

Impact of firewood consumption on forest degradation-a study based on tribal households of India's northeast

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Abstract

Objectives: To assess the impact of firewood consumption in the tribal households of Northeast India on forest degradation through development of a Forest Degradation Index (FDI).

Methods/Statistical analysis: A focused group discussion method was undertaken with some village level leaders, student union leaders, members of village development council and some older people in order to collect required information. Linear regression analysis was run to estimate the determinants of Forest Degradation Index (FDI).

Findings: The study reveals that forest degradation is positively associated with firewood extraction. The study also observed the phenomena like sales of firewood particularly by the poor and land lords. There is an urban centric demand for firewood in the industries, factories, and hotels and some peoples involved in firewood sales as source of their livelihood. Thus excessive pressure on the local forest has been emerged which has led to deforestation.

Application/Improvements: The study advocates adoption of a decentralized management of common forest emphasizing active participation of the local stakeholders. Policy initiative should attempt at improving livelihood, subsidized LPG distribution policy and the education level of the household members of the tribal households.

Keywords: Firewood Consumption, Forest Degradation, Tribal households, Household Energy, Northeast.

1. Introduction

Firewood has been emerged as the oldest and an important source of household energy as well as a vital source of deforestation around the world [1]. During the recent past decades, India has experienced many changes in the patterns of energy consumption both quantitative and qualitative terms [2]. While firewood is still dominating the household energy sector, the use of firewood for cooking has declined only very slowly over the years in rural India. The data shows that it has gone down from 78.2 per cent of all rural households in 1993-94 to 67.3 per cent in 2011-12 [3].

The livelihood of tribal people of northeast is very much related to the nature. Although there is a wide variation in the way in which the tribal people manage their natural resources, in their perception there is no ambiguity about their right over them. The land and forests are an integral part of the habitat to which they belong. Hence from time immemorial they have exercised complete control over these resources [4] Forest is the main source of fuel and fodder, edible fruits of all kinds, leaves, roots, tubers, animals, birds and insects and fish from the streams and rivers constitutes the items of food for the tribal people [5,1] on the other hand, modern sources of fuels are still out of reach of the rural tribal households of the northeastern region due to numbers of reasons like low purchasing power, small requirement, non-availability etc. As a result firewood and cow-dung have excessive application as fuel in villages as contrast to kerosene, electricity and natural gas (LPG) in towns and cities [6].

Therefore, excessive pressure on forest may be expected, owing to these factors along with extreme dependency of the people for survival, which may bring about significant changes to the stock of forest resources leading to depletion and degradation [7] of these resources. It also has serious health impact in the form of respiratory diseases, eye diseases, bronchitis, pulmonary tuberculosis, chest infection etc [8]. Energy

substitution, though on the rise, is still insignificant in rural households of Northeast. However till date, no systematic study has been conducted in the region to address the health and environmental issues of firewood consumption. The present study is an attempt in to fill the gap in knowledge.

2. Materials and methods

2.1. Data source

The study is basically empirical in nature and based on primary survey data collected from three northeastern states namely Assam, Nagaland and Arunachal Pradesh in connection with an ICSSR Responsive Research Project. In order to construct a forest degradation model we have used data collected from 14 tribal villages selected from Assam, Nagaland and Arunachal Pradesh. Data regarding some variables like poverty index were supplemented from household level survey extended to 301 households.

The village level information were collected through a focused group discussion method held with some village leaders like Sarpanch (head of the village), student union leaders, members of village development council and some older people. The information so derived was noted in a schedule called village schedule. During discussion some inconsistency in quantitative observations were noted because of the proximity of the measurements of land and forests and other socio – economic variables. In such a situation we cross checked it from the other village elders.

2.2. Measurement of deforestation

FAO defines forest degradation as: The reduction of the capacity of a forest to provide goods and services [9] (FAO, 2002). There can't be a rigid concept of degradation, in fact it is varied concept and depends upon driver of degradation and the goods and services of interest [10,11]. Forest degradation can be understood as a change process that negatively affects the characteristics of a forest such that its productivity decline.

The conceptual understanding of forest degradation raises numbers of issues that need to consider before measuring forest degradation. It is a complex phenomenon and a single parameter may not capture the whole scenario. Further it depends upon context and goods and services of interest. Keeping all these in mind we attempt to measure forest degradation as a composite measure of degradation. A composite measure of forest degradation called Forest Degradation Index (FDI) is developed to approximate the extent of forest degradation. In order to facilitate statistical enquiry to assess the impact of firewood consumption on deforestation, a composite measure of deforestation called Forest Degradation Index (FDI) is developed assuming FDI as a sum of Forest Health relative to earlier (FH), Forest Damage (FD), and the Forest use Penetration (FP). Thus:

$$FDI = \sum (FH + FD + FP)$$

Where FDI = Forest degradation index

FD = Forest Damage

FC = Forest Health (quality)

FP = Forest use penetration

All three variables (FH, FD, and FP) are coded using five points Likert Scale in such a way that greater values show a higher levels of forest degradation. They are comparable in magnitude so that each component has a substantive impact on the index, and they are positively correlated. The major advantage of the Forest Degradation Index as a measure of environmental outcomes is that it captures the quality of the vegetative cover, and not just its area, based on field visit; the disadvantage is that the index relies on subjective judgment.

3. Results and discussion

3.1. Descriptive statistics of the variables

All together eight variables were identified as probable determinants of FDI. These variables, along with their description and measurement expect are presented in the Table 1.

Table 1. Description of variables

Variables	Description	Measurement
Log FDI (Yi)	Forest Depredation Index, a composite measure of deforestation (Dependent variable)	$\sum (FH + FD + FP)$
Management rule	Existence of CPRs management rule	1=yes 0=otherwise
dist_cpr	Distance to forest area from the village	Actual distance in km
Communication (X ₁)	Extent of road communication service available	Very bad=1; bad=2; good=3; very good=4
Emergence_mkt	Existence of market for CPRs; visible or invisible	Never exist=1; sometimes=2; often=3; regular=4
log_pop	Log of village population	compiled from village survey
log livestock	Log of livestock	Measured by actual number of cow unit from household data
Poverty	Village poverty index	Measured from household data
Forest	% of forest area to the total geographical area	60% to 65%=1; 65% to 70%=2; 70% to 75%=3; 75% above=4

The descriptive statistics of these variables is presented in the Table 2. Although the statistics Skewness and Kurtosis indicate normality of these explanatory variables (since the value of these two statics lie in between 1.5 to +1.5), yet we observed significant correlation between some variables. Those variables were dropped and we retain with only six explanatory variables.

Table 2. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
log_FDI	14	.85	1.11	1.0046	.08531
log population	14	2.14	3.35	2.4377	.30839
log_fwcolt	14	3.11	4.05	3.5798	.22814
log_povty	14	.00	1.85	1.4221	.47717
management	14	.00	1.00	.6429	.49725
communication	14	2.00	4.00	2.5000	.85485
log_forest	14	1.78	1.91	1.8356	.04688
Valid N (list wise)	14				

3.2. Determinants of forest degradation

In order to identify the determinants of deforestation in the context of our study area, the forest degradation index (FDI) is regressed upon the set of explanatory variables. The ultimate regression results are shown in the Table 3. The estimations show that forest depletion is positively associated with size of population of the village. However, the relation is not found significant. Log of firewood collection have a positive and significant influence on deforestation. The variable is highly significant at 0.01 levels. It implies that excessive use of firewood in household sector, commercialization of firewood due to heavy demand in urban hotels and bakery, have resulted in deforestation around.

The poor people are bound to depend on forest due to lack of access to other source of livelihood. Hence we observed greater extent of deforestation associated with high level of poverty. The log of village population size (log pop) is positively associated with FDI, however the relationship is not found significant. As shown in the Table 3, the variable 'Management' is a dummy variable. It takes the value 1 if there is any active extraction norm may be formal or informal and it takes the value '0' otherwise. The variable has the expected negative sign though statistically not significant. It implies that existence of active norm over the use of natural resources associated with smaller extent of deforestation.

The variable 'communication' measured in terms of road communication found statistically significant 0.05 levels. It demonstrates that better road communication associated with greater extent of degradation [12].

Table 3. Determinants of forest degradation

	Coefficient	t-ratio	Sig
(Constant)	-2.524	-1.653	.142
log_population	.220	2.214	.062
log_fwdcolt	.477	3.807	.007
log_povty	.033	.770	.466
management	-.054	-1.972	.089
communication	.104	4.974	.002
log_forest	.551	1.135	.294
Dependent Variable: log FDI			
F-statistics: 11.01 $p=0.003$			
$R^2=0.90$ Adj $R^2=0.82$			
Sample size:14			
Source: Field Survey, 2016-17			

4. Conclusion

Firewood substitution is highly demanded considering the problems of forest degradation and health impact. Policy initiative should attempt at improving livelihood, subsidized LPG distribution policy and the education level of the household members in tribal households. Apart from widespread firewood consumption in the tribal households for cooking and heating purposes, there is an urban centric demand for firewood in the industries, factories, and hotels and some peoples involved in firewood sales as source of their livelihood. Thus excessive pressure on the local forest has been emerged which has led to deforestation. It implies that excessive use of firewood in household sector, commercialization of firewood due to heavy demand in urban hotels and bakery, have resulted in deforestation around.

In the northeastern region demand for forest product has been increasing rapidly since after its independence owing to population growth and developmental activities. The national policies which attempted to divert the non-monetized rural economy to a monetized one also results in increased extraction of forest produce, especially firewood. The emergence of private property right over land and forest has also resulted in inappropriate management and encroachment of common forest.

Hence there is an urgent need of developing a sustainable forest management policy. The study recommends policy intervention to empower the local management institution of common property resources introducing a decentralized management module. Hence, there is an urgent need to strengthen the traditional system of community management headed by Gaon Burha or Village Chief in addition to the village panchayat with specific purpose of management of this resource.

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6. References

1. G.W. Sharpe. Introduction to forestry, 4th edition. New York: MacGraw-Hill Book Company. 1976.
2. India's energy sector. bookstore.teri.res.in/docs/books/TEDDY_2013_Sample_Chapter.pdf. Date accessed: 31/03/2012.
3. Energy sources of Indian households for cooking and lighting, www.indiawaterportal.org/.../energy-sources-Indian-households-cooking-and-lighting. Date accessed: 29/11/2012.
4. Land, forest right and development policies in north east India. *The Eastern Anthropologist*. 1997; 50(2), 113-137.
5. C.V.F. Haimendorf. Change and development among tribes of Arunachal Pradesh. Tribes of India- The Struggle for Survival. 1985.
6. V. Elwin. A philosophy of NEFA. Directorate of Research, Govt. of Arunachal Pradesh. 1959
7. A.K. Nanda, S. Khurana. From hearth to earth: use of natural resources for cooking in Indian households. *Demography India*. 1995; 24(1), 33-58.
8. V. Laxmi, J. Parikh, S. Karmakar, P. Dabrase. Household energy, women's hardship and health impact in rural Rajasthan. *Energy for Sustainable Development*. 2003; 7(1), 50-68.
9. Second expert meeting on harmonizing forest-related definitions for use by various stakeholders, <http://www.fao.org/forestry/15533-0cb816e82c09c14873ce9226dd13910b9.pdf>. Date accessed: 22/01/2002.
10. H.G. Lund. What is a degraded forest? Forest information services. Gainesville, USA. 2009.
11. Towards defining forest degradation: comparative analysis of existing definitions. <http://agris.fao.org/agris-search/search.do?recordID=XF2009440929>. Date accessed: 08/09/2009.

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