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Forest depletion and people's vulnerability: A study of Sorada range in Ganjam, Odisha

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Abstract
Vulnerability is the exposure of groups of people or individuals to stress, disruptions in livelihoods, loss of assets and income and loss of security and life, rather than to specific agents of disaster, such as floods, windstorms or technological hazards. Degradation of forest takes the local communities to various states of uncertainty, and render them vulnerable to a number of associated problems. Vulnerability such as climate vulnerability, product vulnerability, species vulnerability, land use vulnerability, livelihood vulnerability and health vulnerability are associated with the loss of forests. The paper focuses on to the degree of influence of forest depletion on socioeconomic vulnerability of people? An attempt is made here to assess this influence.
The problem raised here is examined through a case study of 107 households who have settled in 5 tribal villages (Ramanbadi, Rubangi, Gambhariguda, Balasi and Sanaganda) of Sorada Forest Range, Ganjam district, Orissa. In total they collect 28 types of products from the forest, out of which 9 are common to all villages. Dimensions of disruption is measured through decline in collection of the 9 forest products over last 5 and 10 years.
Since socioeconomic vulnerability is not a directly quantifiable and measureable phenomenon, one of its proxy indicators, namely inadequate days of food is chosen for the study. Three surrogates of forest loss such as increase in collection time, increase in travel distance and decrease in forest income are used to measure the influence of forest depletion on vulnerability. Both simple and general regression models provide the strong evidence to the conclusion that the forest depletion positively influences vulnerability in the region, beyond a minimum. People try to avoid this vulnerability at the cost of forest itself, which calls for policy and institutional innovation.

Keywords: forest loss, vulnerability, travel distance, food inadequacy, collection time

1. Introduction

Forests represent a complex renewable natural capital (Anderson and Bojo, 1992) [3] and constitute the major component of environmental resource base of the economy. It serves the humanity directly or indirectly by way of providing goods such as food, water, fuel, fodder, fertilizer, fiber and medicine and plethora of services (Pearce and Warford, 1992, Gutierrez, 1992, Reid and Miller, 1993) [7]. The impact of forest loss has been with us for over a long period of time. Deforestation causes soil erosion and land degradation. From a land without vegetative cover, rain removes nutrients by washing away the top layer of the soil and by leaching nutrients deep into subsoil unavailable to plant (Karapagam, 1993). Loss of forests threatens agricultural ecosystems of hill side. Apart from contributing to global warming, it destabilizes the microclimate. Loss of forest degrade environment and creates chaotic situation.

Loss of forest affects the very basis of human life in many ways. It takes the local communities to various states of uncertainty and renders them to a number of associated problems. Vulnerabilities such as climate vulnerability, product vulnerability, species vulnerability, land use vulnerability, livelihood vulnerability and health vulnerability are associated with the loss of forests (Adger, 1996 and 1999, Dwivedi, 1993, Frankhauser & Tol, 1999 and 2001) [2, 4, 5]. This paper addresses the issues relating to the degree of influence of forest depletion on socioeconomic vulnerability of people of Soroda range of Ganjam District of Odisha.

The specific objectives are to assess and estimate the impact of forest loss on socioeconomic vulnerability of the people. *Firstly*, an attempt is made to develop a framework for measuring the impact of forest loss on socioeconomic vulnerability of people by developing appropriate surrogates of the relevant processes for the study region of Ganjam district in Odisha. *Secondly*, the paper focuses on to estimate the influence of different measures of forest depletion on alternative dimensions of socioeconomic vulnerability in the study region.

The problem of this research study is pursued in the Ganjam district of Odisha, India. For several reasons, the region represents a slice of the Indian socioeconomic life. Geographically, the district contains coastal, plain and hilly tracts. Typical villages and towns exist here. Ganjam has the highest population among the 30 districts of Orissa. Its population of 35.29 lakhs. About 90,000 tribal people live in the district. The district's economy is predominately based on agriculture and forests. Commercial and industrial activities are gaining ground.

The forest area of the district (Ghumusar North and South Forest Divisions) has declined from 3216 sq. km in 1968-69 to 2664 sq. km. in 1992-93. Even though the process of forest loss is more than a century old, there has been unprecedented depletion during the last two decades. In late 1980's it was recognized that forest degradation in Ganjam district has brought the economic-ecologic systems of villages to a perilous state. In response to this, the Government of Orissa imposed ban on commercial forest exploitation in 1990 (GOO, 2001) [6]. It was intended that the move will preserve and protect the socio-cultural and environmental milieu of the district. The state has experimented social and community forestry in a large scale. The study problem thus is concerned with finding explanations for and measurement of the nature and extent of the socio-economic vulnerability due to forest depletion in Ganjam district. The field work for the study has been done in the Ghumusar South Forest Division, which has been bifurcated in 2004 into two divisions after the survey. Thus the district has three forest divisions now, namely Ghumusar North, Ghumusar South and Berhampur. Of these, the field survey has been done in the Ghumsar South forest division.

2. Materials and Methods

2.1. Materials

The paper involves processing of primary and secondary materials. Under secondary materials, the broader concepts of vulnerability and forest depletion pursued through the relevant literature collected from the libraries of different national institutes and office of the Conservator of Forests, Berhampur. The quantitative base of the study is derived from a field survey. All relevant information about the villages are collected from the offices of the different Blocks, Panchayats, Tehasils, Forest Ranges, Forest Divisions and NGOs.

The central theme of the problem is addressed through a large amount of primary information collected from 107 sample households spreading over 5 villages in the study area. The method of purposive sampling was used for village selection. After several rounds of discussion with a wide set of field personnel, the villages were selected on the basis of their interaction with the nearby forests, and the state of the settlement and its natural resource base.. After preliminary survey of all the chosen villages, a questionnaire-cum-schedule was used. Then a census approach was followed to collect the data from all the households of each of the villages. During the process of data collection information on the particulars of the family, property, income, output of forest products, hardships due to forest depletion, and indicators of hardships, impact of forest loss, coping strategy, loss of employment due to forest degradation, distress sale of crops and property, migration, and benefits form forest development, etc are collected and recorded. Then through secondary and territory tabulation, a series of analysis tables were filtered for interpretation and inference. The information on forest products were maintained in local measures. Conversion factors were developed by physical weighing of most of the items to make quantitative analysis with standardized data. The prices of the different commodities and items were ascertained from the different villages. Later, after thorough discussion with the people of the villages the ex.-village price set was finalised. The local rates and conversion factors are used to construct the price set at standard units of weights and measures (Panda, 2006) [8].

Forest loss and vulnerability are not directly observable at the household level. Therefore, a number of proxy indicators have been developed. Attempts have been made to measure socioeconomic vulnerability from the household information on poverty, unemployment, starvation and inadequate food. Similarly forest depletion has been observed through the increase in travel cost or effort for collection of forest products and decrease in income from forest related activities. The information on all these have been collected for the year 2002-2003, five and ten years before by using memory recall method. In order to evaluate the impact of forest depletion, a composite Likert scaling technique has been used, which is a simple data reduction device to construct a summary measure.

Several types of regression models are estimated for a variety of dependent variables. The dependent and independent variables used in the models are defined and the output of the estimated regression models are interpreted and analysed. Broadly the general regression model is estimated in this study.

The general linear regression models estimated in this study can be explained through the following equation:

$$y_i = \alpha + \sum_{j=1}^{K} \beta_j \; x_{ij} + e_i$$

x_{ij} is the value of the *jth* explanatory variable of the *i*th household. β_j is the slope coefficient with respect to the *jth* explanatory variable. There are K number of dependent variables, which as a set differ from model to model in terms of number and type of variables. The regression models use OLS estimators.

2.2 The study area

The study was carried out in 5 appropriate villages such as Ramnabadi, Rubangi, Ghambariguda, Balasi and Sanaganda of Sorada forest range, Ghumusar South forest division of Ganjam district of Orissa (Fig. 1). The people’s dependency on forest is the basis of selection of the villages for the study. The sample villages Ramnabadi, Rubangi, Ghambariguda are access to the nearby Podakhol forest and the rest two villages are accessable to Pipalaponka forest.

Ramanabadi occurs in the Sorada forest block of Ganjam district of South Orissa in India, 25 kilometers North of the Sorada town. The village is bounded by Pondakhol Reserve forest in the east which stretches towards West. The village Rubangi is to the North and Nuagan to the South. The village is situated on a small compact patch on the foothills of Pondakhol. The settlement area has an inverted U shape. The houses are situated straight opposite to each other. All the houses are made of thatch grass. Only the village primary school is made of cement roof. The houses are neat and clean, looking spacious. Women use the Basti road for drying of Siali leaf collected from the forest. The people are cool and affable in temperament.

The hamlet *Rubangi* occurs on the way to Ramanabadi, 22 kilometers North of the Sorada town. It is located within the Pondakhol Reserve forest. Its existence is not many years old. The people are forest dwellers and have migrated to Rubangi from other places. The village consists of only 16 households. The settlement is spread over a small area. Each house is made of clay and bamboo, and thatched roof with no window looking outside. On an average a house has covered area of less than 180 sq.ft. One primary school is located on the way to Ramanabadi. One prominent geographical feature of the village is that a huge land opening or deep gorge has been formed near the settlement. The older people are of the view that it is growing bigger and deeper with time. As it is people approaching towards the Basti area people apprehend that they may have to evacuate the place again and settle elsewhere.

The village *Gambhariguda* is adjacent to Ramanabadi. It is a hamlet in Sorada forest block, 30 kilometers North of the Sorada town. The village is bounded by Pondakhol Reserve forest. It exists on a small compact patch of land on the foothills of a large mountain. About half of the households of the village have migrated since 2000 and at present there are only 18 families living in the hamlet.

Balasi and Sanaganda are situated in the neighbourhood of Ramanabadi, 18 kilometers away from the North of the Sorada town. The villages are surrounded by Piplapanka Reserve forest. Balasi occupies a small area. The settlement takes a T – shape. The houses stretch through two rows. Sanaganda, adjacent to Balasi, is larger in terms of area and households. The houses occur in two rows. A few other houses are scattered over the village area.

2.3 Model

Neither forest loss nor socioeconomic vulnerability is directly visible and quantitatively measurable. Surrogate and proxy variables are, therefore, developed based on the insights for analysis and inference. Obviously, multiple views are possible. Moreover, indicators vary between places and through time, and are not expected to move unidirectionally. The households of all villages may not be equally vulnerable to forecast depletion. Keeping all these in view an important indicator, such as *inadequate days of food* is chosen for analysis through regression models. The right approach to see the consequence of inadequate food is through the information on undernutrition. It is possible to get undernutrition data from a health-related survey with the help of medical experts. However, this has not been attempted in this study. Given the state of poverty and hunger, it is reasonable to expect that the people may be living with inadequate quantity of food for some days in a year. It is this information, which have been collected through this survey, from which the variable (INADOF) is derived.

2.4 Definition of variables

The variables constructed for analysis are defined in Table 1.

Table 1: Definition of variables.

Sl	Variables	Explanation of the variable
[1]	[2]	[3]
1	Hunger	No. of days of hunger per annum in a family
2	INADOF	No. of days of inadequate food per annum in a family
3	INCOLT	Sum of increase in collection time devoted by a household for each trip of the nine forest products* (hrs) over a period of 5 years.
4	INCTLD	Sum of increase in travel distance (kms.) in collection of each of the nine forest products over 5 years by a household
5	DINFOY	Decrease in income from forests calculated as the sum of the change in the value of the forest output of the nine forest products at current local prices over a period of 5 years for each household.
6	FASIZE	Family size (No. of members)
7	AGEHOH	Age of the head of the household (Years)
8	PROPTY	Sum of value of property such as land, house and other assets (Rs.) owned by the household.
9	PFYTTY	Proportion of forest income to annual stated family income.
10	FINCOM	Annual income of a family from the forest as stated by the head of the household in 2002-03 (Rs.).

Note: *The nine forest products are firewood, house wood, bamboo, thatch grass, mango, anla, siali leaf, honey and pithal root.

The variables include the proxies for forest loss and vulnerability, besides the socioeconomic dimensions of the sample. The observations for 107 sample households are noted village-wise, so as to estimate the models separately and for the entire sample.

2.5 Hypotheses

It is proposed to verify the following hypothetical propositions through this study.

Hyp. I. There occurs a minimum amount of vulnerability in a system characterised by overall poverty and backwardness.

Hyp. II. Socioeconomic vulnerability is an increasing function of forest depletion in the study region.

Hyp. III. There is a tendency on the part of the people to avoid vulnerability at the cost of the forests.

3. Results

Deforestation data in terms of area and quality are not only deceptive, but also are not helpful to develop a variable at the household level. Similarly forest offence, revenue and outturn data, while available in time series, are also not suitable for household cross-section analysis. Therefore, three indicators have been chosen as proxies of forest loss at the household level so as to estimate the coefficients of their influence on socioeconomic vulnerability. These three variables include increase in collection time (INCOLT), increase in travel distance (INCTLD) and decrease in forest income (DINFOY) (Table 1). These are identified as the surrogates of forest loss and are considered as explanatory variables in the vulnerability models. The descriptive statistics of increase in collection time (INCOLT) for all forest products are given in Appendix A. It is evident that the minimum increase in the hours spent for collection of forest products ranges between 8 to 14 hours in different sample villages, whereas the maximum ranges between 20 to 26 hours over a period of five years. The average increase in collection time is about 14 to 19 hours. In the entire sample, the average increase in collection time is about 17 hours. The CV varies in the range of 21 to 25%. This suggests that collection time for the forest products consistently affect the economy of all the households. The standard deviation of INCOLT is the highest in Ramanabadi village. It implies that increase in collection time varies to a larger extent and is a sign of uncertainty in availability of forest products.

The second surrogate of forest depletion relates to the increase in travel distance (INCTLD) to fetch the forest products. The descriptive statistics of INCTLD shows that over a period of 5 years the mean increase in distance ranges over 13 (Gambhariguda) to 21 km. (Balasi). In the entire sample on an average the people are covering about 18 km. more now in comparison to the situation before 5 years in order to collect the variety of forest products. The minimum distance coverage is 8 km in Ramnabadi and the maximum comes to 28 km in Rubangi. The maximum distance coverage by the villagers ranges between 18 km. and 28 km (Appendix A).

Decrease in forest income (DINFOY) is another proxy indicator of forest loss. The descriptive statistics of DINFOY shows that on an average, the earnings of a household from forests are reduced by Rs. 505 to Rs.1104 over a period of 5 years. The people of Ramnabadi are the worst sufferers among all the villages, as forest loss implies largest income loss to them. The maximum decline in income ranges from Rs 750 (Gambhariguda) to Rs 2000 (Ramnabadi). Erratic decline in collection of the some of the forest products and fluctuation in prices are responsible for high CV.

The descriptive statistics of the socioeconomic variables and other covariates such as FASIZE, AGEHOH, PROPTY, INCOME, FINCOM and PFYTTY chosen for the regression models are also presented in Appendix A. Mean FASIZE of the entire sample is 5.03. It varies between 4.56 (Sanaganda) and 5.86 (Ramanabadi). The mean age of the head of the household (AGEHOH) is about 47 ranging between 45 and 48 years. In case of value of property, the high value of standard deviation in the total sample has raised the value of coefficient of variation (132.40), which implies that some households have high value of property in comparison to others. The aggregate annual stated mean income of the total sample is Rs. 8975. Gambhariguda has the lowest mean income of Rs. 6339, whereas it is highest in Ramanabadi (Rs. 11464). The high value of coefficient of variation implies wide variation in mean income of the sample villages. In the total sample the mean forest income is about Rs. 2778. Again the high SD has raised the values of CV. In entire sample the PFYTTY is 0.34. Among the sample villages it ranges between 0.24 (Ramanabadi) and 0.40 (Gambhariguda) (Appendix A).

The average number of days of inadequate food (INADOF) in all villages ranges between 62 days (Ghambariguda) to 88 (Ramanabadi). In the total sample, the average number of days of inadequate food comes to about 77 days. In every village there are some families who live without adequate food for quite a number of days. It is disappointing that the maximum varies between 2 and 6 months. The people of Ramanabadi and Sanaganda are exposed to the maximum number of days of inadequate food (180 days). The CV is high in most of the village. The aggregate sample CV is 51.25%. The lowest CV of Gambhariguda village implies that all the sample households are in the trap of this common problem. This is also corrobated by the range, as the minimum period of inadequate food is about 7 weeks, which is quite high (Appendix A).

The simple regression models contain evidence to confirm the hypothesis that vulnerability is influenced by forest depletion in Ganjam district. The coefficients bear the expected signs (positive or negative) implying that the qualitative significance of the variables used to explain INADOF are appropriate. In most of the cases t – statistics are adequate rendering the coefficients acceptable at high levels of significance. Even the quantitative significance of the intercept and slope coefficients is also not very bad, though it is too low in some cases. However the fundamental statistical attribute, which questions the plausibility of the interpretations, relates to $\overline{R}^2$. Because of low coefficient of determination, particularly in the total sample models one nurtures a surmise that SRMs are not adequate. In it there is an indication that the phenomenon of vulnerability is far too complex to be explained through simple models. Therefore, the explanatory power of a set of variables on the RHS needs to be examined.

The general regression models (GRM) are conceived to address the complexity of the problem and particularly to estimate the influence of independent variables when an appropriate set is jointly put into the system. A wide range of GRMs has been estimated using OLS technique keeping different combinations of explanatory variables on the RHS for dependent variable INADOF, which is the proxy for socioeconomic vulnerability. The best set of the estimated models has been chosen for analysis based on the criteria of simultaneous holding of the following four conditions of optimal regression output highest attainable $\overline{R}^2$, highest attainable t and F statistics, inclusion of a reasonable mix of independent variables; and avoidance of multicollinearity problem.

The details of the estimated models as processed through the LIMDEP (Version 7.0.3: EA/Limdep 1.0.2 of August 17, 1999) software are furnished as Appendix B. It may be noted that to avoid multicollinearity, only one of the three surrogates of forest depletion, namely INCOLT has been retained on the RHS. The other proxies of forest degradation, such as INCTLD and DINFOY, have been dropped based on the guidance taken from correlation matrix and regression estimations. The other independent variables represent the socioeconomic features of the households. These are two more variables, which indirectly captures the influence of forest depletion. These variables are FINCOM and PFYTTY. In accordance with vulnerability and forest depletion INADOF are expected to be positively influenced by INCOLT, FASIZE and AGEHOH and PFYTTY, whereas negatively by INCOME, PROPETY and FINCOM.

In the INADOF general regression models, the village intercept coefficients are positive and high (Appendix B). Out of 5 villages only in 2 villages the constant coefficients are significant at an acceptable level. The total sample coefficient is negative and not significant. This implies the situation that inadequate food is avoidable with the qualitative improvement of other variables present in the model.

Among the slope coefficients, it is observed that most of the variables have the qualitative significance with expected levels of t-ratio. In this model INCOLT has a positive influence on inadequate food days. The slope coefficients of most of the independent variables such as FASIZE, AGEHOH, INCOME, PROPETY, PFYTTY and FINCOM in the different villages are low and not significant at an acceptable level of confidence. Though in case of total sample the coefficients of INCOLT, AGEHOH are significantly influencing INADOF.

The coefficient of determination ($\overline{R}^2$) is high for all the sample villages and varies between 62% and 81%. This implies that the variation in the dependent variable (INADOF) is well explained by the independent variables taken in the model. The estimated equation (with t-ratio in parentheses) for the total sample is

$$\widehat{INADOF} = \underset{(-0.99)}{(-)\,22.21} + \underset{(5.01)}{3.76}\ \boldsymbol{INCOLT} + \underset{(1.73)}{2.97}\ \boldsymbol{FASIZE}$$
$$- \underset{(-0.61)}{0.72}\ \boldsymbol{INCOME} + \underset{(3.43)}{0.76}\ \boldsymbol{AGEHOH} - \underset{(-0.07)}{0.0003}\ \boldsymbol{PROPTY}$$
$$+ \underset{(0.05)}{1.45}\ \boldsymbol{PFYTTY} - \underset{(-0.76)}{0.003}\ \boldsymbol{FINCOM} \qquad \overline{R}^2 = \mathbf{0.605}$$

(GRM)

This general model explains more than 60% of variations in inadequate food days of a family. Intercept coefficient suggests that in the absence of other explanatory variables, the minimum period of inadequate food days is about 22 days per annum. Out of the seven variables considered in the total sample model the slope coefficient of INCOLT is positive and high. Besides INCOLT, AGEHOH also influence the INADOF. The slope coefficient of FINCOM takes its usual sign but is very low, which implies that increase in FINCOM marginally reduces INADOF.

4. Discussion

The regression model provides strong evidence to the proposition that forest depletion positively influences vulnerability in the region. This inference is established from all slope coefficients. The intercept coefficients indicate two dimensions of the reality. *First*, there is some amount of permanent or minimum tendency for vulnerability given the present state of forest degradation, as evident from positive intercepts found in the village models (Appendix B). This implies that there are several other socioeconomic factors behind vulnerability in the region. Such factors might include high incidence of poverty, low levels of productivity and poor state of health, which operate through a vicious circle. The *second* dimension relates to the negative magnitudes of the intercept. The household try to attain a situation of zero vulnerability by accepting a positive rate of forest depletion. This implies a certain trade-off between vulnerability and forest degradation. At the margin, people are forced to devote more time to forest – related activities and walk longer distance to survive by minimising food inadequacy. There is thus a tendency to avoid vulnerability at the cost of forest in the short-run which is counterproductive in the long-run as the state of uncertainty increases.

The general regression model indicates that the intercept coefficient is negative. It implies the inadequate food days can be avoidable at the cost of more depletion of forest or improve of the other variables present in the model. In the entire sample on an average the households suffer from inadequate food for a minimum of 22 days. This confirms the ***First*** *Hypothesis*, that there is a minimum amount of vulnerability in the study region. This is mostly due to general poverty and backwardness. The *Second Hypothesis* is the core of the paper. The estimated model reiterate an inference and agree with this hypothesis that socioeconomic vulnerability, measured through inadequate days of food, is an increasing function of forest depletion in all the sample villages of the study region.

There is an interesting observation relating to negative intercept coefficient in the INADOF model, when INCOLT and INCTLD are kept on the RHS. This implies that people struggle to achive zero vulnerability at a positive level of forest depletion. This confirms the Hyp. III. There is a tendency on the part of the people to avoid vulnerability at the cost of the forests. This is an evidence of survivability struggle of the people on the forest.

5. Conclusions

The empirical analysis of the study establishes that forest depletion leads to a series of adverse ecological and environmental consequences, which ultimately result in a greater degree of socioeconomic vulnerability. Socioeconomic vulnerability of people is evident from the period of inadequate food. INADOF (No. of days of inadequate food per annum in a family) has been used as dependent variables in the regression models. The average number of days of inadequate food comes to about 22 days. The people of Ramanabadi and Balasi are exposed to maximum number of days of inadequate food.

Three proxy variables of forest depletion – increase in collection time (INCOLT), increase in travel distance (INCTLD) and decrease in forest income (DINFOY) - influence vulnerability. Among these INCOLT is the most influential one. In the entire sample, the average increase in collection time is about 17 hours. Mean increase in travel distance comes to about 17 km. more in comparison to the situation before 5 years in order to collect the variety of forest products. Descriptive statistics of DINFOY shows that the earnings of a household from forests are reduced by Rs. 505 to Rs. 1104 over a period of 5 years in the different village. The model provides strong evidence to the conclusion that forest depletion positively influences vulnerability in the region.

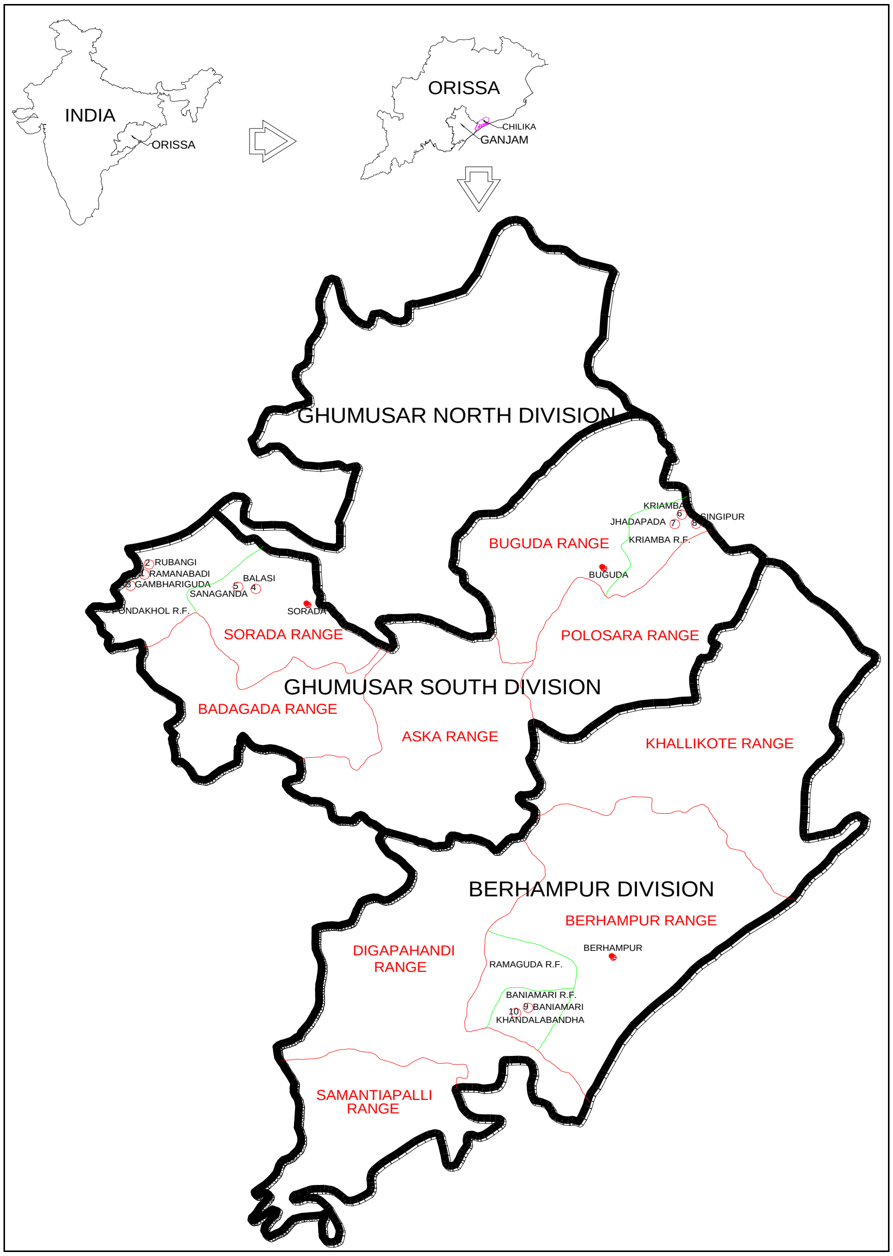

Fig 1: Map showing the study site. Inset is the India and Orissa map

Table 2: Appendix A. Mean SD and CV of the variables in sample villages and entire sample.

Sl	Variables	Ramnabadi	Rubangi	Gambharigudi	Balasi	Sanaganda	Total
1	INADOF	88.57 (39.51) [44.60]	67.38 (37.43) [55.55]	62.22 (11.66) [18.73]	81.75 (37.98) [46.46]	80.00 (52.20) [65.25]	77.69 (39.82) [51.25]
2	INCOLT	19.23 (4.81) [25.01]	17.44 (3.69) [21.17]	14.30 (3.24) [22.66]	18.50 (3.62) [19.57]	18.22 (3.56) [19.54]	17.76 (4.18) [23.54]
3	INCTLD	14.36 (3.26) [22.70]	17.56 (4.24) [24.15]	13.83 (2.86) [20.68]	21.60 (3.66) [19.64]	20.26 (3.88) [19.15]	17.48 (4.72) [27.00]
4	DINFOY	1104.25 (565.51) [51.21]	787.50 (275.37) [34.97]	505.28 (145.87) [28.87]	1031.18 (261.18) [25.33]	612.28 (254.05) [41.49]	827.52 (423.44) [51.17]
5	FASIZE	5.86 (2.38) [40.61]	5.00 (1.50) [30.00]	4.66 (1.57) [33.69]	4.80 (1.99) [41.46]	4.56 (2.06) [45.18]	5.03 (2.03) [40.36]

6	INCOME	11464.25 (565.51) [4.93]	9250.00 (3435.11) [37.14]	6338.89 (1165.76) [18.39]	7900.00 (2918.18) [36.94]	8768.00 (3531.49) [40.28]	8974.77 (4013.14) [44.17]
7	AGEHOH	48.07 (13.44) [27.96]	48.94 (12.86) [26.28]	47.11 (9.31) [19.76]	48.65 (13.05) [26.82]	45.60 (15.77) [34.58]	47.57 (13.10) [27.54]
8	PROPTY	14097.86 (18530.59) [131.44]	9012.50 (3194.14) [35.44]	4148.33 (1569.88) [37.84]	4518.50 (967.93) [21.42]	5499.16 (3457.15) [62.87]	7864.10 (10412.38) [132.40]
9	PFYTTY	0.24 (0.19) [79.17]	0.33 (0.14) [42.42]	0.40 (0.20) [50.00]	0.35 (0.15) [42.86]	0.38 (0.11) [28.95]	0.34 (0.17) [50.00]
10	FINCOM	2603.57 (1638.08) [62.92]	2831.25 (1110.99) [39.24]	2611.11 (1367.21) [52.36]	2567.50 (946.50) [36.86]	3232.00 (1202.33) [37.20]	2778.97 (1309.95) [47.14]

Figures within parentheses indicate the standard deviation
Figures within square bracket indicate the CV
***Source*:** Panda 2006

Table 2: Appendix B. Coefficients of the general ***INADOF*** models of different villages under OLS estimation with t-ratios in parentheses.

Sl	**Vilage**	**Constant**	**INCOLT**	**FASIZE**	**INCOME**	**AGEHOH**	**PROPTY**	**PFYTTY**	**FINCOM**	$\bar{R}^2$	**F**	**Obs.**
[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**	**[11]**	**[12]**	**[13]**
1	Ramanabadi	(+) 83.08 (+1.48)	(+) 0.22 (+0.14)	(+) 1.77 (+ 0.64)	(-) 0.003 (- 1.55)	(+) 0.82 (+ 1.99)	(-) 10.00 (- 1.09)	(-) 6.19 (- 0.14)	(-) 0.001 (- 0.23)	0.62	7.23	28
2	Rubangi	(+)123.17 (+1.67)	(+) 4.30 (+ 2.50)	(+) 2.89 (+ 0.66)	(-) 0.001 (+ 0.42)	(+) 0.41 (+ 0.78)	(-) 0.02 (- 3.37)	(-) 330.05 (- 3.16)	(+) 0.04 (+ 2.19)	0.79	8.85	16
3	Gambharigudi	(+) 100.78 (+3.06)	(+) 1.06 (+ 1.23)	(+) 1.36 (+ 0.79)	(-) 0.001 (- 2.10	(+) 0.17 (+ 0.70)	(-) 0.0007 (- 0.45)	(-) 122.60 (- 2.0)	(-) 0.19 (+ 1.75)	0.72	7.14	18
4	Balasi	(+) 58.00 (+1.19)	(+) 5.27 (+ 3.30)	(+) 3.16 (+ 0.92)	(-) 0.005 (- 1.18)	(+) 0.26 (+ 0.79)	(-) 0.01 (- 2.2)	(-) 110.14 (- 1.75)	(+) 0.001 (+ 0.75)	0.81	12.5	20
5	Sanaganda	(+) 46.41 (+ 0.86)	(+) 3.76 (+ 1.87)	(-) 1.89 (- 0.53)	(+) 0.005 (+ 0.85)	(+) 0.42 (+ 1.02)	(-) 0.007 (- 4.19)	(+) 142.67 (+ 1.12)	(-) 0.003 (- 1.87)	0.80	14.41	25
Total		(-) 22.21 (- 0.99)	(+) 3.76 (+ 5.01)	(+) 2.97 (+ 1.73)	(-) 0.72 (- 0.61)	(+) 0.76 (3.43)	(-) 0.38 (- 1.40)	(+) 1.45 (+ 0.05)	(-) 0.32 (- 0.76)	0.60	24.22	107

***Source*:** Panda 2006

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