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Determinants of Households' Participation in Tree Planting Activities at the REDD+ Project Sites in Southern Leyte, Philippines

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Abstract. This paper aims to identify the determinants of households' participation in tree planting activities using available survey data, which included 797 randomly selected smallholder households from five REDD+ pilot project sites in Southern Leyte, Philippines. Binary logit regression model was employed to identify the factors that affected household-respondents' decisions to participate in tree planting or tree farming activities. The model was also employed to predict the probability of participation for given socio-economic and other characteristics of smallholder households. Results of the analysis show that REDD+ project site, membership in an organization, experience in environmental risks, access to natural resources, household size, and the total on-farm income of households were positively associated with tree planting. On the other hand, non-farm income, age of spouse, and decisions on production and livelihood activities that were made solely by household heads were negatively associated with participation. These determinant factors, in conjunction with their associative influence on participation, may be used as inputs

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for instituting or redesigning a roadmap aimed at enhancing smallholders' participation in tree planting activities and ventures.

Keywords: *REDD+, environmental practices, tree planting, participation, binary logit regression*

INTRODUCTION

Deforestation and forest degradation, through destructive logging, agricultural expansion, conversion of pasture land, infrastructure development, among other factors, account for about 12 percent of greenhouse gas emissions in the tropics (Van der Werf et al., 2009; Huettner, 2012). Reducing Emissions from Deforestation and Forest Degradation most popularly known as REDD is a mechanism designed to use market/financial incentives to reduce the emissions of greenhouse gases from deforestation and forest degradation. Moreover, REDD+ includes climate mitigation activities by forest occupant-households and communities for the sustainable management of forests and for the enhancement of forests' carbon stocks. Hence, Lasco, Pulhin, Bugayong, and Mendoza (2011) state that "many sectors in the Philippines are looking into the potentials of REDD+ to help finance forest protection and rehabilitation in the country." As a policy strategy, the country seeks to maximize the co-benefits from REDD+ involvement and participation as shown in its 2010 Philippine National REDD-plus Strategy which gave rise to the piloting of REDD+ project sites (FMB, 2004; FMB, 2011; The Philippines REDD-plus Strategy Team and DENR, 2010).

The Province of Southern Leyte experienced a loss of forest cover from 17.8 M ha in 1934 to only 7.17 M ha in 2003 or a loss of almost 60 percent for the period. It was identified as a REDD+ pilot site on Forest Policy and Piloting of REDD measures

through the Department of Environment and Natural Resources (DENR) and with support from BMU/GIZ (The Philippines REDD-plus Strategy Team and DENR, 2010; Carandang et al., 2013). The pilot project site is one of the remaining forests. It has active peoples' organizations involved in agro-forestry and forest protection activities. It is also one of the areas where the community-based forest management (CBFM) reforestation program of the government is implemented (Armenia et al., 2013). However, because of the very limited opportunities of upland farm-households, the project site also demonstrates the unsustainable upland farming practices of households who have access to natural forest resources, forest products, and by-products. The dependence of households on upland farms to support family needs and their continuous encroachment and dependence on forest resources and products contribute more to forest degradation and destruction, thus, making it an appropriate site for the REDD+ program.

The success of environmental conservation practices, especially on forest resources, depends largely on the participation of the forest-occupant households. Paul (1989 as cited by Datta & Sarkar, 2010) views participation as an active process by which beneficiary/client groups influence the direction and execution of a development activity in order to enhance their well-being in terms of income, personal growth, self-reliance, or other values they cherish. Their beneficiaries' participation in environmental activities such as tree planting helps preserve biodiversity and other natural resources. Households or individuals with diverse profiles participate in different environment-related activities. However, not all individuals are involved in these environmental activities. Different factors contribute to their decision to participate or not. These include awareness and understanding of environmental risks, attitudes, and knowledge of forestry programs (Bell, Roberts, English, & Park, 1994); household size and farm area (Salam, Noguchi, & Koike, 2000); level of resources controlled by the household in terms of land area managed; their tenurial security; and their cash income (Emtage & Suh, 2004).

But some other socio-cultural factors might be operative to prevent the potential of participation from being fully realized (Datta & Sarkar, 2010). Hence, this paper presents an analysis of one of the major activities of the households in the study sites. More specifically, it analyzed the factors affecting the households' decision to participate in tree planting activities and practices among smallholder household residents in the REDD+ sites in Southern Leyte, Philippines.

METHODOLOGY

The Project Site

The REDD+ pilot project sites are composed of 5 out of 19 Local Government Units (LGUs) in Southern Leyte (Figure 1). The five sites are generally characterized by relatively narrow strips of flat lands along coastal areas but rugged and mountainous towards the interior part. Of the five pilot sites, Bontoc has a total land area of 102.1 km^2, which covers 5.9 percent of the total land area of the province. Maasin City has a land area of 197.8 km^2, which comprises 11.4 percent of Southern Leyte. Silago has a total land area of 195.8 km^2, which occupies 11.3 percent of Southern Leyte. Sogod covers a total area of 192.7 km^2, which is equivalent to 11.1 percent of Southern Leyte's total land area. Finally, Tomas Oppus has the smallest land area of 85 km^2 among the five geographical units.

Sources of Data

Data for this paper were obtained from the research project entitled "Socio-economic Baseline for the REDD+ Project Sites in Southern Leyte, Philippines." The project, which was conducted to establish socio-economic baseline data and information for future assessment of project impact, covered a sample of 71 REDD+ barangays and 20 non-REDD+ barangays. These barangays are located in five LGUs in Southern Leyte, namely: Bontoc, Sogod,

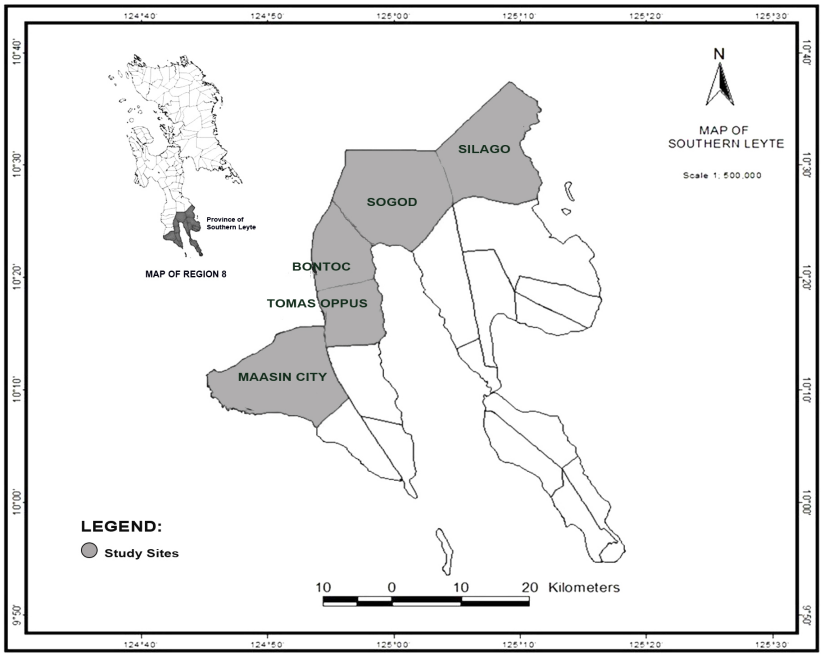

Figure 1. Map of Southern Leyte showing the five study sites (adapted from Armenia et al., 2012)

Tomas Oppus, Silago, and Maasin City. Data and information came from 797 upland households that were selected randomly. Based on the total number of households per barangay, a total of 597 sample households from the REDD+ sites were randomly selected using proportional allocation technique. Similar procedure was also employed to choose the 200 sample households from 20 barangays in non-REDD+ project sites (Armenia, Bulayog, Patindol, Glova, & Seriño, 2012).

Location and Classification of Households

From the socio-economic baseline project data, the REDD+ sites were selected for the REDD+ project intervention activities, while non-REDD+ sites were identified as control. Households in REDD+ sites were located in relatively interior areas and comparatively farther from available transport facilities, closer to

the forest resources, and where farm holdings are more favorable for crops and tree farming. For purposes of this paper, however, farm-households both from REDD+ and non-REDD+ sites are classified as a) participants or b) non-participants in tree planting or tree farming activities.

Focus Group Discussions

Two focus group discussions (FGDs) were conducted at the project sites to validate, verify, and/or highlight important findings from the analysis. FGDs were also done to counter check whether the results of the analysis were reflective of the actual field conditions of households in the project sites. This approach had been used in previous studies to capture divergent viewpoints about the determinants of participation decisions (Hopkins, 2007 as cited in Kwayu, Sallu, & Paavola, 2013).

Members and non-members from people's organizations, namely: the Young Innovators for Social and Environmental Association (YISEDA) located in Barangay Lunas, Maasin City and the Anahao Movement for Productive Community Organization (AMPCO) in Barangay Anahao, Bontoc were visited. Representative groups were requested to participate in the two FGDs conducted in the two project sites. The FGD participants were asked questions based on the results of the data analysis. The results of the FGDs and field observations were used to substantiate and supplement the report for this study.

Logistic Regression Model

A binary logit regression model was employed to identify the factors that affected the households' decision to participate in tree planting or tree farming activities. The model is one of the most common approaches used to study the decision between two alternatives. The model may also be employed to predict the probability that an individual with certain socio-economic characteristics and other determinants can choose one of the

two alternatives (Long & Freese, 2001; Gujarati, 2004). This model has also been employed to identify the determinant factors toward participation to forest stewardship or woodland programs in advanced countries since the 1990s (e.g., Bell et al., 1994; Nagubadi, McNamara, Hoover, & Mills, 1996; Crabtree, Chalmers, & Barron, 1998). Logit regression modeling was likewise adopted in the Philippines to assess, among others, the decision to participate in the Sloping Agricultural Land Technology (SALT), smallholder agroforestry systems, and tree growing among upland farm-households (Armenia, Sandoval, & Abit, 1990; Sureshwaran, Londhe, & Frazier, 1996; Emtage & Suh, 2004; Schuren & Snelder, 2008).

Adopting from Gujarati (2004), a binary choice logit regression may be illustrated in equation (1):

$$Ln\left(\frac{P_i}{1-P_i}\right) = \beta_o + \sum_{j=1}^{k} \beta_j X_{ij} \quad (1)$$

Where: P_i=probability of the event occurring, β_o = constant term, β_j = coefficients, and X_{ij} = independent variables. Based on the general empirical model presented in equation (1), the effect of explanatory variables on farmer's decision to participate in tree planting activity could be expressed through the following linear relationship with their corresponding model specification shown in equation (2):

$$Y_1 = \beta_0 + \beta_1 X1 + \beta_2 X2 + \beta_3 X3 + \beta_4 X4 + \beta_5 X5 + \beta_6 X6 + \beta_7 X7 + \beta_8 X8 + \beta_9 D1 + \beta_{10} D2 + \beta_{11} D3 + \beta_{12} D4 + \beta_{13} D5 + \beta_{14} D6 + \beta_{15} D7 + u_i \ldots \quad (2)$$

Where: Y_1= participation on tree planting activity, 1 if participant and 0 otherwise; X1 = age of the household head in years; X2 = age of spouse in years; X3 = educational attainment of household head in years of formal schooling; X4 = educational attainment of spouse in years of formal schooling; X5 = number of household

members; X6 = annual on-farm income of household in pesos; X7 = annual non-farm income of household in pesos; X8 = farm area cultivated in hectares; D1 = project site, 1 if REDD+ site, 0 if otherwise; D2 = active membership in farmers' organization, 1 if member, 0 if otherwise; D3 = experienced environmental risks and degradation, 1 if yes, 0 if otherwise; D4 = access to support and extension services, 1 if yes, 0 if otherwise; D5 = access to natural resources, 1 if yes, 0 if otherwise; D6 = head of household make sole decision on farm inputs and farm activities, 1 if yes, 0 if otherwise; and D7 = household head make decision on production and livelihood activities, 1 if yes, 0 if otherwise; u_i is the residual term.

The model in equation (2) was estimated using the STATA statistical package. To ensure the validity of the results, the estimated model was subjected to the standard post-estimation diagnostic procedures such as model specification errors, goodness-of-fit, and multicollinearity tests (Long & Freese, 2001; Samprit & Hadi, 2006).

RESULTS AND DISCUSSION

The Determinant Factors

Table 1 presents the summary characteristics of sample smallholder households by participation to tree planting or tree farming. Location wise, although majority of participating households were identified from the REDD+ sites (81%), a small proportion (19%) of participants also came from the Non-REDD+ sites. With regard to membership in organizations, majority of the participants (64%) were active members and only 36 percent were non-members. The greater majority of participating households (86%) experienced environmental risks and degradation than those who did not (14%). Likewise, more or less 40 percent of participating households had access to natural resources. However, majority of sample households (59%) with no access to natural resources still participated in tree planting activities.

Table 1. Distribution of household respondents by selected determinants of participation

ITEMS	PARTICIPATION IN TREE PLANTING				TOTAL	
	Non-Participant		Participant		Count	Col %
	Count	Col%	Count	Col%		
Project site/Location						
Non-REDD	182	25.9	18	18.9	200	25.1
REDD	520	74.1	77	81.1	597	74.9
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**
Membership in farmers' organization						
Non-member	354	50.4	34	35.8	388	48.7
Member	348	49.6	61	64.2	409	51.3
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**
Experienced environmental risks						
Did not experience	222	31.6	13	13.7	235	29.5
Experienced	480	68.4	82	86.3	562	70.5
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**
Access to support and extension services						
With access	148	21.1	19	20.0	167	21.0
Without access	554	78.9	76	80.0	630	79.0
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**
Access to natural resources						
With Access	385	54.8	39	41.1	424	53.2
Without Access	317	45.2	56	58.9	373	46.8
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**

Table 1. Distribution of household respondents... (*continued*)

	PARTICIPATION IN TREE PLANTING				TOTAL	
	Non-Participant		Participant		Count	Col %
ITEMS	Count	Col%	Count	Col%		
Decision making on farm inputs activities						
Other household members	441	62.8	59	62.1	500	62.7
Household head	261	37.2	36	37.9	297	37.3
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**
Decision making on production and livelihood activities						
Other household members	586	83.5	81	85.3	667	83.7
Household head	116	16.5	14	14.7	130	16.3
Total	**702**	**100.0**	**95**	**100.0**	**797**	**100.0**

For both participants and non-participants of tree planting activities, the average age of household heads was 53 years and about 47 years for their wives. About 8 years of formal schooling was also observed for both household heads and their spouses. For annual on-farm income, participants in tree planting activities had higher average annual on-farm income (Php 75,870.55) than non-participants (Php 70,471.17). However, non-participants of tree planting activities had higher non-farm income (Php 46,092.16) than participant households (Php 39,006.23). Moreover, participant households cultivated a higher average area of 5 hectares, while non-participants had about 4 hectares (Table 2).

Table 2. Household characteristics included in the logit model by participation to tree planting activities

ITEMS	PARTICIPATION IN TREE PLANTING	
	Non-Participant	**Participant**
	Mean	Mean
Age (Household head)	53.50	53.23
Age (Spouse)	47.72	46.62
Educational attainment (Household head)	7.27	8.02
Educational attainment (Spouse)	8.35	8.95
Household size	4.72	5.08
Annual on-farm income (Pesos)	70,471.17	75,870.55
Annual non-farm income (Pesos)	46,092.16	39,006.23
Farm area (hectares)	3.93	4.77

Results of the Logit Model

The binary logit regression model was employed to identify the factors that affect household-respondents' decisions to participate or not participate in tree planting or tree growing activities. Given certain characteristics of households, the model was likewise used to predict the probability of participation or non-participation to tree-planting activities among households in the project site. Although the coefficients of the logit model are not directly interpretable unlike the standard regression, the signs of the coefficients may be used to identify association between participation and the statistically significant variables included in the model. As applied in this study, variables with positive and significant coefficients may be associated with participation in tree planting or tree farming activities. On the other hand, factors with negative and significant coefficients may also be used to

describe the characteristics of the most likely non-participants to tree planting in the project. Contrary to expectations, the other variables such as awareness of environmental risk and degradation, access to support and extension services, and educational attainment of head of households, did not have positive and significant impact on participation to tree planting or tree farming activities. Hence, their associative influence in the model can just be attributed to chance probability.

As gleaned from Table 3, results of the logit regression on factors affecting participation to tree planting activities show that REDD+ project site (D1), active membership in organization (D2), experienced environmental risks (D3), access to natural resources (D6), household size (X5), farm area in hectares (X8), and annual on-farm income (X6) have positive and statistically significant coefficients. These factors are indicative of the characteristics of farm households who would more likely participate in tree planting or tree farming activity in the project site. On the other hand, age of housewife (X2), annual non-farm income (X7), and the household heads who make sole decision on production and livelihood activities (D7) have negative and statistically significant coefficient implying that households whose heads are the sole decision makers on production and livelihood activities, those with older housewives, and those with higher income from non-farm sources are the ones who would most likely not engage in tree planting or tree farming.

The positive and statistically significant coefficients of the REDD+ and access to natural resources dummy variables capture the inherent and favorable geographical locations of the project site where upland smallholders would most likely participate in tree planting activities in the project area. The positive association between access to natural resources and participation to tree planting activities could perhaps be attributed to the proximity of participating households to where these natural resources can be found. As delineated by project REDD+ project proponents, the sample REDD+ barangays are located relatively closer to forest

Table 3. Logit model estimates on the factors affecting tree planting activities

Variables	Coefficient	Std. Error	P>[Z]
Dummy Variables			
REDD+ project site	1.261***	0.416	0.002
Membership in an organization	1.008***	0.314	0.001
Experienced environmental risks	2.770***	0.741	0.000
Access to support and extension services	-0.466	0.340	0.171
Access to natural resources	0.655**	0.299	0.028
Farm inputs/farm activities	0.487	0.321	0.130
Production and livelihood activities	-0.796*	0.464	0.087
Continuous Variables			
Age (Household head)	0.007	0.015	0.645
Age (Spouse)	-0.022*	0.012	0.079
Educational attainment (Head)	0.037	0.022	0.107
Educational attainment (Spouse)	-0.003	0.019	0.874
Household size	0.238***	0.065	0.000
On-farm income	2.830**	1.270	0.026
Non-farm income	-6.380**	2.820	0.024
Total farm area in hectares	0.039*	0.024	0.097
Likelihood Ratio (x^2 = 93.29, df = 14, Sig = 0.000)			
Hosmer-Lemeshow test of Goodness-of-fit (Prob>chi2 = 0.6680),			
Goodness-of-fit: Percent Correct Classification = 91.18%			

***Significant at 1%, **significant at 5%, and *significant at 10%

resources. Further, both have biological and physical environment comparatively favorable to tree planting or tree farming activities vis-à-vis the non-REDD+ sites.

The positive association between participation and experiences of environmental risks such as increase in temperature, drought, flooding due to typhoons, and soil erosion may be attributed to upland dwellers' perception or understanding on the positive effects of tree planting on the environment. Exposure and understanding of environmental risks, which could be due to training on environmental aspects of forestry programs, may have contributed to decisions on participation to tree planting activities (Bell et al., 1994).

The association between active membership in farmers' organization and participation on upland farming or smallholders' tree farming systems is already well documented. For instance, participation in SALT, reforestation programs, agroforestry practices, and smallholders' tree planting and management decisions were found closely influenced by or associated with active membership in relevant community/farmer organizations (Armenia et al., 1990; Nagubadi et al., 1996; Emtage & Suh, 2004; Nkamleu & Manyong, 2005). In this study, the positive association between membership or active involvement in organizations and participation in tree planting or tree farming may have been attributed to the fact that tree planting activities in the study sites are usually associated with active involvement as well as participation in community-related activities as well as previous exposure and experiences in community forestry programs. In the project sites, the existence of CBFM sites in some areas where upland dwellers are already exposed to and knowledgeable on forestry programs may have positive contribution on their decisions to participate in tree planting activities. This is in consonance to what Bell et al. (1994) found that attitudes and knowledge on forestry programs may influence a landowner's decision to participate.

Economic incentives are usually considered the major drivers to participation in any economic activity. In this study, household size, farm area, and the amount of on-farm income had the expected positive relationships with participation to tree planting activities. On the other hand, non-farm income, age of spouse, and decisions made solely by heads of households on production and livelihood activities had negative coefficients and therefore negatively associated with participation. Since upland household dwellers in the project sites are generally resource poor, the more number of household members and relatively larger farm holdings would imply higher availability of labor and land resources at the disposal of households and therefore the higher the likelihood of participation.

The result is in consonance with the findings of Salam et al. (2000) on the positive influence of household size and farm area on tree planting decisions in homestead agroforestry in Bangladesh, but contrary to the finding of Alassaf, Majdalwai, and Nawash (2011) in marginal upland farming areas in Jordan. In the case of on-farm income, its positive association with participation can be attributed to the fact that participation may be enhanced by the availability of income to support the immediate and basic needs of households during the initial establishment of the tree farms. Likewise, participation can also increase the future expected income opportunities of participating households. This is in consonance to what was claimed by Datta and Sarkar (2010) that active participation in forest conservation activities presupposes a sense of commitment, attachment, and economic motivation of forest dwellers.

Moreover, the economic success conditions of participation identified by Pasicolan, Udo De Haes, and Sajise (1997) on small tree farm holdings in the Philippines without government support showed that: 1) farmers' direct need for tree products and other uses, 2) wood products market prospects, 3) farmers' economic situation, and 4) farmers' enterprising attitude, among other

things, are the important drivers of participation and success in smallholder tree farming. Further, the findings of Emtage and Suh (2004) on the social and economic factors affecting small-scale forestry development in Leyte, Philippines showed that level of resources controlled by the households in terms of land area managed, their tenurial security, and their cash income are correlated with higher levels of participation in forestry activities, and greater intentions to plant more trees in the future.

The negative association between non-farm income and participation can be explained by the nature of income opportunities faced by upland dwellers in the project sites. While all of the upland dwellers face somewhat similar income opportunities to engage in upland and tree farming systems, some households are more inclined towards non-farm entrepreneurial ventures in view of their inherent management capabilities and their strategic locations in the villages. Hence, as their income from non-farm sources increases, the likelihood of their participation to tree farming goes down. These findings and observations were noted in the baseline study of Armenia et al. (2012) but contrary to what Salam et al. (2000) found for homestead agroforestry in Bangladesh wherein farmers, whose main source of income is non-agricultural, are more likely to decide to plant trees.

It is commonly observed that both the household heads as well as their spouses are active partners in most crops and livestock farming systems most especially in upland agriculture. However, the physical capability of the spouses as partners may decline with age. As in the case of aging spouses, the negative association between participation and age of spouse is expected. Likewise, the negative relationship between participation and decisions made solely by heads of households on production and livelihood activities is indicative that the likelihood of participation to tree planting may not be forthcoming when only the head of households make decisions on matters related to production and livelihood activities.

Predicted Probability of Participation

The result of the logit regression model indicating positive and significant relationships between tree planting and selected predictor variables may be used to predict the average probability of participation given certain characteristics of farm households. For instance, given the following characteristics of households: 1) farm areas are within the REDD+ project sites, 2) they are active members in farmers' organizations, 3) they experienced environmental risks, and 4) they have access to natural resources. The blue line in Figure 2 shows an increasing probability of participation with increasing levels of on-farm income.

On the contrary, the red line shows the very low probability of participation with increasing level of on-farm income if the farm-household comes from the non-REDD+ site; it is not a member of an organization; it did not experience environmental risks; and it had no access to natural resources. This result has important implications on the characterization of project beneficiaries to ensure higher participation in implementing the

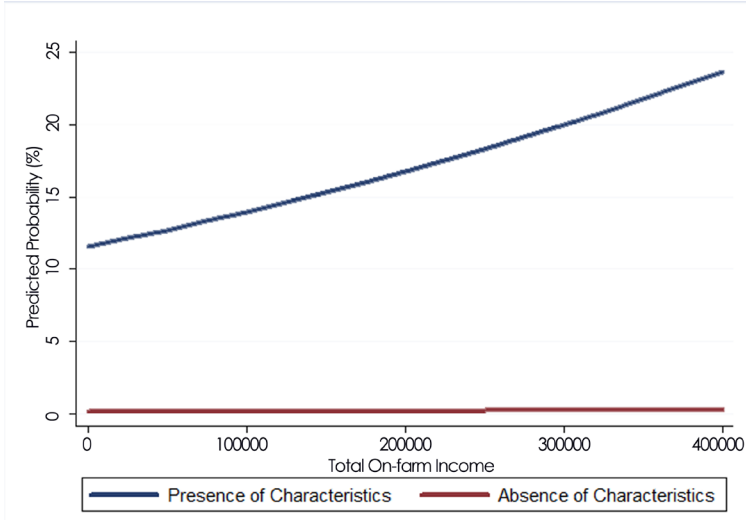

Figure 2. Predicted probability of participation to tree planting with given levels of on-farm income

REDD+ project. Moreover, the expected increase in probability of participation with increasing annual on-farm income indicates that participation of smallholder households, with low on-farm income but with the other desired characteristics of would-be participants, may be expected to participate; that is, if counterpart projects that enhance on-farm income can be instituted as stop-gap support to a tree planting or tree farming program.

CONCLUSIONS AND RECOMMENDATIONS

The smallholder upland households make appropriate choices and decisions to commit their limited human and non-human resources to activities they think will provide the most benefits. In making such choices, such as their participation in tree planting or tree farming, their decisions are usually influenced or associated with the interplay of physical, institutional, and socio-economic factors. The factors that were positively associated with participation were: location of farms within the REDD+ project sites; the household's active participation in farmers' organizations; their relative access to natural resources, which implied that participation was enhanced if farm areas were relatively closer to forest resources and available land was relatively suitable for tree farming; they were cultivating relatively larger farm holdings, which indicated the relative availability of land to be allocated for tree planting; and they were earning modest to higher annual on-farm income.

The positive association between participation and on-farm income implied that households would most likely participate if their family earned at least a modest on-farm income to support their immediate family needs, while they allocated labor and financial resources to establish and manage their tree farms with anticipated income. On the other hand, the negative association between non-participation and non-farm income implied that non-participation might be the more rational decision for households

earning more non-farm income sources than the expected income from tree farming activities.

The following policy recommendations can be drawn:

1. To enhance participation among upland households, some factors that were found positively associated with participation should be considered in targeting, characterizing, and prioritizing project beneficiaries. These include location of farms within the REDD+ project sites, the household's active participation in farmers' organizations, their relative access to natural resources, larger farm holdings, and higher annual on-farm income.

2. Participating households or potential smallholder households with appropriate characteristics but with very limited on-farm income must be provided with immediate alternative income sources. Such initiative needs to be designed and implemented in conjunction with tree planting or tree farming programs. For instance, there is a need to continue and sustain the "cash for work scheme" where households are paid for labor provided during the initial establishment and management of tree farms implemented by the REDD+ project. However, this scheme should be exclusive to the smallholder and marginal upland households.

3. Alternative livelihood support schemes such as trees and crop intercropping, and small-scale cottage industries may be implemented to provide other income opportunities to participating households while there is still no income from tree farming.

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