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Factors affecting smallholder farmers' participation in degraded forest rehabilitation practices. The case of Gemachis District, West Hararghe Zone, Oromia Region, Ethiopia

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The global forest coverage has declined from year to year due to human and natural factors. To address the problems, different rehabilitation strategies have been implemented through government and community in a coordinated manner. This study investigated factors affecting smallholder farmers' participation in degraded forest rehabilitation at participatory forest management in Ethiopia. We used two-stage sampling procedure to select 140 sample households randomly from the district using probability proportional to size. Both quantitative and qualitative data were collected from primary and secondary sources. Tobit model was employed to analyze factors affecting smallholder farmers' participation and the level of participation in forest rehabilitation. The findings demonstrate that livestock holding size, the benefit derived from the forest, forest cooperative membership, perception of households and access to extension services positively affect farmers participation and the level of participation; whereas distance of the forest from the home negatively affects farmers' participation and the level of participation in forest rehabilitation. The study suggested that awareness creation, clear discussion with communities, strengthening existing benefits, creating related ones and providing more extension services, information and supports are required to improve farmers' participation in degraded forest rehabilitation practices.

Key words: Smallholder farmers, participation, forest degradation, rehabilitation, participatory forest management, tobit.

INTRODUCTION

The total global forest area has declined by 3%, from 4128 million ha in 1990 to 3999 million ha in 2015 (Keenan et al., 2015; FAO, 2015). The annual rate of net

forest loss halved from 7.3 million ha per year in the 1990s to 3.3 million ha per year between 2010 and 2015. The natural forest area declined from 3961 million ha to

3721 million ha between 1990 and 2015, while planting forest (including rubber plantations) increased from 168 million ha to 278 million ha (Keenan et al., 2015). The Africa total forest area is declining from 705 million ha in 1990 to 624 million ha in 2015. Due to both natural causes such as drought, fire, storms and disease, and human cause such as clearance for agriculture, over-exploitative timber harvesting, the expansion of settlements, and infrastructure development, natural forest area have been reduced within 25 years. However, planted forest area has increased from year to year because of expansion of reforestation, afforestation and other forest rehabilitation and restoration strategies through community participation (Keenan et al., 2015; FAO, 2015).

Ethiopia has one of the largest forest resources in the horn of Africa. It owns a total of 53.1 million ha covered by woody vegetation which consists of 12.5 million ha of forest land and 40.6 million ha of another woodland (FAO, 2015). The total forest area of the country has declined from 15.1 million ha in 1990 to 12.5 million ha in 2015. The annual rate of forestland decline is 104, 600 ha per year that is 0.8% of forest cover of the country. About 95% of the total forest of the country is located in three regions namely Oromia, SNNP and Gambella regional states (Yitebitu and Eyob, 2014). Both natural and human factors are the main causes of forest degradation in Ethiopia. Human causes are mainly population growth (Badege, 2001; Temesgen et al., 2015), expansion of agricultural land and exploitation of existing forest product (Badege, 2001; Adugnaw, 2014; Temesgen et al., 2015), overgrazing (Badege, 2001), expansion of urban areas and infrastructural development (Adugnaw, 2014). The natural causes of forest degradation are drought, fires and diseases (Gobena, 2010). Ethiopia has been taking measures to rehabilitate degraded forests and forestlands (Mulugeta and Habtemariam, 2014). Establishment of protected and forest priority areas, as well as protecting the sacred forest sites are attempts taken to protect forests in the country. Degraded forest and land are rehabilitated through conservation of the remaining forest, woodlot development, planting of grass tufts, construction of micro-catchments, and enrichment of planting in degraded areas (Eshetu et al., 2014). Similarly, rehabilitation of forests through afforestation, agroforestry, building of soil and water conservation structures, reforestation and area enclosures with participatory forest management practices is another conservation effort that the government is implementing (Adugnaw, 2014; Mulugeta and Habtemariam, 2014; Temesgen et al., 2015). Currently, degraded forest rehabilitation activities are implemented through community participation in Participatory Forest Management (PFM) (Gobeze et al., 2009; Winberg, 2010; Alemayehu et al., 2015) and participatory enclosure management (Eshetu et al., 2014). The government has shifted a policy towards forest management and rehabilitation from state-centered approach to participatory or community-centered approach for sustainable management and utilization of forests (Alemayehu et al., 2015).

Participatory Forest Management (PFM) was started in Ethiopia in 1990 with the help of NGOs to address deforestation thereby managing the forest in a sustainable manner (Said and O'Hara, 2010; Temsgen et al., 2015; UNDP, 2012). It was introduced first to Ethiopia over the last 27 years; the approach is expanding to cover more and more hectares of forest across the country (UNDP, 2012). In Ethiopia, PFM was adopted well in 2010 including regional governments and at every woreda office (Winberg, 2010).

Various studies have been conducted on the degraded forest rehabilitation practice implemented through community participation. They reveal that lack of linkage among actors (Alemyahu et al., 2015), absence of clearly defined property rights and user rights, gender disparity in participation, lack of active community participation (Semeneh, 2016) and absence of rules and regulation to penalize absenteeism (Eshetu et al., 2014) are major constraints that affect rehabilitation practice. Nevertheless, having rules and regulation on penalties in monetary terms and in kind can increase community participation on development activities (Haregeweyn et al., 2012). However, those studies did not elicit the socio-economic factors (education, benefits obtained and others), physical factors and demographic factors towards rehabilitation practice. They also failed to address the determinants of participation towards rehabilitation activities.

In addition, studies conducted on the factors affecting community participation in forest management in Ethiopia address only the levels of participation of forest users association or groups towards forest management (Tadesse and Abay, 2013). Similarly, studies conducted on the determinants of collective action on bamboo forest management do not examine the forest rehabilitation activities performed by the community (Semeneh, 2016). Due to socio-economic (education, income and wealth) factors and forest users' perception (Tefera et al., 2005), institutional (property rights, incentives and extension services) (Semeneh, 2016) and others factors, participation of farmers in forest management activities to rehabilitate degraded land vary contextually and spatially (within communities and even within individuals). This paper aims to assess factors affecting farmers' participation and level of participation in the rehabilitation of degraded forestland through the participatory forest management program.

METHODOLOGY

Description of the study area

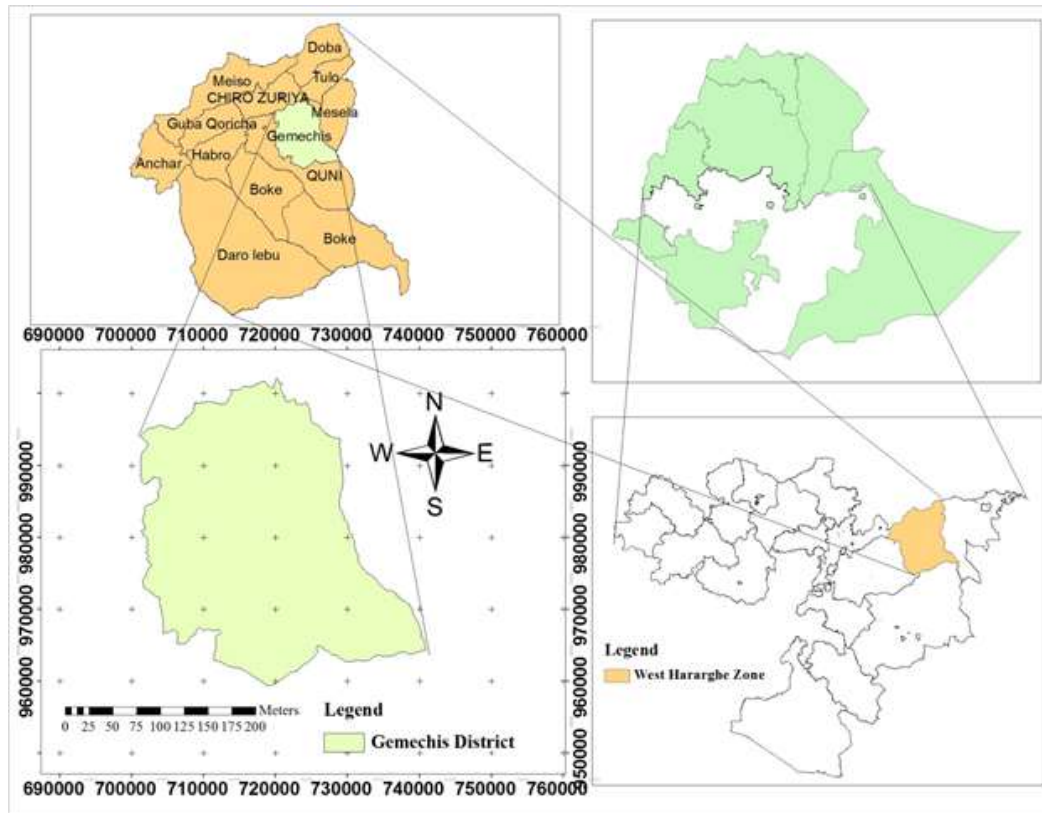Gemachis district is one of the districts found in West Hararghe

Figure 1. Map of the study area.
Source: Own computation from GIS data, 2016.

Zone of Oromia National Regional State, Eastern part of Ethiopia. The district is located about 343 km southeast of Addis Ababa and 17 km from Chiro town, the capital town of West Hararghe Zone. Kuni town is the administrative set of the district. It shares a border with Chiro district in the West and North, Oda Bultum district in the South and Mesala district in the East directions (GDoANRO, 2016). It is located at 9° 0′ 44.992″ latitude in the North and 6° 39′ 50.42″ longitude in the East. The district covers an area of 77,785 ha and it has 35 rural *Kebeles* and 3 urban administrative towns. The district s found within 1300 to 3400 m above sea level (m.a.s.l). The minimum and maximum annual rainfall is 800 and 1200 mm with an average of 850 mm. The district has bi-modal distribution in nature with small rains starting from March/April to May and the main rainy season extending from June to September/October. The minimum and maximum temperature is 15 and 30°C while the average temperature is 22°C. The total population of the district is 243,497 of which 124,140 are males and 119,357 are females. The number of agricultural households in the district is 42,869 with 38,057 males headed and 4,812 females headed. The average family size is estimated to be 6 and 4 per household in rural and urban areas, respectively. The district is the first most densely populated district in the zone. Participatory forest management was started in the district in 2011 with the help of Hararghe Branch of Oromia Forest and Wildlife Enterprise and other district government offices. PFM covers a total of 921 ha of land and organized farmers living in and nearer the forests into seven user groups to address forest degradation and deforestation in the area. Of the land use pattern of the district, 32,994.5 ha is cultivable, 6185 ha is grazing land; forest, bushes, and shrubs cover 1385 ha; 6603.62ha is not arable and 17,949.34 ha is used for other purposes such as encampments

and infrastructure facilities (Figure 1).

Sampling technique and sample size determination

Two-stage sampling technique wasemployed to select *Kebeles* and sample respondents. In the first stage, out of 35 rural *Kebeles* in Gemachis district, three *Kebeles* were selected purposively because the only *Kebeles* were adjacent to the forestland. In the second stage, 140 sample respondents were randomly drawn from the sampling frame using simple random sampling based on probability proportional to size. A total number of household head were obtained from district and sampling frame of all listed *Kebeles* was organized to select sample respondents.

Type of data and data collection methods

Both primary and secondary data sources were used to collect qualitative and quantitative data for this study. Primary data (demographic (age, family size, and gender), socioeconomic (education status, benefit derived or expected from forest, forest cooperative membership, etc), institutional factors (rules and regulations, property rights, and extension services) and perception of household) were collected. The data were collected from sample households in the district by preparing and distributing a semi-structured questionnaire through interview schedule as well as from three focus group discussions. The questionnaire was pre-tested on five randomly selected farmers prior to execution of a formal survey to modify the interview schedule prepared for the study. Five

enumerators who are familiar with the study area, understand the native language and have prior experience in data collection were recruited. Those enumerators trained on the content of the questionnaire and data collection procedure. Secondary data (demographic characteristics, physical characteristics, topography, maps, forestland area coverage, etc.) were collected from district agricultural office, other governmental offices, internet, and reports. Checklist was developed for the collection of data from secondary sources and focus group discussion. Quantitative data such as demographic, socio-economic, institutional factors and others as well as qualitative data such as perceptions and participation status were collected.

Method of data analysis

Descriptive statistics (percentage, mean and standard deviation), inferential statistics (independent sample t-test and chi-square test) and econometric model (Tobit model) are used based on their importance for analyzing the quantitative data that have been collected from primary and secondary sources through SPSS version 20 software and STATA 13.1 software. Qualitative data were analyzed through description, explanation, and narration of collected data. Tobit regression model was used to analyze factors affecting farmers' participation and level of participation in degraded forest rehabilitation practices. It is possible to analyze participation and its intensity through the censored regression model; if there is no bias and too many zeros (Zbinden and Lee, 2005). Cragg (1971) modifies the Tobit model to overcome the restrictive assumption inherent in it; he suggests the "double-hurdle" model tackle the problem of too many zeros in the survey data. Similarly, Heckman selection model is another model which helps us to analyze participation and the extents of participation; develops correct selection bias (for not having a randomly selected sample which means our sample is not representative of the group we want to study) (Dageye and Mengistu, 2016). This model was chosen because it has an advantage over other participation models (Logistic and Probit) and it reveals both the probability of participation and level of participation in rehabilitation practice. Following Tobin (1958), the Tobit model can be defined as:

$$PI_i^* = \beta_i X_i + U_{i=1,2,\ldots\ldots n}$$

$$PI_i = PI_i^* \text{ if } PI_i^* > 0$$
$$= 0 \text{ if } PI_i^* \leq 0 \tag{1}$$

Where:
PI_i = is participation index for the ith farmer
PI_i^* = is the latent variable and the solution to utility maximization problem of the level of participation subjected to a set of constraints per household and conditional on being above a certain limit,
X_i = Vector of factors affecting participation and level of participation,
β_i = Vector of unknown parameters, and
U_i = is the error term which is normally distributed with mean 0 and variance σ^2.

Individual major degraded forest rehabilitation activities were considered to assess the level of participation in the PFM approach. Participation index of each farmer was calculated using the following formula:

$$PI_i = \left(\frac{\sum_{J=1}^{N} Y_{ij}}{N} \right) 100 \tag{2}$$

Where,
PI_i = Participation index for the ith farmer
Y_{ij} = Participation of ith farmer in j[th] activity.
N = Total number of activities taken up in the degraded forest rehabilitation practices.

Definition of variables and working hypotheses

Dependent variables

Participation index was the dependent variable of the Tobit regression model used for the study. The individual activities (tree hole preparation, tree planting, construction of soil and water conservation, forest management and protection, sharing benefits and meeting for planning and decision making) within the forest were used for measuring participation and the level of participation in forest rehabilitation practice. Similarly, others authors have used the approach to measure participation and extents of participation of the community in natural resource management (Badal et al., 2006; Meshesha and Birhanu, 2015). The participation index was constructed by dividing the summation of individual activities within the forest to overall activities and multiplying by 100 percent. The minimum and maximum numbers of forest rehabilitation activities performed by sample respondents were 1 and 7 per year, respectively.

Independent variables

Farmers' decision to participate and the level of participation in degraded forest rehabilitation in a given period of time is hypothesized to be influenced by a combined effect of various factors such as the demographic, socio-economic, institutional, psychological and biophysical environment in which farmers operate. Based on the brief literature reviewed in this study, a total of 12 explanatory variables were hypothesized to explain participation and level of participation of the sample households towards degraded forest rehabilitation activities. The summary of the explanatory variables is presented in Table 1.

RESULTS AND DISCUSSION

This section presents the findings obtained from the study. Descriptive and inferential statistical analyses are employed to describe demographic and physical, socio-economic and institutional characteristics. Econometric analysis is employed to identify factors affecting farmers' participation and level of participation in degraded forest rehabilitation practices in Gemachis District.

Summary of descriptive and inferential analysis results

This section presents the summary results of demo-graphic and physical, socio-economic and institutional factors of sample respondents in the study area (Tables 2 and 3). The Chi-square result in Table 2 indicated that there was a significant difference between participant and non-participants of households in terms of forest cooperative membership, benefit obtained from the forest, secure property rights, access to extension

Table 1. Summary of hypothesized explanatory variables.

Code	Variables	Type of variables	Expected sign
	Dependent variables		
PARTINDE	Participation index score	Continuous	
	Independent variables		
AGEHH	Age of household head(Years)	Continuous	$\pm$
SEXHH	Sex of household head (1=Men and 0=Women)	Dummy	$\pm$
HHSIZE	Household size (Number)	Continuous	+
EDUSHH	Education status of household head (1= literate and 0=illiterate)	Dummy	+
LANHSIZ	Landholding size (Hectare)	Continuous	-
BENDEFST	The benefit derived or expected from the forest (1= Yes and 0= No)	Dummy	+
LIVHSIZE	Livestock holding size (TLU)	Continuous	+
FCOOPME	Forest cooperative membership (1= Yes and 0=No)	Dummy	+
PRORIGH	Perceived security of property rights (1=Yes and 0=No)	Dummy	+
AEXTSER	Access to extension service (1=Yes and 0=No)	Dummy	+
DISFHOM	The distance of forest from home (Kilometer)	Continuous	-
PERCHH	Perception of household head (1= Agreed and 0=Disagreed)	Dummy	+

services and perception of household towards participation at 1% significant level. Household's home far from the forest, lack of interest to join the group, absence during community registration and lack of awareness were the major reasons for households not to join forest cooperatives. Rules and regulations, external support delivered from organizations and incentives given enable the households in the forest cooperatives to participate in degraded forest rehabilitation practices. Both direct (grasses, beekeeping, dead fuelwood and money from hunting) and indirect benefits (reduction of soil erosion and floods coming from upper stream, access to irrigation and training on forest management and protection) were obtained from the forest area. The household home far from the forest, non-membership of forest cooperatives, weak protection in some of the forest area and lack of money for purchasing and transportation of grasses were major factors for the household not to obtain or expect benefit from the forest.

The forest user certification delivered to the group, an agreement signed among users of the group, proximity of the home to the forest resources and written rules and regulations within the forest cooperatives enable the households to participate more in degraded forest rehabilitation practices in the study area. Similarly, in the country for participatory forest management user groups, use rights such as access to forest, right to own a defined physical property, withdrawal rights (right to obtain the products and benefits of a resource), management right (right to regulate resource use patterns and transform the resource by making improvements) and exclusion rights (right to determine who may have access) and legally securing these rights have been provided for the community groups to be

involved and maintain participation in the decision making process (MOA, 2012).

Access to extension services in forest management, rehabilitation, protection, and conservation is the other variable used for this study. Advisory services on tree planting and soil and water conservation structure construction, training on forest management, inputs (tree and forage seedlings and beehives) and the field day were major extension services given to sample respondents by government (District Agricultural Offices, Research Center and Oromia Wildlife and Forest Enterprises of Hararghe Branch) and non-government organizations. Perception of the household towards participation in degraded forest management can be viewed from the angles of perceived benefits, effect of forest degradation and approach of PFM in the area. Clear discussion among communities, government inducement, awareness created for the communities through devolution and decentralization of resources and power, empowerment of farmers in planning, implementation and decision making process in PFM approach and vulnerability of livelihoods of farmers to the effects of forest degradation enabled the households to positively perceive participation in degraded forest rehabilitation practices and in turn increased their participation in the area.

But, sex and education status of sample respondents is not the same based on the hypotheses/expectation in this study. The Chi-square result in Table 2 indicated that there was no significant difference between participant and non-participants of households in terms of sex and education status of sample respondents. Equal opportunity given to male and female household heads to organize themselves in forest cooperatives and right to

Table 2. Summary of descriptive and inferential statistics for dummy explanatory variables.

Variables		Non-participant (54)		Participant (86)		Total (140)		χ^2
		N	%	N	%	N	%	
Sex	Female	7	13	14	16.3	21	15	0.29
	Male	47	87	72	83.7	119	85	
Education	Illiterate	24	44.4	37	43	61	43.6	0.03
	Literate	30	55.6	49	57	79	56.4	
Forest cooperative	Non-member	54	100	15	17.4	69	49.3	90.46***
	Member	0	0	71	82.6	71	50.7	
Benefit	Non-users	39	72.2	1	1.2	40	28.6	82.07***
	Users	15	27.8	85	98.8	100	71.4	
Property rights	Non-holders	45	83.3	4	4.7	49	35	90.27***
	Holders	9	16.7	82	95.3	91	65	
Extension services	Non-accessed	49	90.7	13	15.1	62	44.3	76.89***
	Accessed	5	9.3	73	84.9	78	55.7	
Perception	Disagreed	22	40.7	8	9.3	30	21.4	19.47***
	Agreed	32	59.3	78	90.7	110	78.6	

***: indicate significant at 1% level.
Source: Own survey result, 2016

use forest resources, government inducing participation, presence of great indigenous knowledge on natural resources conservation by the community, perceived effects of forest degradation on their livelihoods and perceived benefits of rehabilitation practices enabled the households to participate more in forest management, conservation and rehabilitation practices in the study area.

The two sample t-test result in Table 3 revealed that there was a significant difference between participant and non-participant in forest rehabilitation practices in terms of distance of the forest away from home and livestock holding size in the study area. Shortage of infrastructures (road and transport), information asymmetry, being a non-member of forest group and fewer beneficiaries of direct benefits from forest resources enabled the households far from the forest not to participate in degraded forest rehabilitation activities. The major feed resources of the livestock such as grasses, trees, and shrubs are obtained from an enclosed forest area. Moreover, in turn, it serves as incentives for the households to participate more in rehabilitation practices. But, the two sample t-test result in Table 3 revealed that there was no significant difference between participant and non-participant in forest rehabilitation practices in terms of average age, household size and landholding

size in the area. Sharing their experience and indigenous knowledge on forest management, susceptible to erosion due to living in the mountains area, livelihoods dependence in the forest, less income-generating activities other than agriculture and inducement of government in participation enable the household to participate in forest management, rehabilitation, and other activities.

Participation status of sample respondents

The survey results showed that about 38.6% of sampled households were non-participants in degraded forest rehabilitation practices; while 61.4% of the sample households were participants in rehabilitation practices. Household home far from the forest, less direct benefit obtained from the forest, information asymmetry and non-members of forest cooperatives were major factors that made them not to participate in degraded forest rehabilitation practices. Similarly, 7.1, 26.4 and 27.9% of sample respondents from participants were passive, medium and active participants in degraded forest rehabilitation practices, respectively (Table 4).

The result of the survey revealed that seedling hole preparation, tree planting, construction of different soil

Table 3. Summary of descriptive and inferential statistics for continuous explanatory variables.

Variables	Non-participants (N=54)		Participants (N=86)		Overall (N=140)		Min	Max	t-value
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.			
Age	37.81	9.98	40.85	12.64	39.68	11.74	18	80	-1.58
Household size	6.22	2.34	5.62	2.56	5.85	2.49	1	15	1.42
Distance	3.99	1.21	0.80	0.70	2.03	1.82	0.1	6.5	17.55***
Land size	0.38	0.28	0.40	0.37	0.39	0.34	0.06	2.5	-0.13
Livestock size	2.21	1.51	2.78	1.78	2.56	1.70	0.03	10.03	-1.95*

***, *: indicate significant at 1 and 10% level.
Source: Own survey result, 2016.

Table 4. Status of participation made by sample households in degraded forest rehabilitation activities.

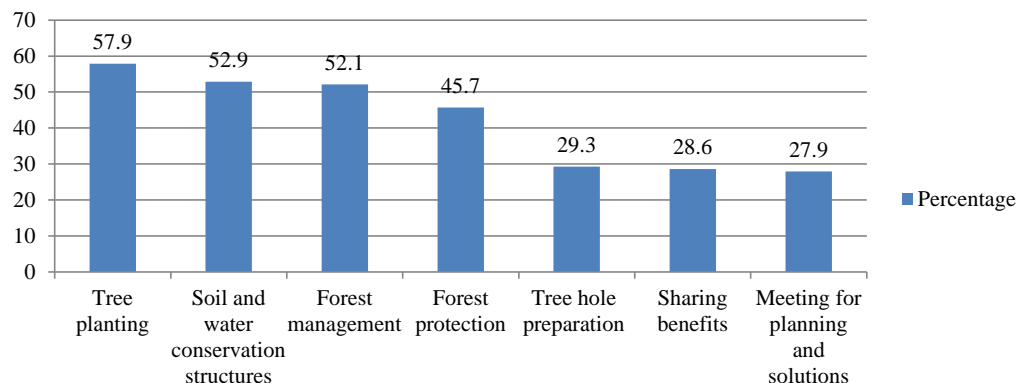| Participation categories	N	%	Index value	Mean of Index	Std. Dev of Index
Non-participants	54	38.6	0	0	0
Passive	10	7.1	14-29	0.23	0.08
Medium	37	26.4	43-71	0.49	0.07
Active	39	27.9	86-100	0.98	0.03
Total	140	100	0-100	0.42	0.40

Source: Own survey result, 2016.

Figure 2. Major degraded forest rehabilitation activities practiced by sample respondents.
Source: Own computation from the survey, 2016.

and water conservation structures, forest protection through daily monitoring and evaluation, forest management, sharing benefits and meeting for planning, problem identification and decision making were major degraded forest rehabilitation activities practiced by sample respondents. The results of Figure 2 indicated that 57.9, 52.9, 52.1 and 45.7% of the sample respondents participated in tree planting, soil and water conservation structures, forest management and forest protection activities, respectively.

The focus groups discussion indicated that member of forest cooperatives highly participated in degraded forest rehabilitation activities than non-member of forest cooperative sample respondents. Each member of the

forest cooperative protected the forests from illegal practice through rotational guarding methods. The forest management activities practiced by sample respondents were pruning canopy of juniper trees, cultivating planted seedlings of trees and removal of weeds from forestlands. Member of the respondents shared benefits such as grasses, old trees and other monetary benefits as cooperatives. Especially, grass sharing system practiced by the respondents were equally giving to each member of forest cooperatives in the form of lottery method and the grasses left over members sold with less cost to a non-member of the communities living in the *Kebeles*. Most of the non-members of forest cooperative households involved in tree seedling plantation, soil and

Table 5. Factors affecting participation and level of participation in forest rehabilitation practices.

Variables	Coef.	Std.Err.	t	Marginal effects		
				CHILP	CHIPP	TOCH
AGEHH[a]	- 4.752	6.486	- 0.73	-4.037	-0.053	-3.043
SEXHH	9.194	8.689	1.06	7.638	0.111	5.673
HHSIZE[a]	4.594	5.036	0.91	3.816	0.055	2.834
DISFHOM	-16.417***	3.483	- 4.71	-13.638***	-0.197***	-10.129***
EDUSHH	0.441	5.339	0.08	0.367	0.005	0.272
LANHSIZ[a]	- 4.473	3.006	- 1.49	-3.716	-0.054	-2.759
LIVHSIZE[a]	8.861***	2.995	2.96	7.361	0.107**	5.467***
BENDEFST	17.419*	10.071	1.73	8.336*	0.137*	6.105*
FCOOPME	24.329***	7.006	3.47	19.843***	0.293***	14.964***
PERCHH	24.330***	7.898	3.08	17.598***	0.367**	12.767***
PRORIGH	16.212	10.274	1.58	12.874*	0.215	9.463
AEXTSER	24.103***	6.691	3.60	19.306***	0.304***	14.434***
Constant	-43.028	36.154	-1.19			
Sigma	20.993	1.611				
N	140					
LR $\chi 2$ (12)	262.80					
Prob > $\chi 2$	0.000					
Log likelihood	-390.712	Pseudo R^2	0.252			

***, ** and*: indicates statistical significant at 1, 5 and 10% level, respectively.
Note: CHILP=Change in the level of participation, CHIPP=Change in the probability of participation and TOCH=Total change
a= variables converted to natural logarithm.
Source: Own computation of model result, 2016.

water conservation and forest protection activities.

According to focus groups discussion, a non-member of forest cooperatives participated mainly through government inducement in campaign program and by non-government organization support such as monetary and food aid program. Communities living in and nearer forestlands participated mainly through voluntary and government inducements by organizing different groups in associations to obtain different benefits from the forests. Each of the forest cooperative members met once weekly to plan, identify problems and solve them and set rules and regulations on benefit sharing mechanisms of grasses and other issues.

Econometric analysis results

Here, censored Tobit regression model was performed to identify factors that determine the participation decision of smallholder farmers to participate (or not) and the level of participation in degraded forest rehabilitation practices. The result of Tobit estimation shows that the decision made by respondents to participate or not and the extent of participation in degraded forest rehabilitation practices in the study area are significantly influenced by households distance from the forest, livestock owned, benefit derived or expected from the forest, forest cooperative membership, perception on participation and access to extension services (Table 5).

Distance of forest from home (DISFHOM)

Distance of the forest from the home had a negative impact on participation and level of participation of degraded forest rehabilitation activities at 1% level of statistical significance; that satisfies prior expectation. The marginal effect indicated that as households are far away from the forest by one kilometer, their level of participation, their likelihood of participation and both participation and level of participation in forest rehabilitation decreased by 13.64 units, 19.7%, and 10.13 units, respectively, keeping other factors constant. The household far from the forest did not benefit from the forest because it requires additional cost for transportation of grasses/other forest resources and information asymmetry on the different forest rehabilitation programs. The result is consistent with others studies conducted by Tadesse and Abay (2013) in Ethiopia and Musyoki et al. (2013) in Kenya. They found a negative relationship between distances of a household's home from the forest and participation in forest management and rehabilitation practices due to information asymmetry and rare benefits obtained from the forest.

Livestock holding size (LIVHSIZE)

The variable had a positive sign and statistically significant at 1% level which satisfies the prior expectation. The marginal effect implies that an additional of livestock in TLU would increase the intensity of participation, the probability of participation and both participation and intensity of participation in degraded forest rehabilitation by 7.36 unit, 10.7%, and 5.47 unit, respectively, keeping other factors constant. The highest number of livestock owned by the households requires a high amount of feed resources and in turn, participates in forest management and rehabilitation activities. The major livestock feeding system in the study was the cut and carry system due to the absence of grazing land. The major feed resources utilized by the household were grasses, crop residue, agro-industrial product and trees, and shrubs. The major source of grasses and trees and shrubs are obtained from an enclosed forest area of PFM. The sample respondents had a high number of cows as compared to non-participants and produced milk and sell to the market in the group. This result is in line with the findings of Musyoki et al. (2013) in Kenya and Oli and Treue (2015) in Nepal. They found that households that own comparatively large amounts of livestock seem to rely more than others on community forests for the fodder and bedding material, in turn, they were more participants than a small number of livestock owners.

Benefit derived or expected from the forest (BENDEFST)

The variable had a positive effect and statistically significant at 10% level that satisfies the prior expectation. The marginal effect implied that being users of forest products compared to non-users would increase the level of participation, the likelihood of participation and both participation and the level of participation in forest rehabilitation practices by 8.34 units, 13.7%, and 6.11 units, respectively, keeping other factors constant. The highest number of livestock owner and households closer to the forest utilized feeds for their livestock either by sharing system or through payment. Most of the users of timber and non-timber forest products engaged in different livelihood activities such as beekeeping, cattle fattening, milk production and other livelihoods activities in individual and forest cooperative manner. The prevailing shortage of land was initiating farmers to diversify forest-based incomes through managing the forest in a sustainable manner. The result is consistent with findings of Tadesse and Abay (2013), Eshetu et al. (2014), Alemayehu et al. (2015) in Ethiopia and Blay et al. (2008) in Ghana and Musyoki et al. (2013) in Kenya. They found that benefits obtained or expected from the forest such as timber and non-timber forest products serve as incentives for the households to engage more in forest management and rehabilitation practices.

Forest cooperative membership (FCOOPME)

The variable had a positive effect and statistically significant at 1% level which conforms to our expectation. The marginal effect indicated that being a member of forest cooperatives compared to non-member would increase the level of participation, the probability of participation and both participation and the level of participation by 19.84 units, 29.3%, and 14.96 units, respectively, keeping other factors constant. PFM approach practicing through community participation organized farmers in groups for sustainable management and rehabilitation of the degraded forestland. The households closer to the forest, previously living in forestland, having interest in group action and unemployed ones were organized in a cooperative manner in the study area. Organization of household in a cooperation create a set of rules and regulation, incentive mechanism (the right to use, manage and control of forest resources) and external support obtained from different organization encouraged respondents to participate actively in degraded forest rehabilitation activities. The result is similar with studies conducted by Gobeze et al. (2009), MOA (2012), Tadesse and Abay (2013), Alemayehu et al. (2015), Semeneh (2016) in Ethiopia and Musyoki et al. (2013) in Kenya. They found that households who were living in the forest previously and nearer the forest organized in the group/association/ cooperative to manage forests and their result indicates a strong relationship of forest cooperatives and participation in forest management and rehabilitation practices.

Perception of household head (PERCHH)

The variable had a positive relationship and was statistically significant at 1% level in line with prior expectation. The marginal effect implies that agreed respondents to participate compared to disagreed respondents would increase the extent of participation, the likelihood of participation and both participation and the extent of participation in forest rehabilitation practice by 17.59 units, 36.7% and 12.77 units in the study area, respectively, keeping other factors constant. The perception of farmers towards participation in rehabilitation viewed from the angles of perceived benefits obtained from the forest, perceived extent of forest degradation and their effects, perceived current PFM approach, perceived rules and regulation and perceived responsibility of community in the area as a whole for sustainable management of forest in the area. In other ways, the farmers highly benefited in indirect ways from rehabilitation practices in conserving natural resources such as water and soil thereby protecting soil erosion. The improvement of groundwater resources entails farmer's access to irrigation and changes the attitude of farmers towards actively participating in forest

management and other related rehabilitation activities. The result coincides with the study conducted by Tadesse and Abay (2013) who indicate positive perception of households has a positive influence on the level of participation in forest management at Alamata forest in Tigray region of Ethiopia. Similarly, the study conducted by Arowosoge (2015) indicates that the attitudes of the community have a positive relationship with the participation of communities in forest conservation in Nigeria.

Access to extension services (AEXTSER)

The variable had a positive relationship and statistically significant at 1% level on both participation and level of participation of forest rehabilitation activities in line with prior expectation. The marginal effect revealed that households who have access to extension services compared to their counterparts would increase the level of participation, the probability of participation and both participation and extent of participation by 19.32 units, 30.4%, and 14.43 units, respectively, keeping other factors constant. Households with access to extension services were a member of forest cooperatives, had strong linkage with group/extension agent and access to information on different extension programs. In addition, sample respondents obtained more knowledge and information about forest utilization and management through training, advisory services and field day, access to different forage seed/seedlings and other agricultural inputs. The result is consistent with a study conducted by Zbinden and Lee (2005) who indicate that households who have extension service are more likely to participate in forest rehabilitation program in Costa Rica. Similarly, the study conducted by Musyoki et al. (2013) indicates that household training on forest management, utilization, and rehabilitation have a positive influence on the participation of forest management, and rehabilitation practices in Kenya.

CONCLUSION AND RECOMMENDATIONS

The decline of forest capacity at the global and national level is a great problem that currently affects the livelihoods of people in different ways. To address the alarming rate of forest degradation, different forest rehabilitation and restoration strategies were practiced through community participation. Similarly, Ethiopia has been implementing different rehabilitation strategies through establishing participatory forest management, participatory watershed management, and participatory area enclosures through community participation in different areas. But, absence of uniform participation, unfair benefit sharing, absence of strong punishment and others are major constraints observed in different rehabilitation strategies across different places. Therefore,

improving community participation and the level of participation are necessary through strengthening the bottom-up approach for sustainable management of the forest.

Distance of the forest from the home, livestock holding size, benefit derived or expected from the forest, forest cooperative membership, perception of households and access to extension services have impacts on participation and the level of participation in degraded forest rehabilitation practices. Information asymmetry, time delay, fewer direct benefits obtained from the forest, low incentives, rules and regulation of participatory forest management approach and lack of extension services on the forest create a gap on households participation in forest management, protection and rehabilitation practices in the area. Therefore, improvement of rural infrastructures such as road and transportation, timely dissemination of information, improvement of production and productivity of livestock, strengthening of existing benefit schemes and creating related ones give farmers the opportunities to join the group; and awareness creation is an option to improve households' participation and the level of participation in degraded forest rehabilitation activities in the study area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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