

Competitive Research Grant

Sub-Project Completion Report

on

**Agro-forestry for livelihood development of
Jhumia community (shifting cultivators) in
Chattogram Hill Tracts, Bangladesh.**

Project Duration

May 2016 to September 2018

**Silviculture Genetics Division
Bangladesh Forest Research Institute
Chattogram- 4000
Bangladesh**



Submitted to

**Project Implementation Unit-BARC, NATP 2
Bangladesh Agricultural Research Council
Farmgate, Dhaka-1215**



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Citation

Project Title:

Agro-forestry for livelihood development of *Jhumia* community (shifting cultivators) in Chattogram Hill Tracts, Bangladesh

Project Implementation Unit:

National Agricultural Technology Program-Phase II Project (NATP-2)
Bangladesh Agricultural Research Council (BARC)
New Airport Road, Farmgate, Dhaka – 1215
Bangladesh

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Acronyms

BARC	Bangladesh Agricultural Research Council
BFRI	Bangladesh Forest Research Institute
CHTs	Chattogram Hill Tracts
NATP	National Agricultural Technology Program
CRG	Competitive Research Grant
PRA	Participatory Rural Appraisal
PCR	Project Completion Report
PIU	Project Implementation Unit

Table of Contents

Sl No.	Subject	Page No.
1	Executive Summary	x
2	CRG Sub-Project Completion Report (PCR)	1
	A. Sub-project Description	1
	A.1. Title of the CRG sub-project	1
	A.2. Implementing organization	1
	A.3. Principal Investigator & Co-principal investigator	1
	A.4. Sub-project budget (Tk)	1
	A.5. Duration of the sub-project	1
	A.6. Justification of undertaking the sub-project	1
	A.7. Sub-project goal	2
	A.8. Sub-project objective(s)	2
	A.9. Implementing location (s)	3
	A.10. Methodology	4
	i. Project site selection	4
	ii. Farmers selection, problem identification, assessment of need and potential	4
	iii. Accounting of pre-intervention status	4
	iv. Analysis of existing system and selection of technologies for intervention	5
	v. Project Inception meeting and seedling distribution among the farmers.	5
	vi. Implementation of intervention and performance evaluation	5
	A.11. Results and discussion.	6
	A.11.1. Data collection, analysis, discussion and achievements	6

		A.11.2.	Capacity build up and income generation of the project farmers.	14
		A.11.3.	Conclusion	17
		A.12.	Research highlight/findings	17
	B.	Implementation Position		19
		B.1.	Procurement	19
		B.2.	Establishment/ Renovation facilities	19
		B.3.	Training/ Study tour/ Seminar/ Workshop/ Conference Organized	19
	C.	Financial and physical progress		20
	D.	Achievement of Sub-project by objectives		20
	E.	Materials Development/Publication made under the Sub-project		22
	F.	Technology/Knowledge generation/Policy Support		22
		i.	Generation of technology (Commodity & Non-commodity)	22
		ii.	Generation of new knowledge that help in developing more technology in future	22
		iii.	Technology transferred that help increased agricultural productivity and farmers' income	22
		iv.	Policy Support	23
	G.	Information regarding Desk and Field Monitoring		23
		i.	Desk Monitoring	23
		ii.	Field Monitoring	23
	H.	Lesson Learned/Challenges		24
	I.	Challenges		24

List of Tables

Sl. No.	Subject	Page No.
Table1.	Survival and growth performance of different bamboo species in farmers' land and homestead at project site	13
Table2.	Bamboo seedlings production and income of some farmers in their own nursery after training.	15

List of Figures

Sl. No.	Subject	Page No.
Figure 1.	Project site map	3
Figure 2.	Baseline survey and discussion meeting with local people at the sub project site	4
Figure 3.	Inception meeting and seedling distribution	5
Figure 4.	Farmers household types	6
Figure 5.	Comparative income and expenditure of farm household	6
Figure 6.	Farmers response on forestry crop	7
Figure 7.	Farmers response on fruit crops	7
Figure 8.	Farmer's response on bamboos	8
Figure 9.	Farmer's response on livestock	8
Figure 10.	Farmer's response on fish cultivation	9
Figure 11.	Sources of water used by the farmhouse hold	9
Figure 12.	Distribution of bamboos, timber, fruit and medicinal plants seedlings among the farmers	10
Figure 13.	Agro-forestry practices in farmers land and homestead	11
Figure 14.	Farmers' field and homestead garden of bamboos and other plants. Data collected after six months of plantation.	12
Figure 15.	Demonstration plot of bamboo base agro-forestry practices in farmer's field. Data collected after one year of plantation.	13
Figure 16.	Farmers training programme on bamboo branch cutting technique and management	15
Figure 17.	Farmers are producing bamboo seedlings from branch cutting technique after training in their own nurseries.	16

List of Annexure

Sl. No.	Subject	Page No.
Annexure1.	Training module on bamboo cultivation through branch cutting technique	25
Annexure2.	Training module on bamboo grove management.	26
Annexure3.	Training module on nursery establishment and management for bamboo and other plant species in hilly area	27
Annexure4.	Questionnaire for Participatory Rural Appraisal (PRA)	28

Executive Summary

Jhum / slash-burn / shifting cultivation is the age-old farming system that has been supporting the subsistence livelihood of the hill farmers in the Chattogram Hill Tracts (CHTs) for centuries. It is recognized that once the *jhum* practice was a sustainable cultivation approach when the fallow period under *jhum* was longer, 15-20 years or more. However, in course of time, the fallow period as a key element in *jhum* production system gradually became narrower. At present, the fallow period under *jhum* or so-called *jhum* cycle has been shortened to 2-3 years, which is not enough for replenishment of soil fertility. Frequent cultivation of the hill slope within 2-3 years instead of 15-20 years results in stress conditions of the landscape inviting physical, chemical and biological degradation. In a survey it was found that the production of paddy in *jhum* cultivation has been declined to 20 - 25% in comparison to several decades back. Due to shortened fallow period of *jhum* cycle along with other technical weakness, the shifting cultivation is no more in a position to cope with future needs of the hill farmers. The land use practices in the hill region of Bangladesh is associated with various complexities. High altitude, steep slope, rainfall pattern, long drought, land tenure, accessibility etc. are among them. Even the settled agriculture is impeded by many ways. Therefore, it was mentioned that the income producing hedgerows and other agro forestry components, such as high value timber and fruit trees, are necessary to integrate in settled agriculture.

The purpose of the research project was to introduce an alternative farming system for livelihood improvement of hill farmers and their capacity building for sustainable land use. Agro-forestry systems were practiced as a viable tool for upland management, increase and sustain the crop productivity and improve the environmental conservation. The project site was selected at the Sarai union of Lama Upazilla under Bandarban district of Chattogram Hill Tracts. Sixty hill farmers were selected through Participatory Rural Appraisal (PRA) as the project targeted group. Based on the response of developed questionnaire supplied to the farmers, their problems, need and potentials were identified. Accordingly, the appropriate timber, non-timber and other agro-forestry species were identified. It was found that

bamboos have an important role in the livelihood of hill communities as a very fast growing species. Besides, the restoration of bamboo resources in the hill region is very essential for the prevention of land slide and soil erosion for the conservation of water shade and soil fertility. Twelve hectares of bamboo plantations were raised in farmers' field and homestead. Bamboo based agro-forestry modules were developed and practiced which provided a very good crop diversification to sustain the crop productivity in the hilly area. Farmers were trained up on bamboo propagation and management, nursery development on timber, non timber and medicinal plants which helped them to create income generation. These increased incomes were also facilitating the respondents to upgrade their living conditions which provided them better access for food, education, shelter, health and cloth.

It was found that 99% plantations were successfully established in the farmers land. Farmer's best choice was observed for inter-cropping with bamboos, timber tree (acacia) , fruit tree (mango), betel nut, lemon, year round vegetables, papaya, banana and pineapple. It was a very good opportunity to make the crop

diversification for sustainable hill farming. The farmers were happy and expecting to improve their livelihood with the implementation of the project activities successively. It was observed that farmers' had a positive attitude and perception regarding agro-forestry to get better return than mono cropping of agricultural crops in the hilly areas after the intervention of project activities.

CRG Sub-Project Completion Report (PCR)

A. Sub-project Description

1. **Title of the CRG sub-project:** Agro-forestry for livelihood development of *Jhumia* community (shifting cultivators) in Chittagong Hill Tracts, Bangladesh.
2. **Implementing organization:** Silviculture Genetics Division, Bangladesh Forest Research Institute

3. Principal Investigator

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4. Sub-project budget (Tk):

- 5.1 Total: 30, 00,000/- (Thirty Lac.)
- 5.2 Revised (if any): Not applicable

5. Duration of the sub-project:

Start date (based on LoA signed): June /2017
End date: 30 September 2018

6. Justification of undertaking the sub-project:

The hill region of Bangladesh represents many important resources like forest, agriculture, water, energy etc. and an excellent natural ecosystem. Once the landscape was covered with various forest types and green vegetation but gradually became denuded due to unscientific hill resource management.

The ethnic people of the Chattogram Hill Tracts (CHTs) have practiced a traditional farming system of shifting cultivation (*jhum*) for decades. In the past, the shifting cultivation has served the needs of many generations with goods and services in a sustainable manner. The mixed nature of cropping ensures a steady supply of food all the year round. At the end of each cycle, the land is left to regenerate itself for 6 to 7 years. There was no serious deterioration of soil and the plots lay fallow for at least 7 years. Now the sustainability of traditional forms of shifting cultivation are disappearing because of dramatically increasing population densities arising from both endogenous growth and in-migration by large numbers of lowlanders. In the face of increasing land-use pressures, farmers can no longer afford the luxury of long fallow periods that allow recovery of the secondary forest and rejuvenation of exhausted soil fertility. Therefore, the fallow period or *jhum* cycle under shifting cultivation has been shortened from 10-15 years to 2-3 years. Frequent cultivation of slope land with short (2-3 years) *jhum* cycle has resulted in accelerated run-off of water and soil erosion, declined soil fertility, land degradation, reduced tree growth and crop yields and threatening living environment as a whole. Due to shortened *jhum* cycle along with other technical weakness, the shifting cultivation is no more in a position to cope with future needs of the hill farmers. As a result more than 80% of the population of this region now depends on stagnant and/or declining farming practices. The decline of productivity of these existing farming practices is now a major concern.

Therefore an alternative farming system is required in the region to create sustainable land-use systems, improve farmers' living standards, reduce deforestation, and protect the watershed. Agroforestry is a viable land use option for upland management and can increase and sustain crop productivity in the uplands and improve environmental conservation. Moreover, as a land-use system, agroforestry has been increasingly regarded as an effective and low-cost method for minimizing the processes of degradation associated with land cultivation and for the retention of the ecosystems.

7. Sub-project goal:

The goal of the project is to improve livelihood security of *Jhumia* community of Chattogram Hill Tracts (CHTs) through application of bio-diverse eco-friendly agro-forestry technology.

8. Sub-project objective(s):

- a. Improve the productivity of households and *jhum* land based agroforestry systems to enhance livelihoods of *Jhumia* community.

- b. Introduce sustainable land use system on hill farming for optimizing the yield of food, fodder, timber, fuel-wood, bamboo, cane, medicinal plants etc.
- c. Assess socio economic and environmental benefit of sustainable hill farming practice.

9. Implementing location (s):

Sarai Union of Lama Upazilla, under Bandarban district of Chattogram Hill Tracts (Fig.1).

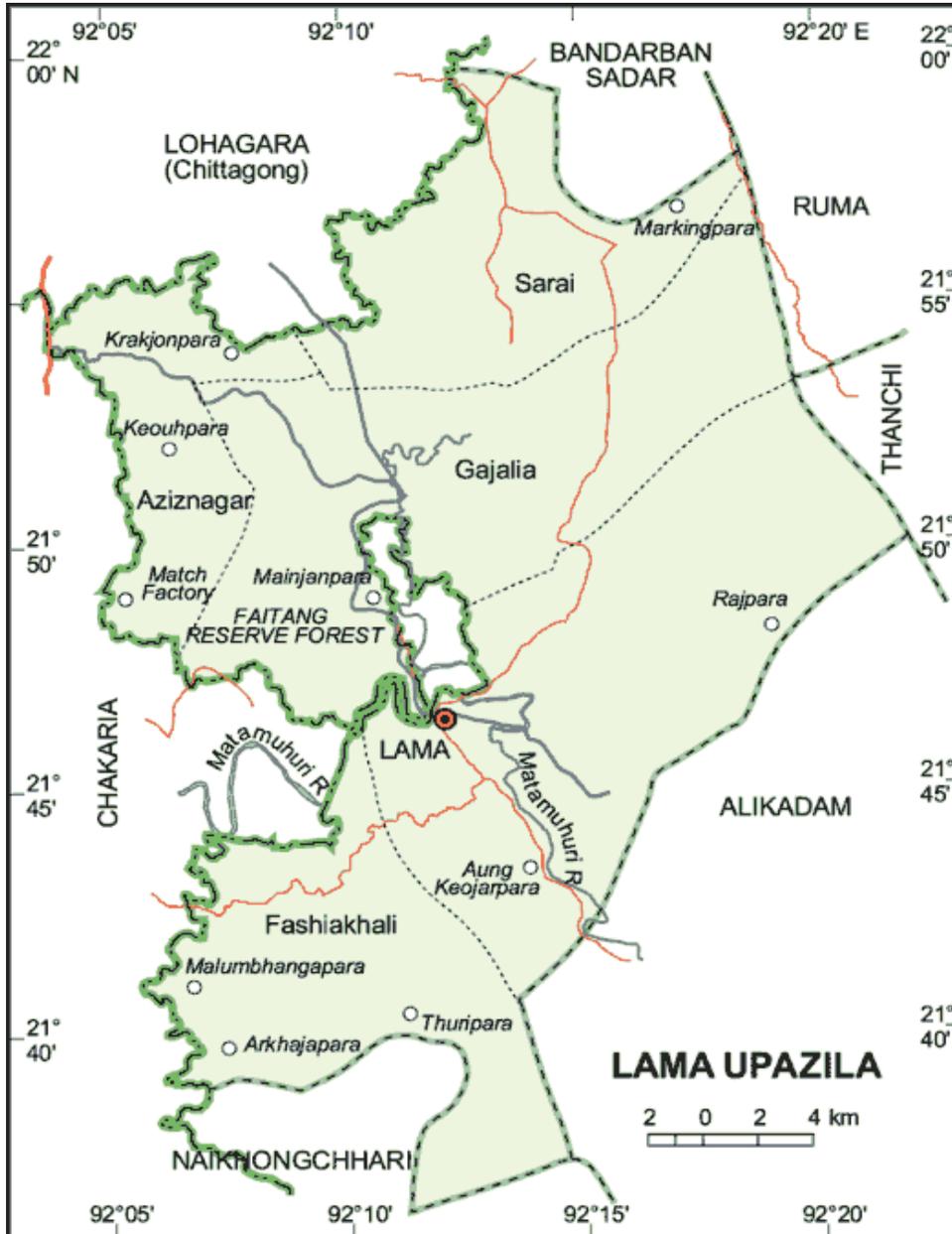


Figure 1. Project site map.

10. Methodology:

i. Project site selection

Baseline survey was done for the selection of project site through the discussion meeting with local people, including the ethnic community leader, Local people representatives, School teachers, Government and non-Government local officials. (Fig. 2). Three unions of Lama Upazilla were assessed for the site selection. These were Sorai, Aziz nagar and Gazalia. Based on the discussion meeting with local people's representatives, farmers and others, emphasized on their interest, cooperation and the farmers' easy access to the project activities to select the site. Information collected on the knowledge of agroforestry practices, existing farming systems and their need base in the hill farming.



Fig. 2A. Discussion meeting with local farmers, representatives and others

Fig. 2B. Briefing on Questionnaires among the farmers

Fig. 2C. Talking the local union chairman in the meeting

Figure 2. Baseline survey and discussion meeting with local people at the sub project site

ii. Farmers selection, problem identification, assessment of need and potential

Key Information Interview Participatory Rural Appraisal (PRA) method with developed questionnaires' was followed to select the targeted farmers group and to identify their problem, need and potential (**Anex-4**).

iii. Accounting of pre-intervention status:

The pre-intervention status of the selected farms was evaluated through case studies/surveys. In the process, the existing farm resources, assets, liabilities, present use of resources, existing farming

practices and technologies used, level of input use and outputs obtained, performances of different enterprises, farm income and expenditure status assessed for each farm household.

iv. Analysis of existing system and selection of technologies for intervention:

Based on the pre-intervention status, the system performance was analyzed in the context of existing biophysical and socio-economic environment of the farm and constraints and potentials identified. To ensure maximum utilization of existing farm resources, alternate/ new packages of technology was identified and finally selected on the basis of farmers' option.

v. Project Inception meeting and seedling distribution among the farmers.

Inception meeting was conducted with the selected farmers and the local people representatives to invent the project activities on 4th November 2017. (Fig. 3.).



Figure 3. Inception meeting and seedling distribution (A & B).

vi. Implementation of intervention and performance evaluation:

After finalizing the proposed interventions, the farmers were motivated through all possible ways to utilize their own resources to adopt the interventions. However, in implementing some new technologies, a few critical inputs were provided free of cost. Throughout the entire period of implementation, regular technical support was provided as and when necessary. The performance of different interventions was monitored regularly and necessary data collected.

11. Results and discussion:

Data collection, analysis, discussion and achievements

Primary data were collected and analyzed to find out the existing farm practices, problem, need, potential, level of input use and outputs obtained, farm income and expenditure status, etc. The selected farm households were categorized in three types based on their land ownership. These exercise revealed that maximum farm households (51) were at marginal level having a range of land 0-10 acres (Fig. 4).

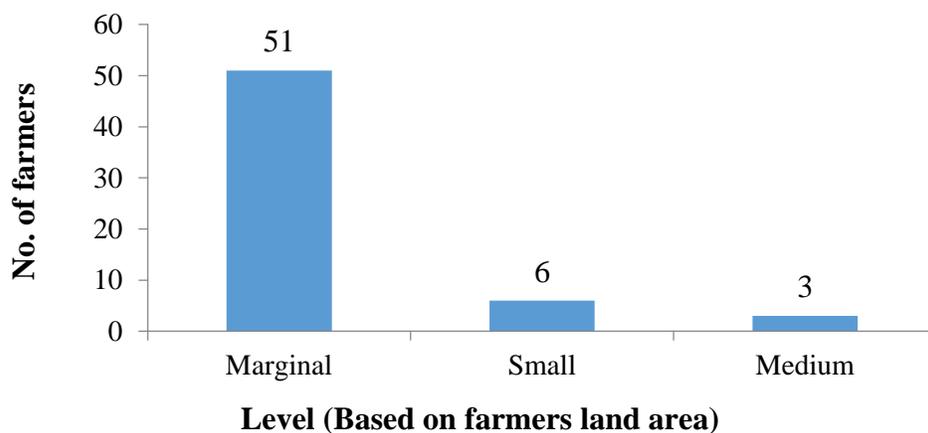


Figure 4. Farmers household types.

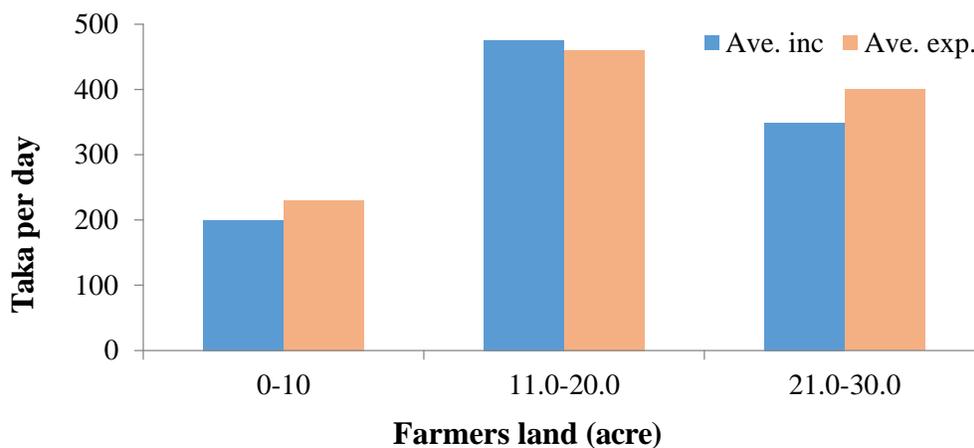


Figure 5. Comparative income and expenditure of farm household

The daily income and expenditures of each farm household are presented in Fig. 5. It was found that all the three types of farm owners have a gap between their income and expenditure. Traditionally the farmers have been cultivating agricultural crops, timber trees, fruits and vegetables. Some of them have

livestock and fisheries as well. The dominating agricultural activities was found rice cultivation. As the project site is the hilly region of Bangladesh, most of the farmers have perennial timber and non-timber tree species, fruit trees and year round vegetables. The available timbers, fruits and non-timber species and the farmers' interest are shown in Fig. 6, Fig. 7 and Fig. 8 successively.

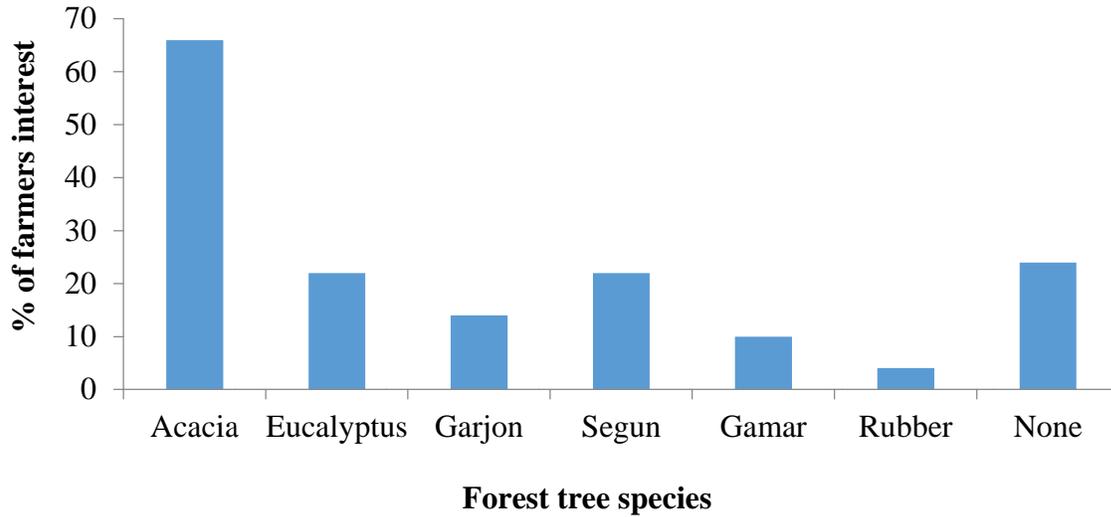


Figure 6. Farmers response on forestry crop.

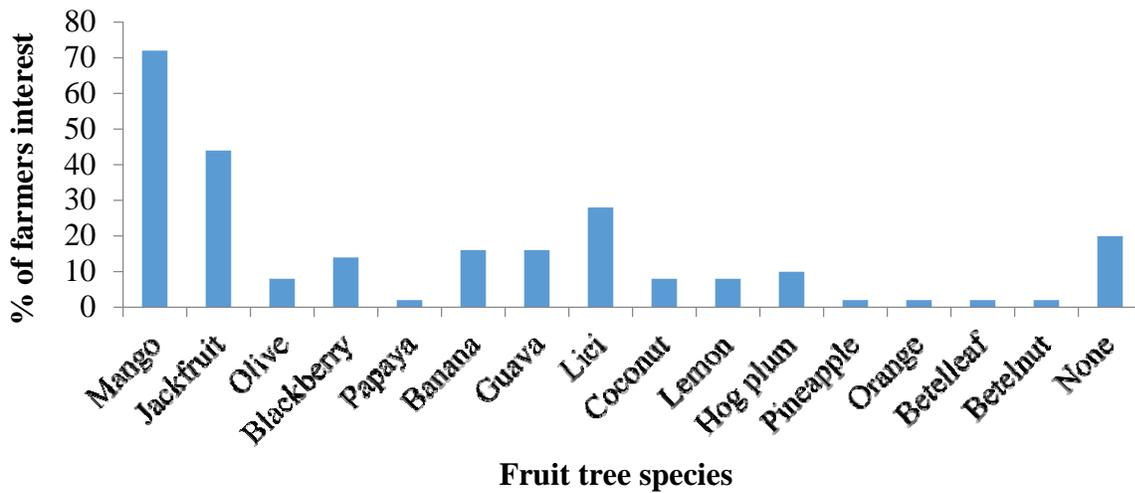


Figure 7. Farmers response on fruit crops.

Among the farmers maximum 66% are interested on tree species acacia (*Acacia auriculiformis*) and 24% farmers have no tree crops. In case of fruit trees maximum 72% farmers have their interest on mango cultivation and 20% have no fruit trees. The farmers are very much interested on bamboo

cultivation. As a first growing non-timber species bamboo has an important role in agro-forestry for hill region. The current data represent that 44% of the farmers have bamboo clumps but 24% have no bamboos Figure -8. The status of livestock and fisheries also presented in Fig. 9 and Fig. 10.

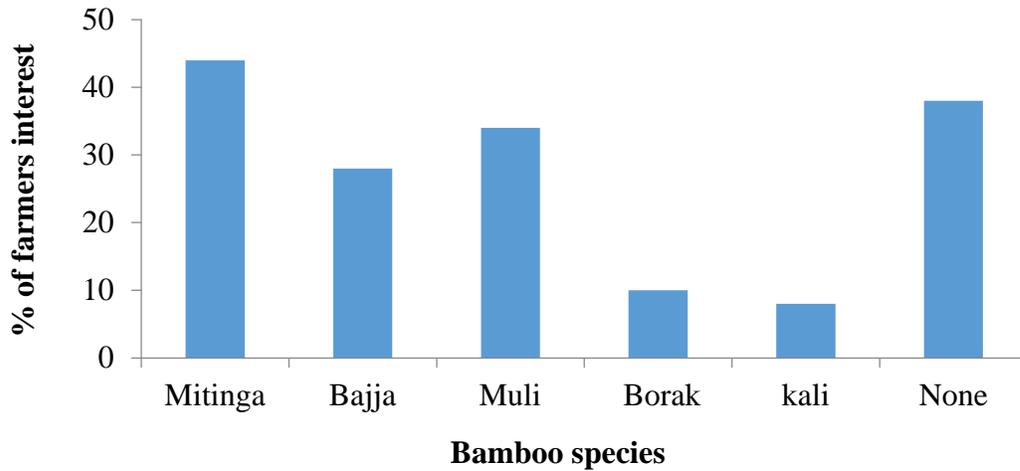


Figure 8. Farmers response on bamboos.

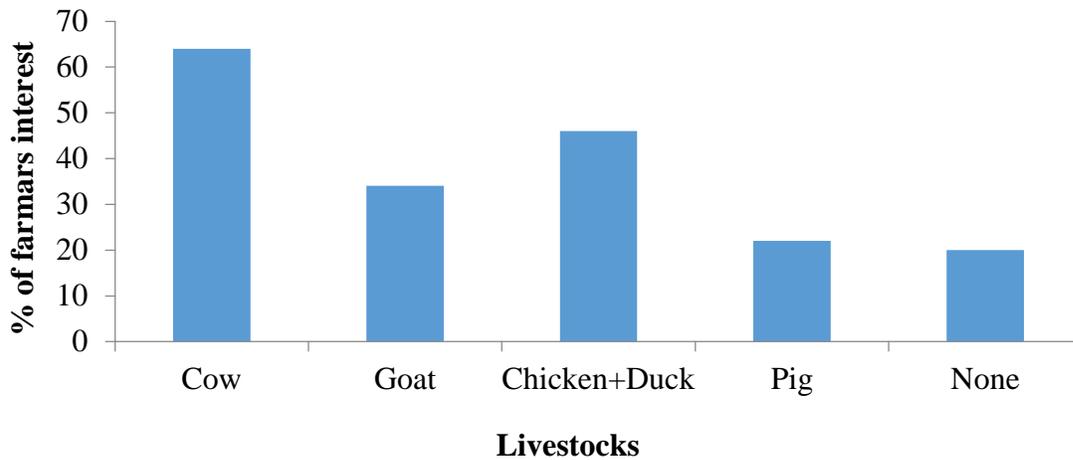


Figure 9. Farmers' response on livestock.

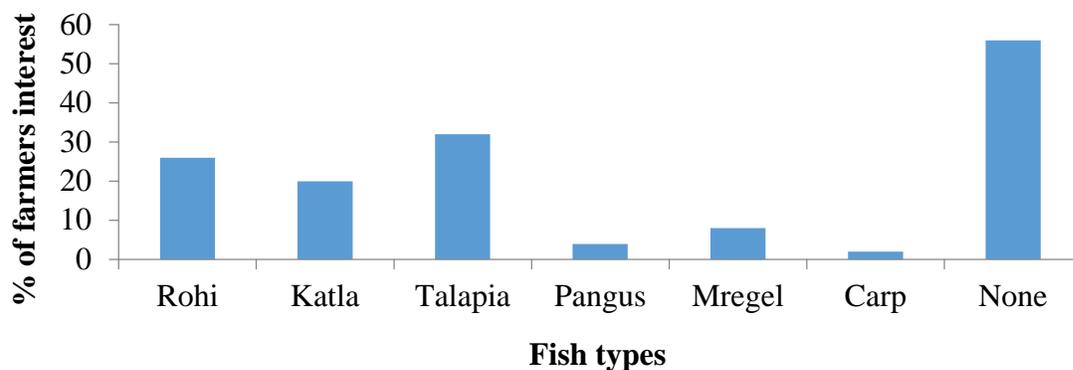


Figure 10. Farmers’ response on fish cultivation.

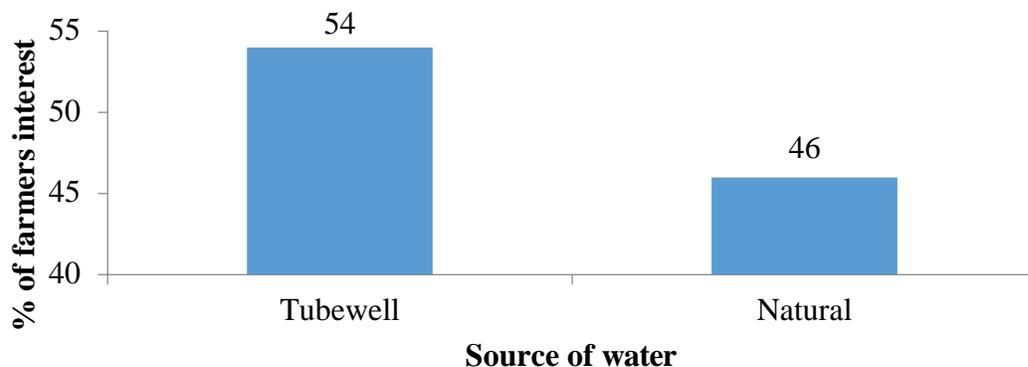


Figure 11. Sources of water used by the farm household

Maximum 64% households have livestock and 20% have none. Besides, 32% farmers have fish cultivation while 56% have no fishes. Data also collected on the sources of water which they use in households. It was found that 54% households use safe tube well water while 46% use unsafe water from natural sources (Fig. 11). The main problems in farm practices in hill region were the lack of supply of quality seeds and seedlings, fertilizer, pesticides and the scarcity of irrigation water.

Based on the farmers response and the land use system of the project site, it was the project activities were prioritized. Four thousand bamboo seedlings of 4 important species such as baijja (*Bambusa vulgaris*), bhudum (*Dendrocalamus giganteus*), ora (*Dendrocalamus longispathus*) and tetua (*Bambusa jaintiana*); fruit crops lemon and betel nut, timber species hybrid acacia and medicinal plant aloe vera and diabetic plants were distributed among the 60 selected farmers (Fig. 12).



Figure 12. Distribution of bamboos, timber, fruit and medicinal plants seedlings among the farmers.

Twelve hectares bamboo plantations were raised in farmer’s field and homestead with the combination of other timber, non-timber, fruits and with year round vegetable species as a part of agro-forestry practices (Fig. 13). Farmers can practice intercropping with bamboos up to three years with seasonal crops as well as perennial fruit crops based on the land position.



Figure 13. Agro-forestry practices in farmers land and homestead.

A. Intercropping with bamboo and fruit crop papaya. B. Intercropping with bamboo and timber species acacia. C & D. Bamboo plantation at canal side. E & F. Intercropping with bamboo and banana at canal side. G & H. Bamboo plantation at homestead. I & J. Intercropping with bamboo, mango and banana at hill base.

The survival and growth performance of different bamboo species both in homestead and farmer's field was found highly satisfactory. In average, 95% seedlings survived and each seedling produced a number of new shoots to form a clump within six months. Some pictures on the farmers field performance of the bamboos are shown in Fig. 14.



Figure 14. Farmers field and homestead garden of bamboos and other plants. Data collected after six months of plantation.

The results revealed that average 23.5 shoots/clump were recorded in ora bamboo with an average height 20.00 ft followed by tatua, baijja and bhudum bamboo (Table 1, Fig. 15).

Table 1. Survival and growth performance of different bamboo species in farmers land and homestead at project site.

Bamboo species	Planting date	Survival %	Ave. number of shoots/ clump after 8 months	Average culm height (ft)
Baijja	October 2017	98	9.3	27.20
Ora	October 2017	100	23.5	20.00
Tatua	October 2017	95	11.3	15.50
Bhudum	October 2017	95	8.5	10.50



Figure 15. Demonstration plot of bamboo base agro-forestry practices in farmer's field. Data collected after one year of plantation.

It has been estimated that each bamboo clump will produce with at least 10 mature bamboos within next three years. Farmers will be able to extract 5-6 mature bamboos from each clump after five years of plantation. It has been calculated that each farmer has 33 bamboo clumps from which they will get 165 mature bamboos in the first year of extraction. Some extent farmers produced seasonal vegetables like bean, chili, ladies finger, sweet gourd and the year round fruits papaya and banana as inter cropping with bamboos up to three years. Besides, they were planted bamboos with the fruit tree mango and timber

tree such as acacia (*Acacia auriculiformis*), eucalyptus (*Eucalyptus camaldulensis*), garjon (*Depterocarpus* sp.), teak (*Tectona grandis*) gamari (*Gmelina arborea*) and rubber (*Hevea brasiliensis*) also in the same area of plantation.

Farmers of the project site were used to practice traditional *jhum*/ shifting cultivation as they had a little knowledge of agro-forestry practices before the intervention of project activities. Later on the farmers realized the importance of the perennial timber, non-timber and fruit yielding tree along with annual agricultural crop due to its diversified contributions to their household economy. Farmers have been practicing different agro-forestry system in their homestead and crop land. These agro-forestry practices are

- i. Bamboo + Pineapple + Lemon + Betel nut
- ii. Bamboo + Jackfruit + Mango + Lemon + Betel nut
- iii. Bamboo + Lemon + Betel nut + Papaya
- iv. Bamboo + Lemon + Banana + Papaya
- v. Bamboo + Banana + Lemon + Litchi
- vi. Bamboo + Banana + Bean + Papaya
- vii. Bamboo + Chili + Potato + Sweet guard
- viii. Bamboo + Acacia + Hybrid acacia
- ix. Bamboo + Eucalyptus.

There is a great scope for developing different agro-forestry system in the hill areas of Bangladesh. Although there are some problems such as supply of quality seeds and seedlings, fertilizer, pesticides, scarcity of irrigation water and ensuring the market price of farm products. Now the farmers are very much interested in planting crops / vegetables with timber or fruit tree species. They have been realizing the benefits of integrated farming system i.e., agroforestry and impacts are also observed in their socio-economic status. By the proper implementation of agroforestry practices, the peoples of hill areas can improve their livelihood in a sustainable way.

Capacity build up and income generation of the project farmers.

Farmers were trained up on bamboo propagation through branch cutting technique (Annexure-1), bamboo grove management (Annexure-2), and nursery establishment for bamboo, forest species and medicinal plants (Annexure-3). Sixty hill farmers of Sarai union of Lama, Bandarban district

participated in the different training programme. They developed their skill on the particular subject matter (Fig. 16).



Figure 16. Farmers training programme on bamboo branch cutting technique and management.

It was found that after training, farmers developed a very positive attitude and perception towards adopting agro-forestry practices to get better return than mono cropping of agricultural practices. They found that it could minimize the risk of damaging one crop by the other crop through practicing multi-cropping. Five nurseries were established at farmers land where they raised seedlings of bamboos from branch cuttings as well as seedlings of different species (Fig. 17). Some of the farmers such as Arif, Shahidulla and Rahima earned cash money ranging Tk 4,000 – 10,000 tk. within three months from March to May 2018 by selling bamboo seedlings (Table 2).

Table 2. Bamboo seedlings production and income of some farmers in their own nursery after training

Farmer's name	No of Seedlings	Total amount (tk)	Remarks
Md. Arif Hossen	440	8,800	Per seedling 20 tk
Md. Shahidulla	400	8,000	
Mrs. Rahima Khatun	250	5,000	



Figure 17. Farmers are producing bamboo seedlings from branch cutting technique after training in their own nurseries.

The farmers are expecting to earn more money from the coming season. As they responded, this extra income supported them to meet their daily expenses. Besides, they will get return from their bamboo plantation after 3-5 years of planting. In consideration of the income status of the respondents, it might be reckoned that the agroforestry practices (cropland and homestead agro forestry) of Sarai union of Lama will play an important role in the economic development of the local farmers who are practicing it. These increased incomes were also facilitating the respondents to upgrade their living status which provided them better access for food, education, shelter, health and clothing. They also opined that their social status had also been increased by this way and they were feeling better. The increased production (combined) from agro-forestry facilitated these villagers to reduce their poverty to some extent and thus they had better access to their daily necessities which helped them to attain a minimal standard of living. The subsistence and commercial uses of diversified products and services of agro-forestry secured their food production, protecting a sound environment and conserving the biodiversity which also helped to conserve and protect traditional forest resources.

Conclusion:

It has been observed that the farmers of the project area are now very positive on practicing agroforestry in their croplands and homesteads. They perceived agroforestry as a profitable land use system which contributed them in many diversified ways such as: improving income, educational status, housing condition, homestead tree species status, household assets, sanitation condition, production of agricultural crops, etc. Their attitude and perception on agro-forestry practice were very supportive to promote and upscale agroforestry in the study area. Moreover, they perceived the importance of trees immensely. These sorts of findings may conclude that the agro-forestry practice is contributing positively to reduce poverty of the project farmers.

12. Research highlight/findings:**Identified the problem, need and potential of the hill farmers for agro-forestry practices.**

- Limited knowledge on agro-forestry practices.
- Supply of quality seeds and seedlings, fertilizer, pesticides.
- Scarcity of irrigation water.
- Ensuring the market price of farm products.

Need based support (seeds and seedlings) provide to the farmers to improve the crop production for agro-forestry practices.

- Seedlings of timber tree
- Seedlings of non-timber tree species
- Seedlings of fruit trees
- Seedlings of medicinal plants

Raised 12 hectares bamboo plantation

- Successfully raised 12 hectares of bamboo plantation in the farmer's field and homestead with other agro-forestry species like timber, fruits and year round vegetables for sustainable crop production.

Nursery establishment

- Established 5 nurseries at farmer's field for seedling raising of bamboos, timber, non-timber and medicinal plants.

Training provided for capacity building

- Sixty hill farmers of Sarai Union of Lama, Bandarban were supported for capacity building on Agro-forestry practices in homestead and their fields.
- Farmers were trained on agro-forestry systems
- Propagation of bamboos and its management
- Nursery establishment for bamboo, timber, non-timber and medicinal plants and
- Pest and disease control of trees and crops.

Income generation

- The farmers have been producing seedlings of bamboos, tree species and medicinal plants in their own nurseries and earning extra money by selling it as well.

Crop diversification

- Demonstrated a very good crop diversification model for sustainable production in homestead and farm land for the livelihood improvement of hill farmers.

Bamboo based agro-forestry modules developed

- Bamboo base agro forestry modules were developed and were practiced by the project farmers successfully.

Changed the farmers perception

- The project farmers developed a positive attitude on agro forestry practices in hilly area. They could realize the benefit of the agro-forestry practices over mono crop agricultural.

B. Implementation Position

1. Procurement:

Description of equipment and capital items	PP Target		Achievement		Remarks
	Phy (#)	Fin (Tk)	Phy (#)	Fin (Tk)	
(a) Office equipment	100%	73,490/-	100%	73,490/-	
(b) Lab & field equipment	100%	95,000/-	100%	95,000/-	
(c) Other capital items					

2. Establishment/renovation facilities: Not applicable

Description of facilities	Newly established		Upgraded/refurbished		Remarks
	PP Target	Achievement	PP Target	Achievement	

3. Training/study tour/ seminar/workshop/conference organized

Description	Number of participant			Duration (Days/weeks/ months)	Remarks
	Male	Female	Total		
a) Workshop					
i. Discussion meeting.	75	25	100	10 th October 2017	Successfully completed
ii. Inception meeting.	60	15	75	4 th November 2017	Successfully completed
(b) Training					
i. Training on Bamboo propagation and bamboo grove management practice.	50	10	60	29-05-2018 to 31-05-2018 03 days	Successfully completed
ii. Training on Introduction of nursery development technique for bamboo and forest species.	50	10	60	02 days	Successfully completed
iii. Training on Raising medicinal plants, distribution and its cultivation	50	10	60	01 day	Successfully completed

C. Financial and physical progress

Fig in Tk

Items of expenditure/activities	Total approved budget	Fund received	Actual expenditure (August 2018)	Balance/unspent	Physical progress (%)	Reasons for deviation
A. Contractual staff salary	4,43,877	3,74,337	3,38,377	35,960	11.28%	
B. Field research/lab expenses and supplies	14,23,350	14,23,350	12,93,300	1,30,050	43.11%	
C. Operating expenses	3,16,733	3,16,733	2,51,097	65,636	8.37%	
D. Vehicle hire and fuel, oil & maintenance	2,50,000	2,50,000	2,10,000	40,000	7.00%	
E. Training/workshop/seminar etc.	1,49,850	1,49,850	1,49,850	0	5.00%	
F. Publications and printing	1,00,000	0	0	0	0.00%	
G. Miscellaneous	1,50,000	1,50,000	1,49,500	500	4.98%	
H. Capital expenses	1,66,190	1,66,190	1,66,190	0	5.54%	
Total:	30,00,000	28,30,460/-	25,58,314	2,72,146	85.28%	

D. Achievement of Sub-project by objectives: (Tangible form)

Specific objectives of the sub-project	Major technical activities performed in respect of the set objectives	Output(i.e. product obtained, measurable, visible)	Outcome(short term effect of the research)
1. Improve the capacity of household and <i>jhum</i> land based agro-forestry systems to enhance livelihoods of <i>Jhumia</i> community.	<ul style="list-style-type: none"> • Conducting Participatory Rural Appraisal (PRA). • A questionnaire development. • Baseline survey. • Site and farmer selection. • Training • Demonstration 	<ul style="list-style-type: none"> • Developed a questionnaire for PRA. (Annex-4) • Farmers, local people, and representatives of Government and Non-Government local offices participated. • Baseline surveyed through discussion meeting with the local people. • Sorai Union of Lama upazilla under Bandarban district selected as the project site. 	<ul style="list-style-type: none"> • Identified the problem, need and potential of the hill farmers. • Find out the rural environment suitable for the project site. • Sixty hill farmers were selected.
2. Introduce sustainable land use system on	<ul style="list-style-type: none"> • Identification of appropriate tree and crop species for homestead 	<ul style="list-style-type: none"> • The available timber, non-timber, fruits and other agro-forestry 	<ul style="list-style-type: none"> • As a fast growing non-timber species bamboo, timber

<p>hill farming for optimizing the yield of food, fodder, timber, non-timber and medicinal plants</p>	<p>agro-forestry practices in selected areas</p> <ul style="list-style-type: none"> • Raising 5,000 bamboo seedlings and distribution for 12 ha plantation at homestead and farmers land • Demonstration 	<p>species were identified through PRA.</p> <ul style="list-style-type: none"> • Distributed 4,000 bamboo seedlings of different bamboo species (baijja, bhudum, ora, tetua) and 200 betel nut seedlings among the sixty farmers of the project 	<p>species like Acacia (<i>Accacia auriculiformis</i>), Hybrid acacia and fruit crop betel nut, coconut, mango, jackfruit, lemon and banana are suitable for the project area.</p> <ul style="list-style-type: none"> • Raised 12 hectares bamboo plantation in the farmer's field.
<p>3. Assess socio economic and environmental benefit based on sustainable hill farming practices.</p>	<ul style="list-style-type: none"> • Data collection and analysis • Farmers feedback. 	<ul style="list-style-type: none"> • Sixty Farmers of Sarai Union Lama, Bandarban were trained up through different training programme i.e., <ul style="list-style-type: none"> - bamboo propagation and grove management, - nursery establishment and cultivation of medicinal plants. 	<ul style="list-style-type: none"> • Farmers produced seedlings of bamboos, medicinal plants and forest species in their nurseries. • They earned extra money by selling the seedlings. • A very positive perception on agro-forestry practices developed among the farmers. • Developed crop diversification at home stead and farmers field. • Improved the soil health, biodiversity conservation. • Stabilization of environment, diffusion of sustainable hill farming practices and reduction in traditional practices.

E. Materials Development/Publication made under the Sub-project:

Publication	Number of publication		Remarks (e.g. paper title, name of journal, conference name, etc.)
	Under preparation	Completed and published	
Technology bulletin/ booklet/leaflet/flyer etc.	01	-	<ul style="list-style-type: none"> • Agroforestry – Farming with Bamboos (Leaflet)
Journal publication	01	-	<ul style="list-style-type: none"> • Adaptation of Agroforestry Technologies among Small Scale Farmers in Chittagong Hill Tracts of Bangladesh
Information development			
Other publications, if any	01	01	<ul style="list-style-type: none"> • Daily local newspaper <i>Dainik Purbakon</i> published the news of seedlings distribution among the farmers at Sorai Union, Lama, Bandarban on 07-11-2017. • Farmers training on “Bamboo Propagation and Management” News letter, Bangladesh Forest Research Institute, Chattogram.

F. Technology/Knowledge generation/Policy Support (as applied):

i. Generation of technology (Commodity & Non-commodity)

- Developed a Bamboo based agro-forestry system in the hill area for sustainable land use and crop production.

ii. Generation of new knowledge that help in developing more technology in future

- Knowledge on agro-forestry practices in the hill area could help to develop more technologies in future.

iii. Technology transferred that help increased agricultural productivity and farmers income.

- Bamboo branch cutting technique and grove management.
- Nursery development for timber, non-timber and medicinal plants.

➤ Practices of agro-forestry module.

iv. Policy Support

- Government policies play an important role in facilitating agroforestry promotion.
- Widespread adoption of agroforestry is strongly influenced by the policy and institutional context within which agroforestry is disseminated.
- In many cases, the spread of agroforestry was triggered when existing or new policies created market opportunities and increased the economic rationale for adopting given agroforestry systems.
- Additionally, the participation and investment of private sectors have major roles on the policy implications in this field.

G. Information regarding Desk and Field Monitoring

i) Desk Monitoring:

A workshop on desk monitoring of agro-forestry base CRG sub- projects held was on 23.9.2018 at BARC Dhaka, organized by the Project Implementing Unit NATP phase -2. The project progresses were presented in the workshop and received positive remarks from the discussion. It was suggested to complete rest of the research activities on time due to the short period of time. Accordingly, all the activities were completed within the project allocated time.

ii) Field Monitoring:

Name of visitor (s)	Designation	Date(s)	Total visit till date (No.)	Remarks (activities performed/modification suggested)
Dr. Mohammad Mohiuddin	Chief Research Officer, BFRI, Chattogram.	4.11.2017	01	<ul style="list-style-type: none"> • The visitor participated in the seedling distribution programme among the project farmers and interacted with them for successful plantation raising.
Dr. Md. Mahbubur	Divisional Officer,	10.10.2017	03	<ul style="list-style-type: none"> • The team monitored the

Rahman & team members	BFRI, Chattogram.	4.11.2017, 25.01.2018		farmers' fields and home stead plantation and nurseries regularly and provided necessary suggestion for proper taking care of the plantation and nurseries.
Dr. Khurshid Akhter & Dr. Md. Mahbubur Rahman and project team.	Director, BFRI	17.11.18	01	<ul style="list-style-type: none"> • The team participated in the seedling distribution programme and also visited farmers' field and nurseries as well. • A very good interaction took place among the farmers and visiting team. • Farmers discussed about their overall achievement for the intervention of the project. • They were happy with this support and expected to extend the project period for their benefit.

H. Lesson Learned/Challenges:

The study concludes that the dissemination of agroforestry at the farm level should be complemented with conducive policy, institutional and economic incentives. Apparently it seems

- i) To minimize challenges through collaboration with farmers at the center.
- iii) Promote adequate learning and training.
- iv) Facilitate producer-consumer contacts and payment for the values.
- v) Long term monitoring and evaluation with focus on farm management.

I. Challenges:

- i. Natural calamity
- ii. Communication
- iii. Crop storage facilities
- iv. Marketing facilities of farm products.
- v. Scarcity of water for irrigation.

Annexure 1. Training module on bamboo cultivation through branch cutting technique.

Session	Time schedule	Subject	Training method	Facilitators
Session-1	10:00 -11:00	Introduction, Farmers' expectation and training objective.	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
Session-2	11:00-12:00	<ul style="list-style-type: none"> • Introduction to different bamboo species of Bangladesh • Bamboo propagation methods • Branch cutting technique • Propagation bed preparation 	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
Session -3	12:00-1:00	<ul style="list-style-type: none"> • Branch collection and cutting preparation • Insertion of cuttings in propagation bed. • Transfer of rooted cuttings in polybag. • Planting of seedlings in field and management 	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
	1:00 – 2:00	Lunch break		
Session-4	2:00-4:00	<ul style="list-style-type: none"> • Field visit • Propagation bed preparation • Cutting preparation and insertion in bed 	Practical	Saiful Alam Md. Tareq Field investigator and Md. Nasir Uddin, Forester. Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
	4:00-5:00	Training summary a open discussion		Facilitators and Participants

Annexure 2. Training module on bamboo grove management.

Session	Time schedule	Subject	Training method	Facilitators
Session-1	10:00-11:00	Introduction, Farmers' expectation and training objective.	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
Session-2	11:00-12:00	<ul style="list-style-type: none"> • Types of bamboos and its uses • Conception on village and hill bamboo groves 	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
Session-3	12:00-1:00	<ul style="list-style-type: none"> • Importance of bamboo grove management • Tending of bamboo grove • Calendar of management operation • Bamboo diseases and their control • Application of fertilizer • Thinning and extraction of mature bamboos. 	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
	1:00-2:00	Lunch break		
	2:00-4:00	Practical on bamboo grove management	Practical	Saiful Alam Md. Tareq Field investigator and Md. Nasir Uddin, Forester. Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
	4:00-5:00	Summary and open discussion		Facilitators and Participants

Annexure 3. Training module on nursery establishment and management for bamboo and other plant species in hilly area.

Session	Time schedule	Subject	Training method	Facilitators
Session-1	10:00-11:00	Introductory session on farmers expectation and the training objectives	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
Session-2	11:00-12:00	<ul style="list-style-type: none"> • Discussion on establishment technique of nursery in hilly areas • Site selection for nursery establishment • Characteristics of site specific species 	Participatory discussion	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
	1:00-2:00	Lunch break		
Session-3	2:00-4:00	Site visit and selection. Nursery layout Bed preparation	Practical	SaifulAlam Md. Tareq Field investigator and Md. Nasir Uddin, Forester. Silviculture Genetics Division, Bangladesh Forest Research Institute, Chattogram.
Session-4	4:00-5:00	Summary and open discussion.	Participatory discussion	Facilitators and all participants

Annexure 4. Questionnaire for Participatory Rural Appraisal (PRA).

Questionnaire

CRG sub project -ID-386

“Agro-forestry for livelihood development of *jhumia* community (shifting cultivators) in Chattogram Hill Tracts, Bangladesh”

Field survey site: Keazupara, Sarai union, Lama, Bandarban.

- | | |
|---|--|
| (1) K...tKi bvg
(Farmer’s name) | t |
| (2) wj½
(Gender) | t cyiI (Male) <input type="checkbox"/> / gwnjv (Female) <input type="checkbox"/> |
| (3) eqm
(Age) | t |
| (4) cwievti m`m` mSL`v
(Family member) | t |
| (5) tckv
(Occupation) | t |
| (6) Rwgi cwigvb KZ
(Land area) | t |
| (7) vlcwZ wK aiþbi
(Cultivation practices) | t |
| (8) cðvb Avev`x dmj wK
(Main crops) | t |
| (9) ebR e„y cðRwZ AvtQ wKbv
(Forest species) | t |
| (10) e„y cðRwZi bvgwK wK
(Main forest species) | t |
| (11) djRe„y wK wK AvtQ
(Fruit tree species) | t |
| (12) tKvb JIax Dw`q` vI Kti b wKbv | t |

(Medicinal plant cultivation)

- (13) wK wK JIax Dw™ç` Av†Q t
(Types of medicinal plants)
- (14) euvkSvo Av†Q wKbv t
(Any bamboo clumps)
- (15) †Kvb cÖRvwZi euvk Av†Q †Kbv t
(Name of bamboo spp.)
- (16) euvk †v†li Dci †Kvb cÖwkÿb Av†Q wKbv t
(Training on bamboo cultivation)
- (17) euv†ki †viv jvMv†Z AvMÖnx wKbv t
(Interest in bamboo cultivation)
- (18) euv†ki †v†li Dci cÖwkÿb †c†Z AvMÖnx wKbv t
(Interest in bamboo training)
- (19) cÖvwY m᳚ú` Av†Q wKbv t n`uv (Yes) / bv (No)
(Live stocks)
- (20) cÖvwY m᳚ú†`i bvg †K t
(Main live stocks)
- (21) grm` †vl Av†Q wKbv t n`ii (Yes) / bv (No)
(Fish cultivation)
- (22) wK ai†bi gvQ †vl Kiv nq t
(Fish types)
- (23) K...wRvZ dmj †v†l †Kvb Amyweav nq †Kbv t
(Obstacles in farm cultivation)
- (24) wK ai†bi Amyweavnq t
(Types of obstacles)
- (25) Amyweav `yixKi†b wK wK c` †ÿc †blqv nq t
(Any measure taken for solution)
- (26) K...wl Kv†R †K wK ai†bi myweav †c†Z AvMÖnx t
(Required support for agriculture)
- (27) K...wl Kv†R †ivM evjvB Gi Avµgb nq †Kbv t
(Disease attack in agriculture)

- (28) ተገባሪ የጉዳይ ምክንያቶችን ማስቆጣጠር ዘዴዎች ተ
(Controlling measures of disease)
- (29) ማንኛውም የገንዘብ ማጠቃለያ/ማጠቃለያ ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Any support from local Govt./Non.Govt .org)
- (30) ሰጠው የሰጠው ለቀን ሰጠው ገንዘብ ተ
(Daily income)
- (31) ሰጠው የሰጠው ለቀን ሰጠው ገንዘብ ምንጮች ተ
(Daily income sources)
- (32) ሰጠው የሰጠው ለቀን ሰጠው ገንዘብ ማጠቃለያ ተ
(Daily expenditure)
- (33) ሰጠው የሰጠው ለቀን ሰጠው ገንዘብ ማጠቃለያ ምንጮች ተ
(Expenditure items)
- (34) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Gap between income &expenditure)
- (35) ዓመታዊ ጠቅላይ ሰጠው ገንዘብ ማጠቃለያ ተ
(Yearly savings)
- (36) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Maintain bank A/C)
- (37) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Bank loan)
- (38) ተገባሪ የገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(School going children's no.)
- (39) ተገባሪ የገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Interested with children education)
- (40) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Common diseases)
- (41) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Treatment facilities)
- (42) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Source of drinking water)
- (43) ለገንዘብ ማጠቃለያ ማጠቃለያ ማጠቃለያ ማጠቃለያ ተ
(Current income is enough for family expenditure)

(44) cÕavb Lvevi wK t
(Main food)

(45) w`þb Kqevi Lv` MÕnb Kþib t
(Daily meals taken)

(46) Drcw`Z dmþj mviv eQþii Lvevi nq wKbv t
(How much food they get from their land per year)

Signature of the Principal Investigator
Date

Seal

Counter signature of the Head of the
organization/authorized representative

Date

Seal