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Support of Soil and Water Protection to Household Food Security: The Case of ChehaWoreda, Guraghe Zone of Southern Region, Ethiopia

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Abstract
A study was set out to investigate the assessment of the contribution of soil and water conservation to household food security in ChehaWoreda, Gurage Zone of Southern Region Ethiopia. A cross-sectional survey design was used for this specific study. The mixed research approach was employed. In this research stratified random sampling was used to select survey participants. Key informants focus group participants and observation sites were selected using purposive sampling. Data was collected from various sources using a questionnaire survey, key informant interview, focus group discussion and observation. Quantitative data were analyzed using descriptive statistics such as observed counts, frequencies, percentage, cross-tabulation, paired-samples t-test and one way ANOVA. The result revealed that as a coping strategy of solving these problem farmers used mechanical methods such as soil bund, stone bund, Fanyafuu, area closure, cut off drain, waterway, afforestation and terracing; and biological methods of soil and water conservation practices such as chemical fertilizer application, manure application, fallowing, crop rotation and crop residue. Although it is reported that household heads participated in the mechanical methods of soil and water conservation practices, there is a problem in the effective use of biological methods of practice as indicated by some of the farmers. Soil and water conservation has many contributions to household food security. Among these contributions are; increase in animal production, increased crop productivity and production, improved grazing land, increased job opportunities, improve the forest area and increase infrastructure accessibility. Soil and water conservation used to enhance the food security status of the household in the study area. But it needs the more effective use of biological methods of SWC practices and experienced experts.
Keywords: Soil, Water, soil degradation, erosion, conservation, Food Security
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1. Introduction

1.1. Background of the Study

Soil is one of the most essential resources for agriculture. Neely and Sara (2003) located that within the world, about 40% of agricultural land is extraordinarily degraded, of which 80% is because of soil erosion. Sanchez (2002) recognized that in recent decades on soil fertility and soil conservation across the world for you to offer sustainable solutions to the rising food and nutrition insecurity while keeping the natural resource base. As Fleitmann et al. (2007) located that soil erosion and land degradation threaten the food security of 2.6 billion human beings worldwide and; this situation is specifically dangerous in East and Sub-Saharan Africa, where according to capita meals manufacturing has declined during the last forty-five years. Erosion and the following loss of fertile soil is a key socio-monetary and ecological problem, affecting all critical sectors of the nation's economy (together with agriculture, manufacturing of hydropower, fisheries, tourism) and negative marine and terrestrial ecosystems. Hence, the utilization of soil calls for sustainable management.

Ethiopia is considered one of the developing nations in sub-Saharan Africa that highly depends on agriculture to fulfil the call for food, fiber and different goods, nevertheless, diminishing productivity, resulting from degradation of agricultural land caused by way of soil erosion, has been and is still a main given attention one (Admasu, 2005; Akllu and Graaff, 2006; Teshome, et.al 2012).

SNNPRsessential resources have been seriously threatened with the aid of human-caused soil and water degradation. Soil and water degradation is severe trouble that contributes to low agricultural productiveness and food security problems. It encompasses soil erosion, soil nutrient depletion, salinity, changes in soil shape and floor and underground water depletion. Soil erosion through runoff is the maximum serious hassle within the region which leads to soil fertility decline and as a result deteriorating productive capacity of the land. The top and fertile part of the land has been eroded by diverse agents in particular through wind and/or water. The nature of livelihood of the farming network coupled with topographic, soil and rainfall distribution behaviour worsen soil and water degradation in SNNPR as nicely as within us of a Panda 2007, referred to in Genene and Abiy (2014).

Like other parts of Ethiopia, south nation nationality peoples state (SNNPS) agricultural production is

dominated through rain-fed agriculture FDRE (2013). The area is heavily tormented by land degradation ensuing in food lack of confidence and rural poverty. Therefore, exploring the contribution of soil and water conservation to improve family meals protection is utmost important. However, the issue is not but studied in detail in the take a look at sites. Thus, the have a look at focuses on to assessing the contribution of soil and water conservation on household food protection in Chehaworeda, Gurage zone.

1.2. Statement of the Problem

In the world, approximately 1 to 1.five billion people are explicitly negatively suffering from land degradation. Healthy land ecosystems are crucial to sustainable development, but land degradation creates trouble including food insecurity and shortage of stepped forward livelihoods. The other effect of land degradation is it creates fast-growing of land prices, because of these it increases shortage of land and high yield prices, and eventually faced by the hassle of to achieve healthful land ecosystems those are crucial to sustainable development, including meal security and stepped forward livelihoods (ELD Initiative, 2013).

According to Holden et al. (2005) in Ethiopia, the time calls for to generate soil fertility is average almost 10 instances the rate of soil erosion and the country's estimated charge of soil nutrient depletion is some of the maxima in Sub-Saharan Africa. It also will increase the farmer's vulnerability to drought by reducing runoff penetration and soil moisture-protecting capacity. The combined effect of low productiveness and environment degradation lock the terrible in the vicious cycle of poverty and environmental degradation (ibid), so soil erosion has occurred due to either exertive utilization of land for communal or individual consumption. Despite the efforts to opposite environmental degradation in the beyond many years, vast degradation of herbal sources continued to be critical environmental trouble in Ethiopia distressing land agricultural productivity and lowering down economic change (FDRE, 2013).

Shebru (2010) diagnosed that the SNNPRs due to the increase of each human and livestock populations have been developing excessive land degradation problems. This situation not most effective undermines agricultural manufacturing capacity. But also it's far a threaten for the environmental sustainability of the region. Decline agricultural productiveness in highland has largely been associated with high population density, deforestation and multi cultivation of step-slops without effective conservation measures.

In ChehaWoredathere's land degradation problem due to natural and man-made activities. Mohammed (2011) performed a look at on the notion of the neighbourhood community in the direction of deforestation and also Mohammed (2014) studied on soil fertility popularity in the observed area. However, those researchers have not integrated the contribution of soil and water conservation practices for meals security. As a long way as the researcher know-how is concerned there is no research conducted in the observe area regarding the position of water and soil conservation for food security.

1.3. The objective of the Study

1.3.1. General Objective of the Study

The general objective of the study is to investigate the contribution of soil and water conservation to household food security.

The Specific objectives of the study

1. To explore soil and water conservation practices in the study area.
2. To assess the contribution of soil and water conservation practices to household food security in the study site.

1.4. Research Question

1. What are the mechanical and biological methods of soil and water conservation practices?
2. Do soil and water conservation practices contributed to household food security?

1.5. Scope/Delimitation of the Study

This study assessed the contribution of soil and water conservation practice to the household food security in particular and food security of the study area in general. The researcher assessed the study area that has three agro-ecology zones by selecting two Kebeles from each of lowland, midland and two highlands. In this study, the participants were sampled female and male-headed farmers, key informant interviewees and focus group discussants.

1.6. Significance of the Study

This research is intended to contribute as the baseline information in the study area. This particular study could serve as a baseline study for development intervention (e.g. awareness creation, capacity building, problem and technology prioritization) and further research in the issue of soil and water conservation impact on the livelihood of the farming community. Furthermore, the study could update the contribution of soil and water conservation practices to household food security in the study area.

1.7. Limitation of the Study

The study is limited to focus on the contribution of soil and water conservation practices to household food security. As a result, the quality of information gathered through a structured survey questionnaire depends on willingness, recalling capacity and knowledge of the respondents. The researcher has also faced financial limitation. In addition to these, the study suffers from material problems and shortage of time. In order to conduct a mixed form of research, there is a great deal of data collection involved that is more complex.

2. RESEARCH METHODOLOGY

2.1. Study Area

This study was conducted in Chehaworeda located about 185kms southeast of the capital city, Addis Ababa. Found between 8° 8'2" longitude and 37° 38' latitude. The altitude of the study district ranges from 1900m to 3000m a.s.l.

2.2. Research Design

In order to examine the research questions and the practical reality in the study site, the researchers have used the cross-sectional research design.

2.3. Sampling Procedure and Sample Size Determination

Stratified random sampling technique applied to select the six Kebeles of the study area, due to the presence of three agro-ecology, first differentiate each Kebeles respective agro-ecology then the researcher taken two Kebeles in each agro-ecology randomly. This is due to get the effective representation of the 39 rural kebeles of the study area. The last sampling technique used in the selection of the participant household heads in the survey assessment. Yemane (1967) provides an easy method to calculate sample sizes at a 95% level of a confidence interval, with a 0.05 level of precision. The sample size was determined as follows.

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

$$n = \frac{3240}{1 + 3240\ (0.05)^2}$$

$$n = \frac{3240}{1 + 32400\ (0.0025)}$$

$$n \approx 374$$

Where: n=Sample size

N=total population

e=Sampling Error

2.4. Data Type and Sources

The researcher used primary and secondary sources to find reliable and valid data. The primary sources were sampled household, the farm and natural resources management office of the *Woreda*, *Kebeles*and *Woreda* administration office. The secondary source of this study used published and unpublished documents such as articles, journals, internet, books, research papers, office documents and reports.

2.5. Method of Data Collection Procedures

Survey Questionnaire: - A structured survey questionnaire was prepared earlier to conduct the study so as to collect important data on the demographic, socio-cultural, economic and institutional characteristics of sample households.

Focus Group Discussion (FGD): - a checklist to collect helpful information was set and used.

Key Informant's Interview (KII):- individuals who are knowledgeable about soil and water conservation contacted and discussion was held with them.

3. RESULTS AND DISCUSSION

3.1. Physical Method of Soil and Water Conservation

3.1.1. Stone Bunds

Stone bunds are one of the physical methods of soil and water conservation practice to lessen and stop the velocity of runoff, soil erosion, and to increase soil fertility and crop yield. The respondents spoke back that 84.5%, 62.1% and 23.6% of highland, midland and lowland respectively as participated inside the stone bunds practices. In the examine area, stone bund became practised highly in the highland and midland part, this changed into because of the availability stone. Key informants said that stone bund is constructed by using stone and gabion as a height of 60-70cm up to100 cm and top width of 30-40 cm, and also this bund needs to be spaced difficult for animals to cross (see figure 1).

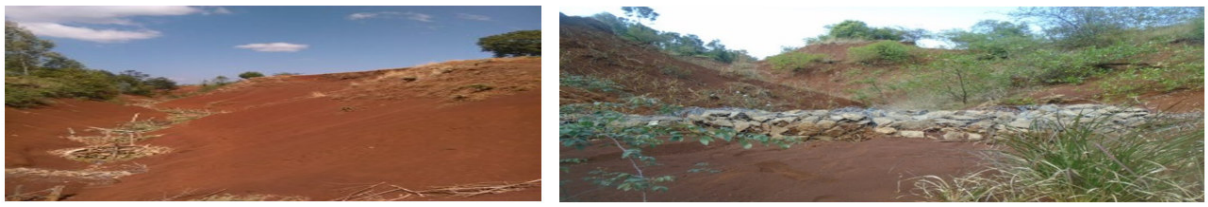

Figure 1: Gabion Structure to Conserve Soil and Water in the Study Area

3.1.2. Soil Bunds

Soil bunds are a physical construction of soil to boom infiltrations by decreasing the speed of runoff. As table1 below said that 85%, 56%, and 18.6% of the respondents in the highland, midland and lowland respectively of the replied as they have participated within the soil bunds practices. This suggests that soil bund is more practised in the highland and midland than lowland, because of the soil form of lowland is difficult to prevent soil erosion and its topography isn't always that much hard as compared with the 2 agro-ecology. Key informants explained that in the look area soil bunds were applied to cultivated lands with slopes above 3 -15% gradient and on grazing lands with mild slopes at wider intervals (as much as 5% slope). It can be carried out so on sloping farm regions blended with coins crops (see figure 2 below).

Figure 2: Soil Bunds Practice in the Study Area

3.1.3. Area Closure

Table 1 below shows that 78.2%, 47.8% and 34.3% of respondents in the highland, midland and lowland respectively were participated in the area closure to rehabilitate the degraded land. FGD participants' explained that the enclosed land stay was away from any human and animal intervention at least for four years. In some cases, they also protected and construct soil and water conservation structures such as soil bund, stone bund, Fanyajuu etc.

3.1.4. *Fanyajuu* (Gilbert Irken*)*

It is a physical method of soil and water conservation, which is similar to soil bund commonly constructed in a very steep slope land. It is basically used to slow down the runoff and allow to speculate within the farmland and increase soil moisture availability (see figure 3). 82.4%, 61.7% and 19.8% of respondents in the highland, midland and lowland were award about the benefit and practised *Fanyajuu*practices soil and water conservation method (see in table 1below). The key informant underlined that in the study area the majority of *Fanyajuu*is constructed from soil or soil strengthens with a stone rise in a collection of the channel.

Figure 3. The Practices of Fanyajuu in the Study Area.

3.1.5. Cutoff Drain

In Table1 show that in the study area 38.5%, 40.2% and 74.3% of highland, midland and lowland respectively participated in the cutoff drain of SWC practices. This soil and water conservation era have been broadly practised by using lowlander research sites. FGD participants in the lowland explained that cutoff drain became more effective than other soil and water conservation technologies inside the black soil kind to prevent the farmland from high excessive rainfall erosion.

3.1.6. Terracing

Table 1. shows that about 90.5% of highland, 53.7% of midland and 32.4% lowland of the respondents were participated in the different type of terracing to conserve soil and water in their farmland.

3.1.7. Waterways

In the research site especially lowland part in the rainy season, farmers used the waterway to remove excess water in their farmland. The survey result indicates that 28.4%, 38.6% and 80.2% of the highland, midland and lowland respectively were using the waterway to unlogged their farmland (see table 1 below).

3.2. Biological Methods of Soil Water Conservation Practices

3.2.1. Manuring

In the study area, the mixed farming system is a common one. As proportional most of the people were participate in Enset (false banana) production because of the common type of food is Kocho (a type of carbohydrate food produced from Enset production). Above 99% of the respondents were used livestock rearing, so this is used to improving Enset production. Manuring is the best practice especially to increase soil fertility of Enset area to increase its production. As stated in table 1. below that 90.5%, 38.3% and 35.6 of respondents highland, midland and lowland respectively used manuring to increase yield increment. Inconsistent with this finding Fikru (2009) which states that in Koga watershed farmers have increased the amount of manure applied because of the high price of inorganic fertilizers which the farmers cannot have enough money.

3.2.2. Crop Residues

Crop residues practices in the study area more practised in lowland than highland and midland. The quantitative result showed as 54.1%, 47.6% and 82.2% of highland, midland and lowland of the respondents use crop residues respectively (shown in table 1). This indicates that lowland area people are more use crop residue to protect their land from soil erosion and to increase soil fertility than the rest area of the woreda.

3.2.3. Crop rotation

As table 1 display that from the whole respondents of highland, midland and lowland 70.9%, 47.3% and 53.3% respectively participated in crop rotation. FGD participants emphasized because the farmers said that "if we sow inside the remaining year legumes, then inside the next 12 months we sow cereal crops. This is because of we have a scarcity of land the use of this land after stayed without crop production to growth it's fertility and by the use of this approach our yield productivity increased due to the boom of soil fertility". Consistent with the present-day finding, as stated by using Santra (2004) because the major benefit of crop rotation is that farmers can hold their fields underneath-stop manufacturing than letting they fallow. In addition, it reduces the need for synthetic fertilizers, pesticides and outbreak of diseases.

Table 1: Mechanical and Biological Methods of Soil and Water Conservation Practices.

Cases	Variables	Responses	Agro-ecology			
			Highland (%)	Midland (%)	Lowland (%)	Total (%)
A mechanical method of soil and water conservation	Participation in Soil bund	Yes	85	66.4	18.6	56.7
		No	15	33.6	81.4	43.3
	Participation in stone bund	Yes	84.5	62.1	23.6	57.7
		No	15.5	37.9	76.4	42.3
	Participation in terracing	Yes	90.1	53.7	32.4	57.7
		No	9.9	46.3	67.6	42.3
	Participation in area closure	Yes	78.2	47.8	34.3	53.4
		No	21.8	52.2	65.7	46.6
	Participation in Fanyajuu	Yes	82.4	61.7	19.8	54.6
		No	17.6	38.3	81.2	45.5
	Participation in Cutoff drain	Yes	38.5	40.2	74.3	51
		No	61.5	59.8	25.7	49
	Participation in water way	Yes	28.4	38.6	80.2	49
		No	71.6	61.4	19.8	51
Biological method of soil and water conservation	Participation in manuring	Yes	90.5	38.3	35.6	39.1
		No	9.5	61.7	64.4	60.9
	Participation in Crop residues	Yes	54.1	47.6	82.2	61.3
		No	45.9	52.4	17.8	38.7
	Participation in crop rotation	Yes	70.9	47.3	53.3	57.1
		No	29.1	52.7	46.7	42.9

Source: own computation, 2017

3.3. Contribution of Soil and Water Conservation to Household Food Security

3.3.1. Increase Crop Productivity and Production

Table 2: The Contribution of SWC in Improvement of Vegetation Cover.

Variable	Rate of change	Frequency	Per cent (%)
The contribution of SWC in the improvement of Vegetation Cover	No change	4	1.1
	Low improvement	21	5.9
	Medium improvement	162	45.5
	High improvement	169	47.5
	Total	356	100.0

Source: own computation, 2017

In table 2 above show that 45.5% and 47.5% of the participant stated that there area medium improvement and high improvement of vegetation cover respectively. And the rest 5.9% and 1.1% of the respondents were said that low improvement and no change respectively happen in the Cheha*Woreda*.

Table 3: The Difference Amount of Crop Productivity After the Implementation SWC Practice.

Crop types	Difference amount in kuntal (Di)	Square of Di	Difference in value (Di)
Barley	369.7	136678	276532.3
Wheat	239.1	57168.8	356921.1
Teff	190.7	36366.5	265436.9
Maize	539.3	290844.5	349433.1
Pea	30.9	954.8	48489.2
Enset	542	293764	29810
Potato	727.7	529547.3	312098.4
Total	2639.4	1345323.9	12101525.6
Mean of the Di	377.1	192189.129	1728789.4

Source: own computation, 2017

There is a significant difference in the amount of crop productivity by the household after the practices of SWC activities in the study area. There are also significant changes in the case of the value of crop production. So, the mean statically values crop production and productivity of the households improved by 377.1 quintals in number and 1728789.4 ETB in value the implementation of soil and water conservation practices. UNEP (2002) stated that soil degradation is one of the factors that contribute to increasing rural poverty and food insecurity, due to the reduction of productivity and subsistence farmers less and less able to accumulate reserves of grains(Table 3).

The correlation of the crop productivity between before and after the using of soil and water conservation were 0.965, 0.825, 0.987, 0.875, 0.925, 0.427 and 0.962 for Barley, Wheat, Teff, Maize, Pea, Enset and Potato respectively. This result showed that there was a strong correlation between Teff, Enset, Barley, Maize, Pea and Potato, but Wheat was a weak correlation in the before and after implementation of SWC practices(Table3).

Table 4: Paired Samples Correlations

Pairs	**Variables**	**DF**	**Correlation**	**Sig.**
Pair one	Enset production before and after the SWC practices.	311	.981	.01
Pair two	Barley production before and after the SWC practices	220	.959	.000
Pair three	Wheat production before and after the SWC practices	173	.426	.024
Pair four	Pea production before and after the SWC practices	34	.922	.000
Pair five	Maize production before and after the SWC practices	119	.872	.013
Pair six	Potato production before and after the SWC practices	151	.933	.000
Pair seven	Teff production before and after the SWC practices	138	.980	.000

According to the survey result as shown in table 4. in the study area there were significant difference between both crop production and productivity before and after applying soil and water conservation practices. Teff productivity before SWC implementation was M = 2.15 (SD = 1.55). By comparison after practices were implemented M = 3.53 (SD = 2.33), t(138) = -18.72, p< 0.01. Wheat, before SWC practices were achieved M = 2.51 (SD = 2.91), after the practices it was changed to M= 3.50 (SD = 2.17) and t (173) = -4.72, p = 0.024. In the case of Enstet productivity M = 116 (SD = 60.74) improved by the M= 138 (65.51) and t (311) = -30.65), p = 0.01. The mean of Barely productivity improved from M= 2.07 (SD = 2.91 to M = 3.75 (SD = 2.11) and t (220) =-29.96, p<0.01.

Maize productivity before SWC implementation M = 3.31 (SD = 2.51). By comparison after SWC practices its productivity was M = 7.84 (SD = 7.12), t (119) = -9.77, p = 0.013. The rest Pea and Potato were improved from M = 1.05 (SD = 0.63) and M = 2.38 (SD = 2.03) to M = 1.95 (SD = 0.95) and M = 7.20 (SD = 7.29), and also the t value as t (34) = -12.17, p<0.01 and t(151) = -10.91), p<0.01 respectively. So the t- test result shown that the hypothesis of before and after SWC practices associated with statically significantly different mean productivity

of crop yield on paired sample t-test was performed.

Table 5: Paired Sample T-test Statistics of crop production in the study

Pairs	Variables	Mean	DF	Std. Deviation
Pair one	The amount of Enset gets in a ha. before soil and water conservation involvement (in number).	116	311	60.74
	The amount of Enset gets in a ha. after soil and water conservation involvement (in number).	138.65	311	65.51
Pair two	The amount of Barley yield in a ha. before soil and water conservation involvement (quintal).	2.07	220	1.44
	The amount of Barley yield in a ha. after soil and water conservation involvement (quintal).	3.75	220	2.11
Pair three	The amount of Wheat yield in a ha. before soil and water conservation involvement (quintal).	2.51	173	2.91
	The amount of Wheat yield in a ha. after soil and water conservation involvement (quintal).	3.50	173	2.17
Pair four	The amount of Pea yield in a ha. before soil and water conservation involvement (quintal).	1.05	34	.63
	The amount of Pea yield in a ha. after soil and water conservation involvement (quintal).	1.95	34	.95
Pair five	The amount of Maize yield in a ha. before soil and water conservation involvement (quintal).	3.31	119	2.51
	The amount of Maize yield in a ha. after soil and water conservation involvement (quintal).	7.84	119	7.12
Pair six	The amount of Potato yield in a ha. before soil and water conservation involvement (quintal).	2.38	151	2.03
	The amount of Potato yield in a ha. after soil and water conservation involvement (quintal).	7.20	151	7.29
Pair seven	The amount of Teff yield in a ha. before soil and water conservation involvement (quintal).	2.15	138	1.55
	The amount of Teff yield in a ha. After soil and water conservation involvement (quintal).	3.53	138	2.33

Source: HH survey, 2017

As the survey data are shown in table 5 below, there were changes in the mean of crop yield before and after the practices implemented. The mean difference of Barely, Wheat, Teff, Maize, Pea, Enset and Potato were -1.68, -1.00, -1.38, -4.53, 0.91, -22.66 and -4.82 respectively. Even if there were a mean difference but it was not that much as a yield gain by performing effective soil and water conservation practices. This was due to the respondents used the application of chemical fertilizer but the quantity and way of application are not as directed by the experts.

Table 6: Paired Samples T-test of Crop Production.

Variables (pairs)	Df	T	Std. Deviation	Sig(2-tailed)	Paired Differences		
					Mean difference	95% Confidence Interval of the Difference	
						Lower	Upper
Barley production	220	-29.96	.83	.02	-1.68	-1.79	-1.57
Wheat production	173	-4.72	2.791	.025	-1.03	-1.42	-.58
Teff production	138	-18.72	.87	.000	-1.38	-1.53	-1.24
Maize production	119	-9.77	5.08	.000	-4.53	-5.45	-3.95
Pea production	34	-12.17	.44	.034	-0.91	-1.06	-.76
Enset production	311	-30.66	13.06	.045	-22.66	-24.15	-21.21
Potato production	151	-10.90	5.45	.000	-4.82	-5.69	-3.95

Source: HH survey, 2017

4.3.2. Increase Grazing Land

Table 7: The Contribution of SWC in the Improvement Grazing Land.

Variables	Agro-ecology						Total	
	Highland		Midland		Lowland			
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
No change	2	1.4	4	3.7	14	13.9	20	5.6
Low improvement	5	3.3	8	7.5	20	19.8	33	9.3
Medium improvement	49	33.1	49	45.8	35	34.6	133	37.4
High improvement	92	62.1	46	43	32	31.7	170	47.7
Total	148	100	107	100	101	100	356	100

Source: own computation, 2017

The data shows that in the three agro-ecology of the study area the improvement of grazing land was different. In the highland 1.4%, 3.3%, 33.1% and 62.1% were responded as no change, low improvement, medium improvement and high improvement respectively. In the case of midland 3.7%, 7.5%, 45.8% and 43% of the respondents replied as there was no change, low improvement, medium improvement and high improvement respectively. However, the data obtained from the respondent in the lowland there was some difference 13.9%, 19.9%, 34.6% and 31.7% replied as for no change, low improvement, medium improvement and high improvement respectively (table 7).

4.3.3. Increase Water Availability

Table 8: The Level of Water Availability Before and After the SWC Practices.

Variables	Frequency	Percentage
The level of water availability before the practice of SWC		
Low level	47	35.1
Medium level	184	51.7
High level	125	13.2
Total	356	100.0
The level of water availability after the practice of SWC		
Low level	12	3.4
Medium level	144	40.4
High level	200	56.2
Total	356	100

Source: own computation, 2017

In fact, water is a tool to improve the food security of the country as well as the world. The response of the respondents in the study area the level of water before practising soil and water conservation were 35.1%, 51.7% and 13.2% as low, medium and high level respectively. But in the case of water availability level, after soil and water conservation were 3.4%, 40.4% and 56.2% replied as low, medium and high level respectively present in their community(Table 8).

4.3.4. Increase Food Availability

Table 9: Food Availability of the Respondents Before and After the Practice.

Variables	Frequency	Percentage
The availability of food for the families in a day before the practice of SWC.		
One time	47	13.2
two times	275	77.2
three times	34	9.6
Total	356	100.0
The availability of food for the families in a day after the practice of SWC		
One time	4	1.1
two times	149	41.9
three times	203	57.0
Total	356	100.0

Source: own computation, 2017

The survey result of the household response shows in table 9 was 13.2%, 77.2% and 9.6% as one, two and three times respectively get the availability to eat food in a day before the implementation of SWC practices. In contrast to this after the implementation of the practice the availability of food to eat in a day was changed to 1.1%, 41.9% and 57% of the respondents as one, two and three times respectively. As table 9 show that there was a significant change in food availability, because of its ($p = 0.01$). The mean difference of 0.99, the standard

deviation of 0.84, t value of -22.22 at the degree of freedom of 355.

Table 10: Paired Sample T-test of Food Availability.

Variable	Paired Differences				
	Mean	Std. Deviation	T	Df	Sig. (2-tailed)
The change in food availability	-0.99	0.84	-22.22	355	0.01

Source: own computation, 2017

4. Conclusion and Recommendation

The focus of this study was to assess the contribution of soil and water conservation practices to household food security in Cheha*Woreda*. Female-headed households are lower in proration and their engagement in the soil and water conservation practices was lower than their counterparts. In the study sites across all agro-ecologies physical and biological soil conservation technologies has been implemented and farming household involvement in the SWC implementation has increased particularly in the last five years.

The contribution of SWC technologies for the increase of soil moisture, reduce erosion and increase agricultural productivity was encouraging. The majorities of households understand and participated with interest voluntarily. Soil bund, tracing, Fanyajuu, stone bund, area closure, waterways, cutoff drain, afforestation, crop rotation, crop residue, manuring and Chemical fertilizer application were among implemented SWC technologies. Development agents play a remarkable role in the awareness creation, supporting and advising farmers about the technical implementation and benefit of newly introduced technologies in the soil and water conservation.

In the study sites, natural and anthropogenic soil degradation barriers were responsible for soil degradation and water depletion. More specifically, high rainfall intensity, topographic nature and overgrazing were cause for soil degradation in the highland. Poor agricultural practices and overgrazing were causes of soil degradation in the lowland. In general, the researchers conclude that in the study sites soil and water conservation practices have been contributing to the increment of agricultural production and improvement of household food security.

Based on the result of this study, the following recommendations are given

- Even though the majority of farmers understand the benefit of SWC and participate voluntarily; still, there are some who are not willing to implement the technology. Hence, the local government and development agents should devise a strategy to aware about the benefits of SWC and introduce locally, culturally and environmentally accepted technologies.
- To achieve effective soil and water conservation technology, it must be done in accordance with guided by the correct guideline of the technology.
- If the way of chemical fertilizer application is guided by the expert, used to highly increases crop yield. But in the study area, most of the farmers used the application of chemical fertilizer in the traditional way. Hence, the kebele development agents should change the attitude of the farmers to use as guided by the experts.

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