

SOCIO-ECONOMIC FACTORS AFFECTING COMMUNITY'S PERCEPTION TOWARDS SOIL AND WATER CONSERVATION PRACTICES IN GECHI WOREDA, SOUTH WESTERN ETHIOPIA

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ABSTRACT

The study was conducted in Gechi Woreda district of Ethiopia to investigate the community perceptions and the strategies used in soil and water conservation practices, particularly the Soil Bund. To achieve this objective, structured, semi-structured questionnaire and focus group discussion were used for data collection. Logistic regression model was used to analyze determinants of farmers' perception of soil water conservation practices of the sampled farmers in relation to their socio-economic conditions. The study showed that majority of the respondents positively perceived the soil and water conservation practices (83%), and shortage of labor (31.5%) and lack of accountability (26.3%) were the major determinant factors of the structure. The result also shows farmers' perception towards the types of soil and water conservation measures practiced in the study area, where the bund integrated with vetiver grass (*Vetiveria zizanioides* L.) was highly preferred and acknowledged by the farmers. The result of the regression model also showed that age of the household head (AGE) (-0.123*), farmers' land size (LS) (-2.870*) and livestock number (LSTK) (-0.418*) had significant negative influence on the perception of farmers in Gechi Woreda. These imply that younger households accepted the soil and water conservation practices than the older ones as the younger are energetic in establishing the soil and water conservation practices. Also, a unit increase in the number of livestock decreases the farmers' acceptance of soil bund in the Gechi Woreda, where free grazing is commonly used and is a challenge for the suitability of the conservation practices. The Educational status (EDCATN) (3.895*) and family size (FS) (1.361**) of the interviewed household head is significantly and positively determined farmers' perception of soil bund. Literate households highly understood the costs of soil erosion and benefits of soil bund and invested more than the illiterate households. Since the construction of soil bund is labor intensive the households with large family members accepted and used soil and water conservation practices while the households with small number of family members did not. Therefore, even though there are a determinant factors, using soil and water conservation practices particularly the integration of physical structure with biological measure plays a significant role for socio-economic improvement of community living in the given areas, through enhancing land productivity.

Key words: Community perceptions, Land degradation, Soil and Water Conservation



INTRODUCTION

Land degradation is a natural or a human activity induced process that causes the land to be unable to provide intended services for an extended time [1]. Degradation of arable and farm lands due to soil erosion is a widespread phenomenon in the highlands of Ethiopia. Land degradation in Ethiopia is mainly of anthropogenic origin, caused by human activities such as deforestation, overgrazing and over cultivation of slopping and marginal lands that have been the major causes of vicious circle of soil erosion, drought, famine and chronic poverty in the country [2]. Decrease in soil depth, soil fertility, organic matter content and plant-available water reserves are the main manifestations of soil degradation that hindered productivity in the agricultural sectors [3]. The impacts of soil degradation by the process of water erosion depend on the existence and qualities of soil and water conservation practices on the farm fields [4].

Farmers are not passive observers of these risks happening to their farm land and it is increasingly evident that farmers who are living under high risk and uncertainty have developed pools of indigenous practices on their farm lands without any external intervention [5]. Thus, farmers' perception on risks of soil erosion plays a key role in their decision making on land management practices. The success of any soil and water conservation intervention depends on the extent to which the introduced conservation measures are accepted and adopted by the farming community [6]. Different farmers may have different attitudes towards the importance of soil conservation. Hence, perception of the farmer affects the choices and sustainable use of soil conservation practices. Perception of soil erosion factors and how to prevent them is a necessary condition for farmers to invest in conservation practices [7].

Nevertheless, the rate of adoption, sustainability and effectiveness of the practices are still very low due to the mismanagement and misunderstanding of the community about the structural importance in improving the soil fertility status and their socio-economic conditions [8, 9]. The farmers in the study area were also less aware of the importance of soil and water conservation practices, and they complained about the structure and the spacing of the bund. They suggested the spacing between the two consecutive bunds needed to be wide at all slope levels for the sake of free traditional plowing.

The seriousness of soil erosion problems and lessons learned from failure of conservation practices should aim at achieving tangible results on the impacts of soil erosion and conservation practices. It is increasingly becoming clear especially

in the case of Ethiopia particularly in Gechi Woreda that land management practices are a complex issue requiring further investigations as they are influenced by different factors at different levels [10]. Regarding these, there is a need for understanding the importance and factors which determine farmers' perception towards soil and water conservation practices [11]. Therefore, this study was aimed to investigate the perception of the community on soil bund and the major determinant factors on soil and water conservation practices in Gechi Woreda. The results of the study will be of significant importance for the communities, decision makers, academic purpose, research institutions, and policy recommendations for further practices of SWC in the study area in particular.

Objective

The overall objective of the study was to evaluate the farmers' perception and strategies used for soil and water conservation practices in Gechi Woreda, south western Ethiopia.

MATERIALS AND METHODS

Study Area

The study was conducted in Bunno Bedelle zone Oromia regional state Gechi Woreda which is located 18 km to the southern part of Bedelle town, and about 446 km from Addis Ababa to the southwestern direction (Figure 1). Geographically the area is located between 35° 54' 15" and 36° 9' 38.3" east longitude, and 8° 8' 50.47" and 7° 50' 46.948" north longitude, respectively. According to the data found in the Woreda land administration office (LAO), the altitude of the study area ranges from 2050 to 3200 meters above sea level (masl) and 27% of the study area is Dega (*Temprate*), 27% is Weyna Dega (*Sub-tropic*) and 23% is Kola (*Tropic*). The area receives annual rainfall of 1450-2297mm for about 6 to 9 months per year starting from March to December in every years of rainy seasons. According to the recent data of the Woreda agricultural office, the mean annual temperature of the study area ranges from 18-24°C.

The dominant reference soil groups in the study area are Nitisols which are characterized by dark red to reddish brown color and well-drained profile. On the steep slopes, the soils are shallow due to severe erosion and are less fertile. Intensive cultivation, removal of forest covers and irregularity of slope are the major drivers of soil erosion in some parts of the area, where the other parts of lands are covered with coffee forests. The major crops grown by farmers were maize, Teff (*Eragrostis tef* (Zucc.) Trotter), coffee (*Coffea Arabica*), groundnut (*Arachis hypogaea* L.) and Chat (*Cate Edulis*). Hence, the major economic

activities of the community were mixed agricultural products, example crop production, animal fattening, honey and Chat (*Cate Edulis*). According to the Woredas communication office report, the total population was about 83960. Oromo is the largest ethnic group (97%) in the area and the other 3% are Amhara, Tigre, and Gurage. Afaan Oromo is spoken as a first language by all people (100%).

Gechi Woreda was purposively selected for this study due to soil and water conservation measures potentially practiced in the area for decades. Two soil and water conservation practices namely, graded soil bund with and without vetiver grass were the most abundantly used and effective structures in Gechi Woreda and selected for this study. The study was mainly focused on the investigation of the farmers' perception and the major determinant factors on those structures.

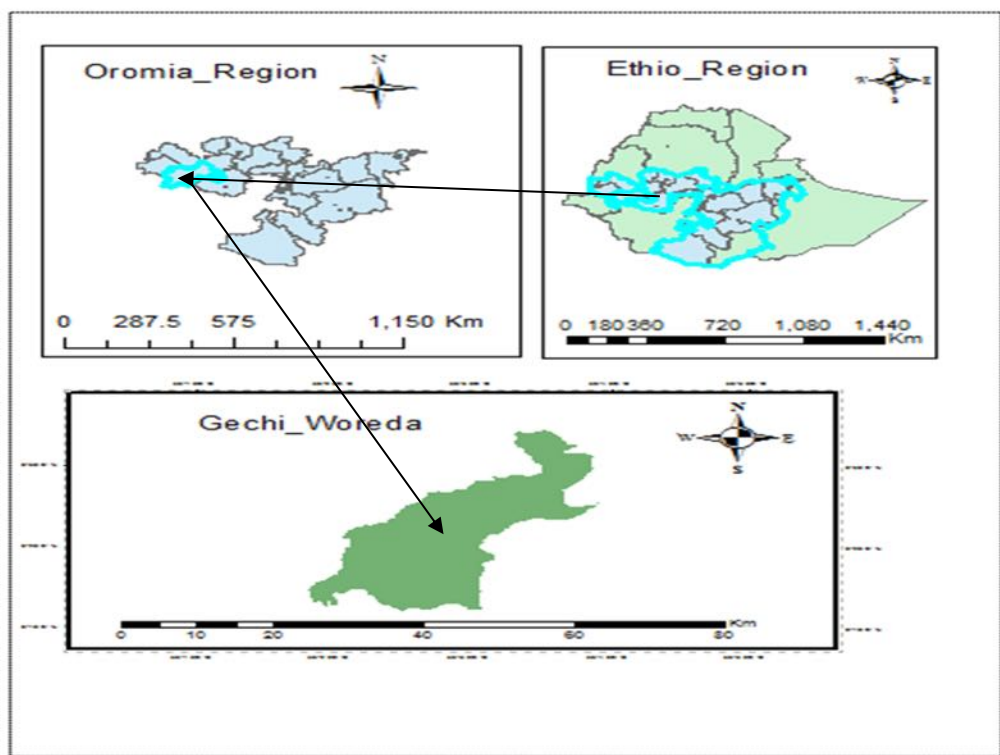


Figure 1: Map of the study area (sketched by the researcher)

Household Sampling and Survey

The total number of the study population dwelling in the rural *kebeles* (Peasant associations) was about 3,808 households. Simple random sampling method was applied to select respondents to whom the questionnaires were presented. The sample size of the interviewees was determined by the Cochran's sample size formula for categorical data [12].

$$n = \frac{X^2 \cdot s(p)(q)}{d^2}, \quad n' = \frac{n}{1 + \frac{n}{N}} \dots \dots \text{Equation 1}$$

Where, n = required return sample size, n' = sample size, X^2 = the table value of chi-square for degree of freedom at the desired confidence level, N = the population size, p = the population proportion (assumed to be 0.10 since this would provide the maximum sample size). $q = 1 - p$, d^2 = the degree of accuracy expressed as a proportion ($\alpha = 0.05$). Since the percentage of the sample size was preferably greater than 5%, Cochran's corrected sample size were calculated as $n' = \frac{n}{1 + \frac{n}{N}}$.

With this formula, a total of 133 households were selected. Both semi-structured and structured and focus group discussion (FGD) were used to assess the perceptions of the community residing in the study area on the soil and water conservation measures. Individual farmers were interviewed on observed changes as result of this conservation practices.

The definition and units of measurement of the dependent and explanatory variables used in the logistic regression model to assess farmers' perception on the soil and water conservation practices are presented in Table 1.

Methods of Data Collection

Questionnaires

Closed and open ended (mixed) as well as simple and contingency items questionnaires were used to collect data on community understanding about soil and water conservation practices and ways of participation during construction phase, major causes of soil erosion and related problems since these was appropriate data gathering tools from respondents. An assessment of the entire necessary document, related literature and other questionnaires (structured and semi-structured) were consulted to design the questionnaires very well. The questionnaires were prepared first in English and translated to the language of the study area that is "Afaan Oromo" and distributed to the farmers. With this questionnaires major determinants of farmers' perception of soil water conservation practices like household age, sex, marital status, educational level of households, land size owned by the farmers, family size, types of conservation practices and number of livestock were addressed and presented in a percentage and frequency.

Key Informant Interview

For this interview the key informants were selected from development agents, model farmers and from nongovernmental organizations and thoroughly interviewed using structured and semi-structured questionnaire to elicit information that makes the study comprehensive.

In this way, the key informants were asked questions on the overall soil conditions, status of soil and water conservation practices, and major determinant factors of soil and water conservation practice in Gechi Woreda. The interview was designed in such a way that it was possible to react accordingly; this format allows the researcher to respond to the situation at hand, to the emerging worldview of the respondent and new ideas on the topic. Short notes were taken during the interview and full account of the story was written immediately after the interview.

Focus Group Discussion (FGD)

A two- way communication was conducted between farmer and interviewer in order to make the process of data collection more effective. Farmers were asked questions on problem of soil-water conservation practices, soil erosion, practice of soil-water conservation and solutions for the problem. The selection of the farmers was made purposively based on their land holdings, on their economic (production) and on their activities to conserve the soil and water and the method they used to hinder the problem of soil and water conservation.

Generally, the respondents subjected to this focus group discussion were selected from model farmer, medium and low income farmers based on their participation on soil and water practices. Farmer's economy or income level that categorized as explanatory variables (mainly Land size and Livestock numbers) is listed in Table 5. Following the above procedure, two focused groups, one from female and the other from male groups that constituted 11 members each were used in this survey.

Field Observation

Field observation was conducted throughout the whole process of the research in order to make sure the validity of information to be obtained. It was done with the purpose of getting guidance for development, for the formal question, and to be acquainted with the values of local people especially the "good" "bad" and "worst" of the society's idea on soil and water conservation practices and its challenges. The fact that local people fail to articulate the details of what they do necessitated the need for maintaining observation throughout the research. This observation was taken randomly from selected farmers to assess what they did to conserve the soil and water; the problems they faced on their fields and the measures they used to mitigate the problems.

Statistical Analysis

Descriptive statistics was applied to discuss the information collected on community perception towards soil and water conservation measures in the study

area. To analyze the significant difference between respondents' perceptions on different causes of soil erosion, Chi-square test was applied using the Statistical Package for Social Science (SPSS) version 20 and the result was presented in tables. Moreover, logistic regression model was also used to analyze perception of the sampled households on SWC practices on their livelihoods.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The prevalence of soil erosion and effectiveness of soil and water conservation practice as a means of land management in the study area was assessed by focus group discussion, interviewing the watershed inhabitants and development agents. The data indicated that among 133 sampled household heads, the male constituted about 56.6%, whereas 43.4% were female headed. About 63.9% of the respondents were married while 20.5% were single and 15.6% were widowed. The maximum average family size ranged from 6-10 which accounts for 62.65% of the total House Holds. The largest age group was 18-36 (46.99%), followed by 37 -60 (45.78%). About 71.1% of the respondents had basic education.

Perception and Its Determinants

All of the respondents stated that they experienced hazards of soil erosion that resulted from anthropogenic and natural factors. The slope of the land, lack of appropriate SWC and viable structures, and intensive and conventional cultivation systems were the major driving forces to cause soil erosion in the study area. In an attempt to address the impacts of soil erosion, the government implemented several soil and water conservation measures through community mobilization campaign and Sustainable land management program on the rehabilitation of different degraded lands in Gechi Woreda. The community was well aware of the socio-economic and environmental impacts of soil erosion, and the importance of soil and water conservation in combating soil erosion problems.

About 62.4% of the respondents reported that they felt positive on the soil and water conservation practices that they constructed on their farm lands even though there were several hindering factors during and after the establishment of the soil and water conservation structures, whereas 37.6% of them negatively perceived the practices. The table (Table 3) showed, the major limiting factors of using soil and water conservation practices on their farm lands. Those major limiting factors were listed and ranked by the respondents as shortage of labor (31.5%), low level of education /shortage of Awareness that enables the community to easily understand the structure (21%), farmers mis-understanding towards the adoption

of soil and water conservation practices (13.5%), shortage of land and land tenure insecurity (7.5%), and varying degree of accountability (26.3%). This result is in agreement with the finding of Zenebe *et al.* and Zerssa *et al.* [13, 14], who reported that the level of education, age, sex, size of household or labor, shortage of land, level of information and land tenure insecurity highly affects the degree at which farmers implement soil and water conservation activities.

Among the sampled households, about 90% of them were participated in the construction of the soil and water conservation structure either voluntarily or involuntarily, while 10% of them did not participated. Out of all participants, 63.3% of them were willingly participated, whereas 26.7% of them were forced by governmental institutions (Development agents, woreda political leaders) to construct the soil and water conservation practices in the study area (Table 4). The chi-square analysis results showed that there was significant differences ($p = .000$) among the voluntarily and involuntarily participants on soil and water conservation practices. This implies that majority of the farmers understood the benefits of soil and water conservation practices in overcoming soil erosion problem and improving their land productivity for their sustainable wellbeing.

The respondents those unwillingly participated on the construction of soil and water conservation practices perceived the structure as it was not a solution for rehabilitating the degraded lands in the study area. The main arguments that they raised were: the structure was labor intensive to construct, the bund embankments and the excavated channel takes large farming size and minimize the area to be cultivated, the spacing was too narrow and was difficult to undertake the traditional farming system within intra-bunds, also the structure needed continuous maintenance and planting the slips of vetiver grass (*Vetiveria zizanioides* L.) consumed more time and hosts rodents or pests that infest the field [15].

Logistic regression model was also used to analyze determinants of farmers' perceptions of soil water conservation practices of the sampled households in relation to their socio-economic conditions. The results of the regression model showed a strong association between the perception and some of the explanatory variables ($R^2 = 0.622$). A positive estimated coefficient in the model implies increase in the farmers' perception of soil and water conservation practices and types of the structure. Whereas the negative estimated coefficient in the model implies decreasing perception with increase in the value of the explanatory variables in the study area (Table 5).

The result showed that age of the household head (AGE) and livestock number (LSTK) had a significant negative influence on soil bunds constructed in the study area. A unit increase in age of household head and livestock number decreases the farmers' perception of soil bund by 0.123 and 0.418, respectively (Table 5). These could suggest that older farmers are more likely focused on other activities whose benefits are realized over time and give less attention for the investment of such labor-intensive structures than the younger households. The older farmers may also believe they benefit less from SWC practices and the practices may take long to bring the progressive changes on their socio-economic aspects.

In contrast, the model result showed younger farmers may invest more on the land management practices because they have enough labor inputs and are able to construct the structures than the older farmers. This is in contrary with Dessalew [7], who reported that younger farmers are more likely to have longer planning perspective to justify investments in technologies whose benefits are realized over time than soil and water conservation practices. Similarly names of authors? [16, 17] stated that old age households are less likely willing to pay for soil conservation practices as they expect they would benefit less from the investment relative to young households.

The households with large number of livestock more likely depend on the free grazing which seriously damage the bunds and biological (vetiver grass) conservation measures in every part of Ethiopia. The result showed an increase in the number of the livestock decreases farmers' perceptions towards the soil and water conservation practices in the study area. In some cases, the conserved areas become closed from any livestock interference and forbidden to undertake free grazing in the closed area, so that it is difficult for the farmer having large number of livestock to feed through cut and carry system. This may also be another reason that negatively contributed for farmers' perceptions of soil and water conservation measures in the study area.

The result of the regression model also showed Education status (EDCATN) and family size (FS) of the household head significantly and positively determined farmers' perception of soil bund as a means of soil and water conservation practices in the study area (Table 5). This suggested that the educated farmers are better at recognizing the risks associated with soil erosion and the outcomes that will be achieved with the presence of soil and water conservation measures on the farm fields. Therefore, those who are literate must have invested more time and labor on soil conservation activities than the illiterate farmers in the study area [10, 16]. The odds ratio also indicated that if a farmer is literate, the awareness of the

educated farmers will be forty-nine times higher than the illiterate farmers in the study area which show highly significant difference (Table 5).

A significant positive relationship found between family size and soil and water conservation practices was due to the fact that soil and water conservation activities need enough inputs of labor and budgets for both construction and maintenance of the structures. The household heads having large family members may tend to willingly participate and maintain the conservation measures installed on their farm fields than the households heads with less family members.

A significant negative relationship was also found between farmers' land size (LS) and their current perception of soil and water conservation measures (Table 5). This might be due to the fact that the construction of soil and water conservation structure was labor intensive and took more time for both establishment and maintenance in the study area. Soon after construction the bunds were stabilized with vetiver grass. Hence, the comparative analysis result showed that household heads with large farm size were invest more time and labor than the farmers owned less farm land until their land treated by the soil and water conservation measures. Thus, households having large sizes of farm land invested more time and cost both during and after the construction of the structure. Therefore, a unit increase in land size decreased the farmers' perception towards soil and water conservation activities by -2.87 in the study area. The odds ratio also suggests if the land sizes of the households increase, the farmers' willingness to invest will decrease four times than the households with low farm sizes as indicated on the table (Table 5).

The logistic regression result revealed the significant positive relationships between the benefits gained from soil and water conservation measures and the current perception of farmers ($p < 0.1$) (Table 5). This is mainly associated with the on-site and off-site progressive changes made by the structure on the economic and social aspects of the households through earning wealth from the vetiver grass besides its conservation purposes. The result also shows farmers' perceptions towards the types of soil and water conservation measures practiced in the study area, where the bund integrated with vetiver grass was highly preferred and acknowledged by the farmers. All these social and economic values must have been the reasons for the choice and acceptance of vetiver (*Vetiveria zizanioides* L.) grass for both conservation and income generating activities by 2.525 in the study area.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The degradation of soil by water is the main cause for degradation of the land around the world, which is mostly associated with the growing agricultural, urban and industrial developments, which accelerated surface soil erosion. Degradation of farm lands due to soil erosion is also a serious problem in Ethiopia where agriculture is the back bone for the economy of the country. To overcome this devastating phenomenon, different soil and water conservation practices became an issue of major concern in Ethiopia and constructed across farm lands. Gechi Woreda is among the rural Woredas of Ethiopia that are significantly affected by soil erosion. To over this problem, the concerned governmental and nongovernmental organizations had collaborated for the rehabilitation of degraded farm lands in Gechi Woreda. To realize these objective soil bunds was selected and constructed based on its appropriateness and accessibility of materials to construct the structure. Therefore, due to the long-term implementation of soil bund, Gechi Woreda was elected to investigate Community perception towards soil bund integrated with and without vetiver grass (*Vetiveria zizanioides L.*).

The survey result revealed that there was overall variability on the soil condition and socio- economic values of the structure as compared to soil bund with and without vetiver grass (*Vetiveria zizanioides L.*) in the study area. According to the respondents selling the clumps of vetiver grass (*Vetiveria zizanioides L.*), roof thatching and using for coffee ceremonies were additional values of vetiver grass (*Vetiveria zizanioides L.*) in the study area. The logistic regression results also showed the age and livestock numbers of the households significantly ($p \leq 0.1$) and negatively influenced farmers perception of soil and water conservation practices, while education, family size, land size and benefits gained from soil and water conservation practices significantly and positively affected farmer perception of soil and water conservation in the study area. Younger farmers invest more on the land management practices as they have enough labor input and able to construct the structures than the older farmers and households with large number of livestock also more likely depend on the free grazing which is seriously damaging the soil bunds and vetiver grass (*Vetiveria zizanioides L.*). Therefore, the households should have to minimize their number of live stocks and use cut and carry system of grazing for the sustainability of the structure in the area.

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Table 1: Definition and units of measurement of the dependent and explanatory variables used in the logistic regression model (n=133)

Variables	Variable Code	Variable type	Unit of Measurement
Dependent variable			
Farmer perception of SWC	PoSWC	Dummy	1 If yes; 0 otherwise
Explanatory variables			
Age of household head	AGE	Continuous	Measured in
Sex of the house hold	SEX	Dummy	1 if male, 0 if female
Marital status of house hold	MRG	Dummy	1 if single; 2 if married; 3 if divorced; 4 if widowed
Educational level of household	EDCATN	Dummy	1 if illiterate; 2 otherwise
Number of livestock owned by the house hold	LSTK	Continuous	Measured in Number
Land size owned by the house hold	LS	Continuous	Measured in hectare
Family size of household head	FS	Continuous	Measured in Number
Soil and water conservation more benefits you	SWCMBY	Dummy	1 if SBWV; 0 if SBWOV

Table 2: Sample HHs by Age, Sex, Marital status, family size and Education level (n = 133)

Variables	Range	Percentage	Means
Age	18-36	46.99	38.66±13.32
	37-60	45.78	
	>60	7.2	
Sex	Male	56.6	
	Female	43.4	
Marital status	Married	63.9	
	Single	20.5	
	Widowed	8.4	
	Divorced	7.2	
Family size	1-5	30.12	6.71±2.86
	6-10	62.65	
	>10	7.23	
Educational status	Illiterate	28.92	1.71±0.45
	Read and write	71.1	

Table 3: Community feeling on applying SWC measures on their farm lands (n = 133)

Questions and response of the respondents	Frequency	Percent
<i>What do you feel about SWC Measures?</i>		
Positive	83	62.4
Negative	50	37.6
<i>What factors determine the use of SWC measures on your farm land?</i>		
Shortage of labor	42	31.5
Low level of education /awareness/	28	21
Unable to adapt technology	18	13.5
Lack of accountability	35	26.3
Land tenure insecurity	10	7.5

Table 4: Causes of soil erosion and farmers participation on SWC activities (n = 133)

	Percentage	df	x ²	p-value
Major causes of soil erosion				
Deforestation	5.9			
Cultivation	39.00	2	2.3	0.3 ^{ns}
Lack of SWC	39.00			
Problem posed by soil erosion				
Yield reduction	35.5			
Enlargement of rills	29.5	2	1.0	0.40 ^{ns}
Soil textural change	27.6			
How did you participate on SWC				
Voluntarily	63.3			
Forced to participate	26.7	2	83	.000*
Not involved	9.8			

* = Shows significant difference at 0.05 among the factors and impacts, ^{ns} = non-significant

Table 5: Logistic regression result for perception of soil and water conservation practices in the study area (n = 133)

Dependent variables: SWC	Coef.	Std. Err.	Odds ratio
Explanatory variables			
AGE	-0.123*	0.11	0.88
SEX	3.915	2.10	0.02
MRG (Marriage)	1.697	1.76	5.46
EDCATN (Educational Status)	3.895*	2.11	49.18
LSTK (Livestock Number)	-0.418*	0.32	0.66
FS (Family Size)	1.361**	0.61	17.64
LS (Land Size)	-2.870*	1.61	3.90
SWCMBY (Soil and water conservation more benefits you)	2.525*	1.47	0.087

*, ** Significant at 0.1 and 0.05 probability levels, respectively

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