Benefit Relationship between Owner and User of Common Pool Resource: Evidence from Joint Forest Management Programme in West Bengal

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Benefit Relationship between Owner and User of Common Pool Resource: *Evidence from Joint Forest Management Programme in West Bengal*

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This empirical study suggests that the economic outcome of joint forest management (JFM) programme has been beneficial for both forest fringe community and government who jointly manage the forest resource. Cooperation yields an outcome preferred by both as they are able to negotiate before execution of all activities. The theoretical model of common property resources suggests that cooperative behavior of JFM guided by norms of restraint and customs may be stable against invasion by narrowly self-interested behaviour. The study also indicates that without costly sanctions against poor JFM-households for extracting illegal forest products, JFM appears to be beneficial for all.

Keywords: *Joint forest management programme, Economic outcome, Cooperative game, Non-timber forest products.*

JEL Classification: *Q23, C71, D13, Q51, Q56.*

I. INTRODUCTION

In the context of Indian forestry, several strands have gone to the present emphasis on community involvement in forest protection. Joint forest management (JFM) programme emerges as one of the latest measures in a long history of policy changes. It attempts to create a new relationship between 'owner' or state and 'user' or community (Sarker and Das 2006: 269). Empirical evidence from across the world now confirms that community-based regimes are a viable option for the management of local common property resources (Baland and Platteau 1996, Berkes 1989, Bromley 1992, Correa 1999, Lama and Buchy 2002, Martin 1992, Naik 1995, Saxena and Sarin 1999, Singh 2001). But it is argued that the survival of community needs of poor communities should be recognized on a priority basis as pillars for strengthening community

participation (Mukherjee 1995). The most important factors motivating massive local peoples' participation for protection and development of forests are the expectations of immediate returns via wages and incomes from sale of old plantation and local consumption need to fill the requirements of fuel wood, fodder, minor forest produce and small timbers (Mukherjee 1995, Naik 1997, Saxena and Sarin 1999). Although the participatory management of forest in Arabari under Mednapore district, which acted as a key precursor to JFM movement in India, was successful, because both government and forest fringe community were economically benefited by this programme, simultaneously, the participatory forest management programme in Arjuni under the same district and very nearest in distance to Arabari, could not be beneficial to both government and forest fringe community. The Arjuni experience shows that unless survival needs of food and livelihood are met, participation in natural resource management would always remain threatened (Sarker and Das 2006: 275, Mukherjee 1995: 3132). This experience goes a long way to show that survival needs are of prime importance and can easily destabilize community rights and benefits to resource management. The findings of Naik (1997), based on two case studies in Gujarat, help identify the critical factors in making JFM successful and controllable. Any JFM which does not recognize the significance of creating strategies for sustaining livelihood – basic food security – at the local level has a doubtful future (Sarker and Das 2006: 286). This study, however, tries to examine whether JFM programme, which emerges as one of the latest measures in the long history of policy change, has been economically beneficial for both community and state.

The paper is organized as follows: Section II presents the importance of the study. The data set and methodology appear in section III. Section IV presents the key results of the study. A simple mathematical model based on empirical findings appears in section V. Conclusions are contained in section VI.

II. IMPORTANCE OF STUDY

Participatory model between the state and local communities has been globally accepted as a concept and essential tool for the sustainability of natural resources. More importantly, evidence of earliest forest management by the state is found in Kautilya's

Arthashastra (BC 321) which refers to 'forests' being managed as 'state reserves for revenue' and for 'public use' (Sarmah and Rai 2001: 209). But, indeed, no rulers in India did execute this policy in the management of forest resource of our economy before 1988. Rather, the forest policy of India before the year 1988 was oriented with commercial need either of the government or of the rulers of India without safeguarding the traditional rights and concessions of the forest fringe communities on forestland. In fact there was no systematic management of forest in the country before 1865. Some of the recorded forest conservation measures were initiated by *Emperor Ashoka*, as is testified by the decrees inscribed in rock and pillar edicts. This concern continued till the beginning of the 6th century. The *Mughals* and the early *British* rulers, however, evinced little interest in forest conservation. Systematic management of forest in country began in 1864 with the appointment of Dietrich Brandis, a trained German forester, as the Inspector General of Forests. The government decided to treat forests as state property by enacting the Indian Forest Act, 1865 (Act VII of 1865). Although, the first act of forestry in India was enacted in 1865, the major laws governing forestry have formulated by the Indian Forest Act of 1878, Indian Forest Act of 1927 and the Forest Conservation Act of 1980 (World Bank 2006: xvi). The Forest Conservation Act of 1878 and that of 1927 emphasized commercial timber production. The Forest Conservation Act of 1980 and the National Forest Policy of 1988 shifted the pendulum strongly towards forest conservation and joint forest management (ibid: 16-18). The National Forest Policy of 1988 constitutes a significant departure from earlier policies of forest management practice for its emphasizes on: (i) obtaining the active participation of local people in forest conservation and development programmes of local forest lands and (ii) the benefit sharing arrangements, which is intended to provide village communities living near the forests a stake in the protection and development on the degraded forests.

Concerning to the local people-centred forest conservation and development programmes under the framework of cooperative management in JFM, it is said that forestry can play a significant role for the well being of the people living in and around the forest areas and, conversely, these people can play a major part in making the forests around them more productive under local management partnership between the state and local communities. In keeping with this, a consensus has also emerged in both academic

and policy-making bodies about the desirability of cooperative model for the management of forest resources. The World Bank Learning Group on *Participatory Development* defined participation as process through which stakeholders' influence and share control over development initiatives, and the decisions and resources that affect them (World Bank 1995:3, World Bank 1996, Banki 1981). This definition acknowledges the sharing of benefits derived from the projects by the beneficiaries of projects and participation as a growth and development. The World Bank's 1991 Forest Strategy, in fact, emphasized greater involvement of local people in the long-term management of natural forests (World Bank 2000: 15). The ad-hoc intergovernmental panel on forests emphasized the crucial importance of sustainable forest management at the fourth session of the Eleventh World Forestry Congress held in October 13-22, 1997. Moreover the Rio Summit of 1992, which happened to be the turning point in the world environment history, paved milestone in the way of sustainability and further strengthened the concept of decentralized planning community participation to sustain forest management (Bhattacharya 2001: 13). The National Forest Policy of 1988 in India has also recognized the interdependence between people and forests, and envisages active community participation in the protection and development of forestlands for sustainability of forest management (SPWD 1998: 2). Managing timber forests along with a view to protecting, developing and utilizing the non-timber forest products (NTFPs) is being recommended for sustainable forest management. Research studies conducted on Orissa, Himachal Pradesh, Madhya Pradesh and Bihar indicate that over 80 per cent of forest dwellers exclusively depend on NTFPs for their daily subsistence and livelihood (Chandrasekharan 1998, Mallik 2000). The new policy lays emphasis on meeting the local needs in particular of the tribal and the rural poor living near the forest and in safeguarding their traditional rights and concessions subject to the carrying capacity of the forests. Livelihood sustenance issue also relates to sustainable harvest of NTFPs which ensures negligible impact on the structure and the dynamics of the timber production (Mallik 2000:386). However, sustainability relies on political, socio-economic and a set of institutional factors. But in the context of sustainability of forest resources what appears to be crucial is who these end-users are. The users may be government, community groups or local forest users. To this end, the requirements of the

fuel wood, fodder, other non-timber forest products and timber for construction by tribal and rural poor living near the forests for their consumptive and productive purposes have been regarded as the first charge on forests. The National Forest Policy of 1988 in India stipulates that the forestry activities be so designed to facilitate improvements in the socio-economic condition of the rural poor and tribal communities. In addition to this, sustainable yield of timber production for expanding government revenue has also been regarded as other important objective of forest management.

However, far-reaching developments in the demographic, economic, social and environmental fields have resulted in the revision of the national forest policy in 1988. Such revision of the forest policy marks a major departure from the earlier policies which emphasize on production of commercial wood and disregard for local need (Poffenberger 1995, Sarmah and Rai 2000: 213), because Government of India, then, could understand that until and unless the benefit of forest fringe communities is secured, neither forest resources nor forest management can be sustainable. So, in order to execute sustainable forest management system, the active participation of local forest communities in forest management for conservation and development plans of forest resources and the participatory forest management on usufruct sharing basis for safeguarding their traditional rights subject to the carrying capacity of forest was first introduced and implemented by the National Forest Policy of 1988.

JFM programmes in India currently span over twenty seven states, represent eighty five million village communities, and cover more than seventeen million hectares of forestland. The programme encompasses an estimated 8.3 million families, half of which are SC and ST (Bahuguna 2004). Most JFM units use the surrounding forests mainly as a safety net or for regular or seasonal subsistence production of firewood, fodder and minor forest products.

In West Bengal, the JFM movement gathered momentum when in 1989 a programme of resuscitation and reestablishment of *moribund sal* and other hardwood forests in the districts of Midnapore, Bankura, Purulia, Burdwan and Birbhum in south West Bengal was initiated by the government with the active participation and involvement of the local people. West Bengal government's resolution in 1989 was issued by declaring the principles of sharing of duties, responsibilities as well as the

usufructs from the forests to the participant local people living in the fringe of the forests. The procedures for establishment of the institution called forest protection committee (FPC), comprising of the participants as members, were also defined. The foundation of an innovative forest protection system and the participatory forest management were thus laid for the forests of south West Bengal which covers approximately thirty eight per cent of the total forest area of the state.

The joint forest management in West Bengal has its origin in the success achieved in rejuvenating a patch of seventeen hectares of degraded forests under a pilot project implemented during 1972 near Arabari in Midnapore district. About six hundred eighteen families living in eleven villages lying in the fringe voluntarily protected these forests when in return they were assured provision of fuel wood and fodder from the regenerated forest and employment in forestry activities. In 1987 these villagers were also declared as beneficiaries for these rejuvenated forests and granted twenty five per cent share from the revenue earned from final harvest. This project made both government and community benefited (SFR 2000: 47). It seems to be relevant to mention that the key precursor to JFM in India, from a management perspective, was a local level initiative in the Arabari (Jeffery and Sundar 1999: 28). JFM can, thus, be seen to emerge as the major policy change and attempt to create a new relationship between the government and the community in terms of cooperative framework. The present study seems to be important in that it tries to examine as to whether the cooperative model of JFM programme has been economically beneficial between government and forest fringe communities in the area adjacent to Arabari of Midnapore, namely, Bankura district where the government provides a gender-sensitive measure under JFM programme from early 90s.

III. DATA SET AND METHODOLOGY

The data have been collected through an intensive field enquiry covering all members from forest protection committee (FPC) villages under JFM programme – three sample female FPCs and three joint FPCs (Das 2008: 51-52, Das and Sarker 2008: 84, Sarker and Das, 2008: 25-26, 2007: 81-82)[1]. For the selection of female FPCs, random sampling technique (SRSWOR) is used. However, total number of members selected for

our field survey including female and joint FPCs, work out to 302. It is worth mentioning that each FPC was formed in the respective village. So FPC/village is synonymous in this study.

In addition to the comparison on current data of after situation of JFM during the year of survey, data during before situation of JFM are also collected during the same point of time from all the households through the *reflexive comparison method* where 'after' and 'before' scenarios are compared for all households under study (Ravallion, 2001; Reddy et al., 2004). However, the reference period regarding before situation of JFM is concerned, 'before situation' is not same in all JFM/FPC villages[2]. Before situation for each JFM village is considered for its preceding one-year period from the starting of JFM programme. However, in spite of these differences, when the data are presented in tabular form according to JFM villages as whole or joint and female FPCs separately, simple aggregation and simple average are considered in order to have a single average value in real term for each case. During the field survey, data were collected from all individual members of the respective JFM villages through the scheduled questionnaire.

This study considers simple technique of measurement like arithmetic mean, proportion and tabular analysis for examining our stated objective. Additionally, a simple mathematical model is also used for our study. Worthwhile to mention that although data were collected from individual household units of both female FPC and joint FPC, this paper attempts to study the economic benefit of community under JFM programme, irrespective of female FPC and joint FPC households.

IV. FINDING

As regards the achievement of JFM programme for Government of West Bengal is concerned, while examining the economic outcome of the programme for the government, State Forest Report (2000) clearly mentions:

"As a result of participatory and joint forest management activities in south West Bengal the vast tract of scattered, over-exploited and degraded forests containing mainly the sal were resuscitated and restored to productivity with great improvement in quality and density" (p. 47).

The forest report also reveals that the overexploitation of trees for timber was so severe that thousand and thousand hectares of forest lands in the south West Bengal except *Sundarban* were almost treated as bare plain land, when the JFM was established; but such lands are almost secured after JFM programme. Secondly, government revenue from the degraded forest was almost nil when the JFM was established, but it has significantly increased after JFM. (Das and Sarker 2008: 82-91; Sarkar and Das 2008: 22).

As regards the community, the forest fringe households, under JFM programme is concerned, at the very outset, we examine some basic characteristics of our surveyed JFM villages (Table 1). All members of five villages out of six are either SC or ST; around 48 per cent of households are landless, 41 per cent are marginal landholder and the rest, about 11 per cent are small landholder; over 77 per cent of households in each village live below poverty line[3]; except Baragari and Katul-2, majority of members in each village are illiterate. This study, however, indicates the abject economic and social conditions of the tribal people who are among the most disadvantaged group in rural Indian society.

Table 2 presents per capita annual net real income[4] (in INR) of surveyed households from forest source, non-forest source and all sources together along with the change of income between two reference time periods. The real income is determined after deflating the money income by cost of living index (general) of agricultural labourer. In doing so we use the technique of splicing (which consists in combining two or more overlapping series of index number to obtain a single continuous series)[5]. Table 2 shows the following important results. Forest is the major source of income for all categories of households during both before and after JFM situations (columns 3 and 6). The dependence on forest income for all categories of households, except small ones (households belonging to the better economic position on land status), has considerably increased after JFM (as shown by the change in forest income during the two reference periods in column 9). Before JFM programme the per capita annual net real income from forest source out of per capita annual net income from all sources for surveyed households ranges between 63.56 percentage point and 70.58 percentage points (column 6). It implies that forest was major source of income for all categories before JFM. The

contribution of per capita annual net real income from forest source out of per capita annual net real income from all sources for surveyed households works out between 67.96 and 87.45 percentage points after JFM programme (column 3). It implies that forest is also the major source of income for all categories of households after JFM. However, per capita annual net real income of all forest fringe households under the study has been increased (ranging between 2.74 and 57.65 percentage points) after JFM (column 11). Such increase of overall income of the households is only due to the net increase in income from forest source after JFM (column 9) because the income from non-forest source of the surveyed households in all villages has decreased to some extent (column 10).

The success of JFM programme with respect to economic outcome for forest fringe community and government, however, highlights some particular issues of the poor households of community, which live below poverty line (Table 3): *i*) about 83 per cent of income of poor forest fringe communities yield from forest source – legal source and illegal[6] source after JFM situation; *ii*) in all FPCs, except Baragari, the change of legal income is highly positive ranging between 42.91 percentage points to 117.17 percentage point; in Baragari this change is negative (–12.92 percentage points); c) when legal income from forest (NTFPs and wage income from forest) are inadequate to meet the bare subsistence level of income of these poor forest communities, they are involved in yielding illegal income by removing timber forest products (TFPs) from the forest land to meet up their minimum livelihood security. Table 3 also reveals that the illegal income from TFPs has substantially increased to one FPC (Baragari joint FPC) by poor categories of households who live below poverty line (column 9). This is mainly because the change of income from legal forest products of these poor categories of people of Baragari joint FPC is much lower (the change is negative) than that of the income from the same categories of households in other FPCs (the change is highly positive). It might indicate that force or law do not effectively control the illegal collection of TFPs of those poor households which live below poverty line, because such a little illegal extraction of timber does not seem to play more adverse effect on productivity of degraded forests and government revenue from forest resources after JFM compared with before JFM situation (SFR 2000: 47).

V. MATHEMATICAL MODEL OF COMMON PROPERTY RESOURCE

This section presents a theoretical model of common property resource (CPR) which tries to show that cooperative behavior guided by norms of restraint and customs may be stable against invasion by narrowly self-interested behaviour.

We start with a static model of the CPR as an n-person game (Dasgupta and Heal 1979, Chichilnisky 1994, Ostrom et al. 1992) which has been used by Sethi and Somanathan (1996). We exclude the assumption of costly sanction on the violation of illegal collection of forest products or of institutional arrangement under JFM. As mentioned in the text, institutional arrangement of JFM could not restrain the poor households, which are mainly dependent on forest resource for their livelihood security and that live below poverty line, from illegal collection of forest products (timber) until and unless a considerable income from legal forest sources meets up their minimum livelihood security. Force or law can not effectively control the illegal collection of TFPs of the landless and marginal categories of households. Hence the possibility of costly sanction against the violation of extracting illegal forest products under JFM programme of this study is ruled out. We also assume a fixed number of n individuals who have complete rights of access and removal to the forest resource, a renewable natural resource, from a 'common pool' under institutional arrangements of JFM. Let the labour or effort expanded per unit of time by agent (FPC member household) i on resource extraction be l_i and the aggregate lobour expanded, L. The sum of individual labour flows: $L = \sum_{i=1}^{n} l_i$

First, we assume the case where the total stock of resource $K=K_o$, an exogenously given constant. Then the aggregate harvesting per unit of time is a function of aggregate flow L and exogenously given constant K_o i.e.

$$h(L, K_o) = f(L) \quad \text{.....(1)}$$

We assume $f_L>0$, $f_{LL}<0$ i.e. the total harvest per unit of time is an increasing function of effort and the value of the function is increasing at a deceasing rate. We also assume $A(L)= f(L)/L$ is decreasing. Each extra effort (labour) of an individual FPC member reduces the harvest available for other FPC member and therefore the average

harvest. In other words f(L)/L diminishes as l_i increases. Let us assume that the cost of labour per unit of time is w, which is constant and exogenously given. This is true because empirical evidence of this study reveals that the wage rate for forest wage labour per day is fixed at Rs.67.50 (Sarker and Das 2008). If we normalize the price of resource to unity, the efficient level of effort (we ignore changes in the stock) at which the marginal product of labour equals the wage

$$f'(L) = w \quad \text{.....(2)}$$

The share of total harvest obtained by ith FPC member is directly proportional to the share of FPC member i's effort to total effort, so that FPC member i's net benefit from resource extraction, denoted by Π_i , is

$$\Pi_i (l_1, l_2, \ldots, l_n) = \frac{l_i}{L} f(L) - w l_i$$

Therefore the aggregate payoff p (l_1, l_2, ..., l_n) satisfies

$$p(l_1, l_2, \ldots . l_n) = \sum_{i=1}^{n} \pi_i = f(L) - wL$$

Let $L_{\hat{c}}$ be the level of aggregate effort which maximizes p. This is the efficient level of effort (given the stock) at which the marginal product of labour equals the wage $f'(L_{\hat{c}}) = w$.

This is shown in Figure a. $L_{\hat{c}}$ is unique due to concavity of the function.

Let us now examine what the outcome will be under the usual assumption of rational, self-interested behaviour by each FPC member. Each FPC member will compare his/her return $A(L) = (f(L)/L)$ with the cost of effort, w. Concavity of the function means that A(L) is decreasing (mentioned earlier). The FPC member intending harvesting an additional unit will compare f(L+1)/(L+1) with w and will go on harvesting if f(L+1)/(L+1)> w. However, from individual point of view labour will be added to the stock harvesting until $L_{\hat{c}} / \dot{c} = w$ (Figure a). This may be interpreted as free entry, zero profit condition with

$$A(\mathrm{L}) = w \quad \text{.....(3)}$$

Payoff of ith FPC member is now

$$\Pi_i (l_i, L) = l_i\big(A(L) - w\big)$$

While the aggregate payoff is

$$\mathrm{P} = L\big(A(L) - w\big)$$

Thus if the resource is characterized by open access, so that the number of user can expand without limit, then it is clear that labour will be put in until the average product equals the wage and rents (profits) are driven to zero as shown at $L_{\dot{C}}$ in Figure a. This is clearly inefficient, because adding harvesting has a negative externality effect on the forest resource. However, disregarding the negative externality, each individual will put in more labour them is efficient so long as there is positively rent (profit) from the extraction (or harvesting). The CRP game has a unique Nash equilibrium, which is symmetric with $\mathrm{L_i} = L_{\bar{C}}$ for all FPC members. It is inefficient and involves overexploitation $L_{\hat{C}} < L_{\bar{C}}$. There are positive rents in equilibrium: $L_{\bar{C}} = nL_{\bar{C}} < L_{\dot{C}}$ so that $A(L_{\bar{C}}) > w$. This is the classic problem of the common users: each individual would be better off if all would restrain their use, but it is never in the interest of any individual to do so (Dasgupta and Heal 1979, Weitzman 1974, Sethi and Somanathan 1996).

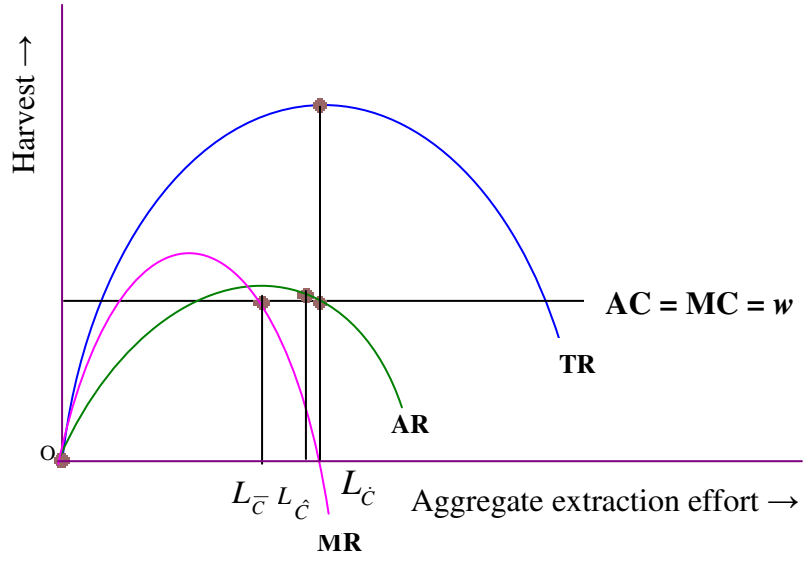

Figure a

In the case of resource dynamics, the case of renewable forest resources is different from the assumption of exogenously given forest resource by virtue of the fact that it is naturally generated within a time period relevant to human exploitation.

Renewable resources are often assumed to follow a 'natural growth law' which is assumed to be simply a function of the size of resource stock. The relationship is not monotonic, but inverse U-shape (the logistic growth function). The growth rate at first rises with the size of stock, and then falls i.e., the slope of the curve is positive and decreasing. It is due to the fact that the natural environment has a 'carrying capacity' for the resource; a maximum population that it can sustain. There is zero growth rate for this size of stock. We assume equal effort level by each type of player – government and community – under cooperative management of forest in the dynamic analysis. This is, mainly, because the CPR game of our study considers two types of players – community and government – in community forestry where forest department and community jointly manage the forest protection activities within a joint cooperative institutional framework without any costly sanctions. Hence we assume equal effort level for both – community and government. Then there is the unique Nash equilibrium for all FPC members at which maximum sustainable yield is equated to the corresponding resource stock. This stage is called the socially optimum average effort level corresponding to the resource stock (Sethi and Somanathan 1996: 777-778). This is shown at K_M in Figure b. If we indigenize K, the aggregate harvest per unit of time is a function

$$H(L, K) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

As renewable resources are often assumed to follow natural growth law, $H_K>0$, $H_{KK}<0$.

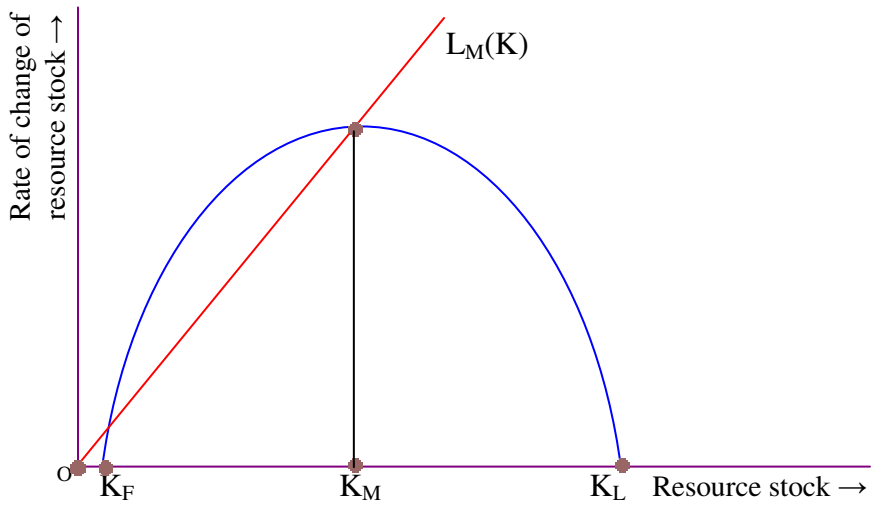

Figure b

In addition to its dependence on the harvest, the evolution of the resource stock will depend on its own natural rate of replenishment, which we represent by the differentiable function $R(K)$. There is finite carrying capacity of the resource stock (K_L in Figure b) so that $R(K)<0$ for $K>K_L$, and $R(K_L) = 0$. Let $K_F>0$ be the minimum viable stock, so that $R(K) > 0$ for $K_F<K<K_L$, and $R(K)<0$ for $0<K<K_F$. The minimum viable stock is the level below which the resource can not recover by natural reproduction even in the absence of harvesting. Finally, let R be a unique maximum at some K_M. This is the standard specification used to characterize the dynamic of renewable resources. The growth rate of the resource stock, taking account of harvesting, is then given by

$$\dot{K} = I(K) - H(L,K) \quad \ldots\ldots\ldots\ldots\ldots(5)$$

The extraction per unit of effort is assumed constant proportion of the stock. Letting $L_M(K)$ denote the (statistically) socially optimum average effort level and $L_N(K)$ denotes the Nash equilibrium effort level corresponding to resource stock K, it is clear that $L_M(K)=L_N(K)=0$. The stable cooperative equilibrium point of the system is the type of behaviour and levels of resource stock that we may expect to see in the long run. This is satisfied at the aggregate effort levels L and resource stock K for which $\dot{K} = 0$. For any $K_F<K<K_L$, $I(K)>0$, so by putting in enough effort the harvest can be raised high enough that it equals the rate of replenishment, thus causing $\dot{K}$ to equals zero (K_M in Figure b). The average product now depends both on aggregate extraction effort and the resource stock.

$$A(L,K) = \frac{H(L,K)}{L}$$

As we assume equal effort level for each type of player – government and community – under cooperative management of forest, the payoff of each type of player will be

$$\pi_i = l_i(K)\big(A(L,K) - w\big)$$

Therefore, the aggregate payoff is

$$\sum_{i=1}^{n} \pi_i = L(K)\big(A(L,K) - w\big)$$

In this perspective it is relevant to mention that the game theoretic framework of Sethi and Somanathan (1996) shows that whenever there is a stable non-cooperative

equilibrium (one in which individuals do not restrain their use with different effort level) with a positive renewable stock, then there is a cooperative equilibrium with a higher stock and that cooperative norms of behaviour is stable. The CPR model of our study also suggests that in spite of equal effort level for each type of player, cooperative equilibrium is also stable with the highest level of stock.

Let us consider a two stage game: the first stage discussed in the CPR game and the second one is the game in which individuals have the option of imposing sanctions on other agent in response to their observed extraction level. Sanctioning behaviour is costly not only for the punished, but also for the punisher (Sethi and Somanathan 1996: 771). But such a sanctioning behaviour is unimportant in our empirical study. Hence at K_M, there is unique sub-game perfect equilibrium in which all agents choose L_N effort level and no agent sanctions any other. Hirshleifer and Rasmusen (1989) show that cooperation can be sustained in sub-game perfect equilibrium in a finitely repeated prisoners' dilemma with rationing. Ostrom et al. (1992) show that even in clearing specified finite horizon games designed to extract commons, high level cooperation can be sustained if the possibility of pre-game communication is present, with or without the possibility of costly sanctions. It seems to be relevant to mention that despite without the possibility of costly sanctions against the violators (poor forest fringe communities) of extracting illegal forest products, forest resources in south West Bengal including our study area was resuscitated and restored to productivity with great improvement in quality and density as a result of participatory and JFM activities compared with before JFM situation (SFR 2000: 47).

VI. CONCLUSION

This empirical study suggests that the economic outcome of the JFM programme under cooperative framework between forest fringe community and government has been beneficial for both community and government. The theoretical model of common property resources shows that cooperative behavior which seems to emerge from JFM programme guided by norms of restraint and customs may be stable against invasion by narrowly self-interested behaviour. The study also indicates that despite without the possibility of costly sanctions against the violators (poor forest fringe communities) of

extracting illegal forest products, forest resources in south West Bengal including our study area was resuscitated and restored to productivity with great improvement in quality and density as a result of participatory JFM activities compared with before JFM situation. But the earlier forest policy of the government was oriented with the commercial need of the government disregarding the traditional right and benefit of the forest fringe communities. Economically both government and community have been greatly benefited by the JFM. Although forest resource of south West Bengal including our study area was improved in quality and density after JFM, as mentioned in the State Forest Report (2000), the institutional arrangement of JFM do not retain the poor households, which are mainly dependent on forest resource for their livelihood security and that live below poverty line, from illegal collection of timber products because the share of forest income from legal forest sources – NTFPs, forestry wage and government's timber share – can not meet their livelihood security. So, more pro-poor programme under both government and non-government initiatives that complement the benefit of JFM programme need to be introduced in the area we surveyed. Attempts should also be taken to establish small units of agro-based industry which may use local NTFPs as the main raw materials of that industry in the forest fringe area. To this work, the Ministry of Environment and Forests and state forest department may wish to consider developing a new national strategic plan for R & D of NTFPs and policies to establish small units of forest based industrial units oriented through community forestry transitions and priorities.

Notes

1. The paper has been prepared based on a research work entitled "Women's Dependence on Forest and Participation in Forestry: *A Case Study of Joint Forest Management Programme in West Bengal"*. We take all samples for our study from a district where almost all female FPCs are operating.
2. Although 'after situation of JFM' is simply the survey period the 'before situation of JFM' implies one preceding year of the formation of each FPC under our survey. JFM programme in Agua, Malibona, Brindabanpur, Belboni, Baragari and Katul-2 villages was started in the years 1993-94, 1996-97, 1991-92, 1993-94, 1996-97 and 1991-92

respectively. A single before situation is selected by the simple arithmetic mean for all FPCs under study.

3. Poverty line income in rural West Bengal on the basis of PCME (per capita monthly expenditure) by NSS of 56th round (1999-00) is INR 350.17. In order to estimate the *poverty line income*, we consider NSS 56th round as the base year. By simple algebraic calculation with the consumer price index for agricultural labourers (CPIAL) we calculate poverty line income during the year 2005-06, the current year (INR 394.08), and also during the reference period of 'before JFM' situation. Such estimates are also used by Das (2008), p. 98; Das & Sarker (2008), pp. 88-91.
4. Income of the forest fringe households has been estimated on household production framework where revenue and cost of rural forest fringe households are calculated on two sources – forest and non-forest – during both before and after JFM situations. As regards revenue is concerned, forest source of revenue is generated from sale of timber, fuel wood and non-timber forest products, and forestry wage labour. Revenue from forest resource is of two types: legal and illegal. Legal income from forest resource is generated from low return forestry activities (like fuel wood, non-timber forest products), forest wage income and legal share of timber products from forest department. Illegal income from forest resource yields from illegal collection of timber (high return forestry activity). Non-forest revenue, on the other hand, rises out of the sale of agricultural farm crops, non-forest wage labour (mainly from agricultural farm labour) and others (self employed business activities like market middleman, tailoring, radio and cycle-rickshaw repairing, sale of livestock and its products, personal and household items, etc.). Income from 'others' of non-forest source constitute a very little part of their total income for our surveyed households during both before and after JFM situations. Most of the households receive their part-time income from their self-employed business activities as their 'others' sources of income, the major income being the forest source. Almost all households under our study during both the situations receive income from their domestic livestock and it is the major part of their income from 'others' source. But out of the total surveyed households, the part-time income other than livestock under 'others' source is insignificant: only nine households from market middlemen, three households from tailoring and two households from radio and cycle-rickshaw repairing receive a small part of their total income during after situation of JFM, although before JFM they did not receive income from the same source. However, non-forest income is of two types: agricultural-crop source and 'others' (almost from livestock). It is worthwhile to mention that to estimate income for forest fringe

households under our study we use the household production framework (Pattanayak and Sills, 2001; Zorn, 1998; Pattanayak, et al., 2004). The household production framework seems to be appropriate for describing the situation of our study because this framework contributes to household's production of utility-yielding services from forest (legal and illegal) and non-forest (agricultural crop and livestock) sources for their own consumption and generating income: household's own labour for forest sector, household's own labour and capital (land, plough, etc.) for agricultural-crop sector, and their own labour and capital for livestock are used as primary inputs in the production process. For details discussion on the procedures of estimation of cost and revenue during both before and after JFM situations see Sarker and Das (2008:26-31).

5. Real earning (in INR) is determined after deflating the money income by Consumer Price Index for Agricultural Labourer (CPIAL). Indian Labour Burro provides Consumer Price Index for Agricultural Labourer [General]. For details see *Indian Labour Journal* (Shimla: Indian Labour Burro, Ministry of labour and Employment, 1991, 2005). From Indian Labour Journal (1991, 2005) we get CPIAL from 1990-91 to 1995-96 with base year 1960-61 and from 1995-96 to 2005-06 with base year 1986-87. Now we apply base transformation procedure (*splicing*) for a single base year.
6. Never did the respondents say that their source of income was illegal; rather, while examining the answers from the respondents regarding the break-up of their source of income, the distinction between legal and illegal source was clearly demarcated.

[*Details of methodology and dataset will add shortly in soft version*]

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