

EFFECTIVENESS OF PARTICIPATORY FORESTRY MANAGEMENT IN THE ENCROACHED FOREST TOWARDS SUSTAINABILITY AND ENHANCEMENT OF COMMUNITY LIVELIHOOD IN BANGLADESH

M.S. Safa, Khamurudin Mohd Noor, Awang Noor Abd. Ghani, and Rusli Bin Mohd

ABSTRACT

Sal (*shorea robusta*) is the only plain land forest in Bangladesh. It is economically and environmentally important to the country. High population and ever increasing poverty stimulates the exploitation of the forest alarmingly and has brought it near a level of extinction. In facing this situation Bangladesh Forest Department implemented a participatory management approach by involving the households living in and around the forests for maintenance and protection.

The study attempted to examine the effect of practicing participatory forestry on the participants' livelihood in the encroached area of the Sal forest. Two major social forestry models, namely Agroforestry and woodlot were included in the study. The encroachers were given degraded and encroached forestland for practicing agroforestry technologies along with a piece of land for a homestead. Living indicators showed that there was a positive change in the daily livelihood of the participants. Participation in the resettlement increased their income, employment generation and financial and non-land assets. The study found that the participation of the encroachers in such a management regime could increase the sustainability of the forest and their standard of living. It is more efficient management option towards sustainability of the forest resources. The findings of the study recommend further extension of the approach to rehabilitate the other degraded and encroached forestland in the country.

INTRODUCTION

Bangladesh is a flood plain delta, which lies in the northeastern part of south Asia between 20°34' and 26°38' north latitude and 88°01' and 92°41' east longitude. The country has been suffering from different disastrous events in managing forest resources since its independence. Due to overexploitation its forest cover has reached just 13.36%. The Sal (*Shorea robusta*) is one of the most degraded forests in the country. It is important to the environment and economy of the country. The area of the Sal forest is 120,255 ha (29,715,611.78 acres) that is spread over the central and northern region.

High population pressure caused consequences like land hungry agriculture, scarcity of dwelling places and unplanned urbanization that led to notable degradation, poor stockings and near extinction of the forest. Moreover, ethnic minorities and ever increasing number of landless peasants have played a vital role in the process of deforestation (Ahmed, 1993). Some three decades ago, more than 60% of these forests were fairly densely wooded (Chowdury, 1994). In order to meet the situation of forest

resource depletion, Bangladesh Forest Department undertook a program to protect the Sal forest involving the encroachers and rural poor living in and around it. It was found in the Betagi-Pamora Community Forestry Project that if genuine landless farmers are properly organized around fallow and denuded lands through proper management that they could increase the output of these marginal lands substantially (Ahmed, 1987). Following this experience FD started the studied social forestry program in the Sal forest for its maintenance and protection. Resource sustainability and the enhancement of the livelihood of the forest dwellers were the main objectives of the program. It was expected by the FD that the participatory management would increase the total benefits of the degraded land along with uplifting the socio-economic status of the participants so they turn out to protect forest resources. Agro forestry technology was the main technical aspect of the program. The participants were provided a total 1.21 ha (299.00 acres) land out of which 1 ha (247.10 acres) was for plantation and the rest for their homestead. The lands were provided to them based on the needs assessment of the homestead and participants socio-economic status.

The 'Betagi-Pamora' program in southern part of the country and the studied program were designed differently. The former one was designed for hilly tropical evergreen forest. The participants were tribal groups and culturally diverse. During the project period it showed positive impact but after its maturity it failed to last for a long period. The reason behind its failure was the lack of cultural uniformity among the participant groups. The studied program was undertaken with a little bit different view than that of 'Betagi and Pamora'. In it, the idea of involving rural poor was amalgamated with the aim of economic reorganization of resources towards Sustainable Forest Management and enhanced socio-economic livelihood of the participants (Ahmed, 2000). Poverty reduction was also considered highly important. The encroachers and rural poor who were involved in the program were uniform in cultural behaviour. A study conducted on different income groups who are living in the degraded Sal forest showed that the timber production of reforested species increased significantly through a participatory management between FD and the participants (Alam, 1998). Besides, it also improved significantly the socio-economic condition of the settlers (Quddus, 1992). But these studies did not focus much on socio-economic factors, indices of living standards or poverty reduction. Hence, the current study has attempted to examine the change in socio-economic structure due to participation in the program. It considered the factors such as asset creation, income generation, employment generation, education, financial asset creation and so forth. It also attempted to focus on the poverty reduction impact of participatory management.

METHODS

The study areas were Dhaka and Tangail Forest Divisions that are located at the central region of the country. Sample size of the study was 118, 157, and 100 for Agroforestry, Woodlot and non-participants, respectively. Using simple random sampling the respondents were selected for the study. The sampling intensity

In: Baumgartner, David M.; ed. Proceedings of Human Dimensions of Family, Farm, and Community Forestry International Symposium, March 29 – April 1, 2004. Washington State University, Pullman, WA, USA. Washington State University Extension MISC0526. ISBN Number 0-9721994-5-4

was 0.46. A survey schedule was used to collect the desired information from a primary source and the secondary information was gathered from the respective source. The data was collected in October 2002. For assessing the impact of participation on settlers' livelihood, the information was collected for two different situations 'with' and 'without'. In the study, the 'with' situation included the participants of the program and 'without' included the non-participants of the program.

Statistical descriptive analysis and nonparametric comparison tests were used to determine the change within the different programs and between 'with' and 'without' situations. The socio economic characteristics of the respondents such as age, occupation, literacy, and ownership of assets and so forth were tested in order to examine the different effects of each of these factors. The analysis was conducted to examine the profile of the respondents for both agroforestry and woodlot programs. In order to test the significant difference of the respondents' characteristics, the comparison was examined within the different programs (Agroforestry and woodlot) and between 'with' and 'without' situation.

Using Kolmogorov-Smirnov statistics the normality of the variables was tested and showed a drastic departure from the normality assumption. Thus, for determining the inter-group difference Kolmogorov-Smirnov Z (One sample Kolmogorov-smirnov non-parametric test) had been used (Coakes, 2001; Norsusis, 1999; Easton and McColl, 2003) in the study.

POVERTY IMPACT ANALYSIS

Poverty impact ratio is an effective tool to study the poverty impact reduction of the economic system. This Poverty Impact Ratio was measured by estimating the distribution of net economic benefits among the entities, namely participants (rural poor), government and consumers involved in the rehabilitation activities. By carrying out financial, economic and distribution analysis (gains and losses) the PIR had been calculated for the social forestry program together.

The proportion of benefits from different entities (the following equation) is an important factor to calculate poverty reduction impact because this sharing will be the portion of net economic benefit of the program that will reach the poor (ADB, 2001). In the analysis the proportion of government expenditure towards the poor has been assumed 50%, the labour proportion of the project of which 70% had been paid to the poor as a labour wage and in case of consumer, the proportion has been assumed 100% because the participants of the reforestation activities were landless and, thus, it was expected that the timber, crops and other by products produced by the participants would meet the demand of the area fully. The formula for calculating poverty impact ratio (PIR) is follows:

$$PIR = \frac{\sum_{i=1}^n \frac{B_i}{P_{B_i}}}{\sum_{i=1}^n \text{Gains and losses (TEB)}}$$

Table 1.—Average family size of participant (n=375).

Program	Total HH surveyed	Total family member	Avg. family size
WL	157	814	5.18
AF	118	615	5.21
NP	100	409	4.09
Total	375	1838	4.90

Table 2.—Distribution of participants by age group (years).

Program	Age groups					Mean age	Total
	15-24	25-34	35-44	45-59	60+		
WL	-	12 (7.64)	35 (22.29)	79 (50.32)	31 (19.75)	48.45	157
AF	-	12 (10.17)	33 (27.97)	45 (38.14)	28 (23.73)	47.48	118
NP	8 (8.00)	33 (33.00)	30 (30.00)	20 (20.00)	9 (9.00)	37.71	100

Figure in the percentages indicate percentage

Where,

PIR= Poverty impact ratio

TEB = Total economic benefit

B₁,.....B_n (i=1,2,3.....n) = Benefit of different parties involved in the project

P_{B1}P_{Bn} (i=1,2,3.....n) = Proportion of poor receiving benefits of different parties

The calculated PIR was compared to the local poverty index to determine whether there was any poverty reduction impact due to participatory forestry management. The poverty index of Dhaka Division (the largest administrative segment) estimated by the Information Ministry using 'Basic Need Method' was compared to the calculated PIR (BBS, 2000). According to decision criteria (ADB, 2001), if it is found greater than the local poverty index, there is a poverty reduction impact of the social forestry program on the settlers' livelihood. The local poverty line was considered 0.52 in the study area (BBS, 2000).

RESULT AND DISCUSSION

Family Size and Composition

Table 1 shows that the average size of the family of the study area consisted of 5 members. Among these three groups in the sample the average size of the family does vary significantly (Table 11). The average family size in Bangladesh is 5.6, which varies across districts and the residence (urban-rural). Bangladesh Population census 1991 reports an average family size of 6.7 and 6.3 in Dhaka and Tangail Division (administrative segment) respectively. Thus, the findings show that the respondents have an average lower size of family (4.9) than that of national average.

Age Distribution of the Respondents

The mean age of all respondents (n=375) was found to be 47 years. The mean age of the respondents of Agroforestry program (AF), Woodlot forestry program (WL), and Non-participant (NP) are 47, 38 and 48 years respectively. The respondents were classified into five classes according to different age levels for AF, WL and NP. The results are presented in Table 2. The highest number of respondents of agroforestry (38%) and woodlot (50%) range in age from 45 to 59 while the highest number of respondents of non-participants (33%)

Table 3.—Education of the Participants.

Program	Education level							Total
	Illiterate	Can write only	Literate					
			I-V	VI-X	SSC	HSC	Graduate	
WL	88 (56)	30 (19)	13 (8)	11 (7)	5 (3)	9 (6)	1 (1)	39 (25)
AF	55 (47)	30 (25)	17 (14)	9 (8)	4 (3)	3 (3)	-	33 (28)
NP	65 (65)	11 (11)	11 (11)	10 (10)	1 (1)	2 (2)	-	24 (24)
Total	208 (55.47)	71 (18.93)	41 (10.93)	30 (8.00)	10 (2.67)	14 (3.73)	1 (0.27)	96 (25.60)

Figure in the parentheses indicates percentage

Table 4.—The main occupation of the participants.

Model	WL		AF		NP		Total	
	No	%	No	%	No	%	No	%
Agriculture	95	60.10	71	60.17	55	55.00	221	58.93
Agriculture labour	28	17.83	13	11.02	17	17.00	58	15.47
Non-agriculture	4	2.55	5	4.24	5	5.00	14	3.73
Service	10	6.37	10	8.47	11	11.00	31	8.27
Small trading	14	8.92	-	0.00	4	4.00	18	4.80
Others	6	4.00	19	16.00	8	8.00	33	9.00
Total	157		118		100		375	

range in age from 25 to 34. There is a significant difference between the mean age of the participant and the non-participant group at a 1% significance level (Table 11).

Education Level of the Participants

The education level of the participants are classified into major three types namely, illiterate, can write only, and literate. The category 'illiterate' consists of the participants who do not know reading and writing at all. The category 'can write only' includes the respondents who are able to write the alphabet with a little reading ability. The other category 'literate' consider the respondents who are eligible to read and write a letter. This category is again classified into five groups according to the year of education.

The results of the education status of the respondents are shown in the Table 3. A large portion (55.47%) of the respondents is illiterate. Only 18.93% of the respondents fall under the category 'can write only'. The illiteracy rate (65%) of non-participant group is higher than the other groups followed by WL and AF. The highest number of participants in the literate category has a first to fifth grade education (Primary level education). The HSC (Higher Secondary School Certificate) and graduate level literacy is very low (3.73 and 0.27%) among the respondents. The education levels of the respondents do not differ across the three different groups of respondents (Table 11).

Bangladesh Population Census 1991 reports 19.3% literacy of the country. This trend is not reflected in the present result. The literacy rate of the respondents is higher than the national average of 19%. Poverty is the main reason leading to a low literacy rate in the study area as well as throughout the country. In Bangladesh before 1990 the primary education was not free. After 1990 the primary education was declared free for female students. In contrast, the heads of the households prefer boys to work with him in the field over going to school. Thus, the education

status of the respondents falls under the category of illiterate in a larger proportion. During the boyhood of the respondents they did not have any proper opportunity to study.

Present Main Occupation of the Participants

The participants had different occupations in the study area. Only 58.93% of the participants were engaged as agricultural labourer (daily worker in the farm area who were paid a wage on a daily basis) followed by agricultural profession (15.47%) namely poultry farming, crop production, fishing, and so forth. Among other categories only 9% of participants had service as a main occupation and this is followed by small trading (5%) and non-agriculture (4%). The non-agriculture category includes all types of activities like day-labour in the industrial area. Among these three groups the participants of AF are less engaged in agriculture activities. Table 4 shows the main occupation of the respondents. A small portion (9%) of participants is doing service. This shows a change in the occupation pattern of the study area. 15.47% of the participants own an agricultural farm, an indication of generating sound income.

Living Standard of the Participants

In order to assess the living standard of the participants, some indicators have been considered and they were categorized into some types, namely electricity, tube-well, type of latrine, health service, depositing financial assets and so forth. The results are presented in the Table 5. Overall use of electricity is noticeably less in the study area. This is because the power supply system in the forest area was not sufficient. As a substitute for power most of the participants had lamps for lighting their households.

There are three main source of drinking water in the study area. The highest portion (69%) of the participants owned tube-wells. Seventeen percent of the participants used government tube-wells as the source of their drinking water. The rest, 26%, used others tube-wells for collecting drinking water. Seventy-six percent of the agroforestry participants own private tube-wells while it was 66% in woodlot and non-participants. According to 91% of the participants, the quality of drinking water was good. It is not badly affected by the acidic property of the soil. The soil type of the forest area was acidic. This is why sometimes the respondents of the area suffer from scarcity of drinking water. The overall condition of the source of drinking water of the forest area was found to be better.

In order to examine the hygienic environment of the study area, the type of latrine that the participants use in their daily life was considered. The type of latrines (Table 5) could be ranked on the basis of safety such as septic, pit latrine, hand made and open. Most of the participants (45%) use a pit latrine. A small number of the participants (12%) use a septic latrine that is highly hygienic and scientific. This is because building a septic latrine is more expensive than the pit latrine.

Table 5.—Living standard indicators of the participants.

Item	Indicator	WL	AF	NP	Total
Lighting facilities	Local lamp	115 (73.25)	85 (72)	58 (58)	258 (68.8)
	Electricity	42 (26.75)	36 (31)	19 (19)	52 (13.87)
Drinking water source	Own tube-well	104 (66.24)	90 (76)	66 (66)	260 (69.33)
	Govt. tube-well	10 (6.37)	6 (5)	1 (1)	17 (4.53)
	Other's tube- well	43 (27.39)	23 (19)	33 (33)	99 (26.40)
Quality of Drinking water	Good	144 (91.72)	104 (88)	95 (95)	343 (91.47)
	Not good	-	3 (3)	5 (5)	8 (2.13)
	Salty	-	11 (9)	-	11 (2.93)
Type of latrine	Septic	22 (14.01)	7 (6)	15 (15)	44 (11.73)
	Pit latrine	67 (42.68)	70 (59)	33 (33)	170 (45.33)
	Open	14 (8.92)	9 (8)	12 (12)	35 (9.33)
	Hand made	53 (33.76)	29 (25)	-	82 (21.87)
Medicare	Quack	43 (27.39)	45 (38)	42 (42)	130 (34.67)
	Homeopath	101 (64.33)	73 (62)	75 (75)	249 (66.40)
	Registered doctor	103 (65.61)	74 (63)	61 (61)	238 (63.47)
	Herbal	15 (9.55)	3 (3)	-	18 (4.8)
Place of depositing money	Self	143 (91.08)	110 (93)	99 (99)	352 (93.87)
	neighbours	1 (0.64)	-	-	1 (0.27)
	Post office	1 (0.64)	1 (1)	-	2 (0.53)
	Bank	31 (19.75)	20 (17)	4 (4)	55 (14.67)

Figure in the parentheses indicates percentage

Table 6.—Description of yearly family expenditure of the participants.

Program	WL		AF		NP		Total (Mean) (Tk.)
	No.	Mean (Tk.)	No.	Mean (Tk.)	No.	Mean (Tk.)	
Food	157	19991.08	118	17814.41	100	14578.00	52383.49
Beverage	99	1114.55	62	738.71	46	668.48	2521.74
Tobacco	132	800.30	92	625.65	78	672.44	2098.39
Fuel	157	1579.04	118	1749.15	100	1177.10	4505.29
Clothing	157	2616.56	118	1973.73	100	1637.00	6227.29
Medicare	157	850.00	118	659.32	100	719.00	2228.32
Education	121	1785.12	83	1290.36	59	1681.36	4756.84
Construction	110	815.45	90	822.22	70	592.71	2230.38
Travel	156	1186.22	118	786.44	100	795.00	2767.66
Social	154	2270.13	118	1931.36	100	1613.00	5814.49
Total	154	33008.45 (\$579.10)*	118	28391.35 (\$498.09)	100	24134.09 (\$423.41)	85533.89 (\$1500.59)

* 1 USD = 57 Taka

Table 7.—Mean difference between participant and non-participant group.

Item	Chi-statistics	p-value
Food	29.50	0.000*
Beverage	5.11	0.024**
Tobacco	0.00	0.958
Fuel	12.47	0.000*
Clothing and footwear	17.53	0.000*
Medicare	1.33	0.249
Education	2.23	0.135
Construction	0.85	0.357
Travel	1.75	0.186
Social activities	8.24	0.004**
Loan repayment	0.00	0.948

* Significant at 1% level
** Significant at 5% level

Medicare represents the health awareness of the participants. Only 64% of the participants go to a registered doctor. But the highest (66%) number of participants relied on homeopathy out of the four sources of Medicare, namely quack, homeopathy, registered physician and herbal. In Bangladesh, consulting a registered doctor is more expensive than the homeopathy doctor. This is why most of the participants take homeopathy. Quacks are cheaper than the other two sources. Thirty-five percent of the participants consult village quacks according to their necessity. A small percentage of participants take herbal treatment.

The indicator 'Depositing financial assets' examines the awareness of depositing monetary assets. The participants of the study area usually deposit their money by themselves or to neighbours, to a post office and or in the Bank. In the study area, most of the participants (93.87%) deposit their money by themselves. Only 14.67% of them deposit their money into a Bank. The rest of them put it in a post office or with neighbours. The practice of depositing money indicates that they are not yet accustomed with institutions for saving their monetary asset. Banks are the most secure places for depositing money. But most of the participants of the study area are not aware of this, indicating their ignorance in social development.

Yearly Family Expenditure

Living expenditure patterns of the participants and non-participants group are described in this section. Table 6.7 shows the yearly expenses of the participants' family that are grouped into food, beverages, tobacco, fuel, clothing, Medicare, education and other category. The highest proportion of the income is spent on food, because the participants belonged to poor small farm categories. Food is a basic necessity in their daily life. All the three groups spent the next highest proportion of their income to buy clothes. Food and cloths are the two important basic needs. Among the three groups, the average food consumption is a bit higher in WL than other two groups. The yearly total mean expenditure of household is Tk. 85,533.89 (\$1,500.59).

Using Kruskal-Wallis test (Coakes, 2001 Norsusis, 1999; Easton and McColl, 2003), it was found that between participant and non-participant group food, fuel and clothing differs significantly at 1% level. In the case of beverages and social activities these groups vary from each other at 5% significance level. The rests do not vary across the groups. Table 7 shows the significant difference between different sources of yearly family expenditure.

Using Kruskal-Wallis test (Coakes, 2001 Norsusis, 1999; Easton and McColl, 2003), it was found that between the three groups AF, WL and NP the expenditure for food and clothing differs significantly at a level of 1%. In the case of beverages, fuel, construction and social activities the variance is at a 5% significance level. The rests do not vary across the groups. Table 8 shows the result of the Kruskal- Wallis test for determining

Table 8.—Mean difference among AF, WL and NP.

Item	Chi-statistics	p-value
Food	36.98	0.000*
Beverage	8.16	0.017**
Tobacco	3.16	0.206
Fuel	14.64	0.001**
Clothing and footwear	21.06	0.000*
Medicare	4.79	0.091
Education	2.37	0.306
Construction	8.67	0.013**
Travel	4.34	0.114
Social activities	9.28	0.010**
Loan repayment	5.57	0.062

* Significant at 1% level
 ** Significant at 5% level

Table 9.—Financial assets of the respondents.

Program	Item	>5000	5001-10000	10001-15000	15001-20000	20001-25000	25001+
WL	No.	57.00	32.00	2.00	2.00	1.00	1.00
	Mean	1559.16	7019.06	11852.50	17105.00	20560.00	36420.00
	%	60.00	33.68	2.11	2.11	1.05	1.05
AF	No.	86.00	32.00	10.00	3.00	4.00	1.00
	Mean	1650.15	6928.53	12375.00	18538.33	22208.75	48400.00
	%	63.24	23.53	7.35	2.21	2.94	0.74
NP	No.	61.00	14.00	4.00	-	1.00	1.00
	Mean	1865.41	6858.21	11677.50	-	21315.00	40110.00
	%	75.31	17.28	4.94	-	1.23	1.23
Total	No.	204.00	78.00	16.00	5.00	6.00	3.00
	Mean	1691.57 (\$29.677)	6935.27 (\$121.67)	11968.33 (\$209.97)	17821.67 (\$312.66)	21361.25 (\$374.76)	41643.33 (\$730.58)

Table 10.—Chi statistics and P-value.

Variables	Chi-statistic	P-value
Age	52.278	.000*
Education (Yr.)	4.634	.099
Family size	26.886	.000*
Financial asset	2.685	.261
Physical asset	3.427	.180
Yearly expenditure	15.897	.000*

*Significant at 1% level (p-value is less than 0.05 indicates significant difference)

Table 11.—Kolmogorov-Smirenov Z and t-statistics for AF and WL.

Variables	Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
Age	.760	.610
Education (Yr.)	.775	.586
Family size	.693	.722
Financial asset	.850	.466
Physical asset	.847	.470
Yearly expenditure	.672	.758
Area of garden	4.741	.000*
Income of garden	1.708	.006*
Income of timber (ha)	1.708	.006*

*Significant at 1% level (p-value is less than .05 indicates significant difference)

significant difference among the three groups of respondent.

Financial Asset Structure of the Participants

Financial assets of the participants are the monetary savings in terms of amount deposited in the bank, amount lent to others with interest or without interest in a given year. In this study, the financial assets were calculated based on the local currency 'Taka'. The financial assets were grouped into 6 categories, namely 'more than Tk 5,000'(\$87.72) , 'Tk. 5,001 (\$87.74) to 10,000 (\$175.44)', 'Tk. 10,001 (\$175.44) to 15,000 (\$263.14)', 'Tk. 15,001 (\$263.14) to 20,000 (\$350.88)', 'Tk. 20,001 (\$350.88) to 25,000 (\$438.60)', 'more than Tk. 25001 (\$438.60)'. There is no significant difference among different groups of respondents in terms of total amount of savings (Table 11). The results are presented in Table 9.

Table 9 shows that almost all participants have some monetary deposit of more than Tk. 5,000. The number of non-participants (75.31%) is higher than the participant group (61.62%) in having the small deposit (>5,000). The number of participants having deposits from Tk.5,001 to Tk.10,000 is higher than in the non-participant group. But a few numbers of participants have deposit from Tk.10,001 to 15,000 and 25000+. Across these two major groups, the number of non-participants is higher in having a small deposit of money.

Kruskal-Wallis Test for the Socio-economic Variables Among AF, WL and NP

Different statistical tests had been carried out to examine the mean difference between socio-economic variables of different groups. The Kruskal-Wallis test (Coakes, 2002; Norsusis, 1999; Easton and McColl, 2003) had been used to examine the inter group mean difference among AF, WL and NP. Table 10 shows the result of chi-statistics. According to both test statistics the variable age, Family size and yearly income significantly differs among groups at the 1% significance level. The rest of the variables do not differ from each other.

Difference between the Socio-economic Variables of AF and WL

Two samples of the Kolmogorov-Smirnov test had been carried out to examine the mean difference between the socio-economic variables of the agroforestry and woodlot participants. Table 11 shows the results of the test. According to Kolmogorov-Smirnov Z statistic the variables, namely area of garden, income of garden and income of timber, are significantly asymptotically different from each other at the 1% level of significance.

Table 12.—Kolmogorov-Smirenov Z and t-statistics for participant and non-participant.

Variables	Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
Age	3.246	.000*
Education (Yr.)	1.113	.168
Family size	2.024	.001*
Financial asset	.712	.691
Physical asset	1.152	.141
Yearly expenditure	1.946	.001*

*Significant at 1% level (p-value less than .05 indicates significant difference)

Table 13.—Change in forest products and resources.

Item	Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
Timber income	8.563	.000
By product	3.675	.000
Forest cover	8.563	.000
Wildlife	0.500	.964

Table 14.—Poverty reduction impact of the participatory forestry management ('000)*.

Item	Govt./economy	Participant	Consumers	Total
Benefit	46.38	13.94	510.72	571.03
Proportion of poor	0.5	0.7	1	2.2
Benefit to poor	23.19	9.76	510.72	543.66
Poverty impact ratio				0.95

* '000 Taka

Difference between Participant and Non-participants

Two samples of the Kolmogorov-Smirnov Z test were conducted to examine the mean difference between the socio-economic factors of participants and non-participants. Table 12 shows according to Kolmogorov-Smirnov Z statistic the variables, namely age, family size and yearly expenditure, are significantly asymptotically different from each other at the 1% level of significance.

Sustainability Measures between Participant and Non-participant group

Table 13 shows the significant change in income of timber and other forest products. Forest cover also increased significantly at a 1% significance level. But wildlife was not significantly changed according to the Kolmogorov-Smirnov Z statistics. The reason for this is the establishment of human habitation. As according to the design of the project, cluster villages were established on the encroached patches of the forest that disturbed the wildlife.

Poverty Reduction Impact of AF and WL

The program involved the rural poor as participants of the new management option. Table 14 shows the result of poverty impact analysis participatory management. The proportion of poor was determined based on government and the Forest Department's policy. The distributions of benefit among three entities involved in the project are shown in the Table 14.

The PIR of the participatory management (AF and WL together) is 0.95. This was compared to the poverty line of the largest administrative segment 'Division' to justify whether there is any reduction impact. It was greater than the prevailing poverty line (0.52) of the locality that indicates a positive poverty reduction impact on the settlers' livelihood. According to the "Cost of Basic

Needs Method" the upper poverty line of the study area was 0.52 (BBS, 2000).

CONCLUSION

The participatory sharing management has positive impacts on settlers' livelihoods as well as on sustainability. The comparison tests showed that the difference between and within different programs varies significantly. The AF has more positive effects on livelihoods. Besides, sustainability measures indicated that the income from forest products and non-forest products increased significantly. Forest cover also increased sufficiently. By analysing living standard indicators it had been seen that there was a variation between participant and non-participants that reflects the improved condition. Poverty Impact Ratio (PIR) concludes that the participation of rural poor in rehabilitating the forest has a greater poverty reduction impact on society as well as individual settlers. The positive impacts of the social forestry program, thus, could be replicated in other degraded forest areas. But a few amendments are also required to make it more sustainable such as infrastructural development for the inhabitants and inclusion of more integrated technology.

REFERENCES

- ADB 2001. Handbook of Integrating Poverty Impact Assessment in the Economic Analysis of Projects. Economics and Development Resource Centre. Manila: ADB.
- Ahamed, F.U. 1987. Social Forestry in Bangladesh: A case study of Betagi and Pomora Experiments. Bangladesh Centre for Advanced Studies (BIDS), Dhaka. PP.55
- Ahamed, F.U. 1993. Respondents to Environmental Degradation: Some Implication of A Social Forestry Project in Bangladesh. M. Phill dissertation, Selwyn College, Cambridge University, Cambridge. Pp.32
- Alam, R. 1998. Participatory Approach in Degraded Sal Forest in Gazipur District. Review paper. Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong. Pp:33.
- Ashton, M.S., Mendelsohn, R., Singhakumara, B.M.P., Gunatilleke, C.V.S., Gunatilleke, I.A.U.N and Evans, A. (2001). A Financial Analysis of Rain Forest Silviculture in Southwestern Sri Lanka. Forest Ecology and Management, 154, 431-441.
- BBS 2000. Statistical Yearbook of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Bangladesh.
- Chowdury, R. A. 1994. History and Importance of Sal Forests and Current Management Status. In: Agro forestry for the degraded 'Sal' forest, proceedings of the national workshop held at Bangladesh Agricultural Research Council (pp.11), Dhaka: BARC and Forest Department with the financial assistance of APAN.
- Coakes, Sheidan J. & Steed, Lyndall G. 2001. SPSS Analysis without Anguish, John Wiley & Sons Australia, Lmt
- Easton, V.J. & McColl, J. H. 2003. Statistics Glossary V1.1. http://www.cas.lancs.ac.uk/glossary_v1.1/nonparam.html (1 of 5), Accessed on 23rd September 2003.
- Norusis, M.J. 1999. Guide to Data Analysis. SPSS 9.0. New Jersey: Prentice- Hall
- Quddus, A.H.G., Ali, S.M.I., Bhuiyan, A.M.A. & Hossain, M. 1992. Greening the Hills: the Betagi-Pamora Agoroforestry Experience. Research report series 1, pp: 148. Dhaka: BARC-Winrock International.

AUTHORS

Mohammad Samaun Safa
PhD Candidate
Faculty of Forestry, University Putra Malaysia
43400, Serdang, Selangor DE
Malaysia
Tel: 012-3601953
E-mail: safsaf_stranger@hotmail.com

Dr. Khamurudin Bin Mohd Noor
Lecturer and Departmental Head,
Department of Forest Management
Faculty of Forestry, University Putra Malaysia,
43400 UPM, Serdang,
Selangor, Malaysia,
Tel: 6-03-89467167, Fax: 6-03-89432514,
E-mail: Kamardin@forn.upm.edu.my

Dr. Awang Noor Bin Abd. Ghani,
Associate professor & Academic Dean,
Department of Forest Management
Faculty of Forestry, University Putra Malaysia,
43400 UPM, Serdang, Selangor, Malaysia,
Tel: 6-03-89467167, Fax: 6-03-89432514
E-mail: awang@putra.upm.edu.my

Dr. Rusli Bin Mohd
Associate professor, Department of Forest Management
Faculty of Forestry, University Putra Malaysia
43400 UPM, Serdang
Selangor, Malaysia
Tel: 6-03-89467206, Fax: 6-03-89432514
E-mail: rusli@forn.upm.edu.my