

Videos in Improving Farmers' Innovation Capacity for Climate-Smart Forest and Agricultural Practices: *An Experience of Madhupur Sal Forest in Bangladesh*

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Abstract

Madhupur Sal forest is one of the major forests in Bangladesh which is also under intimidation of severe deforestation due to settlement of the ethnic people and encroachment for farming. However, deforestation is one of the major factors responsible for climatic change events like recurrent natural calamities and degradation of natural resources. Thus, a pilot project was taken in the forest area by Bangladesh Agricultural University to minimize carbon emission through introduction of low emission agricultural practices (vermi-compost and botanical pesticide) in crop production and to increase women's participation in social forestry program. It also introduced improved cooker in the study area for reducing amount of fire wood for cooking. Video mediated extension approach was used to teach the people of the forest community regarding the consequences of climate change on their livelihoods. Findings showed that, project beneficiaries are now impressively aware on consequences of climate change issues. Around 75% of them are now using own made vermi-compost and botanical pesticide in agricultural production mixed with social forestry, while 42% of them are using improved cooker which has significantly reduced amount of fire wood for cooking. This is ultimately contributing in minimizing the rate of deforestation. However, the project initiatives have created alternate income opportunities of the forest community people through safe and organic cultivation of vegetables and fruits in the leased land. On the other hand, this social forestry programme

will directly contribute in reducing consequences of climate change in the long run.

Keywords

Innovation Capacity, Video-Mediated Extension, Climate-Smart Practices

1. Introduction

Bangladesh, a very small but one of the most populated country in South-Asia. Sixty four percent of its population (166 million) lives in the rural areas and 60 percent of them are landless and resource poor [1]. Livelihoods of the majority of the resource poor population are dependent on subsistence farming, natural resources (e.g. forests, and water) and wage income [2]. Forests are vital for human and animal lives as they are home to millions of species, prevent soil erosion, play a crucial role in water cycle by returning water vapor back into the atmosphere, absorb greenhouse gases that fuel global warming, keep soil moist by blocking the sun, produce oxygen and absorb carbon dioxide [3].

Forestry is a sub-sector, which makes a significant contribution to the livelihoods of people living in rural and remote regions and to promote social, economical and environmental sustainability and provide fruit, fodder, fuel, raw material for small and cottage industries, house construction materials, agricultural implements, cart wheel etc.

The country has only 17.08% (2.52 million ha) of total forest land among which Sal (*Shorea robusta*) forest covers about 0.12 million hectares (4.7%) of the total forest area of Bangladesh [4].

Madupur, Sal forest (Tangail & Mymensingh district) is the largest natural inland forest and Gharo is the major tribal group who follows matrilineal family system. Women are the household head and perform major activities of agriculture and other livelihoods. The forest resources have been meeting up their livelihoods sustainably. Once the *Madhupur* Sal Forest was rich in biodiversity (a huge variety of floral composition, different type of mammals, reptiles, avis and amphibians.), is now in danger [5]. The settlement reached to about 50 villages with about 40,000 populations living inside the forest [6].

A comparison of satellite images of 1962 and 2003 (**Figure 1**) clearly shows 85 percent greenery of Madhupur Sal Forest has disappeared in last 40 years [7]. The forest lands are rapidly turning into agricultural lands for production of paddy, pineapple, banana, ginger and vegetables. There has been excessive reliance on chemicals (e.g. fertilizer, pesticide and hormones) for production of these crops. This, in turn, posed new threats to health and environment in this area, such as increasing pest resurgence, resistance, and human health concerns [7] [8]. Deforestation and climate change are very closely linked, mainly because one leads to another. Deforestation, also known as the practice of cutting down

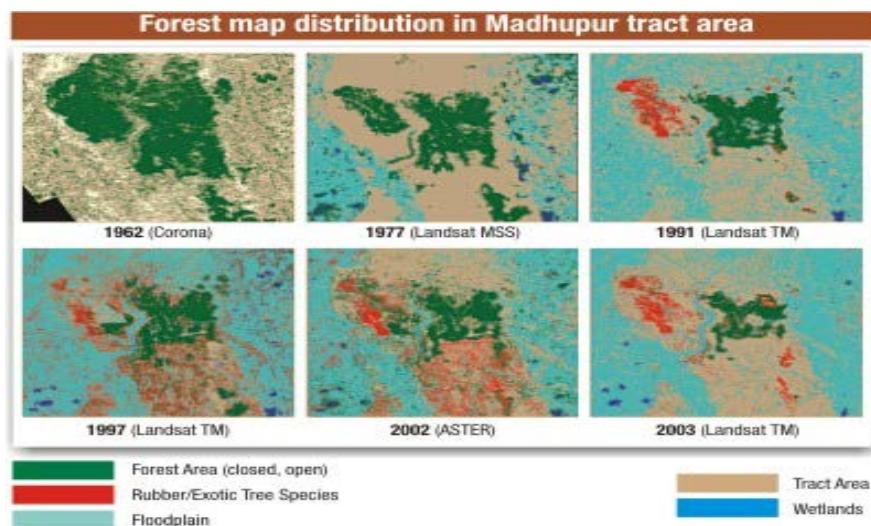


Figure 1. Satellite view of *Madhupur* Sal forest (1962-2003).

forests, is one of the leading factors to the problem of man-made climate change. Approximately 30% of the world's climate change is caused in part by deforestation [9]. One of the main reasons for this is because forests all over the world are treated as "carbon sinks", or areas of natural environment such as oceans that can take carbon dioxide from the atmosphere and convert it into oxygen that we and other animals can safely breathe [3]. By cutting down massive areas of forest, therefore, without replacing the trees that we eliminate, we are causing an unintended change in the amount of carbon dioxide in the atmosphere, which can have an enormous impact on the rest of the world.

In order to control this rapid deforestation and environmental degradation, the Government of Bangladesh has been trying out various programmes to promote diversification of the livelihoods and developing strong strategies to focus on women empowerment [4]. Nevertheless, the forestry programmes and projects have limitation of institutional bureaucracy, lack of innovative learning strategies, limited capacity to respond to the needs of women, ethnic and disadvantaged groups [10]. Thus, keeping in mind the importance of forest on climate change and livelihoods of the marginalized people, the present study was aimed with the following specific objectives:

- To minimize carbon emission through introduction of low carbon-emission agricultural practices (*i.e.*, vermi-compost & botanical pesticide);
- To enable farmers' abilities to experiment and share low carbon-emission practices for agricultural and forest land management;
- To increase farmers' awareness on climate change issues; and
- To enhance farmers' negotiating ability and ensure their participation in social forestry.

2. Methodology

2.1. Study Area

Most of the public forestlands are located in the Chittagong Hill Tracts (CHT),

greater Khulna district, greater Sylhet district, Dhaka, Mymensingh and Tangail districts (**Figure 2**). The present study was conducted in Madhupur Sal forest areas located in Tangail and Mymensingh district of Bangladesh. Previously Sal forests existed as a continuous belt from the central and northern parts of Bangladesh. Nowadays, they exist mainly in the central part of this country, which is mainly located in the Gazipur, Dhaka, Mymensingh and Tangail districts.

Madhupur Sal forest is known as “Madhupur Garh” in everywhere. Madhupur Sal forest is located in Madhupur thana under the district of Tangail. It is situated 80 km North East from Dhaka. It is located from 24.30° to 24.50° North and 90° to 90.10° East [8].

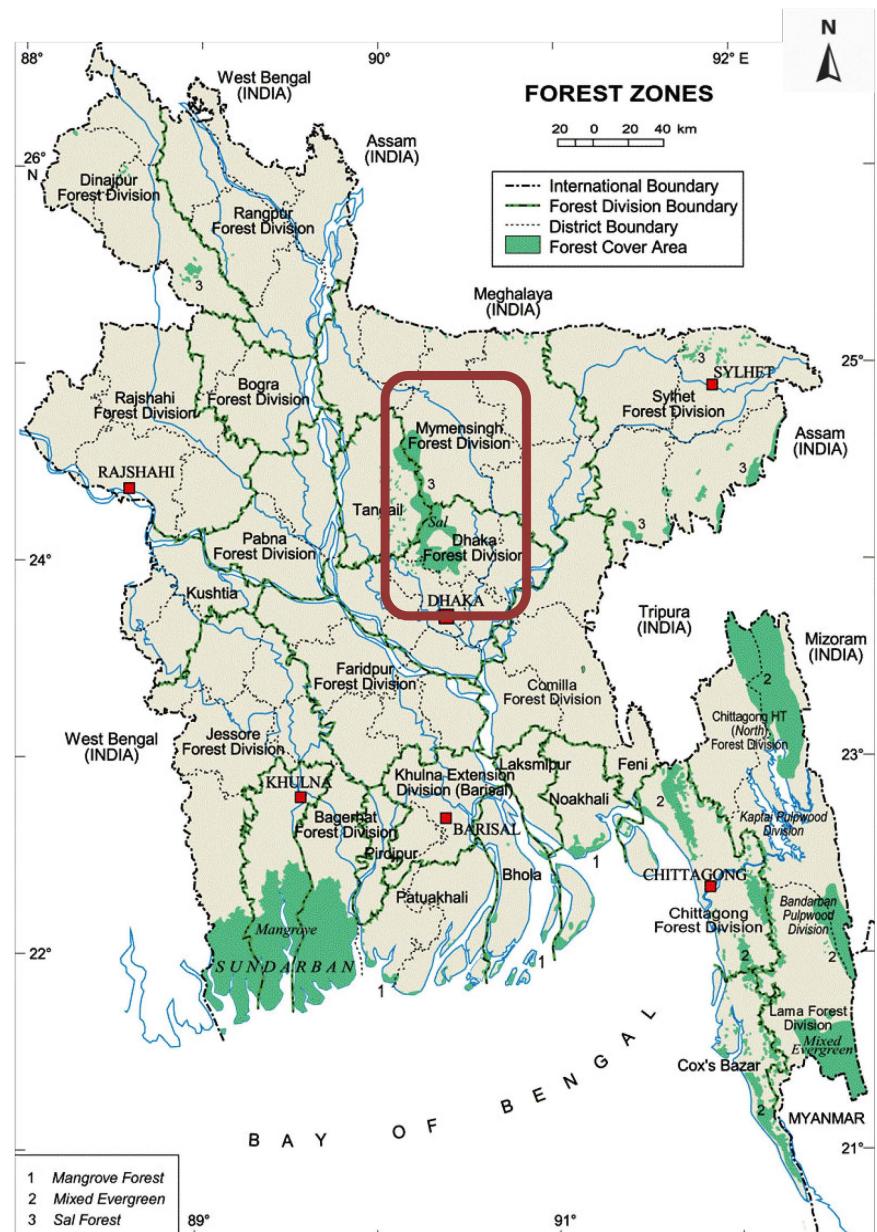


Figure 2. Map of Bangladesh showing forest zones (colored circle zone is the study area).

The total area of Madhupur Sal forest is 45,565.18 acres out of which 2525.14 acres area is declared as reserved forest and the remaining 43,039.04 acres of land are under the process to be declared as reserved forest. For the purpose of biodiversity conservation govt. declared Madhupur national park comprising an area of 20,837.23 acres by a gazette notification on 24th February 1982 out of which 20,244.23 acres are under Madhupur sub-district under Tangail district and 593.00 acres are under Muktagacha of Mymensingh district [3].

However, due to adoption of wrong policies by the government and illegal logging by forest community people have nearly eaten away the entire Madhupur forest, reducing the unique habitat of flora and fauna down to 8,000 acres from 45,000 acres [11]. A large variety of wildlife including Royal Bengal Tiger, Asiatic black bear, pea fowls and deer used to roam in the Madhupur forest just a few decades ago. Besides, this forest contains a huge variety of floral composition, different type of mammals, reptiles, avis and amphibians. The major part of this forest is covered with Sal tree. It houses a total of 176 species of plants including 73 trees, 22 shrubs, 1 palm, 8 grasses, 27 climbers and 45 herbs. Besides, there are a number of exotic species planted in the national park area. Existing faunal composition includes 21 species of mammals, 140 species of birds and 29 reptiles in this park [12]. However, out of three major categories of forest type in Bangladesh, plain land Sal forests are the most endangered and threatened one which has already faced brutal deforestation problems [13]. Thus, the central Sal forest area was chosen for the present study.

2.2. Population and Sample of the Study

Due to time and resource constraints the research team worked farmers' group (formed with representative sample) rather than population. There were 800 household in the selected four villages. The household heads (Hh) of the selected villages were treated as the population of the study. From these population 12.5 percent were selected as sample of the study. Thus, the 100 household heads constituted the population of the study. The research team visited the selected areas several times to identify the interested and relevant farmers for forming the group. Consulting with the staff of Department of Forest (DOF) and Department of Agricultural Extension (DAE) the sample list was finalized for group formation. Following criteria were taken into consideration while selecting farmers for the project.

- Resource poor;
- Should be either small or marginal farmers;
- Should be keen to learn climate change issues;
- Should have interest to participate in social forestry program and to cultivate vegetables following; environmentally friendly farming practices;
- Should have readiness to work in a group;
- Should have preparedness to provide data to the research team whenever they needed.

Table 1. Detailed about the sample size and formation of farmers' group.

District/Sub-district	Name of the Villages	Types of group	Number of farmers in each group
Tangail Madhupur	(Group-I) Pochishmile	Female group	F-25
	(Group-II) Bongshibait	Mixed group	M-05 F-20
	(Group-III) Gasabari	Female group	F-25
	(Group-IV) Jolsottro	Mixed group	M-05 F-20
Total			100

*F-Female; M-Male.

Following the above mentioned guidelines finally four (04) groups were formed consisting of 25 members in each group. Among the four groups two were female oriented and two were mixed in nature.

Data were collected from the respondent farmers twice (before and after the project interventions) by research team using structured interview schedule. A detailed of the sample size of the study are shown in **Table 1**.

2.3. Research Interventions

As an action research project, after formation of the farmers' group several interventions were taken by the research team. Department of Agricultural Extension Education (DAEE) of Bangladesh Agricultural University (BAU) implemented the project with the facilitation of local NGO named *Mohila Kollayan Somity*. The duration of the project was for one year (July 2013 to June 2014) and it was funded by ETC Foundation, The Netherlands. For getting empirical data from the group members structured interview schedule was used. Data were collected by the field coordinator of the research project and field staff of the partner NGO. A summary of the project interventions are shown in **Table 2**.

2.4. Theoretical Framework of the Study

The study was conducted based on innovation theory as well as participatory video concepts for scaling our sustainable agricultural innovations. Innovation is the form of new products, processes, and ways of managing—is essential to economic growth. The innovation capacity of a nation or community is deeply rooted in its micro-economic atmosphere, in areas such as the intensity of scientists and researchers in the workforce, the degree of protection of intellectual property and the depth of clusters. Innovation also holds the key to solving many of the world's most pressing social challenges such as health care and improving the quality of the physical environment. According to E.V. Hippel, the concept of innovation includes: new useful materials, machines and processes (that generate economic rents) and first-of-kind, major & minor improvements over best preexisting practice [14]. Innovation is necessary for agricultural and

Table 2. Glimpse of project interventions.

Interventions	Specific Activities	Photographs
1. Awareness building on climate change and its consequences	<ul style="list-style-type: none"> - Consultation meeting with stakeholders - Group discussion (farmers' group) - Video preparation & demonstration - Stage show of folk song on climate change issues - Organize technology fair 	 
2. Introduction of vermi-compost & botanical pesticide (low emission agricultural practices) for multiple cropping in social forestry	<ul style="list-style-type: none"> - Video-mediated learning sessions for building blocks of capacity building processes (video demonstration). - Day-long learning session comprises three phases-lecture on techniques and benefits of multiple-cropping and social forestry for land management. - Experimentation by the group members on vermi-compost & botanical pesticide 	 
3. Introduction of soil testing kit	<ul style="list-style-type: none"> - Providing day-long training on soil testing (N,P,K, C) at BAU campus & distribution of 04 Humbold-BAU soil testing kits in 04 groups - Experimentation on soil testing 	 
4. Introduction of improve cooker (<i>Bondhu Chula</i>)	<ul style="list-style-type: none"> - Distribution of improve cooker for reducing amount of fuel wood - Motivational meeting with the group members to stop illegal logging 	 

economic development, especially in today's speedily shifting global environment. While farmers have been recognized as innovation generators, many innovation studies continue to consider them as recipients or adopters of outwardly promoted innovations only [15]. However, over times, farmers have also been accepted as innovators (*i.e.* generators of new practices and tools) and experimenters, rather than mere adopters of pioneered technologies. In fact, farmers have been innovating long before the surfacing of formal research and development [16], and there are even claims that some of the technologies developed by scientists were actually based on ideas and practices of local farmers [17]. Nevertheless despite of increasing global challenges, rural farmers are becoming more innovative [18]. They engage in innovation-generating practices such as experimentation, modification of external innovations to suit their local environments, and expansion of new technologies [19].

While, participatory video is a form of participatory media in which a group or group of people creates their own film. The idea behind this is that manufacturing a video is easy and accessible, and is a great way of getting people together to explore issues, voice concerns or simply to be artistic and tell a story. It is therefore principally about progression, though high quality and accessible films (products) can be created using these methods if that is a desired result. This process can be very empowering, allowing a group or community to take their

own action to solve their own problems and also to exchange a few words their needs and ideas to decision-makers and/or other groups and communities. As such, PV can be a highly effective tool to engage and mobilize marginalized people, and to help them to implement their own forms of sustainable development based on local needs. According to Huber, "PV refers to a bundle of alternative applications of video technology in development projects. Its goal is to bring about social change [20]. PV has two broad elements, one is the product (the finished tape or disc) and another is the process of developing the product. Mainstream PV practitioners usually [21] value the process over the product. Participatory video is a comprehensive guide to using video in group development work. Used in a participatory way, video can be a powerful tool, which allows clients to examine the world around them, gain awareness of their situation and turn into more actively involved in decisions which affect their lives. Based on an innovative approach researched over twelve years, the book sets out a complete programme for workers in a range of social work, community, education and health settings [22]. Process goal is to enhance capacity of group to articulate their own problems and potentials, using video as the central media (**Figure 3**).

3. Results and Discussion

3.1. Socio-Economic Characteristics of the Farmers

For getting a clear scenario about the respondent farmers their socio-economic profile was assessed carefully and presented in **Table 3**. In the structured interview schedule sufficient questions were incorporated to analyze their socio-economic profile. Data presented in **Table 3** showed that the average age of the respondent farmers was 41.71 years. It means that majority of the farmers were middle aged category. However, it was a bit lower (38.3 years) in case of female group.

The study also explored that the average household size of the respondent family was 5.55. While the average household size was 5.8 and 5.3 in case of

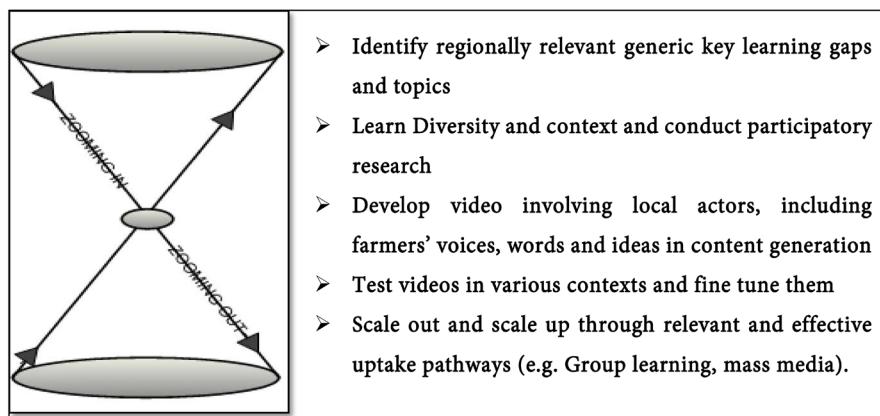


Figure 3. ZIZO: A new approach to scale out agricultural innovation [23] [24].

female group and mixed group respectively. However, the average household size of the study area is a bit higher than the national average of 4.89 [25].

Table 3 also shows that the average farm size of the respondent farmers was 0.39 ha and it was relatively bigger among the members of the mixed group. It is evident from the findings that the farmers are either marginal or small farming categories. The study also explored that the average annual family income of the respondent farmers was 26.15 thousand BDT (Bangladeshi Currency; 1US\$ = approx 80BDT). Like farm size, mixed group had better average annual family income compared to female oriented group.

Findings show that (**Table 3**) about two-third (65.5) of the respondents are ethnic Garoh population. It is evident from the study that the Sal forest area is still rich in ethnic Garoh people. It is also demonstrated in **Table 3** that about half (46 percent) of the respondent farmers have primary education and only 9 percent of them have secondary education. However, a significant portion (44 percent) of the respondents was illiterate. This finding is much greater than the national adult illiteracy rate of 27.24 percent [26]. It is also evident from the study that in terms of educational qualification female group was relatively better compared to mixed group.

It is also reported that among the respondents farmers around a quarter (24 percent) are involved with subsistence farming. However, the majority (42.7 percent) of them are wage labour. While about one-sixth (17 percent) of them are completely dependent on firewood collection from Sal forest for maintaining their livelihoods. It is really remarkable that this rate 3 times higher in case of

Table 3. Salient features of the selected characteristics of the respondent farmers.

Characteristics	Respondent farmers (n = 100)		
	Female group	Mixed group	Average
Age (Mean ± SD)	38.3 ± 7.2	45.1 ± 10.3	41.71
Household size (Mean ± SD)	5.8 ± 1.76	5.3 ± 1.19	5.55
Farm size (ha) (Mean ± SD)	0.31 ± 0.26	0.46 ± 0.35	0.39
Annual family income ('000'BDT) (Mean ± SD)	25.03 ± 2.07	27.16 ± 3.18	26.15
Ethnicity			
- <i>Garoh</i>	68.0%	63.0%	65.5%
- <i>Bangali</i>	32.0%	37.0%	34.5%
Education			
- Illiterate	42.0%	46.0%	44.0%
- Primary	44.0%	48.0%	46.0%
- Secondary	12.0%	6.0%	9.0%
- Above secondary	2.0%	0%	1.0%
Means of livelihoods			
- Subsistence farming	12.0%	36.0%	24.0%
- Wage labour	48.5%	37.0%	42.75%
- Firewood collection from forest	25.5%	8.5%	17.0%
- Others	14.0%	18.5%	16.25%

female group. This is due to the reason that women have relatively less employment opportunities in the country. Moreover in every rural household female member are solely responsible for collecting firewood for cooking daily meals.

3.2. Awareness of the Respondents on Climate Change Issues

One of the important objectives of the study was to improve farmers' level of awareness on climate change and its consequences on live and livelihoods of the people. In this regard series of activities were performed by the research team during the project tenure. The activities were like: consultation meeting with the farmers, preparation of a participatory video by the selected members of the farmers' group and demonstrated among others, organization of folk song in the area etc. Accordingly the respondent farmers were asked to give their responses on several issues of climate change as well as its consequences before and after of the project interventions and data are presented in **Table 4**.

Table 4 clearly indicates that among the eight different issues of climate change in all cases farmers had negative responses at varying level (47 to 95 percent) before project interventions were taken. It was evident from **Table 4** that more than half (53.5 percent) of the respondent farmers had perceived that climate change is occurring equally due to natural changes in environment before joining in the video project. However, it was quite reverse responses in most of the cases by the respondent farmers after the project interventions. It means that

Table 4. Respondent farmers' perception regarding climate change issues.

Issues of climate change	Percentage of respondents' awareness			
	Before		After	
	Yes	No	Yes	No
We are observing irregular weather pattern (e.g. high temperature, low rain fall, short winter etc.) due to climate change	35.5	64.5	89.0	11.0
Frequency of natural calamities like cyclone, flood, drought are increasing rapidly due to climate change	27.0	73.0	69.0	31.0
Climate change is occurring mostly due to human interventions	5.5	94.5	78.0	22.0
Climate change is occurring equally due to natural changes in environment	53.5	46.5	34.5	65.5
There is not much evidence to know with conformity whether climate change is occurring or not	26.0	74.0	59.5	40.5
Deforestation is fundamental human factor responsible for climate change	15.0	85.0	100.0	0.0
Adaptation and mitigation both is essential for minimizing consequences of climate change	18.0	82.0	65.5	34.5
It is possible to minimize the consequences of climate change through adoption of innovative and climate-smart agricultural practices	11.5	88.5	73.0	27.0

the video-mediated extension project contributed significantly in generating awareness on climate change issues among the group members. The finding is partially supported by the study of Arbuckler *et al.* [27].

Based on the total responses of a respondent awareness score of respondent on climate change issues were made. Thus the awareness score of respondent ranged between 0 - 8. The finding of the study on awareness of climate change issues are shown in **Table 5**.

It is apparent from the data presented in **Table 5** that there is significant difference between before and after awareness score of the respondents on their climatic issues. Based on t-value it is also noticed that between two types of farmers' group female group members has relatively better awareness on climatic issues after project interventions.

3.3. Innovation Capacity of the Respondent Farmers

At the initial stage of project local innovations were collected by the field staff of the research team. Two innovations (preparation and use of vermin-compost & botanical pesticide) were chooses from the previous project of the research team. Rest of the innovations was chosen for this project based on their suitability with the local condition as well as relevancy with research objectives. A summary of using capacity of the selected innovations are presented in **Figure 4**.

Figure 4 demonstrates that among the selected six innovations two (*i.e.*, multiple cropping under agro-forestry system and using natural mulch for water conservation during dry season) were used by all the respondent farmers of the study area. While about three-fourth (75 percent) of them are using vermi-compost

Table 5. Differences between farmers' groups based on their climatic awareness score.

Farmers group	Mean climatic awareness score of the respondents (n = 100)		t-value
	Before	After	
Female group (Mean± SD)	1.48 ± 0.54	5.96 ± 0.97	-35.75**
Mixed group (Mean± SD)	1.36 ± 0.52	5.68 ± 0.99	-30.58**
All respondents (Mean± SD)	1.82 ± 0.56	5.82 ± 0.99	-46.67**

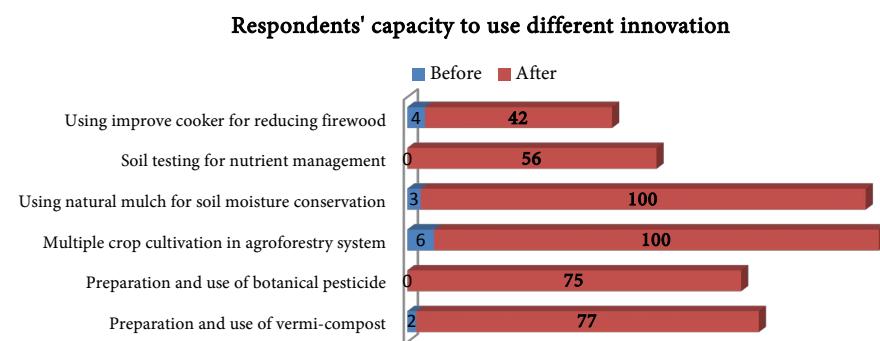


Figure 4. Uses of the innovations by the respondent farmers.

and botanical pesticide in cultivating organic vegetables and fruits in their agro-forestry plots taken as leased from forest department.

On the other hand, more than half (56 percent) of the respondents have got insight from the video-mediated extension project that it is very important to use balanced fertilization for maintain good soil health and especially to improve soil carbon status. Thus, they have been starting to analyze their soil nutrient status by using soil testing kit before fertilization.

This is also remarkable indicator that a little less than half (42 percent) of the respondents have been using improve cooker for cooking their daily meals, which ultimately contributed in reducing rate of deforestation to some extent caused by the illegal logging by the group members in Sal forest.

The respondent were also asked to mention their responses regarding the effectiveness of video-mediated extension programme to improve their knowledge, changing their attitude and starting to practice these innovations in their own context. Their responses were recorded and presented in **Table 6**.

Data presented in **Table 6** shows that two-third (67 percent) of the respondents opined that video-mediated extension programme is moderately effective in improving their knowledge on selected innovations. When, about a quarter (23.5 percent) of the respondent mentioned video-mediated extension as highly effective in knowledge generation on climate-smart innovations. However, more than half (54 percent) of the respondents confirmed that videos played moderately effective role in changing their attitude toward the selected innovations. Where, more than a quarter (29 percent) found it as highly effective in attitude changing. On the other hand, 5.5 percent of the respondents opined that video is not effective for starting an innovation into practice. They also mentioned that their experimentation with the innovations along with video watching motivated them to start practicing these innovations. While, about half (47.5 percent) of them mentioned video-mediated extension as moderately effective in starting an innovation into practice.

3.4. Participation in Social Forestry Program

Generally, farmers (both men and women) were not aware about impact of deforestation on the climate change. It revealed that male farmers consider agriculture and forestry from mainly economic interests. They are more interested about getting immediate benefits. Farmers (usually male and rich) participated in social forestry program of the government for some tangible benefits. They could get half of the share of the tree after twenty years and also use the land (fallow land) for agricultural crop [4]. On the other hand, women paid more attention to the environment, and exhibited emotional interest when we discussed about climate change, and impact of deforestation. Research team's observations indicate that women were more likely to take pro-active roles for planting sapling in the fallow lands. Although, women are merely capable to manage fallow lands from the Forest Department. This is might be due to their weak negotiation

Table 6. Effectiveness of videos in improving knowledge, attitude and practice (KAP).

Areas of capacity improvement	Extent of effectiveness			
	Not effective	Slightly effective	Moderately effective	Highly effective
Knowledge	0	9.5	67.0	23.5
Attitude	2.0	15.0	54.0	29.0
Practice	5.5	26.0	47.5	21.0

capacity and biasness of the Department of Forestry towards male and resource-rich farmers. The project team took initiative for getting access to some fellow land for the project participants. We succeeded to secure access to some land where groups started planting trees (**Table 7**).

Total area under tree plantation was 638 decimal/6.38 acres and total numbers of 3828 acacia (*Acacia verticillatum*) saplings were planted by the group members of the project. After tree plantation farmers started sowing different vegetables seed and seedlings (e.g. eggplant, amaranth, spinach, bottle gourd, radish, coriander, patshak (jute), and peas) in the same field.

Field coordinator of the project and the NGO personnel regularly monitored farmers' field and provide them necessary suggestions and consultations (i.e. weeding, irrigation, vermi-compost application, botanical pesticide spraying and staking to the saplings) (**Figure 5**).

There are some on-going social reforestation programs (mainly publicly funded) in the project area but most beneficiaries are not concerned about the optimal use of their resources [4]. They were using excessive chemicals and fertilizers to produce their crops. This created threats to their health and environment. Moreover, insufficient government effort has been found to meet up the information need of this community regarding climate change issues and effective use of low-emission inputs.

Therefore, project initiatives were very relevant and justifiable to improve farmers' present socio-economic condition through providing need based information and enabling capacity for adopting low-emission practices in their production system.

The respondents were asked to mention their level of income improvement due to participation in social forestry program and preparation of vermi-compost and botanical pesticide introduced by video-mediated extension project. The differences in their income between before and after joining the project activities were assessed and presented in **Figure 6**.

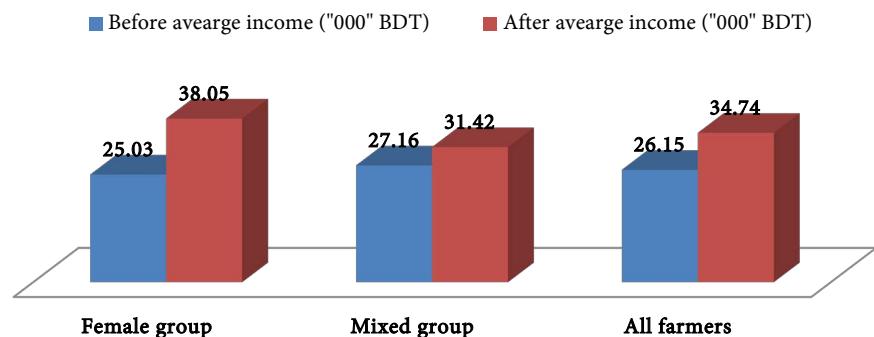
Figure 6 shows that there is a significant improvement in income of the respondent farmers due to participation of social forestry programme and preparation of vermin-compost and botanical pesticide. Group members prepared botanical pesticide and vermin-compost as per guidance of learning videos for cultivating their vegetables and fruits organically. They also sold additional amount of vermin-compost and pesticide to the neighboring farmers that gave them

Table 7. Area coverage of social forestry program by the group members.

Group number	Area under cultivation	Number of saplings
Group-I	157 decimal	942
Group-II	157 decimal	942
Group-III	150 decimal	900
Group-IV	174 decimal	1044
Total	638 decimals	3828

**Figure 5.** Mixed cultivation of saplings and vegetable and consultation of the field staff with the farmers.

Income improvement scenario of the respondent farmers

**Figure 6.** Changes in income of the respondents due to participation in project activities.

addition income. It is evident from **Figure 5** that the income improvement was much higher in case of female member (152 percent) groups compared to mixed member groups (115 percent). However, an additional analysis was done to understand the percent contribution of three different items in their income improvement and shown in **Figure 7**.

Figure 7 exhibits that in case of female groups highest contribution (44 percent) was from botanical pesticide. Next to botanical pesticide 2nd highest contribution (35 percent) comes from vermin-compost. Conversely, in case of mixed group highest contribution (66 percent) comes from vermin-compost. This is may be due to the reason that having male members in the group it was easier for them to collect cow-dung for preparing vermin-compost which was tougher in female oriented group. However, female member groups' income was higher due to their better income from botanical pesticide and organic vegetable and fruit cultivations.

% of contribution of 3 items in income of the female group (inner circle) & mixed group (upper circle)

■ Vermi-compost ■ Botanical pesticide ■ Vegetables and fruit

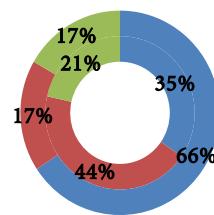


Figure 7. Contribution of different items in average income of the respondent groups.

4. Conclusion and Recommendation

Findings of the study established that before the project, most of the respondents were not aware regarding deforestation and its consequences on climate change. Although the project could create leverage for triggering the change like much awareness generation climate change and its consequences on live and livelihoods of the forest community people, enabling their capacity to work with climate-smart innovations for minimizing consequences of climate change in a tolerant level but could not address many strategic steps and goals. It is very difficult to comment on role of the project in carbon sequestration. Perhaps, it is an ambitious goal to justify this impact in such a shorter period of time. However, findings showed that, project beneficiaries are now impressively aware on consequences of climate change issues. Majority of them are now using own made vermi-compost and botanical pesticide in agricultural production, while a significant portion of them are using improved cooker which has significantly reduced amount of firewood for cooking and reduced people's dependency on forest for fire wood. This is ultimately contributing in minimizing the rate of deforestation. Yet, the project initiatives have created alternate income opportunities of the forest community people through safe and organic cultivation of vegetables and fruits in the leased land. Alternatively, this social forestry programme will directly contribute in reducing consequences of climate change in the long run. Thus, it can be concluded that through creating awareness and improving farmers' innovation capacity it is possible to reduce consequences of climate change and video might work as a potential extension tool in this endeavor. However, to let this dream in true integrated initiative from all concerned agencies for longer duration is needed.

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