in the region and limited quantitative study on the economic importance of forests in the region, the current research paper attempts to analyse the structure and determinants of forest economy in the region. This kind of study would provide indicators of sustainable forest management and help the various stakeholders in evolving better management practices that generate more revenues from the forest as well as maintain environmental stability.

Objectives

The study seeks to address the following objectives:

1. To examine the nature and structure of forests in northeast India.
2. To examine the economic importance of forests in the region.
3. To find the factors driving the forest economy of northeast India.

MATERIAL AND METHODS

The study tries to locate the issue of the forest economy in the evolving economic structure of the northeastern states. The research paper is built on the secondary data of India's eight northeastern states. The secondary data are from the India State of Forest Report (ISFR), Forest Survey of India (FSI), Population Census data, Economic Census data, Net State Value Added by economic activity data, and North-eastern Development Finance Corporation Ltd. (NEDFi) Data bank. Data on forest cover and area, quality of forest, and forest contribution to income and employment are analysed to understand the structure of the forest economy of the region. Multiple OLS regression analysis is adopted to analyse the determinant of forest's contribution to the State's income at a constant price for each northeastern state. The percentage of forestry and logging contribution to the NSDP for each state is taken as a dependent

variable. The share of forest cover in percentage to the total area, literacy rate, percentage of rural population to the entire population, and crop diversification index are taken as independent variables (see Appendix for details). The Herfindahl index is commonly used to calculate the crop diversification index (De and Chattopadhyay 2010). The description of the variables used for the regression analysis and their expected sign and relationship are provided in Table 1.

Table 1: Variable description

<i>Variable name</i>	<i>Detail description of the variables</i>	<i>Expected/Anticipated sign</i>
Forest cover	Percentage of forest cover to the total geographical area	+
RP	Percentage of rural population to the total population	+
LR	Literacy rate	-
HI	Herfindahl Index for crop diversification	-

RESULTS

Forest Area and Forest Cover

India is one of the countries with high forested land and 23.58 percent of the total is forest land. The northeast region figure is more than double India's figure and has 51.0 percent of its area under forest. Except Assam, Meghalaya and Mizoram, the rest of the states in the region have a forest area of more than 50.0 percent of their geographical area. Sikkim recorded the highest percentage of forest area with 82.31 percent, followed by Manipur with 78.01 percent and Tripura with 60.02 percent. As per the Indian Forest Act 1927, forests are classified as Reserved, Protected, and Unclassed forests. Reserved and Protected Forests fall under the supervision of the forest departments in the respective states with proper scientific management, while Unclassed Forests are those forests that are possessed by different clans, communities, individuals and other village-level institutions and are not under any scientific management. As per ISFR 2021 (Government of India 2021), India has 57.05 percent of its recorded forest area under

Reserved Forest, 27.38 percent under Protected Forest, and 15.58 percent under Unclassed Forest. Unlike the overall figure of India, the northeast region has more Unclassed Forest than the Reserved Forest with 52.49 percent of the region's forest area under the former, indicating that most of the forests in the region are owned by communities and villages. This is a phenomenon observed globally. As Agrawal et al. (2013) observed, "Globally, the nontrivial forests are under the community institutions even though official agencies do not want to formally recognise the forest under community institutions".

Apart from the classification of forests on legal ownership, forest cover is classified based on canopy density. In the ISFR, forests are categorised into three canopy density classes¹, namely, VDF or Very Dense Forest, MDF or Moderately Dense Forest, and OF or Open Forest. The northeast region of the country has 64.66 percent of the whole area under forest cover, which is high compared to all of India's forest cover. In the last 35 years starting from ISFR 1987 to 2021, northeast India has shown ups and downs in terms of her total forest cover. The early 2000s show an increasing trend in total forest cover but in recent times it has started declining. Even though the overall picture from 1987 to 2021 shows an increase of forest cover by 4,101 sq. km., a percentage increase of 2.47, the all India figure shows an increase of 72,970 sq. km., a percentage increase of 11.38 in the same period.

The ISFR 2021 shows that out of the total forest cover in northeastern states, VDF constitutes 16.94 percent, MDF constitutes 42.76 percent, and OF constitutes 40.30 percent of the total forest cover. Except in the states of Assam and Sikkim, all the other northeast states have a forest cover of a little above seventy percent of their respective state's total geographical area. Despite the high percentage of forest cover, the conditions of forest in the northeast states seem to be deteriorating. Except for Sikkim and Arunachal Pradesh, all the other states of the region have a lower percentage of VDF as compared to the all India figure of 13.98 percent. Moreover, per capita availability of forest per hectare in the northeast region in the period from 2011 to 2021 shows a decreasing trend from 0.38 to 0.33 indicating that

the increasing population might have adversely affected the rich forest resources of the region.

The compound annual growth rate of Very Dense Forest from 2011 to 2021 shows that all the northeastern states except Nagaland show a minimal positive growth rate with Tripura being the only state showing a two-digit growth rate at 19.49 percent. Nagaland shows a negative growth rate of -0.16 percent. The northeast region shows an increase in VDF growth rate at 1.19 percent and overall India's growth rate is 1.80 percent. Leaving out the exceptions, the overall pictures in northeast India show a decline in the forest area over the year, a decrease in the per capita availability of forest, and a small portion of VDF in the total forest area.

Forest Contribution to Income and Employment

Forests provide both subsistence and commercial avenues to the people residing near forest areas through the gathering and selling of NTFPs, timber, and firewood. Forests provide greater avenues to developing countries than developed ones (Agrawal et al. 2013). The gross value output of forestry and logging for India from 2011-2012 to 2018-2019 shows an increase from INR 1,48,74,825 lakhs to INR 1,96,24,633 lakhs with a compound annual growth rate of 4.04 percent. For the northeast states, the increase is from INR 8,68,351 lakhs to INR 13,07,018 lakhs with a compound annual growth rate of 6.02 percent, which is way higher than India's growth rate. Mizoram

recorded the maximum compound annual growth rate of 22.7 percent, followed by Sikkim with 9.4 percent, and Arunachal Pradesh with 7.08 percent.

The contribution of forestry and logging to the Gross Value of Output in agriculture, forestry, and fishing for India shows an increase from 7.80 percent in 2011-2012 to 8.24 percent in 2018-2019 (Government of India 2021). The picture for the northeast region shows an increase from 13.84 percent in 2011-2012 to 16.92 percent in 2018-2019. The data shows that forestry and logging contribution is higher in states of northeast when compared to India's overall figure. The forest sector has an enormous role in the informal employment generation. The most vital source of informal employment data is the Economic Census data, which is an enterprise-based report. Moreover, employment in the forestry sector is not available in other sources like the National Sample Survey (NSS). Table 2 gives the employment data in the agricultural enterprise as available in the Economic Census data of 2013. In terms of the forestry and logging sector, Arunachal Pradesh provides maximum employment that is 49.88 percent among the northeast states. The possible reason for this is that Arunachal Pradesh has the largest area under forest among all the northeastern states. States like Nagaland, Manipur, and Meghalaya have also a high percentage of employment in forestry and logging. The overall picture shows that northeast India with 6.45 percent of employ-

Table 2: Employment in agriculture enterprises (NE states), 2013

<i>State</i>	<i>Agriculture other than crop production and plantation</i>	<i>Livestock</i>	<i>Forestry and logging</i>	<i>Fishing and aquaculture</i>	<i>Total</i>
Arunachal Pradesh	72 (5.93)	487 (40.08)	606 (49.88)	50 (4.12)	1215 (100)
Assam	69880 (18.35)	217815 (57.19)	19489 (5.12)	73685 (19.35)	380869 (100)
Manipur	3252 (6.94)	20449 (43.61)	6705 (14.30)	16480 (35.15)	46886 (100)
Mizoram	18 (0.09)	21158 (99.56)	36 (0.17)	40 (0.19)	21252 (100)
Meghalaya	1247 (8.35)	10736 (71.87)	2101 (14.07)	853 (5.71)	14937 (100)
Nagaland	127 (3.93)	1922 (59.45)	921 (28.49)	263 (8.13)	3233 (100)
Sikkim	30 (0.45)	6598 (98.21)	87 (1.30)	3 (0.04)	6718 (100)
Tripura	957 (3.43)	20825 (74.74)	2492 (8.94)	3591 (12.89)	27865 (100)
North East	75583 (15.03)	299990 (59.64)	32437 (6.45)	94965 (18.88)	502975 (100)
All India	1361628 (5.95)	19418442 (84.86)	1224809 (5.35)	877622 (3.84)	22882501 (100)

Source: Economic Census of India, 2013. *Note:* Figure in the parenthesis indicates percentages.

ment in forestry and logging has higher employment, which is more than the all India figure of 5.35 percent.

Determinants of Forest Economy

Regression analysis has been undertaken in recent times both at the household level (Garekae et al. 2017; Azeez et al. 2018; Ahammad et al. 2021) and at the macro-level (Faleyimu 2013; Wang et al. 2020) to understand the drivers and determinants of forest economy. A multiple linear regression method of estimation is employed to identify the determinant of a forest’s contribution to NSDP for 2019-2020. Regression is calculated using Licensed Stata 15 of the Department of Economics, Manipur University. The regression result shows that all four independent variables were statistically significant. The percentage of forest cover and crop diversification were significant statistically at $p<0.01$, literacy rate at $p<0.05$ level of significance, and the rural population at $p<0.1$ level of significance (Table 3).

The assumption that a higher percentage of forest cover has a positive relation to the forestry and logging contribution to the economy shows consistency with the result as indicated by the positive sign of the coefficient. The coefficient on the percentage of forest cover is 0.326 indicating that a one percent rise in the forest cover will increase the contribution of forestry and logging by 0.326 percent holding other independent variables constant (Table 4a,b).

An increase in the rural population will have a positive impact on the forestry and logging contribution was contradicted by the result as indicated by the negative sign of the coefficient. The coefficient of 9.169 indicates that a one percent increase in rural population will reduce the forestry and logging contribution by 9.169 percent holding other independent variables constant. The assumption that a high literacy rate

Table 3: Descriptive statistics of variables used

<i>Variables</i>	<i>Observations</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
Forest cover	8	68.629	17.319	36.11	85.41
Rural population	8	.204	.364	.006	1.095
Literacy rate	8	78.841	8.267	65.38	91.33
Herfindahl Index	8	.466	.07	.384	.606

Table 4 (a): Result for multiple regression

<i>Variables</i>		
Forest cover	0.326***	(0.0384)
RP	-9.169*	(3.641)
LR	-0.380**	(0.0871)
HI	85.00***	(14.07)
Constant	-24.42	(11.82)
Observations		8
R-squared		0.979

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4 (b): Variance inflation factor

	<i>VIF</i>	<i>1/VIF</i>
RP	7.347	.136
HI	4.117	.243
LR	2.168	.461
Forestcover	1.855	.539
Mean VIF	3.872	.

will reduce the forestry and logging contribution shows consistency with the result as indicated by the negative sign of the coefficient. The coefficient on the literacy rate is 0.380 indicating that a percent increase in literacy rate will reduce the contribution of forestry and logging by 0.380 percent holding other independent variables constant. The assumption that a higher crop diversification will reduce the contribution of forestry and logging is contradicted by the result as indicated by the positive sign of the coefficient. The coefficient on the crop diversification index is 85 indicating that a percent increment in the crop diversification index will increase the contribution of forestry and logging by 85.0 percent holding other independent variables constant.

DISCUSSION

Most of the northeast region’s forest area is under unclassed forest, which implies that most of the forests are owned by communities and villages. The hill region of northeast India en-

joys a special constitutional provision such as the Sixth Scheduled, Article 371 A, B, C, G, and H. As per the provision, Autonomous District Councils (ADCs) are formed to manage the hill region with their separate acts, rules and regulations. As such, much of the forest area comes under the purview of ADCs. These have certain implications for the effective implementation of forest acts and rules. The acts, rules and regulations are weakly enforced and the forests are mostly governed as per the norms, desires and needs of the clans and communities. This has resulted in the loss of forests in many parts of the region due to weak community institutions, population pressure, illegal logging, etc. As observed by Poffenberger et al. (2006), "Forest management has taken a beating in the recent past in northeast India due to pressure on land, the decreasing cycle of *jhum* cultivation, exploitation of forest for timber, and lack of a scientific management strategy." There has been a strong debate on whether the deteriorating forest condition is attributed to the forest owned by the community, which falls outside the purview of the forest department. A pairwise correlation between forest under community and the area of forest under the very dense forest of all the northeastern states shows a negative sign with -0.379 indicating that the higher the forest under community, the lower the area of very dense forest. However, this is inconclusive, as the significance of the association between the variables given by the p-value between the two variables is greater than the significance level of 0.05.

The region's low percentage of very dense forest and the decreasing per capita availability of forests supports the argument that the region is adversely affected by the increasing population and the widespread practice of *jhum* cultivation. *Jhum* cultivation in the region has brought about forest degradation particularly in Meghalaya, Manipur, Nagaland and Mizoram (Thong et al. 2019). A research taken up by Devi et al. (2021) in the Senapati District of Manipur, India also shows that forest fragmentation has resulted from human-related activities such as deforestation and *jhum* cultivation. Studies in other countries like Chittagong Hill Tracts of Bangladesh (Miah et al. 2020; Ahammad et al. 2021) have also observed such patterns. So it can be concluded that the conditions of forests

in northeast India are deteriorating and several factors, which are prevalent in the region like increase in population, illegal trade of forest products, and clearing of forest for shifting cultivation are contributing to the deterioration and deforestation of the forest.

The forests' role in the economy in terms of earnings and employment creation in the region is high as compared to all India figures indicating a higher dependence on forest resources. This finding is quite in contrast to findings of other developing regions like Nigeria where there is a fall in forest share in total Gross Domestic Product (GDP) (Faleyimu 2013). Dependency on the forest is intense for forest communities and tribal populations, as they are socio-economically and culturally attached to the forest. In India, seventy percent of the NTFPs collection takes place in the tribal belt (Pandey et al. 2016). The northeast states have a diverse tribal demographic population and its terrain is mostly hilly, contributing to a significant dependence on the forest as compared to the rest of the country. High dependence on the forest with unsustainable extraction will worsen the condition of the forest leading to deterioration and deforestation. High dependence on fuelwood coupled with increasing population is one of the main factors for deforestation in the northeast region (Saratchandra 2014; Khataniar and Benazir 2018). The increasing share of forestry and logging in GDP and the deteriorating quality of the forest northeast region is a cause of concern, as it reflects the overexploitation of forest resources.

The regression analysis shows that the percentage of forest cover and literacy rate is consistent with the assumptions. Larger forest cover implies more resources to gather, providing more income and employment and helping in increasing the contribution of forestry and logging. A research paper by Azeez et al. (2018) also observed that forest availability impacts the forest income earning in southwestern Nigeria. A higher literacy rate will divert the people from forest-based primary activities to other more productive non-agricultural activities and reduce pressure on the forest. It will also raise the standard of living and make them less dependent on forest products such as firewood. This finding conforms with similar research carried out in Tanzania, Africa (Ngondya et al. 2011), Bang-

ladesh (Hossain 2021), and India (Reddy et al. 2001). The expected sign of rural population and crop diversification with that of the dependent variable, forest income, turns out to be contradictory. An increase in rural population will shrink forest land due to an increase in settlement and farming areas. It will also lead to the gathering of resources for own consumption and reduce the share of forestry and logging to the NSDP. Higher crop diversification will reduce the contribution of forestry, and logging is contradicted by the result. This has certain implications for the nature of crop diversification taking place in the region. It shows that crop diversification is not able to generate much income for the rural dwellers and crop diversification is for subsistence rather than for a surplus generation.

CONCLUSION

The study finds that the quality of forests in the region is deteriorating as reflected by the slow growth of Very Dense Forests and the decline of the percentage of forest area and per capita availability of forests. Forests occupy a dominant place in the economic sphere and space of this region. But the evolving nature of the structure of the forest sector in the region may throw a lot of challenges to sustainable income and employment in the forestry sector. The region is widely known for its sheer abundance of forests and as such, the dependency on the forest for subsistence as well as commercial is high in the region leading to unsustainable use of forests, which can be witnessed from the marginal percentage share of Very Dense Forests. *Jhum* cultivation, population pressure, illegal trade of forest products, and the reluctance on the part of the Government of India to consider changing the Unclassed category resulted in the current state of the forest in the northeastern states. Moreover, forest administration is very complex and sensitive in northeastern states as compared to other parts of India, as a large amount of forest land is under different customary laws of different tribes and communities.

RECOMMENDATIONS

The result finds that forest cover, literacy rate, rural population and crop diversification

affect the contribution of forestry and logging in the northeast states of India. There is a need for scientific management of forests to generate sustainable income from forests. As the literacy rate has shown positive outcomes on forest resources, there is an urgent need for proper and quality education for the people especially residing near the forest area. Planned settlement for the increasing rural population has to be addressed meticulously. The negative impact of crop diversification on forest income is a concern for the region. A policy environment that encourages settled cultivation with proper scientific input must be encouraged. Forest management under customary laws and traditions seems to have lost its steam and effectiveness due to several internal and external factors, and there is an urgent need from the government to strengthen and complement the community forest management approach by giving institutional and technical support. Almost all the rural communities settling on forest fringes depend on the forest resources for their livelihood, and hence the government should impart training about forest products and value addition with cost-effective ways to generate more sustainable income and employment.

LIMITATIONS OF THE STUDY

The study gives the macro picture of the forestry sector of the northeast region of India, as it is solely based on secondary data. So, it is not far from limitations. The study could have been a comprehensive one if some micro pictures were incorporated. The study has come up with certain findings and policy implications that need to be corroborated with other field-based studies so that an impeccable study on this subject matter comes up.

NOTE

²As per ISFR, the definition of the three categories are given as, "VDF: 70 pc tree canopy density and above, MDF: 40 pc tree canopy density and more but less than 70 percent and OF: 10 pc and more but less than 40 pc tree canopy density."

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Appendix

1. Herfindahl Index is calculated in the following way:

Where P_i is the proportion of the i^{th} crop
 $P_i = A_i / \sum A_i$

In which A_i = Area under i^{th} crop and $\sum A_i$ = Total cropped area.”

2. Dependent and Independent Variables for the Multiple Regression

State	Dependent variable Forestry contribution to NSDP (in %)	Independent variables			
		Forest Cover (in %)	Rural population (in %)	Literacy rate	HI
Arunachal Pradesh	17.79	79.63	0.02	65.38	0.48
Assam	0.78	36.11	0.01	72.19	0.48
Manipur	2.81	75.46	0.07	79.21	0.38
Meghalaya	3.39	76.33	0.12	74.43	0.40
Mizoram	10.41	85.41	1.09	91.33	0.61
Nagaland	5.97	75.31	0.04	79.55	0.41
Sikkim	0.41	47.1	0.10	81.42	0.49
Tripura	4.61	73.68	0.17	87.22	0.48