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Farmers' Psychodynamics to participate in Integrated Soil and Water Conservation Measures in BGRS in Ethiopia

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Abstract

Soil erosion remain an important worldwide environmental impact for many centuries requiring more attention by individual, communities and the environment and its effects on food security and quality of life. Particularly land degradation due to soil erosion is multifaceted and dynamic problem that affects for sustainable resource management in today's developing world (Stringer, 2008). Agriculture depends fundamentally on natural resources and has an important role in their conservation. The deteriorating land and water resources in Ethiopia present a concern to rural land users, and wider public awareness of environmental issues is bringing urgency to conservation issues. Water depletion and land (natural resources) degradation, themselves the result of ever-increasing ecological imbalances, caused the recurrent drought and famine. Sustainable agriculture plays the central role in poverty reduction efforts of the country. Hence, the major concern of this study was to assess the farmers' psychodynamics to participate on integrated soil and water conservations measure in Bambasi woreda. To meet this objective a total of 356 sample households, consisting 178 soil and water conservation participant and 178 non-program participants, were randomly selected from seven kebeles of Bambasi districts (Amba16, Mender 45, Mender 46, Mender 47, Mender 48, Mender 49 and Sonka). Descriptive statistics with appropriate statistical tests, and binary logistic regression model were used. Descriptive statistical analyses such as mean, standard deviation and percentage were used to analyses basic household characteristics and the types of technologies adopted by the farmers. The result from the logistic model analysis revealed that participation soil and water conservation technologies was significantly influenced by variables such as severity of erosion, credit use, total land, access to media and soil fertility, distance from market and perception on soil erosion. One of the major problems affecting land productivity in the highlands has been land degradation. As population pressure has built up, demand for fuel wood and building materials and land for cultivation has resulted in decimation of forest cover and bio-diversity. Intensive cultivation of steep slopes without adequate soil conservation measures has resulted in soil impoverishment through soil erosion and, in some cases, total loss of agricultural land due to gully formation. Land tenure systems, inappropriate extension approaches, and diminishing farm incomes have further discouraged investment in soil and water conservation.

Keywords: Soil and Water Conservation; Farmers Motivation.

1. INTRODUCTION

1.1. Background of the study

Soil erosion remain an important worldwide environmental impact for many centuries requiring more attention by individual, communities and the environment and its effects on food security and quality of life. Particularly land degradation due to soil erosion is multifaceted and dynamic problem that affects for sustainable resource management in today's developing world (Stringer, 2008). On average, one out of every three people on earth is in some way or the other affected by land degradation, estimates indicate that nearly 2 billion hectares of land worldwide are already seriously degraded, some irreversibly (FAO, 2010). Crop production must be improved to help meet the requirements of the growing world population. A major contribution to this improvement will be the capture and use of a greater portion of the limited and highly variable precipitation in dry land areas. Dry land farming technologies including water and soil conservation and management can increase water use efficiency, thus increasing yields and reducing the likelihood of crop failure. In agriculture dependent country like Ethiopia, integrated soil and water conservation is crucial in improving the livelihoods of the rural farm households. However, to realize the intended outcomes, agro-ecology specific technologies that are linked with natural resource management based income generating activities should be promoted (Yenealem Kassa, 2013).

Adoption of soil conservation technology reduces soil erosion and soil loss and also results in increasing quality and quantity of agricultural products thereby increasing household food security. Soil conservation as a way of solving problems of land degradation has been viewed through single decision of conservation practices that utilized single model of adoption in most research work (Ajala, 2001).

In Ethiopia a massive soil and water conservation (SWC) program was started during the 1970s and 1980s since then; different soil conserving technologies with a varied approach has been underway. The focus was on the highland areas of the country where the problem is threatening and food deficit is prevalent. The conservation efforts were mainly undertaken through Food-for-Work (FFW) program benefits (Abera, 2003).

1.2. Statement of the Problem

Many communities worldwide face serious environmental degradation, including deforestation, over grazing, soil erosion, over exploitation of bio diversity and water pollution problem which are certainly resulted from all associated with mismanagement of natural resource (Gomeje, 2014).

Ethiopia is one of the most environmentally troubled countries in the SubSaharan belt. The principal environmental problem in Ethiopia is land degradation in the form of soil erosion, gully formation, soil fertility loss and severe soil erosion (Hurni, 1993). Large parts of the highlands of Ethiopia are severely eroded. The vast majority of the population derives its livelihood from agricultural sectors. This is to mean that under conditions of subsistence agriculture, in both the densely populated highlands and sparsely populated lowland areas of the country, survival is solely linked to the exploitation of land (Gebremedin and Swinton, 2002).

Land degradation has been identified as one of the most serious problems that threaten the sustainability of agriculture in Ethiopia. In an effort to address these problems, the basic paradigm and approach to soil and water conservation has itself evolved over time. In recent years more holistic and land-scape wide approaches that go beyond resource conservation towards improved land husbandry and water management for beneficial conservation have been promoted using a national guideline known as Community Based Participatory Watershed Development, where its impact is yet to be seen (Yenealem Kassa, 2013).

Study conducted by (Tessema Endalkachew, 2011) in the highlands of Ethiopia, found that Soil degradation continues to be major threat of Ethiopian economy, since it is extremely dependent on agricultural sector, even though a number of soil and water conservation (SWC) methods were introduced and practiced. Rather mere coverage report in conservation structure constructed in different degraded parts of the region particularly in Bambasi woreda.

Therefore this study assess farmers' psychodynamics to participate on integrated soil and water conservations measure in Bambasi woreda, where the problem of land degradation and a number of intervention measures has taken place for several years.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of the study was to assess the farmers' psychodynamic factors to participate on integrated soil and water conservations measure in Bambasi woreda

1. To asses farmers' psychodynamic factors to participate on integrated soil and water conservations measure in Bambasi woreda

2. To assess the soil and water conservation measures predominantly used by small holder farmers in the study area

3. To assess the effectiveness of the existed integrated conservation measure in reducing soil erosion in the study area

1.4. Research Questions

Three research questions was developed to answer the factors affecting farmers' participation on integrated soil and water conservations measure in Bambasi woreda

1. What are the farmers' psychodynamic factors affect their participation on integrated soil and water conservations measure in Bambasi woreda

2. What are the soil and water conservation measures predominantly used by small holder farmers in the study area?

3. Are the existed integrated conservation measures effective in reducing soil erosion in the study area?

2. Conceptual Framework

Implementations of integrated SWC measure can be determined by different factors those are characteristics, institutional, Economic and Biophysical factors. Individual factor or a combination of these factors might influence the final decision-making process on whether or not to use soil SWC practices. Below the conceptual framework shows how these factors influence farmers' decision on use of SWC practices.

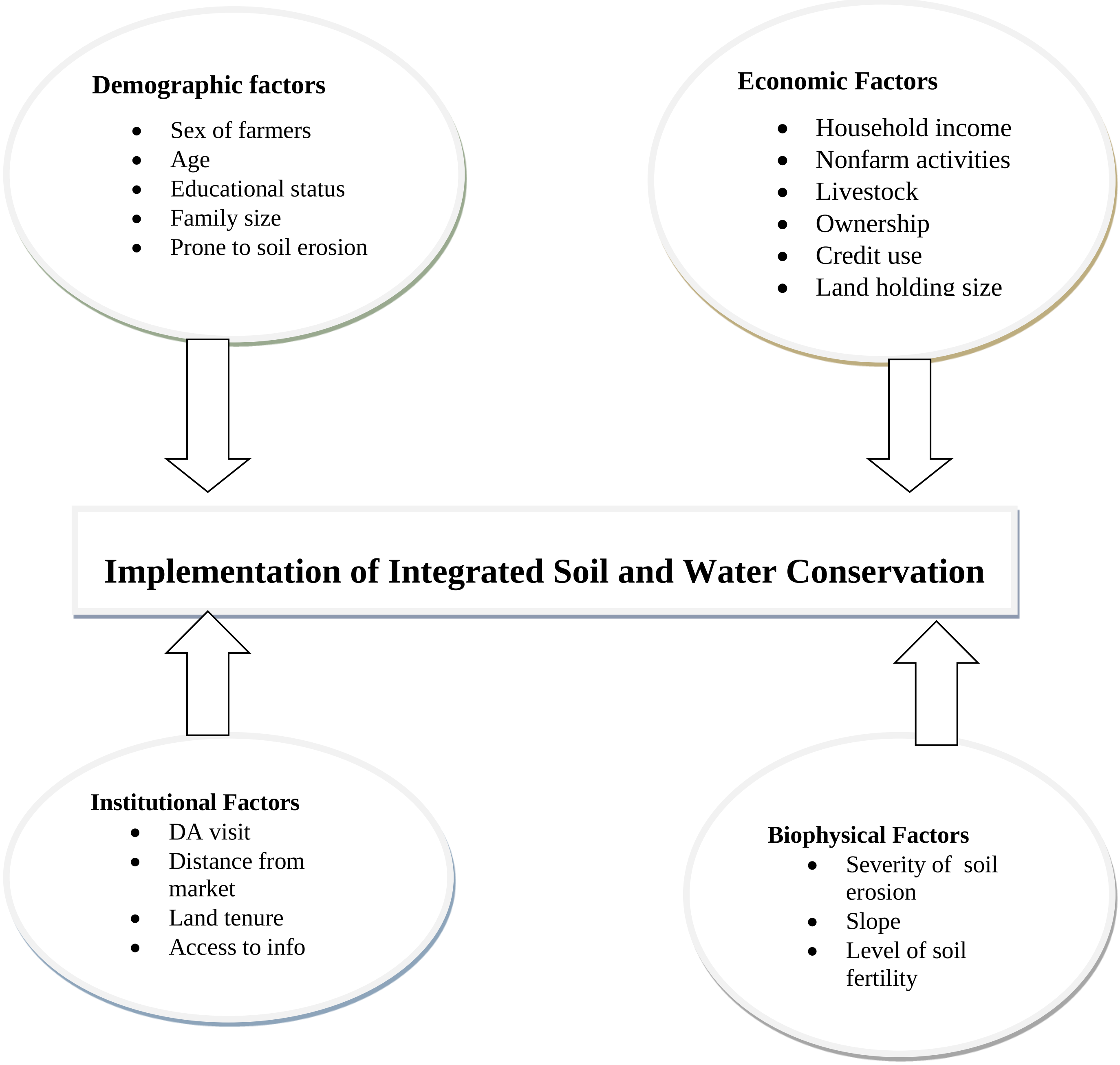
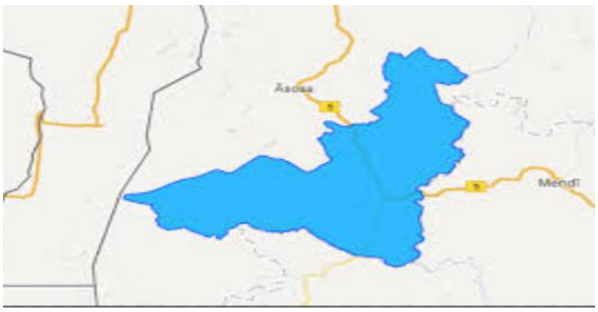


Figure 1: *Conceptual frame work*

Source: Author's compilation

3. Map of the study area

Figure: 1 *Map of the study area*



Source: SLMPII Report (2017)

3.1. Research Approach

For this study mixed approach will be used. Mixed methods is becoming increasingly articulated, attached to research practice, and recognized as the third major research approach or research paradigm. Mixed methods approach to research is an extension of rather than a replacement for the quantitative and qualitative approaches to research, as the latter two research approaches will continue to be useful and important. The purpose of the researcher using mixed methods is to draw from the strengths and minimize the weaknesses of the quantitative and qualitative research approaches.

3.2. Sampling Procedures and Techniques

3.2.1. Sampling Procedure

Purposive and Simple random sampling procedures were applied to select Woreda and kebeles and draw samples for the study populations respectively. Bambasi Woreda was purposively selected due to its accessibility and wide coverage of integrated soil and water conservation program and related to its time of program implementation. Similarly, Purposive sampling technique was used to select sample rural kebeles. The sample frame of the study was the entire household both program participant and non-participant found in the five kebeles in which integrated soil and water conservation program is practicing. Accordingly the identified kebeles are Amba16, Mender 45, Mender 46, Mender 47, Mender 48, Mender 49 and Sonka. By using probability proportional to size sampling technique, the sample sizes from each kebele were determined.

3.3. Sample Size and Sampling Frame

The sample size was determined using a simplified formula provided by Yamane (1967), as follows

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size or total household heads (3184) and e is the level of precision (.05).

When this formula is applied, we will get the following:

$$n = \frac{3184}{1+3184(.05)2} n=356$$

3.4. Data Source

3.4.1. Primary Data Source and Collection Methods

The primary data was collected through both quantitative and qualitative methods of data collection. The primary data were collection through; interview schedule, key informant (KI) interviews field observation and focus group discussion (FGD). To collect the necessary quantitative data like information on different household's characteristics and the impact of the integrated SWC on the livelihoods of small holder farmers' interview schedule were designed. The schedule was pre-tested before conducting the actual data collection.

3.4.2. Secondary Data Sources and Collection Methods

Secondary data were collected from published and unpublished sources to supplement the primary data. Mainly secondary data for this study was collected by reviewing previous researches, publications from the Ministry of Agriculture on integrated SWC program implementation manual, reports and publication by different NGOs like SLMP and GIZ.

3.5. Methods of Data Analysis

Both descriptive statistics and econometric models were applied to analyze the empirical data of the study. The quantitative primary data were coded and entered in to STATA version 12 was analyzed quantitatively. The qualitative primary data gathered through KI interviews, FGD and personal observation methods was analyzed qualitatively through careful translation and narrating into text form. The descriptive statistics and econometric model tools are outlined and discussed as a below.

3.5.1. Descriptive Statistics

Descriptive statistics like mean, percentages, standard deviation was used to describe the main characteristics of the sample respondents. Besides this, to check whether there is real difference between the treatment and control groups or not, t-test and Chi-square tests were used for continuous and dummy variables respectively.

3.5.2. Econometric Models

Binary responses (0 or 1) are modeled by using either binary logit or probit regression model. Gujarati (2004) pointed out that ignoring minor differences will let logit and probit models are quite similar, they usually generate predicted probabilities that are almost identical, though logit model is more preferred over the probit because it is simpler in estimation. In estimating propensity score, the study assessed preferred models and accordingly binary logit model found to be more appropriate.

Variables of Participation on SWC Measure and expected signs

Variables	Definition of variables	Value	Sign
Sex of farmers	sex of household farmer	1=male, 0=female	+
Age	Age of household farmer	Years /continuous	-
Educational status	Household head's education level	1= Literate 0=illiterate/ Dummy	+
Family size	Number of people in the family	Number /continuous	-
Prone to soil erosion	Farmer perception on erosion problem	1= yes 0=no/ Dummy	+
Household income	Income of household farmer	ETB /continuous	+
Nonfarm activities	HH Participation on nonfarm activities	1=yes, 0= no/ Dummy	-
TLU	Livestock Ownership of HH	TLU/Continuous	+
Credit use	Credit access for HH	1=yes, 0= no/Dummy	+
Land holding size	the total size of landholdings by the HH	Hectare /Continuous	-
DA visit	Frequency of contact of farmer with DA	Number/Continuous	+
Land tenure	HH land tenure security	1=Yes, 0=No	+
Access to media	HH access to information	1=Yes, =No	+
Distance from market	HH distance from market	In km /continuous	+
Severity of erosion	HH vulnerability to soil erosion	1= low 2= medium 3= high/Categorical	+
Slope	The natural setting of the land owned by HH	1=moderate 0= gentle/Dummy	+
Soil fertility	Level of soil fertility owned by the HH	1=Yes, 0=No	-

3.6. Empirical Review on cause of soil erosion and types of SWC measure

Slope affecting erosion

Erosion increases dramatically because the increased angle facilitates water flow and soil movement. Data for assessment of the effect of slope gradient and length on soil erosion is limited. However, it is generally accepted that an increase in slope and slope length will increase erosion because they lead to an increase in overland flow volume and velocity. Runoff on low slopes flows slowly and quickly forms a water layer deep enough to act as surface mulch. Increasing slope length enhances soil loss as more runoff can accumulate on long slopes. Thomas (1991) identified that slope shape together with ground/field attributes exercise a strong influence on the nature and extent of visible erosion damage.

Rainfall and wind affecting erosion

Water erosion may take several forms, which include raindrop splash erosion, sheet erosion, rill erosion, gully erosion, and stream bank erosion. A surface running water is responsible for the formation of sheet, rill, and gully erosion. The initiating mechanism for surface erosion is heavy rainfall, during which the impact energy of raindrops break up soil aggregates and causes detached particles to move laterally by splash action (UN, 1997). The extent of erosion is greatly affected by the size and impact energy of the rain drops, the soil structure, the steepness of the slope and particularly, on plant cover.

Soil erodibility

Soils vary in their resistance to erosion partly based on texture and amount of organic matter. The resistance also depends on soil condition and depth. Soils high in silt and low in clay and sand are highly erodible (Nill et al., 1996).

Nioils have high moisture storage capacity, a stable soil structure and hence are less susceptible to erosion than many other soils. Vertisols are characterized by their extensive cracking from the surface to depths of 50cm or more with the advance of the dry season (El Wakeel and Abiye, 1996).

Vegetation and land cover affecting erosion

Throughout the world, the lowest erosion rates, ranging from 0.004 to 0.5t/ha per year, are found in undisturbed forests (Pimentel et al. 1998). However, once forest land is converted to agriculture, erosion rates increase because of vegetation removal, overgrazing, and tilling. Vegetation cover reduces erosion by intercepting and dissipating rain drops and wind energy.

Land use affecting erosion

Tillage operations are sometimes carried out along slopes. Furrows formed along slopes cannot slow down runoff compared to those made along contours. Production of teff, the main cereal crop in the Oromia region, requires fine land preparation to allow the small teff seeds to germinate. However, fine till aging also makes the soil vulnerable to erosion during the early part of the main rainy season.

3.7. Types of Soil & Water Conservation measure

Terracing: Terracing is a technique employed on hillsides to create leveled ground. Terracing is commonly performed by stacking stones in successive walls along the contours of a hillside. Terracing requires a lot of labor with establishment and maintenance. Overtime, vegetative strips can also create terracing as sediments are deposited upslope.

Trenches& Berms: Trenches and berms are established along the contour of unleveled ground to form barriers which prevent water and soil from moving freely down slope. Trenches and berms are often paired together to enhance their function of slowing water and trapping sediment but are effective as separate SWC technologies. Over time, as more sediment is deposited upslope, these structures begin to look similar to terracing.

Check Dams: Check dams are barriers designed to prevent the widening and further erosion of trenches and gullies created from water erosion. Check dams are typically constructed from wood posts and forest residuals and/or stone but can be made from a variety of materials.

Applied Organics & Soil Bowls: Organic material provides soil nutrients and establishes cohesive soil structure that provides resistance to wind and water erosion. The most common forms of applied organics within the study areas included crop residues, compost, and animal manure.

Water Reservoirs: Water reservoirs are areas designated to store water from directing runoff from rain events.

Vegetation Strips & Contour Planting: Contour planting is the practice of planting crops, trees or shrubs along the contour of a slope.

Tree Planting: Many tree species provide soil stabilization for unleveled ground while supplying additional products and services, such as food, fodder, bee forage, shade and beautification, firewood, fencing, and construction material. Trees commonly used for SWC designs also affix, provide shade for coffee, and give mulch from their fallen leaves.

4. RESULT AND DISCUSSION

4.1. Demographic Characteristics of the Respondents

Variable		frequency		percentage		chi-2	p-value
		Particip	Non- Particip	Particip	Non- Particip		
Sex of HH	Male=1	151	133	85	75	0.0550	0.815 NS
	Female=0	27	45	15	25		
	Total	178	78	100	100		
	Illiterate=0	73	109	40	61	0.0257	0.873 NS

Educational Status	Literate=1	105	69	60	39		
	Total	178	178	100	100		
Marital Status	Married	110	66	84	62	0.755	0.685 NS
	Divorce	30	2	3	17		
	Widow	38	10	13	21		
	Total	178	178	100	100		
Total			356				

Source: Own Survey result, 2019

Demographic Characteristics of the Respondents

As table 4.1.shows that about 85% of household heads were male and 15% were female headed household who participant in SWC practice where as 75% of the households head was male and the remaining 25% were female headed household in non participant categories. The figure shows that the number of female headed household was few compared to male in both adopter and non-adopter categories. But compared to participant, non participant constitute relatively high number which may indicate that sex of house holed determine participation of farmers on SWC measure.

As illustrated in the above table 4.1 there was significant difference in educational status of participant and non participant that 40% and 60% of participant HH were illiterate and literate and 61% and 39% of non- participant HH was also illiterate and literate respectively. Thus majority of the participant HH were literate compared to non participant. From this we can generalize that when the educational status of the HH increase its probability to participate on SWC measure might also increase compared to non participant.

In the case of marital status 84% of participant and 62% of non- participant were married and followed by 13% in participant HH and 21% in the case of non- participant were widow respectively and the remaining 3% of participant and 17% of non- participant was divorced. Thus in both adopter and non-adopter case majority of the respondents were married. There was no single (not married) in both adopter and non adopter case. Thus it indicates that married HH were relatively stable and have highly engaged in SWC measure.

4.2. Soil erosion and conservation measure

Item		frequency		Percentage		chi-2	p-value
		Particip	Non-Particip	Particip	Non-Particip		
Prone to soil erosion	Yes =1	116	132	65	74	0.4	0.525 NS
	No =0	62	46	35	26		
	Total	178	178	100%	100%		
Severity of erosion	High	73	46	41	26	5.7	0.264 NS
	Medium	59	73	33	41		
	Low	46	59	26	33		
	Total	178	178	100%	100%		

Reason for erosion	Deforestation	30	85	17	48		0.534 NS
	Repeated Plowing	85	40	48	22		
	Deforestation + Repeated Plowing	40	23	22	13		
	Repeated Plowing + steepy slopy areas	23	30	13	17		
	Total	178	178	100%	100%		
Types of SWCT	Soil bund	73	-	41			0.000***
	Soil bund &grass	76	-	43			
	Terracing	29	-	16			
	Total	178		100%			
Appropriate ness of SWCT	Yes=1	140	-	79			
	No=0	38		21			
	Total	78		100%			
Slope	Steeper	23		13	19		
	Moderate	58	37	33	37	2.18	0.14 NS
	Gentle	97	41	54	44		
	Total	178	178	100%	100%		
factors affect adoption of SWCT	Socio- economic	114	-	64		2.63	0.27 NS
	Bio-physical	40	-	22			
	Technological	24	-	14			
	Total	178					
Total			178				

Source: Own Survey result, 2019

Descriptive analysis of soil erosion and conservation measure

As illustrated in the above table 4.5 about 65% of participant HH and 74% of non- participant HH was perceived that their farm land was prone to soil erosion whereas the remaining 35% of participant HH and 26% of non participant HH were perceived that their farm land was not prone to soil erosion. This may indicate that when the HH farm land were prone to soil erosion they may search other alternative work other than participating and implementing SWC measure on their farm land.

With regards to severity of erosion about 41%, 33% and 26% of participant HH and 26%, 41% and 33% of non- participant HH was respond high, medium and low respectively whereas in relation to the reason of erosion, 17%, 48% and 22% and 13 of participant HH and 48%, 22% and 13% and 17% of non- participant HH prioritize the reason of erosion as; deforestation, repeated plowing, deforestation &repeated plowing and repeated plowing and steep slope respectively. In relation to the first objective of the study i.e. the SWC technologies adopted by the respondents about 41% were participant HH soil bund and 43% were applied a combination of soil bund and grass strip at the same time whereas the remaining 16% was implemented terracing on their farm land.

The finding of focused group discussion and key informant interview also reveals that, farmers are adopting soil bund, soil bund and grass stripe and terracing on their individual land. Since the ecology of the study area is not surrounded by stone households' are not using stone bund but, on communal land peoples are constructing trench, soil bund, soil bund and grass stripe and terracing. Before the beginning of the SLM project households were advised to adopt different technologies like, check dam and gabion cutoff drains but, because of the topography of the land and rain situation, check dam and gabion cutoff drains were found to be inappropriate for the existed topography and rain situation and both of them are removed. During field observation the researcher also cheek and confirmed that households' are adopted soil bund, soil bund and grass stripe and terracing. But, on communal land peoples are constructing trench, soil bund, soil bund and grass stripe and terracing.

In relation to the appropriateness of the introduced SWC technologies about 79% were respond that they was appropriate whereas 21% replied that it were not appropriate and it is possible to conclude that there was no resistance from the farmers side against the participant HH of the newly introduced SWC technologies. With regard to the slope of the land about 13%,33%, and 54% of participant HH and 19%, 37% and 44% of non- participant HH, the slope of their land is characterized by steeper, moderate and gentle slope respectively. This may indicate that the topography of the land under investigation were not steeper slop which means the contributions of the topography of the land in exacerbating soil erosion through flooding is low. But it does not mean that there is no other exacerbating factor like repeated plowing, deforestation and free grazing have immense contributions in fastening soil erosion.

Adoption of SWC technologies was affected by different factors but in this study the major factors that affect participant HH of SWC technology practice was socio- economic factor which account about 64% followed by bio-physical factor which account around 22% and technical and technological factors which account 14% response as the main factor affecting adoption of SWC technologies in the surveyed kebele.

4.3. Qualitative analysis on Factors influencing farmers' participation on conservation measures

The findings of FG reveals wield fire as a factors affecting adoption of SWC technologies. Because of wield fire household's are not fully benefited from conserved fields. were the problem of fairness since adoption of SWC technologies require high number of labor force it was done through group, unfortunately some ketena has a lot of conservation structure on many of their field on the expensive of other the reason is that, kebele administrator are using their power and purposively selecting the peoples land to be conserved by the community since it is not possible to construct conservation individually at this time kebele administrator are biased in selecting the land direction to be conserved by the people.

The other factor is that project phase-out. SLMP were financially helping the people financially 16 birr per five meter soil bound construction this was encourage the people to participate in the SWCT practice because in one way the people understand the advantage of the program, on the other hand they are paid for their daily work according to their contribution to conservation structure. But currently since the project was phase out voluntary participation is highly reduced.

The other problem is migration that almost half of the people are live outside the kebele working in nonfarm activities at the same time they also have land in rural kebele to which they are paying tax for the government. Since they are living far from the kebele most of the time they are not able to participate in SWCT combined with the fragmented nature of the land exacerbated the problem of adoption of SWCT practice. Which means that since the land holding is fragmented adoption of SWCT practice by one farmer is meaningless because if his/her neighbor farmer is not adopt the technology, rather it exacerbate erosion. To reduce this problem some farmers are working for share cropping of their neighbors land.

Absent of strong woreda agricultural administrator who can supervise the program and able to motivate strong DA in the form of promotion is also another problem. The woreda agricultural office are criticized by DA as they are promoting DA that are not good in their performance only through relationship at the same time they are discouraging DA those who has good performance this make most of the DA not to motivate the farmer to adopt SWCT practice on their fields.

Figure: 4.1.*Field photos observing other factors*

4.4. Logistic estimation results for households' participation on SWC measure

Variable	Coef.	Std. Err.	z	P>|z|
Sex	.3753809	.4137544	0.91	0.364
Age of HH	-.0077905	.0164663	- 0.47	0.636
Education statues of HH	-.2686442	.2921788	- 0.92	0.358
Family size	- .0332649	.1077555	- 0.31	0.758
Distance from market	-.2844797	.0705369	- 4.03	0.000 ***
income of HH	0002737	.0000602	4.55	0.000 ***
Perception of HH to erosion	-.6832395	.8293904	-0.82	0.410
Severity of erosion	4966538	.2979985	1.67	0.096 * *
Credit use of HH	-1.817048	.4417079	- 4.11	0.000 ***
Total land of HH	.2283389	.1337473	1.71	0.088*
Media Access of HH	1.733257	.3150775	5.50	0.000 ***
Soil fertility of HH land	.7654205	.3124056	2.45	0.014 **

Number of obs = 356

LR chi2(12) = 167.55

Prob > chi2 = 0.0000

Log likelihood = -162.98377

Pseudo R2 = 0.3395

***, ** and * Significant at 1%, 5%and 10% levels respectively

Source: Own Survey result, 2019

4.5. Interpretation of the coefficients

The dependent variable used in the logistic regression is a dummy variable which value 1 if farmers have participated on adoption of SWC technology practice in Sustainable Management Program (SLMP) 0 if farmers have not participated on adoption of SWC technology practice. The independent variables were Sex of farmers, age, educational status, household size, distance from market, household income, severity of erosion, credit use, total land, access to media and soil fertility were exogenous variables in this model. Among those, household income, severity of erosion, credit use, total land, access to media and soil fertility were significantly and positively determined farmers participation on SWC measure whereas distance from market and perception on soil erosion were significantly but negatively determined farmers participation on SWC measure.

Household Income:- is a determinant factor for the household to participate or not in the SWC measures. The result of logit regression shows that, the variable was found having positive sign and statistical significance at 1% level of significance. The positive sign indicates the presence of positive relationship between total income and farmers to participate in adoption of SWC technologies practice. The result of this finding was contradict with the finding of Tkilil Wolde and Sisay Mekonen (2017) in which they found that wealthier farmers may have other resource options and less concerned about adopting SWC technologies

Severity of Erosion:- is also found to be one of the most crucial factors for a household to participate in SWC technologies practice. The variable is positive and statistically significant at 10% level of significance. This implies that, as compared to base reference or households head whose farm land soil erosion are medium , households head whose farm land soil erosion is high, are more likely to participate on SWC technologies keeping other variable remain constant. According to (Aberha 2008) farmers that suffer from severe gully erosion are more involved in conservation work because they had to conserve their soil from erosion and to prevent the total loss of the land. Farmers are more likely to maintain and replicate conservation measures on plots that are highly prone to soil erosion an (Bekele and Drake, 2003; Swinton, 2003).

Distance from market:- is also found to be one of the most crucial factors for a household to participate in SWC technologies practice. The variable is negative and statistically significant at 1% level of significance. This implies that, when households' head whose farm land is near to local market their probability to participate on SWC technologies were reduced keeping other variable remain constant. This might be resulted from that farmers might search other off farm activity on the nearby city.

Credit Use:- is a determinant factor for the household to participate or not in the SWC measures. The result of logit regression shows that, the variable was found having negative sign and statistical significance at 1% level of significance. The negative sign indicates the presence of negative relationship between credit use and farmers to participate in SWC measure. This might be expressed that when farms got credit they might be used for other nonfarm activity.

Land holding size is a very crucial factor in determining rural farmers' livelihoods, who primarily engage themselves in farm activities. Thus land holding size is also another determinant factor for the household to participate or not in the SWC measure. The land holding size has a negative sign in contradiction to the hypothesis and is statistically significant at 10% level of significance. This implies that when the household farms land is large it leads to the probability of farmers to participate in SWC measure ceteris paribus. This finding contradicts with the findings of (Tsegaye Feyissa, 2014) found that family size was negatively and significantly related to the adoption of SWC practices. The reason for the negative sign of land holding size for adoption might be that most of the farmer who has large household might participated on cultivating un cultivated fertile government land by traveling long distance from their village because they use the additional member of the household in keeping the field and product from domestic and wield animal distraction so instead of adopting SWC technologies in a highly fragmented land holding system. The FGD finding also reveal that for household those who have large number of household size, were participated on cultivating un used fertile land by traveling long distance.

Access to Media:- is a determinant factor for the household to participate or not in the SWC measures. The result of logit regression shows that, the variable was found having positive sign and statistical significance at 1% level of significance. The positive sign indicates the presence of positive relationship between access to media and farmers to participate in SWC measure. This might be expressed that when farms have media access they might be encourage to participate in soil and water conservation measure.

Soil Fertility:- is also found as a determinant factor for the household to participate or not in the SWC measures. The result of logit regression shows that, the variable was found having positive sign and statistical significance at 5% level of significance. The positive sign indicates the presence of positive relationship between soil fertility and farmers to participate in SWC measure. This might be expressed that when the farms farm land is low they might be encourage to participate in soil and water conservation measure to sustain the livelihoods their family.

4.6. The other factor found through FGD

The findings of FG reveals wield fire as a factors affecting adoption of SWC technologies. Because of wield fire household's are not fully benefited from conserved fields. were the problem of fairness since adoption of SWC technologies require high number of labor force it was done through group, unfortunately some ketena has a lot of conservation structure on many of their field on the expensive of other the reason is that, kebele administrator are using their power and purposively selecting the peoples land to be conserved by the community since it is not possible to construct conservation individually at this time kebele administrator are biased in selecting the land direction to be conserved by the people.

The other factor is that project phase-out. SLMP were financially helping the people financially 16 birr per five meter soil bound construction this was encourage the people to participate in the SWCT practice because in one way the people understand the advantage of the program, on the other hand they are paid for their daily work according to their contribution to conservation structure. But currently since the project was phase out voluntary participation is highly reduced.

The other problem is migration that almost half of the people are live outside the kebele working in nonfarm activities at the same time they also have land in rural kebele to which they are paying tax for the government. Since they are living far from the kebele most of the time they are not able to participate in SWCT combined with the fragmented nature of the land exacerbated the problem of adoption of SWCT practice. Which means that since the land holding is fragmented adoption of SWCT practice by one farmer is meaningless because if his/her neighbor farmer is not adopt the technology, rather it exacerbate erosion. To reduce this problem some farmers are working for share cropping of their neighbors land.

Absent of strong woreda agricultural administrator who can supervise the program and able to motivate strong DA in the form of promotion is also another problem. The woreda agricultural office are criticized by DA as they are promoting DA that are not good in their performance only through relationship at the same time they are discouraging DA those who has good performance this make most of the DA not to motivate the farmer to adopt SWCT practice on their fields.

5. Conclusions

The past development efforts to increase agricultural productivity of small farmers contributed to soil erosion and less successful in reserving soil erosion. Due to the cumulative effect of the land degradation problem, many small farmers in Ethiopia are increasingly incapable of producing enough food to satisfy household consumption.

The loss due to soil erosion in the form of declining agricultural productivity, amount of soil loss and quality decline accounts for a great economic and social losses. Despite its contribution, the emphasis given to the soil and water conservation activities in the study area is low compared to other rural development initiatives. Even though the country's Rural Development Policy and Strategy is thought to be relying up on proper utilization of land and labor together with proper management of natural resources in general and soil conservation in particular, in practice the achievement of the study district with respect to soil conservation is not appreciable. Lack of information and knowledge is considered to be one of the major obstacles for reducing land degradation, improving agricultural productivity, and facilitating the adoption of SLM among smallholder farmers (Liniger et al., 2011).

The finding of the study reveals that still there are a lot of households who are not participating in adoption of soil and water conservation technologies in sustainable land management program because of different reason.

Generally from the finding of the study it is possible to conclude that, in the study areas participation in soil and water conservation were exist. As a result households' are able to produce more and diversified their livelihood and food security status but, participation were constrained by highly fragmented nature of land holding system, migration, absence of motivated and committed development agent, lack of awareness and wield fire. So in order to fully adopt soil and water conservation technologies in sustainable land management program the above mentioned problem are need to be addressed in the future.

6. Recommendations

As per the finding of the study result of descriptive statistics and econometric model, the following recommendations are forwarded in order to enhance the adoption capacity of SWC technologies by the farmers and to strengthen rural livelihood and food security status of the households on the study area. On the basis of the survey results and literature reviewed, the following points were recommended.

- Policy research should be conducted adoption of soil and water conservation thecnologies in rural communities.
- With the support and coordination of regional agricultural office, woreda agricultural office and kebele administrator should solve the highly fragmented nature of land holding system problem in to one direction and manageable form in order to enhance the SWC technology adoption capacity of the farmer.
- Woreda agricultural office should refrain from discouraging and de-motivating the employed professional development agent by politicizing the program and they should motivate and encourage development agent
- Woreda agricultural office and kebele should create strong linkage with Assosa University College of agriculture in order to get support especially in the area of agricultural research that can increase the production and SWC technologies adoption capacity of the farmer.

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