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Factors Reducing Illegal Logging on Participatory Forests: A Case Study in Central Sal Forests in Bangladesh

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Abstract

There is growing recognition that safeguarding forests from illegal felling requires the active involvement of local communities, but knowledge of how best to do this is limited. In this study we identified factors that reduce illegal felling on participatory forest management (PFM) project plots in Bangladesh. Data were obtained from an interviewer-administered questionnaire survey of farmers in the region. 581 farmers were randomly selected from 3 forest divisions using stratified random sampling technique. Statistical analysis identified that the following factors were important: (a) farmers' confidence in aspired benefits being received; (b) felling of trees just after completion of agreement tenure; and (c) cooperation of the forest department (FD) in managing and protecting trees from illegal felling. Safeguarding trees from illegal felling requires active partnership between the FD and the participating farmers.

Key words and Phrases: Participatory forest management, Central Sal forests, Illegal felling, Asia, Bangladesh.

1. Introduction

The exploitation of forests in tropical countries has received increasing attention from environmentalists and government policy makers. Much of the writing on this subject has conveyed the impression that many developing countries are on the edge of being transformed into vast deserts and mountain watersheds due to excess forest exploitation (Allen and Barnes, 1985; Eckholm, 1982; Myers, 1982). Illegal logging is a rampant and is one of the most critical threats to forest resources in many timber-producing countries in the developing world (ITTO, 2001). Illegal logging is destroying forests and forest communities around the world (Brack and House, 2005; FERN, 2002). It undermines the rule of law and leads to substantial revenue loss for the state and thus is a major problem for many countries in the developing world (Brack and House, 2005). Illegal logging can be considered as form of 'perverse' social capital (Rosyadi et al., 2005) because it encourages forest crime, corruption and tax evasion, and has serious economic and social implications for the poor and disadvantaged. It retards sustainable development in some of the poorest countries of the world.

Illegal logging is also a major cause of forest depletion in Bangladesh (Salam and Noguchi, 1998; Salam et al. 1999; Rasheed, 1995). Countless illegal loggers and timber traders have been active to plunder trees from the national forests in Bangladesh (Salam et al., 1999). The mass media and a number of environmental groups have predominately portrayed "illegal" logging as criminal acts by unscrupulous business groups/or individuals who openly sponsor criminal acts of encroachment into national forest areas with help of some dishonest Forest Department (FD) staff. Forests in Bangladesh have been declining rapidly as a result of such illegal logging. The natural forests of Bangladesh had been declined at a rate of 2.1% annually over the 20-year period ending in the early 1980s and at a rate of 2.7% in the period from 1984-1990 (FMP, 1993). Although the FD considers 14.6% of the total land area of the country as forested

(BBS, 2000), in reality, only about 6% of the total area of the country merits the term 'forested' (Giri et al., 1996; Collins et al., 1991).

Two main forest conservation approaches can be identified; the protection approach that regulates and minimizes forest use in order to keep the forest intact and free from human impact, and the community forest management (CFM) approach that takes into account the local peoples' dependence on forest resources, the sheer impossibility of keeping them away from forests, and so "intimately involves" (FAO, 1978) them in forestry activities. CFM involves the active protection of a forest area and the regulation of its use by an associated community. This new paradigm of forest management seems to offer substantive promise for sustainable forest management (Kumar and Kant, 2005) and thus this approach of forest management has received increasing attention from governments, researchers and educational institutions worldwide over the past two decades (e.g., Arnold, 1998; Clugston and Rogers, 1995; Douglass, 1992; Fellizar and Oya, 1994; Robinson, 1995). Recently, the rights of local inhabitants of protected areas have begun to receive greater attention in international discussions (Agrawal and Gibson, 1999; Johnson and Forsyth, 2002). Governments of many countries have prioritized CFM as a tool for forest protection in the face of rapidly decreasing forest resources because they have found that they are unable to protect forests without the assistance of local people (Conroy et al., 2002; Sekher, 2001).

CFM approach often involves different ways of empowering local communities by allowing them to be actively involved in planning and decision-making process. The literature is rich with reports describing these approaches such as joint forest management (JFM) in India (Conroy et al., 2002; Sarin, 2001), integrated resource management in India (Saxena et al., 2002), community-based forest management (CBFM) in Nepal (Kellert et al., 2000), the Philippines and Thailand (Arnold, 1998 pp. 24-34) and Vietnam (Poffenberger, 1996), co-management in Canada (Beckley, 1998), social forestry in Southeast Asia (Peluso et al., 1995) and participatory forest management (PFM) in Bangladesh (Rasheed, 1995; Salam et al., 2005) and in some developing countries (Richards et al., 2003). It is clear from well established CFM projects that community participation can result in an increased flow of products and other benefits to local users, and can bring about improvements in the condition of the resources (Malla, 2000; Murniati et al., 2001; Sokh and Iida, 2003) It is, therefore, indispensable to sustainable forest management (Boon and Meilby, 2000).

There is growing consensus among key forest decision-makers in Bangladesh that to safeguard the forests traditional forest management needs to make the transition to a more sustainable approach that involves an iterative process of continuous improvement. In this regard, the government has attached the highest priority to its PFM projects, which was launched with the goal of involving local communities in the management of national forest resources. It has become the dominant strategy in the country's forestry sector from the beginning of 1980s (Khan and Begum, 1997). All the PFM projects expected that participating farmers would come from underprivileged sectors of the local communities, comprising residents who were landless. Under these projects, 1 ha degraded and/or encroached national forest land (termed as a plot) was allotted to each participating farmer and plantation on this plot was established by the costs of PFM projects' fund. Farmers are responsible for taking care and protecting the planted trees on their own plots from illegal felling and possible damages. Farmers receive benefits for these activities in

the form of (a) all benefits of intercrops, fuelwood, and first thinning/pruning; and (b) a share of benefits from final felling after completion of 10-year rotation period. Benefit-sharing distribution was stipulated as: beneficiaries (45%), FD (45%) and Tree Farming Fund (10%) (FD, 1997). A contractual agreement was made between individual farmer and divisional forest officer (DFO) on behalf of the government.

In their study Salam and Kabir (2001) found that trees on a number of PFM plots were illegally felled. Thus, protection of trees from illegal felling is important for the sustainable PFM project. An important element of protecting trees from illegal felling is patrolling the forests (Linkie et al., 2004; Sánchez-Azofeifa et al., 2003). As farmers are responsible for patrolling, safeguarding trees on the PFM plots requires the active participation of farmers. But knowledge of how best to do this is limited. Although much of the literature on PFM projects evaluates the existing conditions and management issues (ADB, 2001; Islam, 2000; Khan and Begum, 1997), no study has identified the essential requisites for reducing illegal felling on PFM plots. This study aims at identifying factors that reduce illegal felling on PFM plots.

2. Materials and methods

2.1 Study site

The plane-land forests in Bangladesh, commonly known as 'Sal forests', can be divided into two regions: central and northern. The central Sal forests are located in Dhaka, Gazipur, Tangail, Mymensingh and Jamalpur districts and the northern ones are distributed in small patches in the Dinajpur, Rangpur and Rajshahi districts. Sal forests under the FD consist of 120,255 ha of which 104,616 ha (87%) are located in the central region with the remaining 15,639 ha (13%) in the northern region. Because PFM projects in Bangladesh have been operating mainly in the central Sal forest areas this study was conducted only in central Sal forest areas. Sal forests have been dramatically reduced in area and now exist only in a number of widely scattered and degraded patches. The forests consist of patches of Sal *(Shorea robusta)* coppice, occasionally with other tree species. Sal forest areas have undergone severe encroachment and most root stocks in the remnant Sal forests have lost their coppicing ability, requiring the use of plantations for re-afforesting such areas. About 20,382 ha of central Sal forest lands were distributed among 18,940 participating farmers for PFM.

2.2 Sample Selection

The study is based on primary cross-sectional data collected using stratified random sampling. There are three forest divisions in the central Sal forests: Dhaka, Tangail, and Mymensingh. Each forest division is divided into a number of administrative blocks known as beats. There are 22 beats in Dhaka forest division, 31 beats in Tangail forest division and 22 beats in Mymensingh forest division. At first, four beats—one from each forest division—were randomly selected. From each selected beat 150 participating farmers were randomly selected, yielding 600 in total. An interviewer-administered questionnaire survey was administered to each of the selected farmers. At the time of survey, 19 farmers migrated temporarily from the study areas and were not included in study leaving 581 participants is to survey.

2.3 Statistical analysis

To identify factors that may reduce illegal felling on PFM plots, a discrete variable logit analysis was carried out. Information on whether at least 1 tree on a PFM plot was illegally felled or not can be framed as binary-choice model. Let T_i represents a dichotomous variable that equals 1 if at least 1 tree from a PFM

plot was illegally felled and 0 otherwise. The probability of illegal felling of at least 1 tree on a PFM plot, $\Pr(T_i = 1)$, is a cumulative density function F evaluated at $X_i\beta$, where X_i is a vector of explanatory variables and β is a vector of unknown parameters. This kind of cumulative density function can be modeled using logistic probability function, which has the following form:

$$P_r(\text{At least 1 Tree on a PFM plot was illegally felled}) = P_r(T_i = 1) = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)}.$$

The estimation form of logistic transformation of the probability that at least 1 tree from a PFM plot is illegally felled $P_r(T_i = 1)$ can be represented as:

$$Ln\left[\frac{\Pr(T_i = 1)}{1-\Pr(T_i = 1)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_n X_n \quad (1)$$

To estimate the parameters of the variables influencing illegal felling on a PFM plot, a maximum likelihood estimation was used as shown in equation (2).

2.3.1 Variables used in the model

The response variable: The response variable is whether at least 1 tree on a PFM project plot was illegally felled, and was coded with the value 1 to indicate that at least 1 tree was illegally felled and zero otherwise.

Independent variables: It is assumed that the factors listed in Table 1 are implicated in reducing illegal felling on PFM project plots and thus they were included in the model as independent variables. Characteristics of the independent variables are shown in Table 1.

2.3.2 Model

Given the above-hypothesized factors that may reduce illegal felling on PFM plots, the model to be estimated is:

$$Ln\left[\frac{\Pr(T_i = 1)}{1-\Pr(T_i)}\right] = b_0 + b_1(FI) + b_2(SP) + b_3(FDC) + b_4(PDMP) + b_5(TFAT) + b_6(EBRH) + b_7(PFAS) + b_8(ABSS) + b_9(CFDS) + b_{10}(FDP) \quad (2)$$

where

FI = total household income;

SP = a dummy variable indicating whether the farmer is satisfied in participating in PFM project or not. If satisfied, SP = 1 and 0 otherwise;

FDC = a dummy variable indicating whether the FD is cooperative in managing and protecting trees of PFM plot or not. If FD is cooperative, FDC = 1 and 0 otherwise;

PDMP = a dummy variable indicating whether the farmer participated in decision-making process or not. If participated, PDMP = 1 and 0 otherwise;

TFAT	=	a dummy variable indicating whether trees were felled after completion of 10-year rotation period or not. If felled, TFAT = 1 and 0 otherwise;
EBRH	=	a dummy variable indicating whether the farmer thinks that he would receive aspired benefits after final felling of trees or not. If the farmer thinks positively, EBRH = 1 and 0 otherwise;
PFAS	=	a dummy variable indicating whether the farmer agrees with the strategies of PFM programs or not. If agrees, PFAS = 1 and 0 otherwise;
ABSS	=	a dummy variable indicating whether the farmer agrees with the benefit-sharing principle or not. If agrees, ABSS = 1 and 0 otherwise; and
CFDS	=	a dummy variable indicating whether the farmer had conflicts with the FD staff or not. If had conflicts, CEDS = 1 and 0 otherwise.
FDP	=	a dummy variable indicating whether the FD staff patrol the PFM plot or not. If yes, FDP = 1 and 0 otherwise.

2.3.3. Test of hypothesis of the logistic regression model

Because of the large sample size, the test that a coefficient is 0 can be based on the Wald Statistic, which has a χ^2 distribution. The corresponding χ^2 critical values at the 1% and at the 5% level of significance will determine a rejection or an acceptant of the null hypothesis.

3. Results

Table 1 shows the characteristics of the variables included in the logistic regression model. It is observed that 47% of PFM plots had been subjected to illegal felling, 60% of the farmers did not participate in any decision-making process, 60% of the plots were not felled even after completion of the agreement period, and about 24% of the farmers were not confident about their share of benefits.

The null hypothesis in the model, $H : \beta_r = 0$, where r = 0, 1, 2, …, 10 is rejected. This result indicates that the variables in the logistic regression model have significant influence on reducing illegal felling on PFM plots.

The results of logistic regression analysis identified the following important factors that might reduce illegal felling on PFM project plots (Table 2). The cooperation of FD staff in managing and protecting trees of PFM project plots (FDC) significantly reduced illegal felling on PFM plots ($p < 0.01$). The odds-ratio indicates that for each unit increase on FD's cooperation in managing and protecting trees of PFM project plots, the probability of illegal felling on a PFM plot reduced from 1.0 to 0.36. Farmers' confidence that they would receive benefits after the final felling of trees (FBRH) was significantly contributed to reducing illegal felling on PFM plots ($p < 0.01$). The odds-ratio indicates that probability of illegal felling reduced from 1.0 to 0.03 on a plot of a farmer who was assured of receiving his/her share of benefits. The delay in felling trees after completion of the agreement tenure (TFAT) was significantly increased illegal felling ($p < 0.05$). The odds-ratio shows that risk of illegal felling was 1.644 times higher on a plot trees on which were not felled after completion of the agreement tenure than for the plots trees on which were felled just after completion of the agreement tenure.

Table 1: Characteristics of the variables included in the model

Variables included in the model	Yes %	No (%)
Whether trees were illegal felled on PFM plot (TIL)	47.2	52.8
Monthly household income (in Tk.)		
<2,000	19.6	
2,000-4,000	48.4	
4,000-6,000	16.7	
6,000 and more	15.3	
Average household income	Tk. 3661	
Whether farmer was satisfied with participation in PFM program or not; (SP)	76.4	23.6
Whether the FD cooperated farmer in protecting trees from illegal felling on PFM plot or not (FDC)	72.8	27.2
Whether farmers participated in decision-making or not (PDMP)	39.8	60.2
Whether trees were felled after completion of 10 year rotation period or not (TFAT)	39.9	60.1
Whether farmer thought that he would receive anticipated benefits after final felling or not (EBRH)	76.4	23.6
Whether the participating farmers agreed with the strategies of PFM projects or not (PFAS)	82.4	17.6
Whether farmer agreed with the benefit-sharing principle or not (ABSS)	96.0	4.0
Whether there were conflicts between the FD staff and the participating farmer (CFDS)	2.1	97.9
Whether FD staff patrolled in the PFM plot (FDP)	91.4	8.6

Table 2: Results of logistic regression analysis

Dependent Variable: Whether trees of the PFM plot were damaged or not.

Independent variable	Coefficient	S.E.	Wald's test	χ^2 p-value	Odds-ratio
FI	0.00	0.00	1.22	0.27	1.00
SP	0.02	0.32	0.01	0.95	1.02
FDC	-1.01	0.28	12.93	0.00	0.36
PDMP	0.18	0.21	0.71	0.40	1.20
TFAT	-0.81	0.22	13.96	0.00	0.44
EBRH	-3.63	0.52	48.95	0.00	0.03
PFAS	-0.46	0.32	2.04	0.15	0.63
ABSS	1.38	0.84	2.70	0.10	3.96
CFDS	-1.18	1.09	1.19	0.28	0.31
FDP	-0.43	0.63	0.46	0.50	0.65
Constant	6.05	2.32	6.82	0.01	424.01
Model χ^2	236.605			0.000	

4. Discussion and Conclusions

Illegal felling contributes to a number of unsustainable land-use practices together with a degraded environment that is not able to sustain the livelihoods of forest dependent people in the near future (Casson and Obidzinski, 2002). The practice of illegal felling is a significant threat to sustainable forest management in Bangladesh (Salam and Noguchi, 1998). Thus, protection of trees from illegal felling is the

cornerstone for the success of PFM projects. Farmers are primarily responsible for patrolling PFM project plots and thus their willingness to protect trees is one of the essential requirements for reducing illegal felling on PFM plots. In participatory approach of forest management, farmers' willingness to protect trees from illegal felling requires their appreciation, encouragement, incentives, effective support and active participation. Moreover, where local community is one of the main stakeholders of forests, meeting their needs and aspirations is the key factor in sustainable forest management (Peluso and Padoch, 1996). Thus, farmers may be less interested in protecting trees from illegal felling unless such factors are properly considered in PFM strategies. Consistent with the above notions, the results of this study identified important factors for reducing illegal felling on PFM plots.

One of the most important findings of this study is that cooperation and active support of the FD was a significant factor for reducing illegal felling on PFM plots. In participatory approach of forest management, protection of trees from illegal felling requires the active and meaningful participation of all stakeholders, especially local communities and the FD (Murali et al., 2003). Thus, PFM project is an opportunity for the community people to show their commitment in protecting trees and for the FD to show that their efforts are for the benefit of the community. In this regard, it is for the community and the FD to demonstrate their willingness to build effective partnership for the cause of sustainable development of PFM projects. The partnership between local communities and the FD involves the co-operative sharing of rights, responsibilities and benefits. In Bangladesh, PFM projects were established on the recovered encroached national forest lands. Encroachers were the influential local elites who were against the PFM projects because the purpose of the projects was against their interests (Salam and Kabir, 2001). There is evidence in PFM projects that local people with the support of local elites illegally logged on PFM plots being managed (Salam and Kabir, 2001). The negative attitude of influential local elite towards PFM projects is a risk to protecting trees on PFM plots. As the farmers are the vulnerable poor, they are less powerful and weaker section within the community. Without active cooperation of the FD, it is difficult for them to protect trees from illegal felling happened with active support of the influential local elite. In the contractual agreement, the FD committed to provide active cooperation to farmers (FD, 1997). But in some occasions, FD staff who are responsible for controlling illegal felling are themselves involves in the illegal felling process (Salam and Kabir, 2001), which diminishes the credibility of the patrols and makes the rules of the FD hypocritical in the eyes of the framers. This study has found that a considerable percentage (about 27%) of farmers did not receive any cooperation from the FD in protecting trees from illegal felling. However, the results of logistic regression analysis confirmed that cooperation of the FD staff (FDC) was a significant ($P < 0.01$) factor for reducing illegal felling on PFM plots. Thus, to reduce illegal felling on PFM plots the FD should be more cooperative.

Another important finding of this study is that confidence of farmers about their share of benefits was a significant factor for reducing illegal felling. Effective management and protection of trees by farmers depend on assured personal benefits of farmers (Jain and Singh, 2000). For instance, one of the most important reasons for the rapid expansion of the Joint Forest Management system in West Bengal, India is the assured promise of shared income from the final felling (Sarin, 1995). The suspicions of participants about receive their share of benefits might disrupt the interests and willingness of farmers' to protect trees from illegal felling. However, the result of this study indicate that one-fourth of the farmers were

suspicious about their share of benefits. Results of regression analysis clearly demonstrated that confidence of farmers in receiving their share of the benefits from the final felling (FBRH) was a significant factor for reducing illegal felling on PFM plots ($p < 0.05$). Trust lubricates cooperation and active participation of farmers in participatory approach of forest management. When a society is pervaded by trust, cooperative arrangements are unlikely to emerge (Baland and Platteau, 1998). In their study, Salam and Kabir (2001) identified that the FD and farmers mistrust each other and blamed for illegal felling on PFM plots. Thus, to reduce illegal felling on PFM plots an effective partnership between farmers and the FD should be established and an effective partnership between farmers and the FD will require an atmosphere of mutual trust and respect.

The aim of participatory forestry programs is for the FD and local participants to share benefits, responsibilities and control over forest management. Contractual agreements specify the distribution of authority, responsibilities, agreement tenure, and the share of benefits. Participants might therefore be disheartened if any of the contractual agreements are violated because of the negligence of the FD. Particularly, they would be worried about their share of the benefits if the trees on their plots were not harvested even long after completion of the contractual agreement period. Initial success might therefore be added through the enthusiasm and expectations of the farmers, but failure to deliver the services promised by the contractual agreements might threaten the farmers' interests in protecting trees from illegal felling. In the study areas, the agreement tenures of considerable percentage of PFM plots was completed well before the survey period, but the trees on these plots were yet to be harvested. Farmers of these plots were disheartened about rule of the FD in felling tress. Taking this advantage, illegal loggers, in collaboration with some dishonest forest officials, local elite and farmers, illegally felled all the valuable mature trees on some these plots. Results of regression analysis supported significantly ($p < 0.01$) that participants might be indifferent to protecting trees from illegal felling, if the trees on their plots are not harvested within a short period of time after completion of the contractual agreement period (TFAT).

Inefficient implementation of forest management strategies and corrupt organizations can play a key role in the poor outcomes of PFM projects (Agrawal and Gibson, 1999). Given the tendency of FD staff to circumvent the rules and ignore the agreements, it is necessary to establish effective mechanisms to ensure that the commitments made in the agreements are implemented in practice. In Bangladesh, interventions to prevent corruption and abuse of authority have traditionally taken the form of hierarchical top-down supervision, where a higher-level official is empowered to oversee the actions of subordinates. Such efforts may, however, increase the possibilities of corruption by creating new groups of overseeing officials who could themselves be corrupted. Complementary oversight by local communities has, therefore, better chances of increasing accountability (Robbins, 2000, p. 440). In this respect, local farmer committee, with representative selected by farmers, could be established. Such a committee could oversee whether any agreement conditions are violated and also set felling schedule in collaboration with the local FD staff. The committee could also oversee overall PFM activities in their locality and be authorized to report central FD authorities if suspicions of fraud or severe mismanagement. Special training and empowerment would do much to improve the bargaining power of these more marginal stakeholders with more powerful stakeholders. For instance, in India and Nepal, the National and State Forest Departments are turning to more process-oriented, less target-based planning, aimed at shifting the control and management of

forestlands from the FD to decentralized peoples' organizations (Hobley, 1996; Malla, 1997; HMGN, 1989; Gilmour and Fisher, 1991; Metz, 1991; Kumar and Bakshi, 2002). Thus, community forestry in these countries has contributed greatly to the development of forest resource management institutions at the grassroots level (Malla, 2000; Jain and Singh, 2000; Paudel and Thapa, 2002). To make the PFM projects sustainable, the interests of the participating farmers should be incorporated in to strategies of PFM program and there should a system of assessing performances and rules of all stakeholders.

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