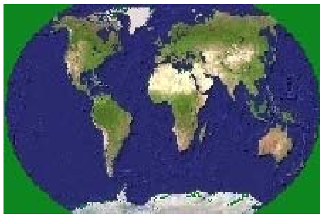

International Journal of Multidisciplinary Research and Development

Volume: 2, Issue: 7, 244-250
July 2015
www.allsubjectjournal.com
e-ISSN: 2349-4182
p-ISSN: 2349-5979
Impact Factor: 3.762

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Forest loss and people's vulnerability in Ganjam district of Odisha

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Abstract
Degradation of forest takes the local communities to various states of uncertainty, and render them vulnerable to a number of associated problems. Several types of 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 basic issue is examined in this paper relates 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 is examined through a case study of 316 households settled in 10 tribal villages (Ramanbadi, Rubangi, Gambhariguda, Balasi and Sanaganda, Kirimba, Jhadapada, Singipur, Baniamari, Khandalabandh) spread over 4 forest ranges of Ganjam district, Odisha. In total they collect 28 types of products from the forest, out of which 9 are common to all villages. Dimensions of disruption are measured through decline in collection of the 9 forest products over last 5 and 10 years.
Since socioeconomic vulnerability is not a directly quantifiably phenomenon, one of its proxy indicators, namely hunger (no of days of starvation) per annum 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. HUNGER is a discrete random variable and has the properties of a count data variable (starvation ranges between 0 and 10). Poisson distribution model used here strongly evidences the conclusion that the forest depletion positively influences vulnerability in the region, beyond a minimum. On an average there is 0.8 probability that a sample household is likely to suffer from starvation for four or less number of days under prevailing condition of forest depletion. This probability is quite high and expected to increase with further depletion of forests. People try to avoid this vulnerability at the cost of forest itself, which calls for policy and institutional innovation.

Keywords: Forest, people's vulnerability, Ganjam, Odisha

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 numerous goods and plethora of services (Pearce and Warford, 1992, Gutierrez, 1992, Reid and Miller, 1993) [7]. Loss of forest affects the very basis of human life in many ways. It takes the local communities to various states of uncertainty and render them to a number of associated problems. Several types of vulnerability 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) [1, 2, 4, 5]. This paper addresses the issues relating to the degree of influence of forest depletion on socioeconomic vulnerability of people.

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 Odisha. Its population of 31.37 lakhs (2001 Census) constitutes 8.55 percent of the total population of the State. 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 Odisha 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 prepared and administered. 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.

2.2 The study area

The study was carried out in 10 appropriate villages of four forest ranges such as Ramanbadi, Rubangi, Gambhariguda, Balasi and Sanaganda, Kirimba, Jhadapada, Singipur, Baniamari and Khandalabandh. (Fig. 1). The people's dependency on forest is the basis of selection of the villages for the study.

Ramanabadi occurs in the Sorada forest block of Ganjam district of South Odisha 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.

Kriamba, village is situated 20 kms west of Buguda town in Ganjam district. It is located on the foothill of Kriamba Reserve forest. The village settlement has a U-shape. Thatched houses stretch in two rows. The village primary school is the only cemented house, which was constructed by the villagers. The village is inaccessible till today. Two villages such as *Jhadapada and Singipur,* are situated at 18 and 25 kms west of the Buguda town. The settlement of Jhadapada consists of only 14 households. 37 Kondh households are living in Singipur. The settlements are of T-shape. The thatched houses stretch in two rows. Villages *Baniamari and Khandalabandha* are bounded by Baniamari Reserve Forest. The settlement is scattered over a large area. There are all total 114 families are living in both the villages.

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 uni-directionally. The households of all villages may not be equally vulnerable to forecast depletion. Keeping all these in view an important indicator, such as *hunger* (starvation) is chosen for analysis through regression model. Hunger could be voluntary or involuntary. A human being may voluntarily desire to remain under hunger for a while to maintain a certain balance in the body. Spacing the food intake by longer hours could also be a medical prescription or a socially determined practice. However, involuntary hunger or starvation is a consequence of non-availability of food in the economy of an individual or his / her household. This not only happens under conditions of famine, but also results from states of acute poverty, destitution and deprivation. It is a state in which an individual or his / her family is forced to live because of undesirable changes in the external conditions and influences. Such circumstantial involuntary hunger, which is beyond the control of a household economy, is an indicator of vulnerability. The right approach to see the consequence of hunger is through the information on without food for a day. Basing on this information, which have been collected through this survey, from which the variable (HUNGER) 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	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.
3	INCTLD	Sum of increase in travel distance (kms.) in collection of each of the nine forest products over 5 years by a household
4	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.
5	FASIZE	Family size (No. of members)
6	AGEHOH	Age of the head of the household (Years)
7	PROPTY	Sum of value of property such as land, house and other assets (Rs.) owned by the household.
8	PFYTTY	Proportion of forest income to annual stated family income.
9	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 316 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.

I. There occurs a minimum amount of vulnerability in a system characterised by overall poverty and backwardness.
II. Socioeconomic vulnerability is an increasing function of forest depletion in the study region.
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 average increase in the hours spent for collection of forest products ranges between 13 to 19 hours in different sample villages, whereas in the entire sample, the average increase in collection time is about 17 hours. The CV varies in the range of 17 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 24 km. (Singipur). 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. (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.1851 over a period of 5 years. The people of Khandalabandh 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 2501 (Baniamari). 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 3.71 (Jhadapada) and 5.86 (Ramanabadi). The mean age of the head of the household (AGEHOH) is about 46 ranging between 42 and 49 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 (93.45), 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. 2672. 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 0.38. Among the sample villages it ranges between 0.24 (Ramanabadi & Baniamari) and 0.40 (Khandalabandh) (Appendix A).

The human body is a nature built system. Its ability to function properly is critically dependent on continuous supply of minimum amounts of energy and nutrients. Like other biological systems and organic entities, the human body derives its requirement of essential ingredients through food intake. The body must receive food at regular intervals of at least twice a day for its proper functioning. The cessation of food intake results in health problems associated with malnutrition and undernutrition, which ultimately lead to disease, disability and death. Hunger is a state of cessation of food intake into a human body. A feeling of lack of food occurs in a human system every 4 to 6 hours. If food intake is delayed by longer hours, the state of hunger sets in.

The descriptive statistics of hunger (HUNGER) of the sample villages depicts the picture of the average number of days of hunger ranges between 0 and 10 days. The people of Ramanabadi though have easy access to forest resources are not free from hunger. The highest minimum and maximum numbers of days of hunger occur in Khandalabandha. The people of this village are exposed to hunger for a minimum period of two days in a year and on an average suffer from it for about 5.4 days which is the highest. In the entire sample, the mean HUNGER is 3.65, which implies that on an average people do not get food for about four days a year. High values of standard deviation have raised the coefficient of variation, which implies that some families suffer from HUNGER to a very great extent in comparison to others.

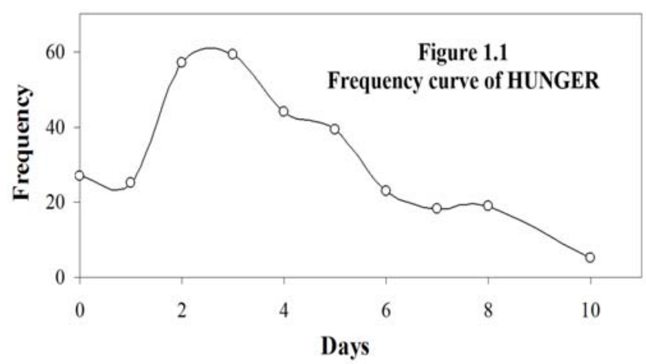
In the Poisson regression model**,** it is interesting to observe that the dependent variable HUNGER, which is used as a surrogate of socioeconomic vulnerability, has the properties of a count data variable. The frequency of days of starvation appears in Table 1.1. The values that occur for the variable are countable integers 0, 1, 2,………, 10.

Such data can be viewed as observations on a discrete random variable, to which the assumption of Poisson distribution is more suitable than the Normal distribution. The peculiarity with HUNGER is that its frequencies are not of a neatly descending order as it is evident from Figure 1.1. Even though the Poisson regression models are best suitable when the highest frequencies occur for zero (such as number of persons from a population not visiting a recreation site or number of persons not affected by a health problem), it is interesting to pursue its non-linear principle and examine if it has different implication so far as the influence of forest depletion on vulnerability is concerned.

Table 2: Frequency distribution of HUNGER

Days	Count	Cumulative Count	Percent	Cumulative Percent	Graph of Percent
(1)	(2)	(3)	(4)	(5)	(6)
0	27	27	8.54	8.54	|||
1	25	52	7.91	16.46	|||
2	57	109	18.04	34.49	|||||||
3	59	168	18.67	53.16	|||||||
4	44	212	13.92	67.09	|||||
5	39	251	12.34	79.43	||||
6	23	274	7.28	86.71	||
7	18	292	5.7	92.41	||
8	19	311	6.01	98.42	||
10	5	316	1.58	100	|

Source: Processed from survey data through NCSS, 2001 computer software



It is not interesting to follow the simple Poisson regression models keeping only one explanatory variable on the RHS. This is for the simple reason that more than one variable explains people's vulnerability and better fit properties are observed from the general models. Out of several simple and general models estimated and inspected through some kind of a grid search in the computer, a possible best explanation of the phenomena is found when INCOLT, FASIZE, INCOME, PROPTY and FINCOM are on the RHS. The output of this model estimated for the entire sample is in Appendix B.

The coefficients and the partial derivatives of the intercept and slopes are significant at the acceptable levels of significance

($\alpha \leq 0.05$), except the marginal effect of FINCOM. They also have the expected signs or qualitative significance. It is reiterated that socio-economic vulnerability is worsened by the measure of forest depletion. The size of the household increases the frequency of HUNGER. It is inversely influenced by the variables representing property and income. It is also interesting to find that the negative explainers have relatively low quantitative significance. They are not significantly different from zero. Further, the values of the parallels of R-squared (goodness of fit) statistics showing the proportion of the variation in HUNGER that can be accounted for by variation in the independent variables.

The estimated equation is

$$HUNGER = \hat{\mu} = \exp(0.72931 + 0.04554 INCOLT + 0.07693 FSIZE - 0.00003 INCOME - 0.00005 PROPTY - 0.00007 FINCOM)$$

From this equation, we can ascertain as to what is the probability that a household will remain under starvation for a period of four or less number of days per year, which is the approximate value of the mean HUNGER.

$$\hat{\mu} = \exp(0.72931 + 0.04554 \times 17.17 + 0.07693 \times 4.85 - 0.00003 \times 8499.21 - 0.00005 \times 6947.04 - 0.00007 \times 2671.36)$$

$$= 2.98924$$

Then, using the probability density function of Poisson distribution as

$$P(Y = y) = f(y) = \frac{\mu^y \exp(-\mu)}{y!}, y = 0,1,2,...$$

we have

$$P(y \leq 4) = P(y=0) + P(y=1) + P(y=2) + P(y=3) + P(y=4)$$

$$= \frac{(2.98924)^0 \exp(-2.98924)}{0!} + \frac{(2.98924)^1 \exp(-2.98924)}{1!} + \frac{(2.98924)^2 \exp(-2.98924)}{2!} + \frac{(2.98924)^3 \exp(-2.98924)}{3!} + \frac{(2.98924)^4 \exp(-2.98924)}{4!}$$

$$= 0.05033 + 0.15044 + 0.22484 + 0.22404 + 0.16743$$

$$= 0.81708$$

This implies that on average there is a 0.8 probability that a sample household is likely to suffer from starvation for four or less number of days under prevailing conditions of forest depletion in the study region. This probability is quite high and is expected to increase with further depletion of forests.

4. Discussion

The regression model provides strong evidence to the proposition that forest depletion positively influences vulnerability in the region. The model shows that there is 0.8 probability that a household will remain under starvation for four or less number of days per year under prevailing conditions of forest depletion. This probability is obviously quite high, which is likely to be worsened by further degradation of forests. 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 hunger, is an increasing function of forest depletion in all the sample villages of the study region.

The observation relating to negative intercept coefficients of INCOME, PROPTY and FINCOM in the general passion HUNGER model, when INCOLT, FASIZE, INCOME, PROPTY and FINCOM are kept on the RHS 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 no. of days of hunger per annum in a family. The average number of days of hunger ranges between 0 to 4 days. The people of Ramanabadi and Khandalabandh are exposed to maximum number of days of hunger.

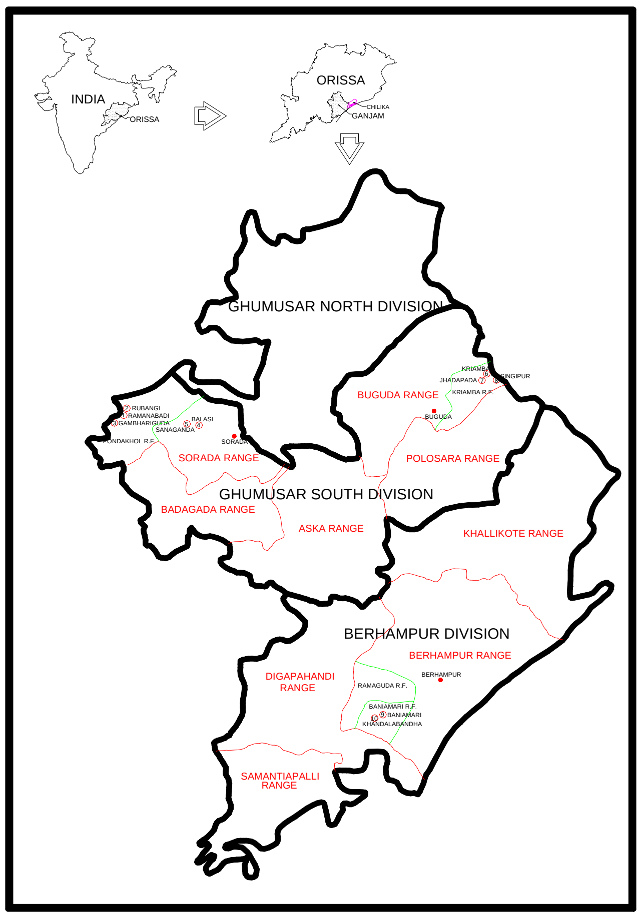


Fig 1: Map showing the study site. Inset is the India and Odisha map5

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

Sl	Variables	Ramnabadi	Rubangi	Gambharigudi	Balasi	Sanaganda	Kiriyamba	Jhadapada	Singipur	Baniamari	Khandalabandh	Total
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]	16.26 (4.10) [25.22]	16.26 (3.67) [19.49]	16.26 (3.45) [17.05]	16.26 (3.81) [29.70]	16.26 (4.35) [25.20]	16.26 (4.48) [26.09]
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]	16.78 (3.50) [20.86]	21.64 (4.20) (19.14)	23.81 (4.55) [19.11]	13.00 (3.04) [4.31]	17.30 (4.31) [24.91]	17.73 (5.06) [28.54]
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]	640.06 (279.12) [43.61]	462.46 (223.33) [48.29]	1636.30 (447.44) [27.34]	1636.30 (447.44) [27.34]	1851.32 (337.80) [18.25]	121.21 618.87 [55.20]
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]	4.93 (2.14) [43.14]	3.71 (1.33) [35.83]	4.62 (1.92) [41.56]	4.92 (1.51) [30.69]	4.86 (2.41) [49.59]	4.85 (2.06) 42.47]
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]	10438.63 (3425.03) [32.81]	7346.43 (2424.43) [33.00	9701.35 (3428.10) [35.34]	8660.53 (2734.02) [31.57]	6253.29 (3133.24) [50.11]	8499.21 (3724.67) [43.82]
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]	45.14 (12.75) [28.25]	42.14 (10.78) [25.58]	46.16 (11.04) [23.92]	45.34 (13.11 [28.91]	44.13 (11.67) [26.44]	45.73 (12.41) [27.41]
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]	6389.11 (2018.05 [31.59]	7738.21 (4146.27) [53.58]	6156.70 (3041.01) [49.39]	8189.28 (1765.48) [21.56]	5596.84 (2836.61) [50.68]	6947.07 (6491.84) [93.45]
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]	0.38 (0.08) [21.05]	0.32 (0.09) [28.13	0.47 (0.14) [29.79]	0.24 (0.01) [4.17]	0.48 (0.49) [102.08]	0.38 (0.28) [73.68]
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]	3709.91 (1246.54) [32.88]	2178.57 (429.99) [19.74]	2643.24 (847.39) [32.06]	1939.47 (535.01) [27.59]	2342.11 (976.97) [41.71]	2671.36 (1191.97) [44.62]

- Figures within parentheses indicate the standard deviation
- Figures within square bracket indicate the CV

Source: Panda 2006

Appendix B. Output of the General Poisson Regression Model for HUNGER

```
+---------------------------------------------+
| Poisson Regression                          |
| Maximum Likelihood Estimates                |
| Dependent variable              HUNGER      |
| Weighting variable                 ONE      |
| Number of observations             316      |
| Iterations completed                 6      |
| Log likelihood function      -563.0895      |
| Restricted log likelihood    -714.1345      |
| Chi-squared                   302.0899      |
| Degrees of freedom                   5      |
| Significance level            .0000000      |
| Chi- squared =   194.13918  RsqP=   .5789   |
| G  - squared =   222.97556  RsqD=   .5753   |
+---------------------------------------------+
+--------+-------------+----------------+--------+--------+---------+
|Variable| Coefficient | Standard Error |b/St.Er.|P[|Z|>z]|Mean of X|
+--------+-------------+----------------+--------+--------+---------+
 Constant   .7293067054          .21684360            3.363     .0008  INCOLT
.4554212128E-01  .84267791E-02    5.404   .0000  17.172468
 FASIZE    .7693257631E-01  .16276566E-01    4.727   .0000  4.8544304
 INCOME   -.2569335543E-04  .11549397E-04   -2.225   .0261  8499.2089
 PROPTY   -.4680418044E-04  .11077012E-04   -4.225   .0000  6947.0427
 FINCOM   -.7249591630E-04  .35974679E-04   -2.015   .0439  2671.3608

+--------------------------------------------+
| Partial derivatives of expected val. with  |
| respect to the vector of characteristics.  |
| They are computed at the means of the Xs.  |
| Observations used for means are All Obs.   |
| Conditional Mean at Sample Point   3.6487  |
| Scale Factor for Marginal Effects  3.6487  |
+--------------------------------------------+
+--------+-------------+----------------+--------+--------+---------+
|Variable| Coefficient | Standard Error |b/St.Er.|P[|Z|>z]|Mean of X|
+--------+-------------+----------------+--------+--------+---------+
 Constant  2.661046302      .91960878        2.894   .0038
 INCOLT    .1661710944      .37763724E-01    4.400   .0000  17.172468
 FASIZE    .2807065205      .71981781E-01    3.900   .0001  4.8544304
 INCOME   -.9374822409E-04  .48345346E-04   -1.939   .0525  8499.2089
 PROPTY   -.1707760128E-03  .47958012E-04   -3.561   .0004  6947.0427
 FINCOM   -.2645183275E-03  .15010576E-03   -1.762   .0780  2671.3608
```

Source: Derived from the computer output processed through LimDep Econometric [Version 7.0.3, 1999 (EA/LimDep: 1.0.2, 1999)] software.

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