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Poverty Induced Forest Degradation in JFM Regime: Evidence from India¹

Amarendra Das²

Abstract

Around 28% of the total forest area in India has been brought under Joint Forest Management (JFM) and rest 72% remains virtually open access to local communities. In such a scenario, communities actively participating in JFM are also engaged in degrading *de facto* open access forests to meet their basic livelihood necessities. This reveals that, the poverty induced forest degradation still continues in JFM regime. This paper theoretically and empirically explains the factors that determine the individual indulgence in forest degradation. Based on a survey of 140 households in three forest fringe villages of Chandaka Wildlife Division of Orissa State in India, the study shows that lack of education, landlessness and low environmental awareness significantly influence the individual involvement in forest degradation. The implementation of JFM merely transfers the dependence of local community from one patch to another. It shows that unless the source of livelihood is secured, forest degradation by rural poor households would persist. In order to halt this depressing scenario, it calls for raising the individual opportunity cost through employment generation, skill formation and land allocation to the landless.

Key Words: Poverty, Forest Degradation, JFM

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1. Introduction

In most of the developing countries, open-access forest, *inter alia* common pool resources, serves as an important source of livelihood for a large population. WCFSD, (1999) states that around 350 million of the world's poorest people depend almost entirely for their subsistence and survival needs on forests and in India, around 275 million landless people and small farmers benefit from gathering resources they find within adjacent forests. Khare *et al*, (2000) shows that out of about 300 million people (or 60 million households) estimated to live below the 'poverty line' in rural India, around 200 million of these people are partially or wholly dependent on forest resources for their livelihoods. Due to heavy population pressure on forests the rate of extraction exceeds the rate of regeneration and causes forest degradation. It has thus been argued that poverty is one of the important reasons behind forest degradation.

Realizing the heavy dependence of local communities on the easily accessible forests, a number of developing countries have formally recognised their user rights by making communities a stakeholder in forest management. In India, the co-management system, known as Joint Forest Management (JFM), came into vogue in 1990. Since then, all Indian states have been trying to bring more and more forest areas under JFM. As on March 2005, 99, 868 JFM committees have been formed and 21.44 million hectares of forest area, constituting around 28% of total forest area, have been brought under this management system (FSI, 2005). However, due to weak monitoring mechanism, the forest areas uncovered by JFM remains as *de facto* open access to the local communities. Against this backdrop, this paper probes into the following questions: (i) do the participants of JFM stop degrading open access forest? (ii) will JFM be able to halt poverty-induced deforestation? The study develops a theoretical model to explain the individual participation in forest degradation under differential opportunity cost condition and supports this with the primary data, gathered from the household survey conducted in three forest fringe villages of Chandaka Wildlife Division of Orissa State in India.

The rest of the paper is organised as follows. Section 2 critically reviews the literature on poverty induced forest degradation. Section 3 discusses a simple model explaining the individual indulgence in forest degradation under differential opportunity cost conditions. Section 4 briefly states the methodology adopted for the study and section 5 presents the findings of study. Section 6 concludes with major policy implications.

2. Poverty Induced Forest Degradation: Evidence from Literature

A large body of economic literature discusses about the bi-directional relationship between poverty and degradation of natural resources. One way, poverty is seen as a cause of natural resource degradation and other way natural resource degradation is seen as the cause of poverty. The most famous Brundlant Commission Report (WCED, 1987, pp. 24) recognizes poverty as an important cause of environmental degradation and emphasizes the eradication of poverty to conserve environmental resources. Similarly, the World Bank (1992) in its World Development Report, explicitly states that poor families who have to meet short term needs degrade the natural capital by excessive cutting of trees for firewood, and mining other resources. On the other hand, degradation of environmental resources, which provides a source of livelihood to the rural people, also causes destitution among rural poor. This leads to cumulative causation with poverty, high fertility rates and environmental degradation acting upon each other to create a vicious circle (Dasgupta and Maler, 1994).

In rural areas common property resources (CPR) such as forests, common pastureland, pond, rivulets and so on provide source(s) of livelihood to the poor households. Directly or indirectly almost all the households are dependent upon these for one reason or other. Different studies have attempted to comprehend the nature and degree of such dependency and quantify them in monetary terms (Jodha, 1986; Reddy, 1999; Reddy and Chakravarty, 1999; Cavendish, 2000;

Adhikari, 2005; Pattanayak and Sills, 2001, Chopra and Dasgupta, 2008). Jodha (1986) based on an extensive household study over 80 villages in 21 districts in dry regions of seven Indian states explains that (i) rural households heavily depend upon CPR for fuel and fodder. (ii) CPRs provide an important source of employment when other employment opportunities are not available. (iii) CPR provides around 14 to 23 percent of total household income. Some times the income share from CPR in the aggregate household income also exceeds this share. For instance Cavendish (2000) from field survey in Zimbabwe shows that open access environmental goods contribute roughly 35% of average total household income. Moreover, the figure for the poorest quintile is 40 percent.

The purpose of using the common pool resources and the level of utility derived from them varies across households and region. Some households use these products as a safety net during crisis periods. Poorer households, which do not have any other option to smoothen consumption, (through the possession of livestock, children in off-farm activities) during crisis period, rely more on forests. Products from these resources can have important roles in overcoming different unpredictable shortfalls (such as, family illness, political turmoil, macro-economic crises or ecological disasters) either as a reservoir of auto-consumption goods or as a resource of 'quick-cash' raised from collecting forest products and taking them to market place. (Angelsen and Wunder, 2003). This way it helps poor people ameliorate the incidence of poverty and destitution (Reddy and Chakravarty, 1999). Therefore, Angelsen and Wunder contend that we can't simply quantify these benefits by summing up their average contribution to subsistence and monetary incomes because the 'safety nets' imply more than that. Although it is poorer who depend more on forest, this dependence is not strictly restricted to this group. To a greater or less extent, wealthy households in rural areas also rely on it (Pattanayak and Sills, 2001). These households use common property resources to meet household requirement for fuel wood and fodder or to add up to their total household income (not subsistence) by selling other valuable products. Chopra and Dasgupta (2008) show that non-poor households collect NTFP as well. This is largely influenced by the access to markets and vicinity to forest. Similarly, Reddy (1999, pp.1440) shows that though the dependence of the poor on commons is high their actual use is relatively lower compared to the better off households. Moreover, in high productive farming areas households depend less on CPRs. In a rural set up environmental resources are also important for other key economic activities (Cavendish, 2000). For example, people collect manure, bamboo for making boundaries, and many other products from forests for agricultural activities. Other products act as complementary goods for a variety of economic activities.

The literature on the nature of dependence on forest and other natural resources shows a high degree of variance with the socio-economic status and geographical location of the household. Nonetheless, a large body of literature also argue that such dependency does not cause the degradation of resource base. Rather it has been reiterated that since the poor households largely depend upon the natural resource, they take all efforts to conserve the resource base. Although we cannot undermine the role of community in conserving natural resources, it is hard to generalise for all resources and regions. For example there is ample literature to show that local communities not only depend upon the forest for self-consumption but also for selling in the market (Chopra and Dasgupta, 2008). Such overexploitation of any resource base causes degradation. In many cases forest serves as the only source of livelihood. In the forest areas where there is no NTFP, people depend upon selling timber, fuel wood or other ill practices such as charcoal preparation to meet their livelihood. In such cases the forest dependency would result in forest degradation. If the number of people involved in such activities is less it might not be unsustainable. However, when a huge population is regularly engaged in such activities and resultantly the rate of harvest exceeds the rate of regeneration. Thus causes forest degradation.

2.1 Poverty Induced Forest Degradation in JFM Regime

Since last two decades there has been a tremendous rise in the formalisation of community participation in forest management. Accordingly, various governments have framed policies to form more and more forest protection committees and making community a stakeholder in this venture. One of the primary objectives of co-management system is to halt forest degradation by the community members through allowing the community to part with some benefits derived from the forest and creating other gainful employment opportunities in exchange of their services devoted to conserve the forest. For example, Forest Policy 1988 of India in one of its' objectives states that *a primary objective of all the agencies responsible for forest management ...should be to associate the tribal people closely in the protection, regeneration and development of forest as well as to provide gainful employment to people in and around forest*

Under this backdrop, it is imperative to re-examine the hypothesis of poverty induced forest degradation. A plethora of studies have attempted to understand the functioning of JFM by assessing the level of common action achieved and linking it up with different factors like community heterogeneity, cost and benefit sharing mechanism, environmental awareness etc. For instance, in contrast to the Olson's theory of common action³ empirical studies show that at low levels of socio-economic disparity higher degrees of common action could be achieved (Saha, 2004). Saha, in his study on 57 Forest Protection committees in West Bengal, India, finds that community with members belonging to similar ethnicity and having less disparity in income achieve higher levels of collective action. On the other hand, Somanathan et al (2002), in a study on the Van Panchayats in the Kumaon and Gharhwal regions in the state of Uttaranchal in Northern India finds no correlation between caste heterogeneity and indicators of the collective action or forest cover. Similarly, in contrast to the analysis of Mancur Olson's theory of collective action⁴, Agrawal (2000) comes out with empirical evidence from the field that the larger communities are more efficient than small communities to protect forest. Other studies have found no such significant relationship (Somanathan et al, 2002). Another set of studies on JFM point out to various factors that influence the success or failure of JFM. The major factors identified are the size of the community, social norms, identification of boundary (Agrawal 2000), legal status of the Protection committee, role of the stakeholders in decision-making (Dutta et al, 2005), environmental awareness of the community members (Hussain & Bhattacharya, 2004), accountability of bureaucracy (Vira, 2005), and agencies behind the inception of JFM (Ghate 2003). All these studies have also come up with very contrasting findings. Thus, the findings from different case studies seem site-specific and can be hardly generalized.

Nonetheless, a higher level of common action does not necessarily mean that community's involvement in forest degradation has stopped. Often communities actively participating in JFM are engaged in degrading *de facto* open access forests. Hence, at aggregate level there will be decline in forest cover. There is hardly any study, which discusses the poverty induced forest degradation in such a context and the present study attempts to fill this gap.

In next section we shall theoretically analyse the individual's decision to indulge in forest degrading activities. Next we'll move on to empirically examine these hypotheses from our field study.

³ Olson (1971 2nd Print, pp.34) explains that *in smaller groups marked by considerable degrees of inequality...there is the greatest likelihood that a collective good will be provided....*

⁴ Olson (1965) states that *Indeed, unless the number of individuals in a group is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational, self-interested individuals will not act to achieve their common or group interest.*

3. Opportunity Cost and Indulgence in Forest Degradation: A Theoretical Construct

We contemplate a forest area where a part of the forest is managed under JFM and another part remains under the official control of government but due to weak legal enforcement it serves as *de facto* open access to all. Under this circumstances, an individual involved in JFM could use the resource base from the conserved forest, subject to the rules designed for all stakeholders, as well as open access forest. A non-participant in JFM could have access only to the *de facto* open access forest. However, use of open access forest involves a penalty subject to the enforcement mechanism. Moreover, we are assuming a scenario where the use of forest is purely for economic purposes (and is in excess of domestic consumption) and that causes degradation of forest. Under this scenario let the total yield from forest for individual i be written as follows:

$$y_i = y_i^{of} + y_i^{pf} \quad \dots(1)$$

where, y_i^{of} and y_i^{pf} are the yields from open access forest and protected forest under JFM where individual i is a stakeholder respectively. For a non-participant of JFM y_i^{pf} will be zero.

$y_i^{of} = y(l_i)$, where l_i is the labour of individual i

$y_i^{pf} = \frac{y^{pf}}{g}$, where, y^{pf} is the total yield from the protected forest by group of g individuals.

Therefore, equation (1) can be rewritten as follows:

$$y_i = y(l_i) + \frac{y^{pf}}{g} \quad \dots(2)$$

y_i^{pf} is not determined by individual effort, but group. The per capita benefit from the protected forest would depend upon the group's success in conserving the forest, the nature of the forest and the group size.

To reach at the individuals' decision on engaging in forest degrading activities in open access forest lets write the individual profit function as follows:

$$\Pi_i = p y_i^{of} - [\varpi_i (y_i^{pf}, I_i^{nf}) l_i + \beta_i(m) \cdot y_i^{of}] \quad \dots(3)$$

where, p is the price of forest products gathered by individual i , ϖ is the opportunity cost of individual i which is determined by the total income of individual. Further, individual's income sources are classified into forestry and non-forestry. Therefore, the labour devoted towards forest degrading activities in open access forest (FDAOF) will depend upon the disposable time left with individual. Similarly, individual would also compare the returns to its labour from all these activities and spend more time for the highest rewarding job. We can write it as follows:

$$l_i = T - t_i^l - t_i^{nf} - t_i^{jfm} \quad \dots(4)$$

where T is total hours in a day, the superscripts to t indicates the time devoted for leisure, non-forestry income and JFM. An individual with zero time spent for JFM and non-forestry income will have the maximum time for accessing open forest and vice versa. The income from JFM i.e. y_i^{pf} will have a direct effect on the individual opportunity cost. For individuals not participating in JFM or for zero income yielding JFM initiatives y_i^{pf} value will be zero. Furthermore, even in presence of JFM, if the return from FDAOF will be higher individual would prefer to be away from JFM. β is the probability of being caught by forest officials, m is the penalty and is proportionately related to y_i^{of} .

To reach at the optimal state we need to get the solution for the first order condition as follows:

$$\frac{\partial}{\partial l_i} \Pi_i = \frac{\partial}{\partial l_i} \{ p y_i^{of} - [\varpi_i(\cdot) l_i + \beta_i(m) \cdot y_i^{of}] \} = 0 \quad \dots(5)$$

$$\Rightarrow \frac{\partial p y(l_i)}{\partial l_i} = \frac{\partial}{\partial l_i} [\{\varpi(\cdot) l_i\} + \beta(m) \cdot y(l_i)]$$

$$\Rightarrow \underbrace{p[y'(l_i)]}_{MR} = \underbrace{\varpi(\cdot) + \beta_i(m) \cdot y'(l_i)}_{MC+MP} \quad \dots(6)$$

Equation (6) gives us the standard marginal condition (MC=MR) for determining the optimal level of FDAOF by an individual. Let's call the right side of equation (6) as marginal private cost (MPC), which has two components such as marginal cost (MC) and marginal penalty (MP). MC is determined by the individual opportunity cost and MP is determined by the degree of legal enforcement and quantum of penalty. Thus, if $\varpi(\cdot)=0$, the level of forest degradation will entirely depend upon the enforcement and penalty structure and if $\beta_i(m)=0$, forest degradation will entirely depend upon MC. When both $\varpi(\cdot)$ and $\beta_i(m)$ are equal to zero, the level of deforestation will be maximum. Given the nature of forest and a similar price structure for all individuals accessing the (open) forest, MPC will have a larger influence to determine individual's participation in FDAOF. Further, given the MP for same level of y_i^{of} , MC ultimately determines the individual's participation in forest degradation. A high MPC will thus minimize the level of forest degradation and vice versa. A higher level of income from either source –JFM or non-forestry sources– keeps the individual opportunity cost high. Notably, if the participants of JFM derive a higher income from their protected forests it will raise the MC level and discourage them to indulge in degrading open access forest. Similarly, strict legal enforcement and prohibitive penalty structure will keep the MP high. It implies that individuals with lower opportunity cost would be more involved in FDAOF and vice versa. Therefore, a higher opportunity cost and stringent penalty structure would be able to prohibit individuals from degrading forests.

3.1 Determinants of Opportunity Cost

Direct measurement of individual opportunity cost is a challenging task for the inaccurate reporting of income from primary and secondary occupations. Therefore, for undertaking our empirical exercise we adopt an indirect approach to measure individual opportunity cost. The opportunity cost (MC in our model) of an individual is determined by a slew of factors; such as: asset possession, educational attainment, availability of off-farm jobs in the locality, social networks and access to credit. Land is the most valuable asset among rural households. Possession of land provides employment, income and social status to the household. Therefore, their opportunity cost remains higher. Similarly, education increases the employability of an individual by increasing the skill and mobility. Availability of off-farm jobs in the locality, also keeps the opportunity cost of unskilled labourers high. Social networks have enormous positive externalities. It increases the mobility of labourers, reduce the transaction cost of employment in the unorganised sector and raises income. Access to credit also increases the opportunity cost of individual by making them self-employed⁵. The credit market is thin in rural areas. Landlessness and thin credit markets limits the scope of being self-employment. The dearth of information owing to weak social networks and lack of education restricts the labour mobility. In absence of mobility and other gainful employment opportunities in the external world the individual is completely dependent upon the work available in the locality; such as wage labour, share cropping etc. In rural areas, more specifically in forest fringe villages, common pool natural resources provide a resource base to the poor household (Jodha 1986; Dasgupta 1993). In the presence of

⁵ Of course it is true that merely availability of credit will not help people to be self employed unless some provision is made by the government for allocating the fund to the asset-less households

abundant supply of labour and limited employment, the wage rate remains lower. Therefore, the opportunity cost of individual remains low. Further, due to weak enforcement and low penalty, the expected penalty for individuals remains low. Given the easy access to common pool natural resources by the households in forest fringe areas and low MPC (or zero opportunity cost) a meagre sum of revenue generated from FDAOF will be profitable for poor households. Thus we can link up the poor man's indulgence in forest degrading activities to their low opportunity cost

4. Methodology

The study completely relies upon the primary data collected from household survey. At the outset a pilot survey was conducted in 19 forest fringe villages of Chandaka wildlife division⁶ of Orissa State in India during September 2005. Primary information on the socio-economic status of village households, their occupation and participation in forest protection were gathered through focus group discussions (FGD) with villagers. Out of 19 villages three were selected with distinct characteristics for conducting household survey. Village-A has been protecting forest very well since last 40 years and hardly any household is involved in FDAOF. Village-B has also been protecting a patch of forest from last 30 years. The Village-C is not involved in forest protection, rather most of the households are engaged in FDAOF on a regular basis. Table-1 gives an idea of the total number of households and the number of households studied. Village-B was small enough to conduct a census study; only two households were omitted due to their absence during our survey. In other two villages households were selected following systematic random sampling method. In each household one person above 14 years old was administered a systematically designed questionnaire. For collecting qualitative information special focus group discussions (FGD) were also held in each village. Several rounds of discussions were also held with the forest officials at various levels to gather information on the operation of JFM and overall status of forest in the specific forest division.

Name of the Village	Total no. of households	Number of households selected	% of HHs selected
Village-A	60	34	56.66
Village-B	35	33	99.05
Village-C	250	73	29.2
Total	345	140	40.57

5 Findings of the Study

5.1 Community role in JFM & degradation of open access forest

In this section we undertake a village-specific analysis to assess the performance of JFM and its effect on the overall status of forest. As mentioned in the previous section, village-A and village-B have been protecting a patch of forest each since last 30 and 40 years respectively and quite recently (in 2004) they have been brought under JFM. However this has not brought in similar outcomes. Both villages are successfully conserving the patches of forest assigned under JFM scheme. However, difference between two villages lies in their economic status and involvement in degrading open access forest. Most of the households in village-A belong to, socially stratified, general and other backward (OBC) categories. Similarly, most of the households possess agricultural land and send their children for secondary and tertiary level of education. Not a single household from village-A is involved in degrading open access forest. The main source of household income in this village is at least non-forestry. Although most of the households use fuel

⁶ See Figure-4.1 and 4.2 in Appendix for the location of study area.

wood for cooking, this is met from their protected forest. Similarly, occasional household needs of villagers for timber are met from the protected forest.

On the other hand, although households of village-B protect the forest assigned under JFM they completely rely upon open access forest for their livelihood. The dependency, however, is not limited to the sustainably extractible usufructs, but degrading the forest. All households of this village belong to the tribal community and most of them are either landless or marginal landholders. Not a single household possesses the legal entitlement over the house plot. Children of the village rarely go for secondary level of education. For a large proportion of households in this village, the main source of income is sale of firewood or charcoal in the nearest market.

The protected forests in both villages do not yield any marketable non-timber products such as *kendu*, *amla* and a variety of leaves used for making plates, broom-making grass etc. Therefore, villagers do not get any immediate economic return and have to wait for a couple of years for getting any economic return from timber harvest. Thus JFM does not address the livelihood problem of villagers in the short run. Due to lack of other gainful opportunities in the locality households of village-B largely depend upon open access forest for deriving their livelihood.

The third village of our study (village-C) carries the similar socio-economic characteristics of village-B. Most of the households in Village-C are engaged in degrading open access forest. Along with meeting their domestic requirement for firewood, and fodder (which might not have caused the degradation of forest) they derive their livelihood from the open access forest by selling firewood, charcoal and sometimes also timber in the market.

It demonstrates that even in presence of JFM, poverty forces the poor households engage in forest degradation. Where rural folk are completely dependent on forest for their basic livelihood requirements and the forest does not bear any immediate benefits in the form of valuable usufructs, community members go for forest degrading activities –such as excessive tree felling and preparing charcoal by setting fire in the forest. The implementation of JFM might enable the community to protect a certain patch of forest, but until their opportunity cost remains close zero they will be involved in low yielding forest degrading activities from the open access forests. Without addressing the livelihood problem of rural households the implementation of JFM merely transfers the dependency from one patch to another.

5.2 Determinants of Individual Indulgence in Forest Degradation

Having discussed the functioning of JFM in two different scenarios here we explore the factors that influence the individual participation in forest degrading activities. Based on a general analysis of individuals and households of three villages we explain these factors.

Inquiries revealed that most of the households in village-B and village-C are involved in forest degrading activities. Since the forest adjacent to their village does not bear any major saleable non-timber forest products, people rely on the sale of firewood and charcoal in the local market to earn their livelihood. The local market for firewood and charcoal is of oligopsonistic in nature and fetches a very low return⁷. Also the enforcement by the forest department is very weak. As a result, the expected penalty is very low in all these three villages. Individuals could further lower the expected cost of penalty as they have reliable information on the movement of forest department officials. Therefore, the expected cost of penalty would vary due to the variability of probability of being caught by the FD officials and the level of penalty imposed by the forest officials. Although the expected cost of penalty varies from person to person, depending upon their access to

⁷ The respondents reveal that the sale of firewood in the locality fetches a minimum of Rs. 20 and a maximum of Rs. 40 depending upon their ability to carry firewood from the forest.

information, it is not of high magnitude. Moreover, all the sellers of forest products face the same price level. Therefore, the major determinant of the individual's participation in such forest degrading activities are the individual's own opportunity cost, which is determined by a few factors like land holding, educational attainment, availability of off-farm jobs in the locality, social network and availability of credit, as mentioned earlier in section III.

Further, the common factors, which determine the individual's opportunity cost, are the access to credit and availability of off-farm unskilled jobs in the locality. In our study area both are missing. The low level of household income in the locality also has not helped the development of rural informal sector, which would have created off-farm job opportunities. Therefore, the major determinants of individual's opportunity cost in our study area are the household's land holdings and educational attainment.

Land Holding	Household having at least one individual Involved in forest degrading activities		
	No	Yes	Total
No Land	10 (22.7)	74 (77.1)	84 (60)
>0 - 1 acre	16 (36.4)	22 (22.9)	38 (27.1)
1 - 2 acres	12 (27.3)	0 (0)	12 (8.6)
2 - 5 acres	3 (6.8)	0 (0)	3 (2.1)
Above 5 acres	3 (6.8)	0 (0)	3 (2.1)
Total	44 (100)	96 (100)	140 (100)

Source: Computed from data collected from HH survey

Note- Values in the parentheses are column percentage
Chi-Square value 56.14 significant at one- percent level.

5.2.1 Land Holding and Indulgence in Forest Degradation

Land is an important determinant of opportunity cost for the people in rural areas and hence it largely influences individual participation in forest degradation. From our study of 140 households, the majority of the households involved in FDAOF are either landless or marginal farmers⁸. The relationship between landlessness and indulgence in forest degradation is established from the chi-square test showing significant result (see Table-2). In addition to the low land holdings, low productivity of agriculture due to lack of irrigation facility keeps the agricultural production low. In village B and C a number of households also lost the land that earlier they occupied in the periphery of the adjacent forest area and now comes under the buffer

⁸ There is wide difference among economists and different organisations to classify the farmers into different categories. Some time times classification is made on the basis of land size and some times on the basis of yield. For a broad analysis, see Patnaik, Utsa (1999) 'Ascertaining the Economic Characteristics of Peasant Classes-in-Themselves in Rural India: A Methodological and Empirical Exercise'.

zone of newly created wildlife sanctuary. Due to lack of legal entitlement over that land they also did not receive any compensation. As a result, the villagers are now unable to do any agricultural activities. Crop damage by elephants adds up to these woes. Thus a number of households opt to leave their land fallow. Out of total 140 households, 96 households are indulged in FDAOF (see Table-2); of these 74 households (77%) are landless, 22 households (23%) own land of one acre or less. Households owning two acres or above of land are not at all indulged in FDAOF.

5.2.2 Educational Attainment and Indulgence in Forest Degradation

Another determinant of individual's opportunity cost is their educational attainment. Low or zero educational attainment keeps the opportunity cost low if the individual does not possess any special inherited skill. Moreover, low educational attainment limits the individual's access to market information and mobility, which determines the entry into any job market. The theoretical analysis discussed in earlier section, suggests that in a forest fringe area illiterate people are more likely to be involved in FDAOF. However, in a household higher educational attainment of one individual has positive externality on the other members. Therefore, instead of individual educational attainment, our analysis uses the average years of schooling for the members of household above age 5. From our sample, out of 96 households indulged in FDAOF, in 5 households all the members are illiterate; 67 households have attained 1 to 5 years of schooling. Table-3 demonstrates that with the attainment of higher level of education, the household's indulgence in forest degradation decreases, which is reflected from the diminishing number of households indulged in FDAOF with the increase in educational attainment. Out of total 96 households indulged in FDAOF, 67 households have attained only 1 to 5 years of schooling, and only a few households are indulged in FDAOF when they have attained higher education. Out of the 26 households, which have attained an average 7 to 10 years of schooling 21 (81%) do not engage in forest degradation; and only 5 (20%) households remain in such a relationship. The association between the level of educational attainment and involvement in forest degradation is strengthened from the chi-square test showing significant result.

Average Years of Schooling	Household having at least one individual Involved in forest degrading activities		
	No	Yes	Total
0	0 (0)	5 (100)	5 (100)
1 - 5	7 (9.5)	67 (90.5)	74 (100)
5 - 7	14 (42.2)	19 (57.6)	33 (100)
7 - 10	21 (80.8)	5 (19.2)	26 (100)
10 - 12	2 (100)	0 (0)	2 (100)
Total	44 (31.4)	96 (68.6)	140 (100)

Note- Values in the parentheses are row percentage
Chi Square value (54.5) significant at 1% level

Source: Computed from the data collected from HH survey

Further, Table-4 shows the level of educational attainment by an individual (between age 15 to 65 years) and his/her main occupation. 54% (86 out of 159) of the illiterate people are engaged in

FDAOF. With increasing levels of educational attainment the number of individuals engaging in forest degradation gradually diminishes. Particularly, few households who have attended the high school level of education prefer to engage in forest degradation. Table-4 also reveals that after attaining high school education, many (27) people would rather prefer to remain unemployed than indulging in forest degrading activities. We also observe that a large number (43) of individuals after attaining high school education are engaged in household work. This is explained by the social norm of the village-A where no woman engages in work outside the home. Therefore, we can draw the conclusion that education has a considerable influence on the individual in determining his/her involvement in forest depleting activities.

Table-4: Educational Attainment of the Individual (Between Age 15 To 65) and their Main Occupation

Main Occupation of the individual	Educational attainment (count)						Total
	Illiterate	UP school	ME School	High School	10+2	University	
No work	14	7	2	0	0	0	23
Service in govt. sector	0	4	2	13	4	1	24
Job in private sector	0	0	1	3	1	1	6
Business	1	3	2	6	2	1	15
Farming in own land	2	11	4	17	2	1	37
Share cropping	1	6	2	2	0	0	11
Wage labour	7	8	6	11	0	1	33
Firewood collection for sale	86	39	12	8	0	0	145
Unemployed	8	6	5	27	4	1	51
Household works	38	34	15	43	2	0	132
Animal rearing	1	0	0	0	0	0	1
Student	0	0	0	16	8	0	24
Helping the main worker	1	8	3	9	1	1	23
Total	159	126	54	155	24	7	525

Source: Computed from the data collected from HH survey

5.3 Multivariate Analysis

Although our bi-variate analysis establishes the relationship between landlessness, low human capital and involvement in forest degradation we go one step ahead, by undertaking a multivariate analysis, to confirm this relation. A multivariate analysis provides the association of each independent variable (with the dependent variable) with greater accuracy after controlling for all other variables.

Our conceptual model for this purpose is specified as follows:

Indulgence in Forest degradation = f (landholding, human capital, awareness, income)

The dependent variable is defined as a binary variable; 1 for households having at least one individual involved in FDAOF and 0 for non-involvement. Similarly, dependent variables namely landholding and human capital are categorical variables. The former variable is coded as 1 for households in possession of land and 0 for households without land; the latter variable is coded as 1 for the households with average schoolings of high school for all members above age 15 and below 65 and 0 for not attaining this level. Environmental awareness is categorized into three groups such as no awareness (0), merely aware (1) and very well aware (2)⁹. Income variable is incorporated in the model as a continuous variable. Indulgence of the household in forest

⁹ Respondents categorised as merely aware are those who simply say yes and listen from radio; very well aware are those who clearly elaborate upon the various impacts of forest degradation.

degradation is expected to have a positive relation with landlessness, lack of human capital, poor awareness on consequences of forest degradation and low income. To avoid the multi-colinearity we have followed the block entry method of logistic regression analysis in SPSS. In separate blocks we include an additional variable to measure its effect. The presence of multi-colinearity makes the initially significant variable insignificant¹⁰. However, our analysis did not show any such problem.

Results of multivariate logistic regression analysis are given in Table-5. Our results come in conformity with the conceptual model. The participation of households in FDAOF is influenced by various household characteristics. Households, those are landless, lack human capital, and have low aggregate household income, are more likely to go for FDAOF. Our results demonstrate that the landless household members are almost 5 times more likely to be involved in forest degradation when compared with land owning households. Similarly, households with an average educational level below high school are almost 12 times more likely to engage in forest degradation as compared to the households with an average educational attainment above high school level. The members of households with merely awareness¹¹ on the impact of forest degradation are 42 times more likely to be involved in forest degradation and the households with no such awareness are 31 times more likely to be involved in forest depletion than the households who are very well aware of the impact of forest degradation.

Table-5: Logistic Regression showing the odds for household's involvement in forest degradation by selected household characteristics

Variables	Model-1	Model-2
Land Holding		
Have land®	1.00	1.00
No Land	6.528*	5.485*
Human capital		
Have attained High School®	1.00	1.00
Have not attained High School	11.584*	10.800*
INCOM	1.00*	1.00#
Environmental awareness		
Very Well®		1.00
Yes		42.051*
No		31.312*
-2 log likelihood	106.206	84.294
Model Chi-Square	68.091	90.002
N	140	140

Note: * p = <0.01; # p =<0.10

® - Reference category

From both bi-variate and multivariate analysis we find that landlessness, lack of human capital and low or mere environmental awareness have considerable bearing on the rural households participation in forest degrading activities. In our analysis the purpose of considering the attainment of high school education as the referent category stems from the fact that merely being literate (primary or middle school education) hardly makes any difference to an individual in terms of skill-gain and better access to information and mobility. In rural areas households, which possess land, get income and employment from this. It keeps the opportunity cost of individual members high and restricts them from participating in low-yielding forest degrading activities. On

¹⁰ For an elaborate analysis of logit model in SPSS see [Field \(2005\)](#)

¹¹ We have categorized the environmental awareness into three categories. 1st is No awareness, 2nd is merely aware (yes) and thirdly very well.

the other hand, education plays a vital role in increasing the access to information from external world, resulting in increasing mobility, and the possibilities of skilled employment. It increases their opportunity cost and discourages them to be involved in forest degrading activities. Further, awareness on the impact of forest degradation dissuades members of households from participating in forest degradation. Nonetheless, mere awareness of the negative consequences of deforestation does not induce individuals to get away from forest degrading activities. Only a high level of awareness induces the individual to refrain from such activities. (In section 5.4 we have discussed how mere environmental awareness fails to stop individuals from forest degradation).

Table-6
People's awareness on the impact of forest degradation and their involvement in forest degradation

Awareness on the impact of forest degradation	Household having at least one individual Involved in forest degrading activities		
	No	Yes	Total
No	1	7	8
Yes	19	87	106
Very well	24	2	26
Total	44	96	140

Source: Computed from the data collected from HH survey

5.4 Environmental Awareness and its Internalisation

For conservation of any natural resource by the community members, environmental awareness is very much important. Hussain and Bhattacharya (2004) have stressed the necessity of environmental awareness among the community members before the implementation of JFM programme. Nonetheless, our study reveals that mere environmental awareness does not necessarily get internalised by the community members to act upon forest conservation. Baland and Platteau (1996) also point out that unless the impact of resource degradation affects the life of community members severely, they hardly come forward for its' protection. Our sample households demonstrate different degrees of environmental awareness and involvement in forest degradation (see Table-6).

Table-7 Awareness on the Impact of Forest Degradation in Different Villages

Village	Awareness on the impact of forest degradation			
	No	Yes	Very well	
Village-A	3 (9.1)	27 (81.8)	3 (9.1)	33 (100)
Village-B	1 (3)	12 (35.3)	21 (61.8)	34 (100)
Village-C	4 (5)	67 (91.8)	2 (2.8)	73 (100)
Total	8 (6)	106 (76)	26 (18)	140 (100)

Note: Values in the parentheses are row percentage

Source: Computed from the data collected from HH survey

Out of the total 140 respondents, 8 of them show their ignorance of the negative outcome of forest degradation and of them in 7 households there is at least one individual indulged in forest degrading activities. 106 respondents show moderate awareness but in 87 households there is at least one member involved in forest degradation. Similarly, out of 26 households who show very good awareness of impact of forest degradation, 24 remained uninvolved in any type of forest degradation activities. The respondents who show their awareness on the impact of forest degradation moderately (here, replying yes) reply that they often listen from radio about this. But unfortunately their awareness does not get internalised. In this locality, environmental problems have also been not so acute as to force the local people to stop forest degradation. Village-wise analysis on environmental awareness (see Table-7) reflects that most of the people in village-B and village-C show moderate awareness but in village-A a majority show very good awareness. This may be simply due to the higher level of education attained by the people in village-A. The failure of villagers in village-B and village-C to internalise their moderate environmental awareness could be due to their landlessness. Most households in these two villages do not possess land. Therefore, the drop of water table or irregular rain caused by rampant forest degradation does not affect them much. So far as the direct impact of forest degradation is concerned, since the villagers' opportunity cost is much lower they don't hesitate to walk a long distance to collect firewood. All the respondents in village-B explain the increasing distance of forest from their village over the years and degradation in the quality of forest. A few decades ago the forest had been adjacent to their village, from where they used to collect firewood as well as timber, but now they have to walk down around 12 kilometres for collecting firewood.

Table-8 Main Occupation of the Individuals in Village B & C (In percentage)

Main Occupation of the individual	Male	Female	Total
No work	0.5	2.4	1.4
Service in govt. sector	7.1	0.6	4.0
Job in private sector	0.5	-	0.3
Business	2.2		1.1
Farming in own land	7.1	0.6	4.0
Share cropping	4.9	-	2.6
Wage labour	11.5	3.0	7.4
Collects and sale forest products for income	34.6	46.7	40.4
Unemployed	19.8	1.8	11.2
Household works	0.5	40.1	19.5
Animal rearing	-	0.6	0.3
Student	6.6	1.2	4.0
Helping the main worker	4.4	3.0	3.7
Total	100.0	100.0	100.0

Source: Computed from the data collected from HH survey

5.5 Role of Women in Forest Degradation

Out of three villages, in village-A no individual is involved in forest degradation to earn their livelihood. However, in village B and C most households are engaged in forest degradation. Out of 349 people in the working age group of these two villages (between 15 and 60) 182 are male and 167 are female. 46.7% of the women's main occupation is collection of firewood for sale (See Table-8). Similarly, 34.6% of men are engaged in same activity. In these two villages it is generally preferred that the female member go to forest for collecting firewood whether for sale or domestic use. The reason behind this is, as villagers explain, the penalty for a woman if caught by the forest guard is lesser than that of men. If the forest guard catches women they simply have to surrender

their sickle or axe along with seize of the bundle of firewood. But in case of men, the penalty could be in terms of money or sometimes jail. Further, on availability, men work as wage labour in the neighbour villages or do farming in their own land or sharecropping. Another reason for women going to forests could be the non-availability of enough other work in the locality.

5.6 Do Tribals Degrade Forest?

There is a debate in India whether tribals are involved in forest degradation or not. In the literature it is widely described and also there is a general notion that tribals don't degrade forest since they depend on it for their livelihood. Nevertheless, from the findings of our study it seems that the romanticized notion that tribals are the conservators of forest cannot be generalized and should be taken with caution while going for policy recommendations. Table-9 shows the caste category and involvement in forest degradation. From the sample of 140 households only the tribal households are engaged in forest degradation. It is observed that tribals are mostly engaged in forest degradation to meet their basic livelihood needs. A broad analysis of their economic conditions will help us to find the reason behind their involvement in forest degradation.

Caste Category	Household having at least one individual Involved in forest degrading activities		
	No	Yes	Total
General	26	0	26
OBC	6	0	6
SC	2	0	2
ST	10	96	106
Total	44	96	140

Note: OBC - Other Backward Caste

SC - Scheduled Caste; ST - Scheduled Tribe

Source: Computed from the data collected from HH survey

From our study of 140 households, 84 households are landless and of them 79 households are tribal. Not a single tribal household has land of more than 2 acres (see Table-10). Out of 106 tribal households 79 are landless, 25 households have land of 1 acre or less, and only 2 have land between one to two acres. As mentioned earlier, the marginal farmers hardly get any yield from their land as it is poorly irrigated. Due to high frequency of crop damage by elephants, many households leave their small amount of land fallow. During the interview of households, they claimed unequivocally that they don't get any compensation for crop damage, even after complaining at the forest office, and when they do, the amount is very low and arrives too late.

Thus agriculture has zero or negligible contribution to these tribal households to provide food and employment. At the same time, people in the working age group are either illiterate or merely literate without any job skills. They also lack information regarding other employment opportunities. Even though sometimes they go out in search of work, labour contractors cheat them. Further, the socio-cultural factors also work against their mobility. There is hardly any employment opportunity available in their locality. Therefore, the ultimate alternative left for them is to clear forest, which is easily accessible, and sell firewood and charcoal in the local market to meet their subsistence requirements.

Size of agricultural land holding	Caste Category				Total
	General	OBC	SC	ST	
No Land	4 (4.8)	0 (0)	1 (1.2)	79 (94)	84 (100)
>0 - 1 acre	8 (21.1)	5 (13.2)	0 (0)	25 (65.8)	38 (100)
1 - 2 acres	9 (75)	0 (0)	1 (8.3)	2 (16.7)	12 (100)
2 - 5 acres	2 (66.7)	1 (33.3)	0 (0)	0 (0)	3 (100)
Above 5 acres	3 (100)	0 (0)	0 (0)	0 (0)	3 (100)
Total	26 (18.6)	6 (4.3)	2 (1.4)	106 (75.7)	140 (100)

Source: Computed from the data collected from HH survey

Note- Values in the parentheses are row percentages

Chi square value (79.86) significant at 1% level

6 Conclusion

The present study examines the role of rural communities involved in JFM in degrading the *de facto* open access forests. In India only 28 percent of the total forest areas have been brought under JFM scheme and the rest 72 percent remains virtually open access to all. A large proportion of households in the forest areas are also living under abject poverty. In this context the study brings forth important findings for deriving crucial policy implications. The study shows that poverty among rural poor households and low opportunity cost forces them to degrade open access forests. Although households successfully participate in JFM, they are engaged in degrading open access forests to eke out their livelihood. Therefore, implementation of JFM without addressing the basic problem of livelihood would not be successful to halt forest degradation by local community. In this context, an important policy implication is that the piecemeal implementation of JFM would not necessarily result in the conservation of forest at macro level. Therefore, in order to halt forest degradation by these communities, different departments and agencies should work hand in hand. First step in this direction should be to generate employment opportunities in rural areas. The next priority should be skill formation and infrastructure development in rural areas. Education increases the employability and mobility of labour. It will enable them to work in other places or be self-employed. Role of government is very much important in this direction to break the vicious circle. Thirdly, provision should be made for channelling more credit to rural educated youths for making them self-employed. Fourthly, allocation of land to the landless would go a long way to restrain the local people from forest degradation. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 brought out by the Government of India is a landmark step in this direction. However, mere allocation of land would not serve any purpose unless the land is of marked quality for cultivation and provision made for irrigation. After addressing these basic problems of livelihood, the implementation of JFM would ensure better participation of local community in forest conservation. Moreover, in order to halt the illegal timber smuggling by outsiders, legal provisions should be made more stringent. Social fencing by

the local community would minimize the monitoring cost. Hence, devolution of greater power to the local communities would help a great deal to minimize timber smuggling.

Our study also throws new insights to carry out further research on community participation in forest conservation. In our study area forests did not yield any immediate return due to lack of non-timber forest products. However, there are forest areas where a number of non-timber forest products –such as *kendu* leaves for making *bidi*, *saal* and other leaves for making plates, and a variety of fruits and leaves having herbal utilities –are available. In many forest areas, eco-tourism is also emerging as a major source of income. In these forest areas, if provision made, local communities will get immediate return to derive their livelihood and will have better incentives to conserve this forest. Therefore, further studies should be carried to examine the different nature of forests and community participation in forest conservation.

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Fig-4.1 Location Map of Chandaka Wildlife Division in Orissa and India

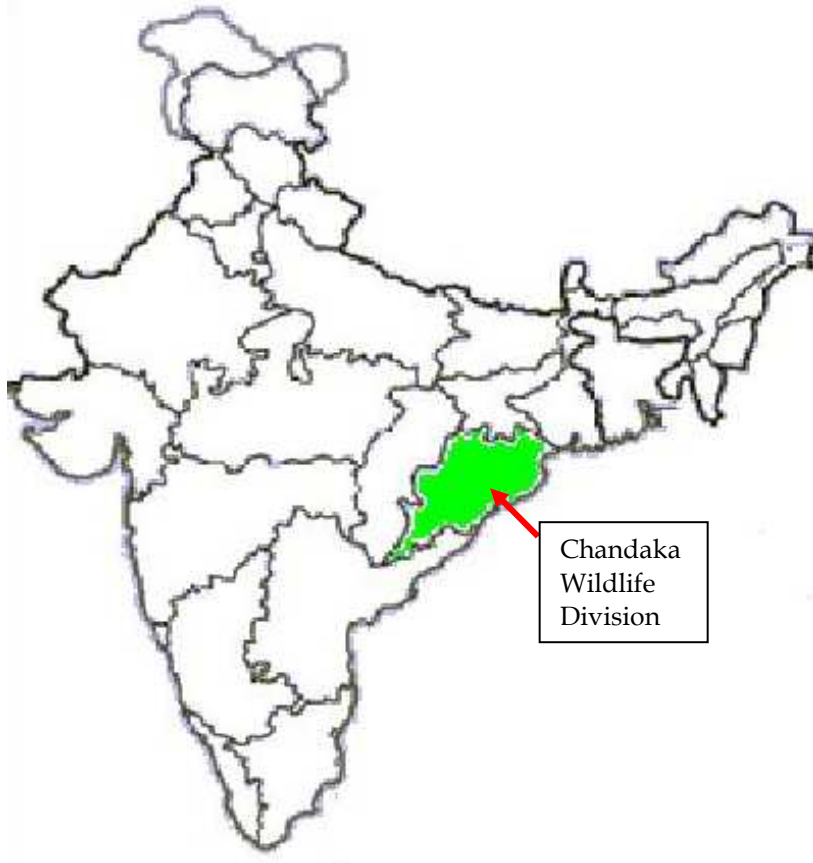


Fig-4.2: Location Map of Villages studied in Chandaka Wildlife Division

Chandaka - Damapara & Nandankanan Sanctuary

