

Land Access and Food Security for Forest Dwellers: An Economic Analysis for India

Dostęp do ziemi i bezpieczeństwo żywnościowe dla mieszkańców obszarów leśnych: przykład Indii

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Abstract

For an economy to grow sustainably, the developmental needs of the poor have to be addressed, alongside concerns for conservation of resources. In spite of the high economic growth experienced in India in recent decades, driven chiefly by growth in the secondary and tertiary sectors, poverty persists amongst tribal communities. Analysis of survey based data reveals the continued significance of access to land and forest resources in impacting livelihoods and food security for forest dwelling communities, comprising mostly of tribals. Access to land and credit emerge as critical for the majority, with substantial dependence on forest products for the poorest among the poor households. The paper adds to the empirical literature on the debate on relevance of small holder agriculture and access to natural resources for poverty alleviation. It also provides an economic context for a recently enacted legislation that seeks to restore tenurial security to forest dwelling tribal communities.

Keywords: Poverty, food security, forests, tribals, land, sustainable development

Streszczenie

Aby ekonomia rozwijała się w sposób zrównoważony, należy zapewnić możliwość spełniania potrzeb rozwojowych przez biednych, a zarazem dbać o ochronę surowców. Mimo wysokiego poziomu rozwoju ekonomicznego, obserwowanego w ciągu ostatnich kilku dekad w Indiach, napędzanego był przez drugo- i trzeciorzędne sektory, bieda nadal stanowi problem dla wielu plemion. Badania pokazują, że dla społeczności zamieszkujących obszary leśne nadal ogromne znaczenie, w aspekcie poziomu życia i bezpieczeństwa żywnościowego, odgrywa dostęp do ziemi i zasobów leśnych. Artykuł podnosi kwestię zasadności funkcjonowania małych gospodarstw rolniczych i dostępu do surowców naturalnych w kontekście walki z ubóstwem. Przeprowadzono także analizę ekonomiczną niedawno uchwalonego prawa, którego celem jest zapewnienie bezpieczeństwa dla społeczności zamieszkujących obszary leśne.

Słowa kluczowe: ubóstwo, bezpieczeństwo żywnościowe, lasy, plemiona, ziemia, zrównoważony rozwój

1. Introduction

Sustainable development requires that ecosystems and the services that they provide are recognised as essential for human well-being and long term social

welfare. In operationalizing the concept, sustainable development becomes an amalgamation of various social, economic and environmental goals.

Measures of sustainable development include indicators of vulnerability among populations and their

ability to adapt to environmental changes such as climate change. Poverty alleviation is an important constituent of sustainable development, as it ensures that the essential needs of the current generation of the poor is met; while multiple indicators of poverty which include income, health, education and access to basic amenities, indicate the ability to cope with ecosystem stresses by vulnerable populations. Poverty alleviation becomes an imperative of sustainable development, so that resource conservation can be achieved in the long run.

In South Asia the proportion of the poor living in rural areas has not been declining rapidly enough, despite urbanization and experiences of high economic and even agricultural growth in certain cases (IFAD, 2011). For countries such as India, the failure of per capita GDP figures in representing poverty reduction (or otherwise) among specific sub populations is a matter of concern. A review of the progress on MDGs (UN, 2006) found *clear signs of hope* for meeting these, alongside reasons for serious concern for disparities that were found to continue to exist both between and within countries.

In terms of hunger and malnutrition, India is home to 28% of the world's hungry population, and ranks 67th in the Global Hunger Index among 119 countries (IFPRI, 2010), although it is the world's second fastest growing economy. Data from the National Family Health Survey (2005-06) found 45% children underweight (IIPS and Macro International, 2007), while specific sub groups within the population are found to be worse-off with the proportion of underweight children crossing the 50% mark among tribals (Dasgupta and Thorat, 2009; IFAD, 2011). In view of the persistent concerns with poverty alleviation and food security, the Government of India envisages providing a legal guarantee of protection from hunger and food deprivation to the entire population by enacting a national legislation (NFSA, 2011).

Forest and land eco-systems contribute to human well-being through various provisioning regulating, cultural and life-supporting services which they provide (MEA, 2005). The tribal population is found mostly in the forested regions of the country and the focus of the current paper is on these forest dwellers¹. There are large numbers of such forest dwellers in India the majority of who reside in states with poverty levels well above the national average. Data reveals that tribal communities, particularly in rural areas, are easily amongst the most deprived and disadvantaged, with the majority of such households falling below the poverty line in several states such as Bihar, Chattisgarh, Madhya Pradesh, Jharkhand, Maharashtra and Orissa (GOI, 2007-2012).

¹ The term forest dweller is used throughout this paper to indicate both forest inhabitants and forest adjacent inhabitants. As noted earlier, a substantial portion of forest dwellers are tribals.

These communities have been central to concerns and debates over forest management in recent years. Literature on forestry sector policy initiatives such as Social Forestry and Joint Forest Management indicates that while these have sought to address livelihood concerns, the outcomes have been mixed; while forests may be improving under state-initiated, participatory programmes, forest dwellers livelihoods have not improved uniformly across the country. A range of options have emerged, from viewing forest dwellers as central to any sustainable management programme for forests to the requirement for differentiated policy by type of forest, and further that forest conservation requires that forest dwellers are made less dependent on forests (Agarwal and Yadama, 1997; Gadgil, 2007; Ramnath, 2008; Rangarajan, 2005).

It is argued that over time the rights of tribals over their traditional land holdings have gradually been extinguished leading to insecurity of tenure and fear of eviction (Eighth Report, 2008). Developmental pressures on land availability and the expropriation of common property lands has added to the challenges. Paradoxically, these communities are caught between displacement threats for reasons of forest conservation and displacement which arises from development initiatives such as construction of dams and mining industry. A lack of integrating livelihoods into regeneration programmes for forests has persisted. Little convergence across developmental schemes has been achieved for forest dwellers, due to restrictive legal provisions in forestry laws. As a result communities have been left out of the formal sector employment and processes of economic growth while displacement and migration of tribals has continued, leading to hardships for many, who have added to the numbers of the *informal sector* and the urban poor, lacking in access to formal sources of credit and alternative means of income generation (GOI, 2007-2012).

The inadequacy of the existing institutional structure in addressing the increasing marginalisation of scheduled tribes and other forest dwellers, also led to a demand for reforms culminating in the passing of a legislation (FRA, 2006), that seeks to restore rights to forest dependent households². An equity or rights-based perspective to human wellbeing prioritises principles of justice as more important than

² There are 2 main sets of rights to be gained in the FRA. These can be classified as (a) land rights (private and/or communal) including for past illegal eviction/ displacement and (b) community rights including collective management of common (or community) forest resources; rights over common property resources such as produce of water bodies; grazing rights (for both settled and nomadic communities); rights over *habitat* for Primitive Tribal Groups (PTGs); other customary rights and usufruct ('ownership') rights over Non Timber Forest Products (NTFPs). The latter could be in the nature of either community or individual rights.

utilitarian or instrumental arguments and thereby seeks to support and empower the poor. An important aspect of the Act is in establishing tenurial security for households on land cultivated over generations by these households (more than 75 years)³.

The paper analyses the determinants of poverty in the specific context of poverty alleviation and food security for populations residing in forested areas. It explores what are the determinants for ensuring food security which is a key marker of the presence/lack of vulnerability among the tribal poor⁴. A specific focus is on the entitlement to land, that has been a part of the traditional livelihoods of forest dwellers. The poverty and land access issues are analysed using field data collected through a survey of 22 villages spread over three states in India (nine in West Bengal, six in Andhra Pradesh and seven in Orissa). Villages were sampled purposively from 14 districts to reflect a range of agro climatic conditions. A total of 459 forest households were interviewed in a primary survey.

The paper is organised as follows. Section II details the poverty and natural resource dependency issues for tribal communities in the current context of the Indian economy, focussing on the role of land in poverty alleviation. Section III describes the sampling and methodology of the study. Section IV presents findings on key markers of poverty and forest resource use and Section V discusses the results from an econometric model probing food security and its implications for access to land in a poverty alleviation strategy.

2. Poverty and natural resource dependency among tribal population

This section describes the issues of poverty and natural resource dependency, in particular for land, amongst forest dwelling tribal populations. The empirical analysis focuses on three states: Andhra Pradesh, Orissa and West Bengal. Economic markers in the post reform period reveal economic growth in these states. However, disparities clearly emerge when development indicators in these states are disaggregated by social categories. Studies have also established that nearly 50% of children in Orissa and West Bengal are underweight, with efforts at reducing disparities in health outcomes remaining ineffective for the most part (Pathak and Singh,

2011; Gragnolati et.al, 2005); with reductions being particularly slow for tribal populations whose food consumption is dependent on the vagaries of nature and is characterised by deprivation for the major part of the year (GOI, 2002-2007). Map 1 shows the proportion of population below the poverty line in different states across India while Map 2 provides the proportion of poverty among rural tribal population in these states. It is seen that states with high tribal populations account majorly for the average levels of poverty seen in a state. A high correlation is found between the two.

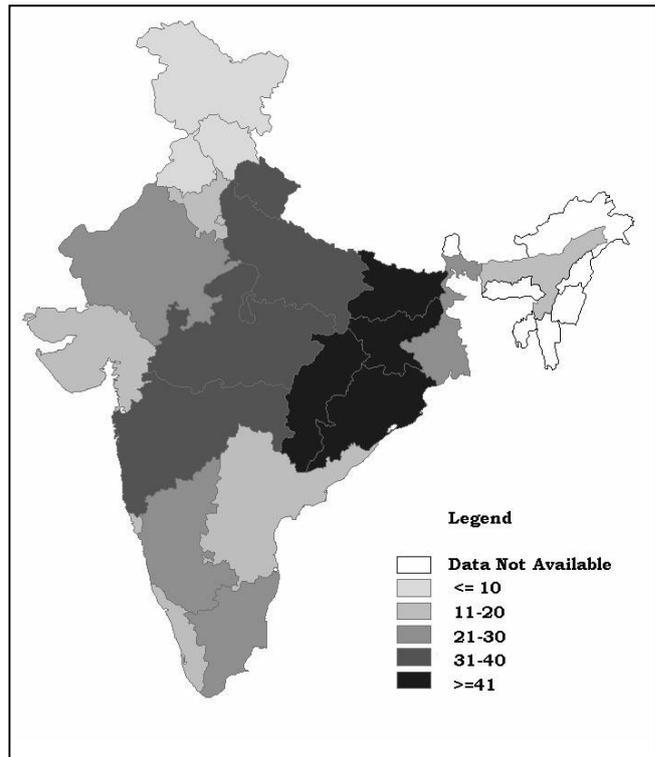


Figure 1. Percentage of Population Below Poverty Line in Indian States (2004-05).

In India, Scheduled Castes (SCs) and Scheduled Tribes (STs) and in some cases the Other Backward Castes (OBCs) are considered as socially disadvantaged groups, which have a higher probability of living under adverse conditions and poverty (Sen, Gang and Myeong-Su, 2002; Nayar, 2007). The 11th Plan document (GOI, 2007-2012) notes that *a major weakness in the economy is that the growth is not perceived as being sufficiently inclusive for many groups, especially SCs, STs, and minorities; the lack of inclusiveness is borne out by data on several dimensions of performance.*

The tribal population of the country was 8.2 percent of the total population, as per the 2001 Census, indicating a growth rate of a little less than 25 percent in absolute numbers over the period 1991-2001. Poverty among STs increased, primarily in rural areas, unlike any other social group during this period. The absolute numbers of poor have in fact increased in several states over the same peri-

³ As always, the success of this enabling legislation will depend on its implementation. As noted elsewhere (Bromley, 2008), formalisation of tenure to be effective in realising its objectives, requires a coherent legal system which can enforce the rights that have been granted.

⁴ Food security is defined as a situation that exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (State of Food Insecurity, 2001).

od, including *Orissa* which is one of the states selected for the study. It is of particular significance to the present study that the 11th Plan also notes that the ST population suffers from multiple deprivations, particularly in terms of inequitable asset ownership such as land. Their health, nutrition and education indicators are much worse than the rest of the population, indicating higher relative deprivation. In rural India, data for 2004-05 clearly reveals a high degree of correspondence between high levels of poverty among SCs, STs and overall poverty. Even states which have low overall poverty levels, such as *Gujarat, Andhra Pradesh and Kerala* also report high poverty levels for STs. Andhra Pradesh is selected for this study. *West Bengal*, another state selected for the study, shows high poverty for SCs as well. In the three states that form the basis for the current analysis, Orissa, West Bengal and Andhra Pradesh, rural poverty among STs is higher than the state average by 30 percent, 14 percent and 19 percent respectively. As Dasgupta (1993) had noted, environmental economics and the economics of destitution are tied to each other in an intricate web. This has become a stark reality in the case of forest dwellers in India, who have increasingly faced relative destitution while the economy has flourished in an aggregative sense.

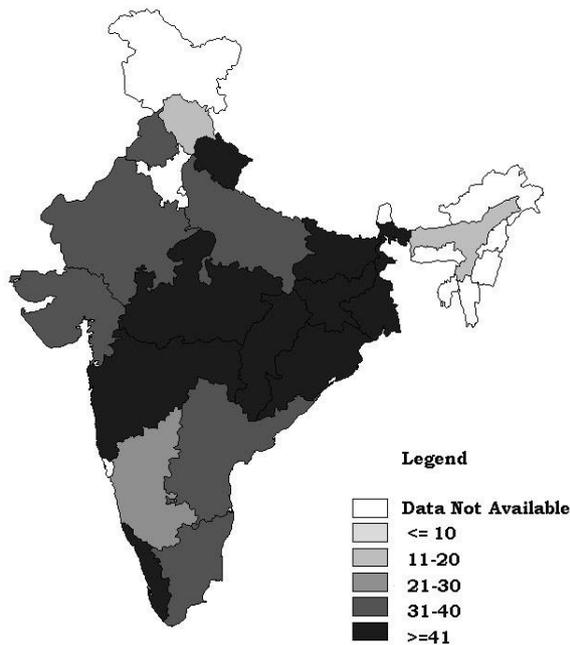


Figure 2. Percentage of Rural Tribal Population Below Poverty Line in Indian States (2004-05).

Land in Poverty Alleviation

It is often argued that rural poverty is exacerbated by highly unequal distribution of land and inequitable access to water and other agricultural inputs. Empirically the relationship between tenurial security and enhanced agricultural productivity is not a

settled one (Bromley, 2008; Feder and Onchan, 1987; World Development Report, 2006). However, in the context of poverty alleviation the question is whether access to land at the level of small holder or subsistence farming can make a difference? The question gathers relevance in the current context of high economic growth alongside the persistence of frustratingly high levels of poverty in rural areas with regard to specific communities.

At the macro level, the poverty reduction effects of agricultural growth in India have been established (Ravallion and Datt, 1996; Rao, 2005). However, a certain amount of skepticism is often expressed with respect to the relevance and sustainability of small holder farming in rural livelihoods, particularly in view of the growing importance of the non-farm sector. It can be argued that the diversification of rural portfolios arises as much from market based opportunities as from adverse circumstances, the withdrawal of the state from supportive agricultural programs and a lack of options for sustaining oneself (Eriksen and Silva, 2009; Mukhopadhyay, 2009).

As researchers have noted, poverty reduction in urban areas proceeds more slowly than in rural areas (Ravallion et al., 2007) hence rural-urban migration or urbanization by itself cannot offer a panacea either under the current circumstances. Recent developments that have occurred with regard to improvements in communications, micro-credit institutions and the availability of small scale farm technology may instead have more potential to contribute to the livelihoods of forest dwellers, if their access to land improves (Biggs et al., 2011; WDR, 2008).

While small holder farming does face multiple challenges, studies have noted the continuing relevance of access to land and agriculture in reducing vulnerability and food insecurity by virtue of important resilience factors associated with small holder agriculture, and its relevance for pro-poor growth (IFAD, 2011; Osbahr et al, 2010). Further, it is apprehended that climatic change impacts can lead to the loss of forest resources, adversely affecting forest-dependent people who live in extreme poverty, such as through reduced NTFP availability (IPCC, 2007). The importance of access to arable land and specific institutional interventions in arresting immiserization elsewhere has also been studied (Bromley, 2005).

Theory on common property resources (CPRs) has been a major basis for understanding livelihoods and income generation for forest dwellers and rural spaces. Theory on natural resource management in developing economies has been intricately linked to the development of theory on the commons (Baland and Plateau, 1996, 2003; Dasgupta, 1993; Ostrom, 1990, 2001, 2005). In the *de jure* sense, today, forestlands in India are largely owned by the government. However, in the *de facto* sense, various

access and use rights have existed and cultivation is an important part of the traditional pattern of livelihoods of many forest dwelling communities encompassing a range of private and/or communal arrangements for cultivation (Chopra and Dasgupta, 2008).

Concerns of efficiency in resource management, including co-operation, distribution, enforcement and long run sustainability have been central to this literature. The tradition has been one of focussing on property rights in the discourse on economic approaches for efficiency in managing forestry and land based institutions; this, in turn, leads to an understanding of the evolution of institutions on the basis of the rules that promote the development of institutions. There have been substantial theoretical developments over the last three decades with the use of game theory by economists and political scientists, demonstrating that co-operative outcomes can be sustained through socially constructed incentives. A rationale can be created for the argument that granting tenurial rights for cultivation of land to forest dwellers can be a sustainable option to alleviate poverty without leading to adverse environmental and ecological outcomes.

3. Sampling and Methods

The key research question raised here is whether access to natural resource, such as land, remains important for ensuring food security and poverty alleviation for marginal and small cultivators belonging to specific community of tribals in a high growth economy. Empirical evidence on this was gathered through a survey of selected households in 22 villages spread over three states.

Sampling

The target population for this study is drawn from forest dwellers residing in different regions of the forested parts of the three states. The sampling is done at three levels: regions with tribal presence in forested areas, hamlets/villages and households. As mentioned earlier, the three states selected for the study are West Bengal, Orissa and AP.

Regions: For each state, regional level agro-climatic criteria are used to stratify the sample. This criterion embodies in itself variations in type of forest cover, the nature of resource dependency, and the administrative basis for historically granting rights to forest dwellers. The regions cover hills and plateaus, plains, and coastal areas. Subsequently, study sites were selected through purposive sampling, to ensure representation of the scenarios for forest dependency, including those where rights of use by forest dwellers may have changed over time. A representative sample of such scenarios for instance, includes forests which have become parts of national parks and sanctuaries, protected forests and forests where there has been displacement of dwell-

ers due to developmental projects such as hydel power and highway construction.

Village Cluster / Hamlet level Sampling: Hamlets at each of the study sites were identified subsequently and a few were selected using random sampling method. The target was to ensure a minimum of at least one hamlet covering the forest dependency and use criteria in the selected sites.

Household Sampling: Having selected hamlets for the research, key informant interviews were used to develop a subjective wealth ranking exercise on the basis of which all the households were stratified. The selection of individual households was done through proportionate random sampling. Table 1 presents details of the selected sample for the study.

Table 1. Selected Districts, Number of Villages and Households in the Sample.

State	Districts	Villages	Households
West Bengal	West Midnapore, Jalpaiguri, Darjeeling, Bankura, Purulia	9	176
Orissa	Deogarh, Nuapada, Bargarh, Sambalpur	7	144
Andhra Pradesh	Adilabad, Visakha, West Godavari, East Godavari, Kurnool	6	139

Methodology

Data collection took place over a period of six months in the three states. The quantitative data was gathered at both the household and the village level by administering two interview schedules. The village schedule was for key informant interviews while the household one was administered to all the households selected in the sample for the study.

The data has been analysed at two levels. At first, data was analysed using simple analytics and the reported information. Subsequently, an applied econometric technique was used to gain further insights on whether and how improving access to land impacts food security. The model analyses the determinants of food security amongst forest dwellers.

Econometric Model: A food security function is estimated using the Heckman selection technique, fitting a regression model with selection by using full information maximum likelihood estimation. This technique helps us overcome the problem of not being able to observe food security (from land cultivated) for those who do not cultivate land in the survey period in the sample. The model is based on the logic that certain factors determine whether a household cultivates land, perhaps a mix of factors within the household's choice set and those which are given to the household. For instance, the household may consider that the returns to being in alternative occupation are higher than the returns from

cultivation. Thus, the decision to cultivate is not a random one, and it would be incorrect to use the Ordinary Least Squares method. Food security is observable only for those who are actually in cultivation. For the others, this variable is not observable, although there are underlying decision-making processes based on the returns from cultivation. Meaningful solutions to such models can be found if there are some variables that affect the chances for observation (of being a cultivator household) but not the final outcome (of having food security or the lack of it). Alternatively put, the extent of food security is observed only for those for whom the production of food at home exceeds the alternative return from other occupation. In econometric terms, this would mean that the variable, months of food security from own production, is truncated.

The model is formulated in terms of two equations: a selection equation – a probit estimation (takes a value of 1 if a household is a cultivator household, 0 otherwise) to explain the decision of whether to go in for own cultivation or not, and a regression equation to explain the months of food security that are obtained, observable only for those for whom the selection equation takes a value of 1.

Model: Selection equation: $z_i^* = w_i \gamma + u_i$; $z_i = 1$ if $z_i^* > 0$ and 0 otherwise

Regression model: $y_i = x_i \beta + \varepsilon_i$; observed only if $z_i = 1$

$(u_i, \varepsilon_i) \sim$ bivariate normal $[0, 0, 1, \sigma_\varepsilon, \rho]$ where ρ is the correlation between ε_i and u_i ⁵.

4. Key Insights from Data Analysis

The primary survey conducted among the households in the selected villages provides data on several socio-economic variables affecting their access to a sustainable livelihood and the ability to cope with risks associated with it. The options available to households for making a living, and, the ability of households in coping with the risks that they face while making a living are important factors determining vulnerability to poverty. Some preliminary insights on key variables that serve as markers for assessing vulnerability to poverty among the sampled households are presented here.

Village Characteristics

The size of the villages is typically small for India, with most villages having less than 100 households. While in Andhra and Orissa, tribal households dominate, in West Bengal there are some lower caste households included as well. A subjective

wealth ranking method was developed for each village in the dataset. Although Andhra Pradesh has the highest *per capita* net state domestic product, in the selected tribal study villages, the proportion of very poor households turns out to be the highest; higher than Orissa and West Bengal.

These villages have poor access to infrastructure in general although slight variations are seen in the three states. In terms of a basic access variable, 20 percent of the selected villages in two states do not have access to an all-weather / metalled road, and in West Bengal 45 % do not have such access. In terms of another basic infrastructure variable, primary schools are also not available in all the villages. It is prudent to remember that poor access to infrastructure has implications for the ability to sustain livelihoods and in building capacity to handle threats to livelihoods in terms of human capital investment and access to alternative sources of livelihood. It is noted that 50 percent of the population is illiterate while another 25 percent is educated only till the primary schooling level.

Income Poverty

It is found that 45 percent of the households have *per capita* income (and *per capita* expenditure) below 7.95 U.S. \$ per month. This corresponds to the cut-offs (INR 356) defined for a poverty line for rural areas as per current norms of the Planning Commission, Government of India. Application of more recent recommendations (Saxena Committee Report July, 2009) implies that approximately 75 percent of the households are poor, with monthly *per capita* income levels below 15.64 US \$ (INR, 700). This is an indicator of the stark levels of poverty prevalent amongst this section of the population. Alternatively, considering food security as an indicator of vulnerability, 25 percent households have food security for just 4.5 months, 50 percent for 7.5 months and the average across the entire sample in the three states is about seven months in the year.

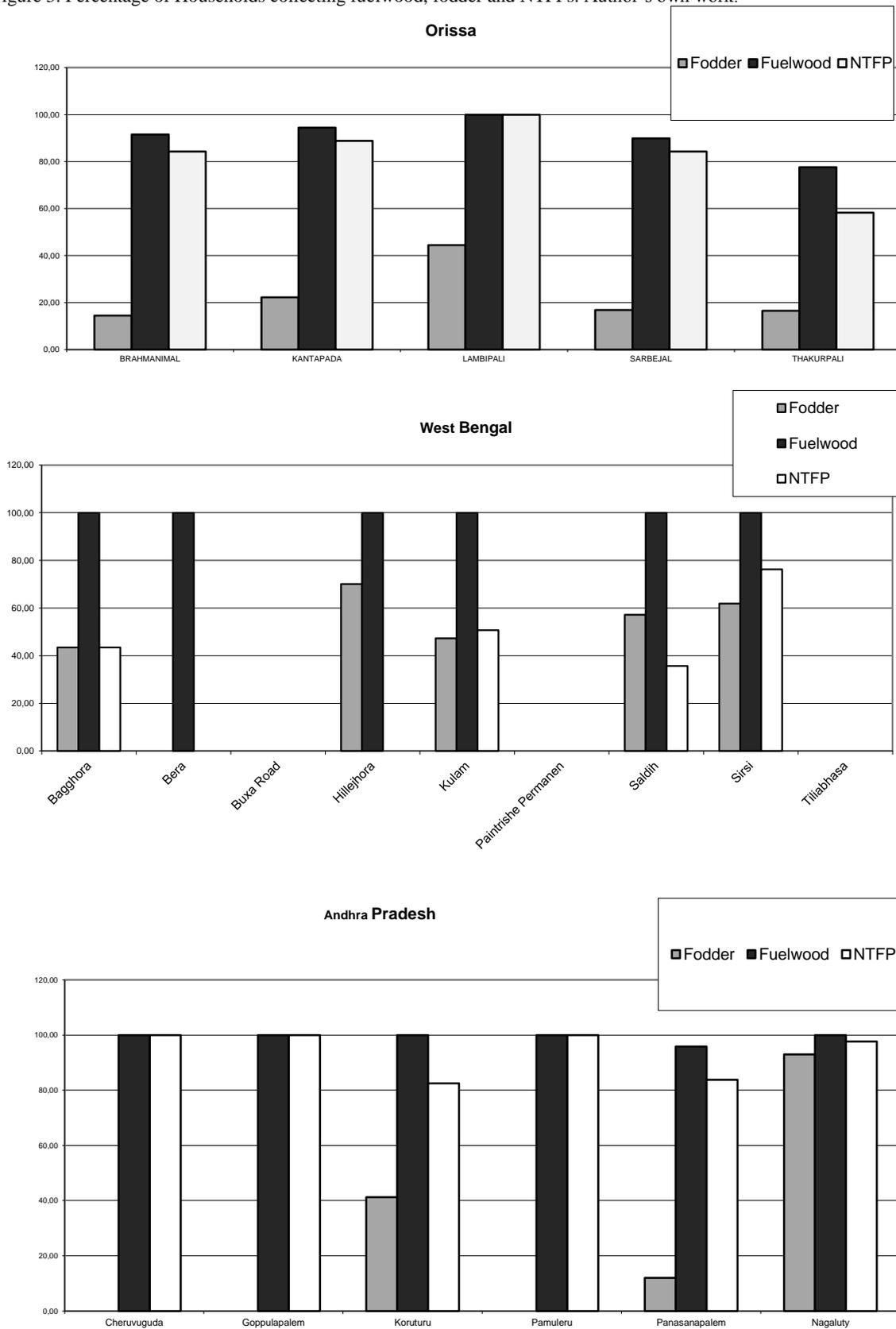
Land, Forests and Access to Credit

Land cultivated

There has been considerable debate over the actual amount of land that is cultivated, often without legal title. In all 262 households out of the total sample of 459 households provided data on the amount of land occupied individually without title. 75 percent households reported having cultivated 3 acres or less, of which 25 percent of the households reported cultivation on a mere 0.6 acres or less. The overall average for the sample is 2.12 acres. Thus, these households are essentially marginal and small cultivators. The relationship between growth and experiences with poverty linked to land access in other countries may it seems have some relevance for India as well.

⁵ It follows that standard regression techniques would yield biased estimates when $\rho \neq 0$. Heckman provides consistent, asymptotically efficient estimates for all the parameters in such a model. In actual estimation, a likelihood ratio test of the independence of these equations (testing for $\rho = 0$) with the corresponding chi-squared statistic is done.

Figure 3. Percentage of Households collecting fuelwood, fodder and NTFPs. Author's own work.



Forest based livelihood

Many studies have established that forest ecosystems provide a host of provisioning services including fuelwood, fodder and NTFPs for communities dependent on them in India⁶. 75 percent of the households in the sample earned cash from forest products, which however constituted only 25 percent or less of the household monthly income. The relevance of the forests in supporting livelihoods in terms of fuelwood (in the absence of other forms of energy for cooking, heating and lighting), fodder collection and grazing for livestock and collection of NTFP for self-consumption is quite substantial. In terms of occupational profiles, while only 0.10 % household heads report collection activity from forests to be their primary occupation, for another 0.11 % households, collections constitute the main secondary occupation for adult earning members. Considering direct collections from forests, the proportion of households engaging in fuelwood collection is expectedly high across all the three states, while the proportion of households collecting NTFPs is much higher in Andhra, followed by Orissa and relatively much less in West Bengal (figure 3).

Village Access

A village facilities score was attempted using principal component analysis. This variable sought to capture the *access* aspect of households by taking into account the facilities available to a village. The five facilities that were considered include availability of an all weather road, bus stop, primary health centre, primary school and public distribution system (PDS) outlet in the village. A village got a score of one for each facility that it had and 0 for those which it did not. Subsequently a principal components analysis was done and a score was thereby generated, as a proxy for capturing the access effect. An overall low score (0.5 and below) for all three states is indicative of the fact that for most villages the reach of developmental programmes and access to facilities is limited. However, the availability of an all weather road is positively correlated (5% level of significance) with the number of households collecting NTFPs, indicating the importance of income generation from collections where access to neighbouring markets may be available.

Access to Credit

There is a significant and positive relationship between (a) borrowings from banks or self-help groups (as against private money lenders) and the income level of the household and (b) total amount of land cultivated and the amount of loan obtained. There is also a significant positive correlation be-

tween the loan amount and the months of food security that a household is able to enjoy. However, the correlation between amount of land cultivated and food security is lower, although significant. Formal sources of borrowing are linked to land holdings and incomes, while private lenders meet the credit needs of the more disadvantaged in terms of assets. There also emerges a similarity with the argument being made at the national level for Indian agriculture, that credit is a major constraining factor for growth in agricultural productivity and incomes.

Table 2. Summary Statistics for Variables used in Model Estimation. Author's own work.

Variable	Number of Observations	Mean Value
Age of head (years)	459	44.54
Agricultural land cultivated (acres)	347	3.04
Food security (number of months)	404	7.43
Total borrowings (INR)	246	5362.44
Share of forest based income in monthly household income (%)	250	17.14
Education (0=illiterate, 1=literate, 2=primary, 3= higher)	459	0.92
Primary occupation (0=cultivation, 1=labour, 2=collection, 3=other)	459	0.86
Monthly per capita expenditure (INR)	433	403.09
Inverse dependency ratio (number of : earners/dependents)	390	1.35
Per capita monthly income (INR)	432	612.77

5. Inferences on Food Security: Results and Discussion

The dependent variable in the food security estimation is the number of months of food security that a household reports from its own cultivation. For the selection (or cultivation) equation the explanatory variables used are: age of head of household, education of head of household⁷, *per capita* monthly income, share of forest based income in total household income. For the regression equation (or food security) the explanatory variables used are amount of borrowings, land cultivated, whether head of household is literate, and the inverse of the

⁶ There is a large body of literature on the contribution of forests to livelihoods. This is not reported here due to space constraints.

⁷ The educational attainment of the head of the household is converted into a categorical variable for ease of estimation and interpretation. On average, the heads of household in the sample are not even literate, thereby belonging to one of the most vulnerable groups in society as per this indicator.

dependency ratio⁸. Table 2 presents some summary statistics on the variables used in the estimation.

Table 3 presents the results obtained from the estimation of the Heckman selection model. The results indicate that food security improves if: the access to credit is higher; the extent of land cultivated is higher; the level of literacy is greater; and if household dependency ratio is lower. Also, a household is more likely to be primarily a cultivator household if the age of the head of the household is higher; the level of education (below primary) is lower; the share of forest based income in total income is higher; and the per capita income is lower.

Table 3. Results from Heckman Selection Model for Determinants of Food Security. Author's own work.

Wald Chi2(4) = 5.75 ; Prob > chi2	0.00
LR Test of Independent Equations (rejects null hypothesis rho=0) ; Chi2(1)=18.91 Prob>Chi2	0.00
Regression model dependent variable:	Coefficient Values
Number of Months of Food Security	
Independent Variables:	
Total Debt	0.000023
Educational level (dummy for illiteracy)	-1.17
Inverse dependency ratio	0.58
Land Cultivated	0.244
Selection Equation:	
Educational level (dummy for primary and below)	0.42
Share of forest based income	0.014
Monthly per capita income	-0.002
Age of Head	0.013
Andhra Pradesh state dummy	significant
Orissa state dummy	insignificant

Note: Unless otherwise mentioned, co-efficient values are significant at 95 percent level of confidence.

While these results are intuitively appealing as they confirm to expectations, it is worthwhile to dwell on a few inferences that can be drawn from these results in the specific context of the study. The results, on which households are likely to be cultivator households in our specific context, are clearly vulnerability markers such as illiteracy and low *per capita* income. Further, an alternative formulation, replacing share of forest based income instead of the inverse of the dependency ratio in the food security equation produces a negative, significant relationship although the debt variable becomes weaker. The reason being that there is a significant negative correlation between the proportions of

forest based income and the amount of borrowings by a household. Food security, therefore, is likely to be lower among those who depend more on forest based collections for cash income. This, despite the fact, that there is a higher probability of such households being cultivator-households. The reasoning being that while the amount of land available is critical, the amount of credit that the household has access to is important for determining the food security position for the household⁹.

Access to land and access to credit emerge as key determinants in improving the poverty situation in forest dweller households. The poorest among these households are likely to have lower access to credit and a higher share of forest dependency in meeting their livelihood needs. The extent of dependency on forests is mediated by the amount of land available and the access to credit, for achieving food security. Other developmental variables do not play a significant role.

Conclusion

It is obvious that tackling poverty remains a huge challenge for the economy with regard to tribal populations, quite irrespective of the economic growth experienced at the aggregative level in the recent past. High levels of poverty (45 to 75 % households), forest dependency (75 % households), lack of food security (over 5 months annually) and lack of access to infrastructure and basic facilities such as schooling and outlets for public distribution of foodgrains persists amongst these households. Results from the data analysis indicate that access to land, access to forest resources and access to credit are important in determining food security for forest dwellers. In terms of direct provisioning, fodder, fuelwood and collections of NTFPs continue to play a significant role in income generation and household consumption, particularly for the poorest households amongst the sampled ones. While the extent of land cultivated is relatively minor at the individual household level, it has a positive relationship with ensuring household level food security. It is also interesting to note the existence of an inverse relationship between forest dependency and access to land and credit.

Food security is a primary marker for policy makers seeking to address poverty alleviation Institutional reform that aims at providing land for cultivation and tenurial security for small holder cultivation thus continues to have significant relevance for achieving poverty alleviation. Access to land and credit for cultivation continue to be primary determinants of food security for these communities where the processes of macro-economic growth

⁸ Certain other variables found to be important in other studies could not be used meaningfully in the regression due to econometric problems such as highly significant correlations across variables. Social category of the household (whether SC/ST) for instance had very little variation in the dataset.

⁹ Note that even if credit is used for non-agricultural purposes, at the household level it could play a role in determining the amount of self-consumption that a household can opt for.

have not as yet demonstrated discernible impacts on poverty alleviation.

Thus, there seems to be multiple strategies that can be advocated. On one hand, institutional reform can aim to secure individual and community rights to access and utilization of forest ecosystem services, help in consolidating incomes and consumption of forest based products, lead the way for revamping of NTFP regulation, and protect against displacement and disruption of livelihoods due to activities such as mining. On the other hand, policies that secure access to land and credit can stop further immiserisation and food security in particular. The sustainability of the process will no doubt depend upon the extent to which the communities are able to increasingly merge with the formal sector, with the help of improved economic positions and access to education or skill development. Sustainable development is thus best served when poverty alleviation is addressed alongside conservation of precious forest resources.

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