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Factors Affecting Farmers Participation in Soil and Water Conservation Practices at Qenshiben Watershed Central Ethiopia

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Abstract

Soil erosion is among the foremost causes of declining soil resources in Ethiopia, which in turn affect agricultural productivity. To limit this problem, soil and water conservation measures have been practiced for the past two decades via free labor community mass-mobilization programme. Following the launch of the programme, farmers massively and voluntarily implemented soil and water conservation measures on the farm lands at different parts of the country. Participation of farmers in soil and water conservation practices or watershed development and management programme is influenced by different factors. The present study used survey data to assess factors affecting farmers' participation in soil and water conservation measures at Qenshiben Watershed. Probability sampling technique was used to select 138 household respondents, who were selected to obtain socio-economic data using structured questionnaire. Both descriptive and inferential statistics were used for analysis of the collected data using statistical packages for social scientists (SPSS 20.0). Logistic regression result indicated that gender, family number, livestock ownership, off farm income, extension support and farmland slope position of household significantly ($p \leq 0.05$) affected farmers' participation in soil and water conservation measures. The finding demonstrated that there should be a continuous awareness creation mechanism on the importance of soil and water conservation measures. Moreover, the stakeholders and policy makers should consider those factors affecting participation of farmers in the conservation practices.

Keywords: farmers' participation, factors affecting, soil and water conservation measures

INTRODUCTION

Soil erosion is a worldwide environmental problem that reduces the productivity of all-natural ecosystems and agriculture, which threatens the lives of most smallholder farmers [1, 2]. The high erosion rates are mainly affecting the developing countries such as Ethiopia, due to intensive cultivation, deforestation, plowing of marginal lands and extreme climate hazards [3, 4]. Studies conducted in Ethiopian highlands show that soil erosion is seen as a direct result of the historical human settlement in the highlands because of its favorable climatic conditions, political factors and soil fertility [5]. Inappropriate land use, poor farming practices and removal of the natural vegetation aggravate soil erosion and so productivity declines, resulting in food insecurity for smallholding farmers [6, 7]. According to the Ethiopian highland reclamation study report, 27

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million hectares or almost 50% of the highland area was significantly eroded, 14 million ha seriously eroded and over 2 million ha beyond reclamation [8].

To solve the problem of soil erosion, soil and water conservation (SWC) practices were initiated in Ethiopia during the 1970s and 1980s [6, 9, 10]. The main intent of the initiatives was to minimize erosion, restore soil fertility, rehabilitate degraded land, and increase agricultural productivity. Since 2012, the country has formulated community-based watershed development policies, fully considering community participation in sustainable development and management of watersheds. Community-based participatory integrated watershed management activities are being vigorously implemented in most regions. As part of this effort, a 30-day watershed management public works campaign has been initiated across the state over the past decade [11]. After the launch of the programme, regional, zonal, and district agriculture offices were mobilized to support farmers in implementing SWC measures. Farmers massively and voluntarily implemented SWC measures on the farm lands at several watersheds. The "community-based watershed management and development guidelines" envisage a high degree of participation and local autonomy in the designing and implementation of micro-watersheds.

However, the current watershed development and management programme had given autonomy to community, their participation in SWC practices is influenced by different factors. Many studies conducted in different parts of the country showed personal, social, economic, biophysical and institutional factors influences decision of farmers' participation in SWC measures [12–15]. In the study area on the far side presenting an observation and analysis report of number of households participated in watershed management activities; no extra significant study was performed on the farmers' participation in SWC measures. Since the current watershed management approach is campaign-based, evaluating farmers' participation in SWC practices would be vital for boosting and enhancing the SWC attempt. Therefore, the present study was carried out to examine the factors affecting farmers' participation in SWC practices in Qenshiben watershed.

MATERIAL AND METHODS

Description of the Study Area

The present study was conducted within the Qenshiben watershed (Figure 1) located within the Alicho Wuriro district of Silte Zone Administration in the Central Ethiopia regional state. Geographically, the watershed extends from 7º 51' 0"N–8º 1' 0" N and 38º 7' 30" E–38º 15' 0"E. It is located 210 km South of Addis Ababa, which is the capital town of Ethiopia.

It is estimated that the annual precipitation in the study area ranges from 900 mm to 1120 mm, and that the average annual precipitation in the watershed is 1010 mm. The precipitation distribution of Qenshiben watershed is uni-modal rainfall with one long rainy season (April, May, June, July, August and September). The study area has an average minimum temperature of 9.6ºC and a maximum temperature of 26.6ºC on an annual basis. The watershed has tropical (Dega) and subtropical (Woina dega) agro ecologies, in which 80% of the watershed is dominated by highland tropical agro-ecology [16].

It is estimated that the study watershed has covered 4496 ha as a whole. The study watershed is characterized by undulating, rugged, and craggy topography with an altitude ranging from 2400 m to 3100 m above sea level. In line with the Food and Agriculture Organization (FAO) of the United Nations soil classification system, the soil of the study watershed is characterized by *Pellic Vertisols* and *Haplic Phaeozems* soil types. *Pellic Vertisols* is the dominant soil within the watershed, which covers 80% of the watershed and *Haplic Phaeozems* soil type covers only 20% of the watershed [17].

Mixed plantation, cultivated and grasslands are the major land use land covers in the watershed. Mixed plantation is the dominant land use type, which covers 75%; while crop and grasslands cover solely 15% and 10% of the watershed, respectively.

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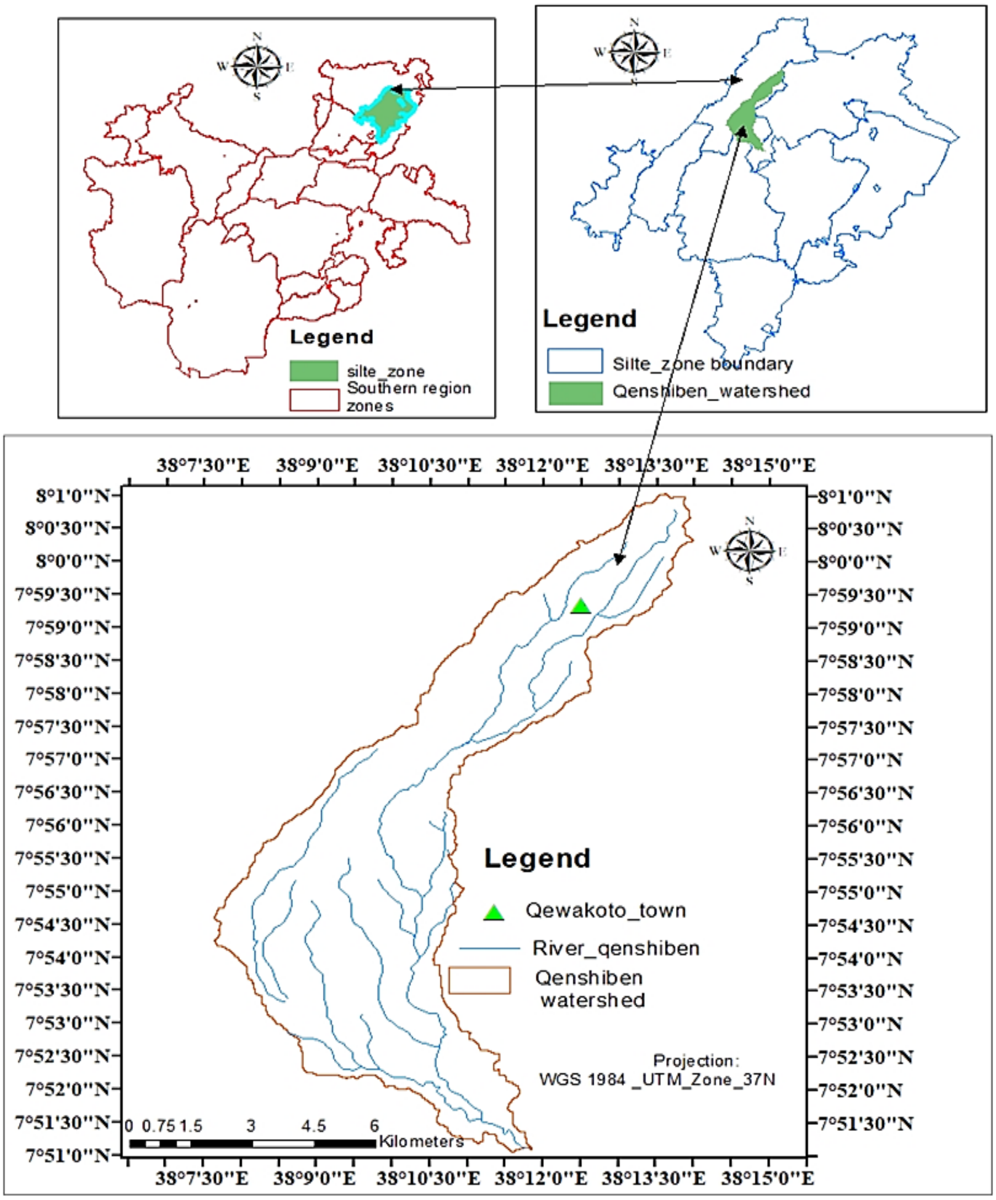

Figure 1. Location map of the watershed.

The primary source of resources in the watershed is subsistence agriculture, specifically in the form of a mixed crop and livestock system. Maize (*Zea mays*), sorghum (*Sorghum bicolor*), barley (*Hordeum vulgare*), and wheat (*Triticum aestivum*) are the four essential cereal crops of the watershed. Potato (*Solanum tuberosum L.*), cabbage (*Brassica oleracea var. capitata*), faba bean (*Vicia faba L.*), pea (*Arachis hypogea*), and haricot bean (*Phaseolus vulgaris*) are the main vegetables that grow in the study area [16].

Method of Data Collection

Household Sampling and Sample Size Determination

The sample farm household heads were drawn through a multistage stratified sampling technique. The sampling technique involves four stages. In the first stage, identification of the villages found in the watershed was carried out by taking the lists from the district based on their position (upper, middle and lower) in the watershed. In the second stage, selection of representative villages was carried out from each part of the watershed. Accordingly, Gone, Bunisa and Albazar villages were selected from the upper, middle and lower part of the watershed, respectively. Sampled villages were selected purposively based on their experiences and knowledge regarding soil erosion and land management practices and their accessibility for transportation. Since they have the same livelihood condition in the watershed, they were ensured their representation in each part of the watershed. In the third stage, total household respondents were selected. Accordingly, 138 households (107 male-headed and 31 female-headed) respondents were randomly selected from the three sample villages in a proportional-to-size of each representative village.

The respondent households sample size was determined by using Cochran (1977) standard formula with marginal error of 5% and confidence interval of 95% [18].

$$n = \frac{z^2 * pq}{d^2}$$

Where, n = number of sample size when population is less than 10,000
z = 95% confidence limit (1.96)
p = 0.1 proportion of the population to be included in the sample (10%)
q = 1 – p (0.9)
d = degree of accuracy desired (0.05).

Household Survey Technique

Before full implementation of the survey, the structured questionnaire was pre-tested as a pilot survey in the sample villages. The pilot survey ensures that the present questionnaire is relevant and meaningful to the average respondents, and to decide which questions were relevant for the purpose of the study. Subsequently, necessary modifications were made on the basis of the feedback obtained from the pre-test. Accordingly, the necessary socio-economic and institutional data have been collected via face-to-face personal interviews with household respondents. Lists of household heads recorded at each Village (Kebele) administrative office was used as sample frame for random selection of the households for interview.

Methods of Data Analysis

Descriptive and inferential statistical data were analyzed using SPSS statistical software version 20.0 and Microsoft Excel 2010. For the analysis, descriptive statistics such as frequency, means, and standard deviation and inferential statistics such as test of significance, correlation and Chi-square test were used step by step. For the analysis of factors affecting farmers' participation in SWC practices, binary logistic model was used.

Econometric Model Specification

Binary regression is a method of estimating or predicting a value on some dependent variable given the values of one or more independent variables. According to Neupane *et al*. [19], this model is popular statistical technique in which the probability of a dichotomous outcome such as participant or non-participant is related to a set of explanatory variables that are hypothesized to influence the outcome. Furthermore, according to Tabachnick and Fidell [20]; binary logistic regression is said to be useful since it has a capacity to analyze a mix of all types of independent variables such as continuous, discrete and dichotomous. The present study quantified the probability of the factors that significantly influence farmers' decision to participate in SWC practices. In the logistic model, the coefficients are compared with the probability of an event occurring or not occurring and bounded between 0 and 1. The odds ratio and predicted probability of the independent variables indicate the influence of these variables on the likelihood of participating in soil erosion management if other variables remain constant. Therefore, to test the hypothesis, binary logistic model was used which identified the socio-economic variables that influence participation of farm households in SWC activities.

Mathematical Expression of the Logistic Model

$Li = \ln P/1\text{-}p = \beta0 + \beta1x1 + \beta2x2 + \beta3x3 + \beta4x4 + \beta5x5 + \beta6x6 + \beta7x7 + \beta8x8 + \varepsilon$ [21]

where,
Ln=natural logarithm
P=probability of participation
1-p=probability of being non-participant
$\beta 0$=constant term
$\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$, $\beta 6$, $\beta 7$, and $\beta 8$, are coefficients of explanatory variables
x1, x2, x3, x4, x5, x6, x7, and x8 are predictor variables included in the model
ε =error term

Prior to analysis of the variables, model multi-collineality and model test of goodness of fit were checked. From the analysis of the present study, the tolerance values of all the variables were > 0.1 and variance inflation factor (VIF) was <5. This indicated that there was no multi-collineality between the explanatory variables of the present study. The overall Chi-square value from the findings was 0.56 (>0.05) and the model Chi-square 115.048, this translates to good fitness of the model. From the study findings, the Nagelkerke R2 was 0.813, hence the model showed more accuracy in predicting the effect of dependent variable.

Variables Included in the Model and their Hypothesized Effect

A dependent variable is a variable that is said to be affected or explained by another variable. In the present study, farmers' participation was treated as a dichotomous dependent variable. It was represented in the model by 1 for a participant farmer and 0 for a non-participant farmer. The decision of a farmer to participate in the SWC activities may be affected by different socio-economic, physical and institutional factors. Based on the findings of past studies, the following variables were hypothesized to determine farmers' decision to participate in SWC practices.

Education Status of the Household Head (ESHH)

It is a dummy variable, which takes a value 1 if the household head is literate and 0, otherwise. Education increases farmers' ability to understand the process and use the information. It was expected to have a positive effect on farmers' decision to participate in SWC practices.

Age of the Household Head (AHH)

The effect of farmer's age on participation decision taken can be considered as a composite of the effect of farming experience and planning horizon. While longer experience has a positive effect, young farmers on the other hand may have longer planning horizon and hence, may be more likely to invest in conservation. In the present study, age was hypothesized to have a negative influence on the farmers' decision to participate in SWC practices.

Gender of the Household Head (GHH)

It is a dummy variable, which takes a value 1 if the household head is male and 0 otherwise. The sex of the household head has been included to differentiate between males and females in their valuation of environmental protection. In the present study, gender was hypothesized to have positive influence on farmers' decision to participate in SWC practices.

Family Size of Household (FSHH)

This refers to the total number of family members. Thus, in the present study, family size was hypothesized to have a positive influence on the farmers' decision to participate in SWC practices.

Off-Farm Participation of Household (OFPHH)

Farmers' involvement in off-farm income-generating activities is expected to help them to support their income. But the more time farmers spend on off-farm jobs, lesser the time they get for watershed activities. Thus, in the present study, it was hypothesized that off-farm income was negatively correlated with the farmers' decision to participate in SWC practices.

Livestock Ownership of Household Head (LSNHH)

Livestock production constitutes a very important component of the agricultural economy of developing countries, a contribution that goes beyond direct food production to include multipurpose uses, such as skins, fiber, fertilizer, and fuel, as well as capital accumulation. Thus, it was hypothesized that livestock number was positively correlated with the farmers' decision to participate in SWC practices.

Farm Land Size of Household Head (FLSHH)

Farm size is an important factor to consider when it comes to agricultural production, therefore becoming one of the essential elements of the present study. Farmers with large farm size could decide to participate in SWC practices to increase their agricultural productivity. Therefore, in the present study, it was hypothesized that farm size was positively related to farmers' decision to participate in SWC practices.

Farm Land Slope Position of Household Head (FLSHH)

It is an indicator of the erosion potential of a farmland. Therefore, farmers' whose farmland is located on steep slopes are more interested to participate in watershed management programmes. Thus, it was hypothesized that the slope of a farmland is positively related to farmers' decision to participate in SWC practices.

Land Tenure Security of Household Head (LTSHH)

It is a dummy variable, which takes a value 1 if the farmer has secured land tenure security and 0 otherwise. For farmers to be able to decide to carry out long-term investment on their farmland, they need the security of tenure. Therefore, in the present study, it was hypothesized that land tenure security was positively correlated with the farmers' decision to participate in SWC practices.

Extension Support Received by Household Head (EXSHH)

It is a dummy variable, which refers to any form of assistance rendered to the farmers in the area of soil conservation practices. It takes a value 1 if the respondent received any assistance from any source and 0 otherwise. Hence, assistance (material, technical and any other incentives) from any source encourage the farmers to decide on participation in SWC practices and a positive effect was hypothesized.

Awareness in Effectiveness of SWC (AESWC)

It is a dummy variable, which takes a value 1 if the farmer has taken part in soil conservation activities in the past and 0 otherwise. The role of perception of technology attributes in enhancing or eroding participation decisions was well acknowledged. In the present study, it was hypothesized that farmers' expectation of the effectiveness of conservation practices in retaining soil from erosion will have a positive effect on decision of farmers' participation on SWC practices.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Household Respondents

The survey result indicated that, the sample population was 77.5% male and 22.5% women headed. The age of the respondents was categorized as 21–30 years, 31–40 years, 41–50 years, and 51–60 years accounting for 9.4%, 31.2%, 47.1%, and 8.7% of the population, respectively, while 3.6% were above 60 years of age (Table 1). The family size in the study area ranged from 1 to 12 persons. In general household size of 1–3, 4–6, 7–9 and above 10 accounted for 10.1%, 64.5%, 19.6%, and 5.8% respondents, respectively (Table 1). In the case of literacy, 77.6% of the farmers had no formal education, 18.1% attended primary school while 4.3% of households were able to read and write. The survey results also revealed that 87%, 7.2%, 3.6%, and 2.2% of the household respondents were married, single, widowed and divorced, respectively (Table 1). The majority of farmers (34.8%) had the livestock in the range of 2.2– 2.9 and the other ranged from 0–2.1, 3–4.6, 4.7–6 and above 6 accounting for about 23.9%, 16.7%, 13.8%, and 10.8%, respectively (Table 2). Moreover, the result revealed that the majority of farmers (81.6%) cultivated less than 1 ha of land. Households cultivating more than 1 ha accounted for only 18.4%. This indicated that there was a serious shortage of farmland in the study area.

Farmers Perception on Soil Erosion and Conservation Measures

The survey result showed that 88.4% of the farmers acknowledged the presence of erosion on their farmlands, while the remaining 11.6% did not acknowledge the presence of erosion on their farmlands. From the households that acknowledged the presence of erosion on their farm lands, 45.1%, 36.9%, 7.3%, and 10.7% perceived the presence of soil erosion as, rill, sheet, splash and gully erosion, respectively (Figure 2). Farmers were also asked to answer their perception on the degree of erosion on their crop lands. Therefore, 13.1%, 59%, and 27.9% of farmers perceived that there was at least low, moderate and severe erosion problem on their cultivated land, respectively. Since 87% of the respondents agreed that they experienced medium to high levels of soil erosion, it can be concluded that the threat of soil erosion was real in the study area. Farmers' perception and understanding about the degree of erosion problem on their cropland govern their willingness and participation in SWC activities. This finding agreed with Bekele et al. [22] who reported that 95% of farmers easily identified the problem of soil erosion in their cropland.

Table 1. Socio-economic characteristics of household respondents (n=138).

Socio-economic factors	Classification	Participation status	
		Participants	***Non-participants***
Gender	Male	70	37
	Female	29	2
Age (in years)	20–30	10	3
	31–40	32	11
	41–50	46	19
	51–60	8	4
	Above 60	3	2
Family size	1–3	9	5
	4–6	63	26
	7–10	21	6
	Above 10	6	2
Education	No formal education	75	32
	Able to read and write	3	3
	Primary school	21	4
Marital status	Married	91	29
	Divorced	1	2
	Widowed	2	3
	Single	5	5
Livestock number in tropical livestock unit (TLU)	0–2.1	41	20
	2.2–2.9	42	10
	3–4.6	9	4
	4.7–6	4	3
	Above 6	3	2
Farm land size (ha)	<0.5	40	19
	0.6–1	43	11
	1.1–1.5	8	2
	1.6–2	5	4
	Above 2	3	3

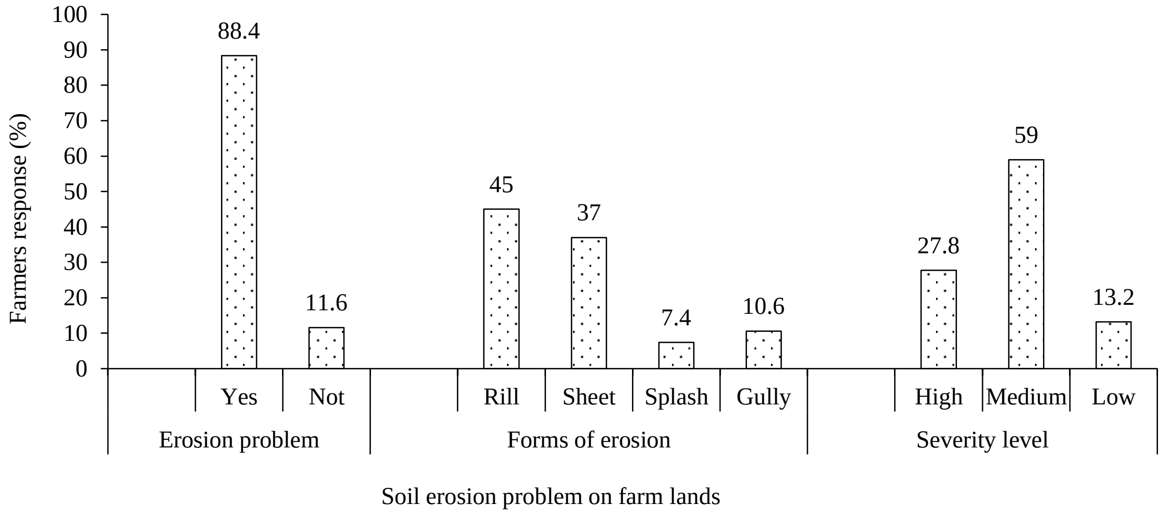

Figure 2. Problem occurrence and severity of erosion on the farm lands.

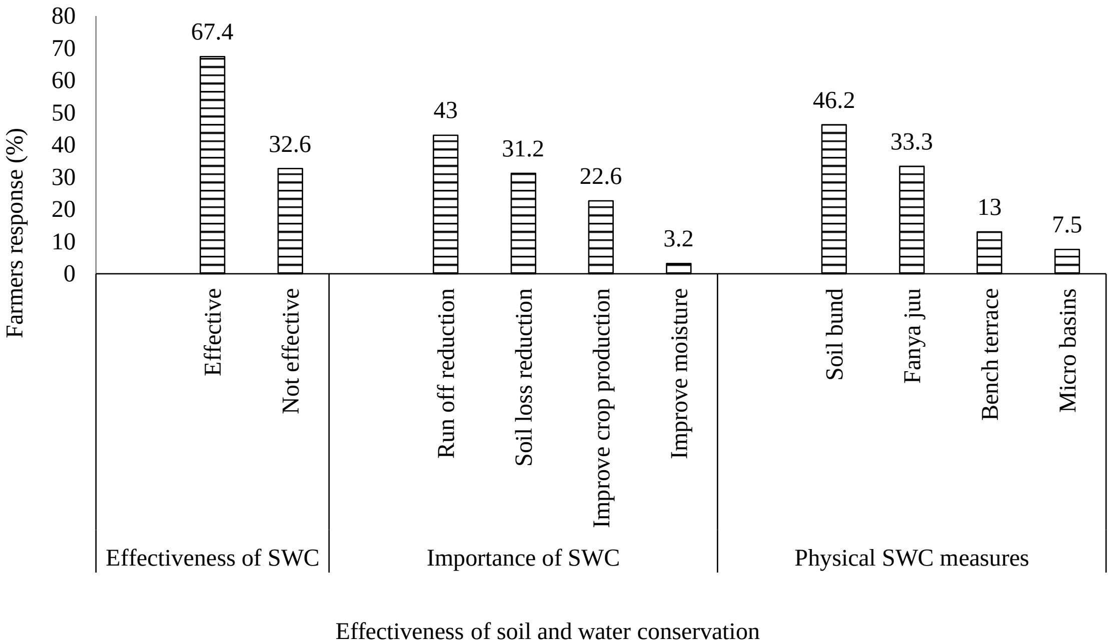

Figure 3. Farmers' perception in SWC measures.

Farmers' participation in SWC practices showed interesting difference with differences in the perception of the effectiveness of introduced conservation structures in arresting soil erosion. The result showed that 71.74% of the respondents were willing participants in SWC practice. The other 28.26% of the respondents were unwilling to participate in conservation practices in the study area. From the total respondents those who participated in conservation practice, about 67.4% of the farmers believed on the effectiveness of SWC measure while 32.6% did not believe on the effectiveness of SWC measures. Further, the result revealed that 71.7% and 56.4% of participant and non-participant households, respectively have confirmed the effectiveness of SWC measures. The farmers were also asked to respond on the type of soil and water conservation measures found on their farmlands. As presented in Figure 3, the soil bund, fanya juus and bench terraces were the dominant introduced SWC measures implemented on their farmland which accounted for 45.2%, 33.3%, and 12.9%, respectively. The remaining 8.6% of household respondents' farm land had implemented micro basins on their farmlands.

Moreover, farmers were asked to respond on the effectiveness of implemented SWC structures. It was revealed that implemented structures were effective in run off reduction, reduction in soil loss and improvement in land productivity which accounted for 41.9%, 22.6%, and 31.2%, respectively (Figure 3). The remaining 4.3% agreed by other effectiveness of SWC measures such as improvement in soil moisture.

Factors Affecting Farmers' Participation in SWC Measures

The logistic regression model result showed that out of the eleven variables hypothesized to determine decision of farmers to participate in SWC measures, six were statistically significant at 1% and 5% probability level. More specifically, the coefficients of gender of the household head, farmland slope position, off farm income participation, extension service, family number and number livestock of the respondents were significant. The remaining five explanatory variables were not statistically significant at the conventional probability levels implying that they were less important in explaining the variability in the farmers' decision to participate in SWC practices. Specifically, educational status, age, farmland size of household respondents and land tenure security did not significantly affected farmers' participation in SWC activities. Therefore, household education level, land tenure security, perception in effectiveness of SWC measures, farmland size and age of household respondents were not included in the discussion. The discussion of significant explanatory variable in the light of other scholars' is presented following the tabulated result of binary logistic regression (Table 2).

Gender of Households (GHH)

As hypothesized, being male significantly and positively influenced the decision of farmers to participate in SWC practices at 5% significant level. Thus, the male-headed households were more likely to participate in SWC activities than female-headed households. A unit change from being headed by a female household to male increases the probability of participation in SWC practices by 9.49 times (Table 2). The possible reasons for this result could be participating and constructing SWC measures needs substantial labor and female-headed households are constrained with labor availability than male-headed households in the study area. The study is in line with Deressa et al. [13] who reported that male-headed households had better opportunity to take an adaptation measure than female household mainly due to cultural and social barriers in the area that limits women's access to land and information using agronomic practices.

Family Size of Households (FSHH)

As expected, the binary logistic regression result showed that FSHH respondent is statistically significant and positively associated with farmers' decision of participation on SWC activities at 5% level of confidence. The positive coefficient indicated that other factor held constant when family labor increases by one unit, the interest of farmers' participation in conservation activities increases by 2.072 factors (Table 2). This positive impact may be due to the laborious nature of SWC work which needs more labor force. Hence, the household with more family size is favorable to supply more labor. The present study was consistent with those of Teshome et al. [23] and Belachew et al. [24]. Their study reported that family number has positive influence on farmers' adoption of SWC measures. This can be explained by the fact that labor inputs constitute the largest cost factors for SWC line interventions.

Livestock Number of Households (LSOHH)

In line with prior expectation, livestock holding in tropical livestock unit (TLU) positively influenced household's decision of participation in SWC activities at 1% probability level. This result revealed that a unit increase in the number of livestock in TLU would result in 1.54 times increase in the decision of farmers' participation in SWC activities (Table 2). The reason could be that the highest number of livestock owned by the households requires a high amount of feed resources and in turn, participates in SWC activities for more agricultural production. This result was in line with Wolka & Negash [25], who reported, the number of cattle as an indication of economic security that had a positive influence on farmers' participation in watershed management activities at Bokole sub-watershed. Similarly, Musyoki et al. [26] in Kenya and Oli and Treue [27] in Nepal 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.

Farmland Slope Position of Households (FLSHH)

Contrary to prior expectation, the regression analysis result of this variable was found to be statistically significant at the 5% level of confidence but negatively associated with farmers' participation in SWC activities (Table 2). This could be due to farmers' lack of knowledge about the effects of slope for soil and nutrient losses from their farmlands. This result is consistent with Agidew and Singh [14] who found that farmland slope was significantly and negatively influencing farmers' decision of participation on SWC activities. Alemu [28] also found statistically significant and negative relationship between slope and farmers' participation in conservation investment. He argued that the returns from investment on steeply sloped plots might be low, hence less adoption on such plots.

Off-Farm Income Participation of Households (OFPHH)

As prior expectation, the regression analysis result showed that farmers' participation in off-farm income generation activity was statistically significant at 1% level of confidence and negatively influenced farmers' participation in conservation activities. The negative coefficient of the variable indicated that engaging in non-farming activities reduced farmers' participation in conservation activities by 0.06 units (Table 2). This could be due to the fact that the number of days' farmers work on an off-farm income generation activity left them with little time and less interest for being associated with the SWC activities. The present study was consistent with Adugnaw and Desalew [29], who reported that farmers who were involved in off-farm income generating activities were far from the farming plots and likely to put less effort in maintenance and hence on retention of conservation structures. Similarly, Kagoya et al. [30], found a negative influence of off-farm income on adoption of SWC practices in Nabajuzi watershed of the Lake Victoria Basin.

Extension Service Received by Households (ESHH)

Contrary to prior expectations, the result of regression analysis of this variable revealed that agricultural extension service is found to be statistically negative and significant at 1% level of confidence (Table 2). This means as the contact of agricultural extension services received by a farmer increases, decision to participate in SWC activities decreases. This could be due to farmers being either reluctant to uptake external recommendations or take some more time to comprehend and participate in conservation activities.

Table 2. Factors affecting farmers' participation.

Explanatory variables	Estimated coefficient (B)	SE	Wald statistics	Significance level	Exp (B) Odds ratio
GHH	2.250	1.072	4.406	0.036*	9.486
AHH	-0.124	0.097	1.636	0.201	0.883
ESHH	0.531	1.299	0.167	0.683	1.700
FSHH	0.729	0.337	4.683	0.030*	2.072
LSOHH	0.433	0.167	6.717	0.010**	1.542
FLSHH	1.166	1.661	0.493	0.483	3.210
OFPHH	-2.809	1.093	6.607	0.010**	0.060
LSPHH	-1.884	.898	4.400	0.036*	0.152
EXS	-4.253	1.001	18.045	0.000**	0.014
LTSHH	0.100	0.923	0.012	0.914	1.105
ESWC	0.707	0.970	0.532	0.466	2.028
Constant	3.507	4.151	0.714	0.398	33.340

***, * Indicated: Significant at 1% and 5% level of confidence, respectively.*
Hosmer and Lemeshow test Chi-square = 0.566 Significance= 1.00
Model Chi square= 115.048 Cut value=0 .5 Nagelkerke R2= 0.813

The result was consistent with the study conducted by Berhanu et al. [31] who reported that the influence of development agents (DAs) negatively influenced the adoption of SWC technologies by the farmers due to their involvement in activities such as rural land tax estimation. Farmers hesitate to contact the DAs, and thus are less likely to accept the technology [32].

CONCLUSION AND RECOMMENDATION

The result of the present study revealed that farmers' participation in SWC measures was affected by socio-economic and institutional factors. Gender of household, family number, livestock number, off farm income, extension support and farmland slope position significantly influenced the decision of farmers' participation in SWC. Particularly, off-farm income, extension service and slope indicated a negative influence. Whereas; family size, gender and livestock number positively affected farmers' decision in SWC measures.

Therefore, policy makers and stalk holders should take into account the most important variables that were affecting farmers' participation in the study area. The study also recommended that similar research should be conducted in the other watersheds to validate the findings of the present study and a more in-depth study should be done by incorporating other factors that affect farmers participation in SWC measures such as farmers past experiences and farmers' trust to government policy, to further enhance the identification of factors that affect farmers' participation in watershed management programmes to improve the prediction of the level of their participation.

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Competing Interests

I declare that the authors have no competing interests as defined by this Journal, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

Availability of Data and Materials

The datasets used and/or analyzed during the current study were available from the corresponding author on reasonable request.

Authors' Contributions

- *DA*- has made significant contribution started from proposal writing, data collection, data analysis and interpretation and the final manuscript preparation.
- *AT*- has participated in advising, guiding and editing proposal and manuscript preparation process.

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