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ASSESSMENTS OF FARMERS' PERCEPTION ON SOIL EROSION AND SOIL AND WATER CONSERVATION MEASURES: IN CASE OF ARSI NEGELE WOREDA, CENTRAL ETHIOPIA.

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ABSTRACT

This study was conducted in Arsi Negelle woreda of West Arsi Zone, Oromia regional state. The main objective of the study was to assess the farmer's perception on soil erosion and soil bunds construction and to assess the benefit obtained from soil bund construction in Arsi Negelle woreda. Three representative sites were selected purposively. The data was collected from three sites namely: lowland, midland and highland. 131-households were selected randomly from six kebeles. The analysis was carried using SPSS software. Both closed and open-ended types of questionnaires were used. The 50.4%, 44.3% and 5.3% of respondents were said that, major causes of soil erosion were absences of soil and water conservation and deforestation, absences of soil and water conservation and overgrazing and ploughing along slope respectively. The survey results showed that 63.4 % of sampled households were benefited (yield, moisture and soil fertility is increased) from practicing of soil and water conservation on their farmland, whereas 36.6 % of respondents said that they were not benefited from practicing of soil bund on their farmland. According to the survey result showed 37.4% and 26% of respondents were got technical advices concerning soil bund technologies from DAs and district Agricultural experts respectively. In conclusion, this study provided as soil bunds and soil erosion had significant effect in the study area.

Keywords: Soil bund, Soil erosion, SWC, Soil fertility

1. INTRODUCTION

Each year, in Ethiopia about 1.5 billion tons of top soil washed away from their original location (Hurni, 1987). The estimated annual loss of soil varies depending on land categories, whereas the highest loss reported for cropland, which is about $42 tha^{-1} yr^{-1}$ of soil. The contributing factors for soil erosion in most parts of the country are-poor agriculture activities (including intensive tillage, complete removal of crop residues, low levels of fertilizer application), lack of

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appropriate soil conservation measures and cropping practice (Abebayehu and Eyassu, 2011). Soil erosion is the main form of land degradation. Degradation resulting from soil erosion and nutrient depletion is one of the most challenging environmental problems in Ethiopia. The Ethiopian highlands have been experiencing declining soil fertility and severe soil erosion due to intensive farming on steep and fragile land.

In central rift valley of Ethiopia, soil erosion is a serious problem because of fragile and easily erodible soil. The land of Arsi Negelle is well known for the devastating soil erosion problem that has resulted in a decline in agricultural productivity in the region (Titola, 2008). Descorois, (2008) reported overgrazing, over-cultivation of cropland, deforestation, poor land use practices, improper management systems, and a lack of appropriate soil conservation measures as the predominant cause of land degradation and soil erosion resulted from poor management practices. Continuous cultivation with little protection measures exacerbated the level of soil erosion and hence land productivity had declined significantly and farmers were cultivating the land without giving more attention for soil maintenances. This caused the loss of top soil and reduced productivity capacity of the land and economy of the country. Thus, soil conservation measures are a necessary part of the system for combating erosion during critical times of the year and showed certain effect (Adimassu, 2012).

Soil and water conservation (SWC) measures have been practiced in Arsi Negelle Woreda for decades (from elder interviewed) as amelioration measures for soil erosion. The most important reason for limited use of SWC technologies is farmers' low adoption and awareness. Kessler (2006) considers SWC measures fully adopted only when their execution is sustained and fully integrated in the household's farming system. Previous studies show that various personal, economic, socio-institutional and bio-physical attributes have influential roles in farmers' decisions about the adoption of SWC measures in different areas of Ethiopia.

Soil and water conservation measures are used as amelioration measures, but sufficient research was not done on assessments of farmers' perception on soil erosion and soil and water conservation and impacts of soil erosion in the study area. Therefore, this research was conducted to assess farmers' opinion on the effect of soil erosion. Thus this research work was focused on assessing the perception of farmers on soil and water conservation measures, benefit obtained from soil bund construction in the study area.

1.1 General Objectives of study

- ✓ The general objective of this study was to assess farmers' perception on soil erosion and soil and water conservation measures and benefit obtained from soil and water conservation measures.

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1.2 Specific objectives

- To assess farmers' perception on soil and water conservation measures and soil erosion
- To assess the benefit obtained from soil and water conservation structures

2. MATERIALS AND METHODS

2.1 Description of the study area

The study was conducted at Arsi Negelle Woreda, which is located at 225 km south of the Addis Ababa. Geographically, it is situated in the central rift valley system between7^0 09'-7 ^{0}41' N longitude and 38 ^{0} 25'-38^0 54' E latitude (Fig.1). Arsi Negelle is bordered in the south by Shashamene woreda, in the southwest by Shala woreda, in the north by Adami Tullu and Jido Kombolcha with which it shares the shores of Lakes Abijata,Shala and Langano, and in the east by Arsi Zone (ORS, 2004).The Woreda has 43 rural and 3 urban kebeles.

The study area covers three agro-ecological zones. Namely:-lowland, midland and high land based on altitude. The altitude of the study area ranges from 1675 to 2300 meters above sea level. The high altitude zone occupies the largest area followed by mid and low altitude climatic zones.

Average annual temperature varies from 10 ^{o}C to 25 ^{o}C while the annual rainfall varies between 500-1000mm (ORS, 2004).

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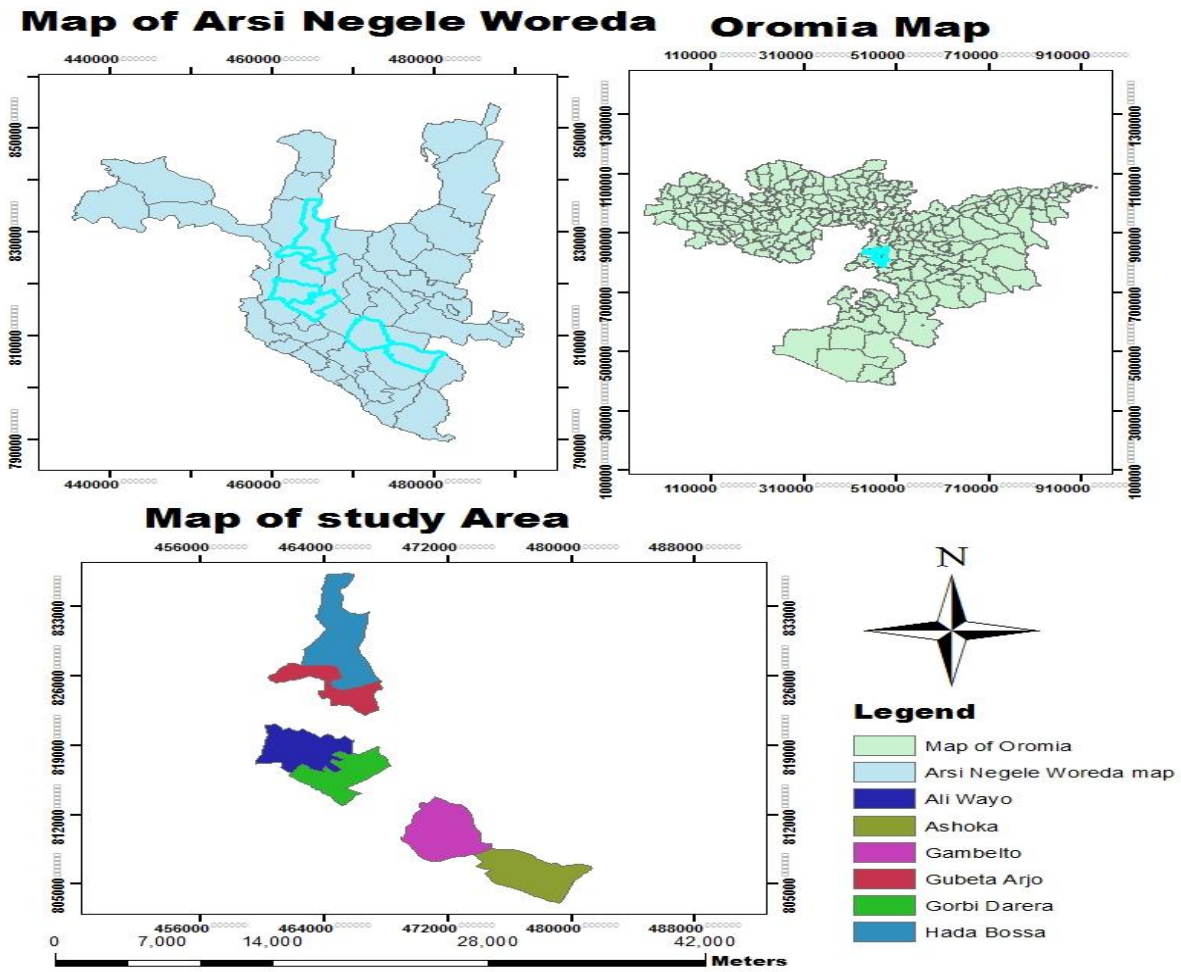

Figure 1: Arsi Negelle District map.

2.2 Experimental design and sampling

The three representative sites were selected purposively. A semi-structured questionnaire was prepared, covering interventions for improving or maintaining, and the effect of soil bund structures and was pre-tested before the actual interview was conducted. It was therefore possible to modify the questionnaire on the basis of the farmers' responses. Because the interview was conducted in the field, observation of the structures was important for improving understanding and explanation. In the first stage, Kebeles were grouped based on agro-ecology and a total of six kebeles were selected (two from each agro-ecology, namely: Hada Bosso, Gubeta Arjo, Gorbi Darera, Ali Woyyo, Ashoka, Gembelto) with total number of house hold head is 2331.

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Data were generated by means of a household survey, carried out by stratified random sampling. For this research work, the study stratified random sampling into three based on altitude. A multistage sampling procedure was employed to select the sample kebeles and farm households. Random sample of 131 sample households were selected randomly from six kebeles using a probability proportional to sample size sampling techniques in each kebele. In selecting sample respondents' simple random sampling technique was employed. In the second stage, the sample size was determined using a probability proportional to sample size-sampling technique in each kebele (Cochran, 1977 as cited in Bartlett, 2001), which is given by:

$$n_o = \frac{z^2 p(1-p)}{d^2}. \rightarrow n = \frac{n_o}{1+\frac{n_o}{N}} \text{.....} Eq.1$$

n_o = the desired sample size when population is greater than 10000

n =sample size of finite population correction factors, when population is less than 10000

Z = 95% confidence limit i.e.1.96

P = 0.1 proportion of population to be included in sample i.e. 10%

N = Total number of population

d = margin error or degree of accuracy desired (0.05)

Based on the Equation.1, the sample sizes of surveys were 131.

Table 1: Distribution of sample respondents by kebeles

Number	Kebeles	Total number of household heads	Sample size
1	Hada Bosso	420	24
2	Gubeta Arjo	400	23
3	Ali Woyyo	370	20
4	Gorbi Darera	330	18
5	Ashoka	431	25
6	Gambelto	380	21
	Total	**2331**	**131**

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Random sample of 131 sample households were selected randomly from six kebeles using a probability proportional to sample size sampling techniques in each kebele. Finally, quota sampling was used to randomly select sample household from a list of all farmers in each kebele.

During household survey, socioeconomic data were collected through a semi-structured questionnaire. Both closed and open-ended types of questionnaires were used. Data and information on their perception of farmers on trends of soil and water conservation (SWC), changes as result of practicing of soil and water conservation and farmers' perception on soil erosion and soil and water conservation structures were collected. Information obtained from the interview of households. The data collected were then analyzed descriptively by means of SPSS version 20.

3. RESULTS AND DISCUSSIONS

3.1 Demographic and Socio economic Characteristics of Sampled Households

Majority of sampled household (56.5%) were male headed while 43.5% were female head as observed in Figure 2. The age of sampled household heads 27-40 year was about 34.4%, 53.4% of the sample households were found in the age 40-60 years and 12.2% of sample household were found in the ages greater than 60 years.

In terms of literacy level, 20.6% of sampled households were unable to read and write, whereas 79.4% were literate. In this study area, literate households were more than unable to read and write. This implies that educated people could be positive significant in adoption technologies than unable to read and write. This finding was in consistence with the findings of Long (2003), Anley *(*2006) and Krishna (2008), who found a positive significant between education level of the households and adoption of improved soil and water conservation technology. One can conclude that as education level is important to understand benefit of soil and water conservation structures in a better way.

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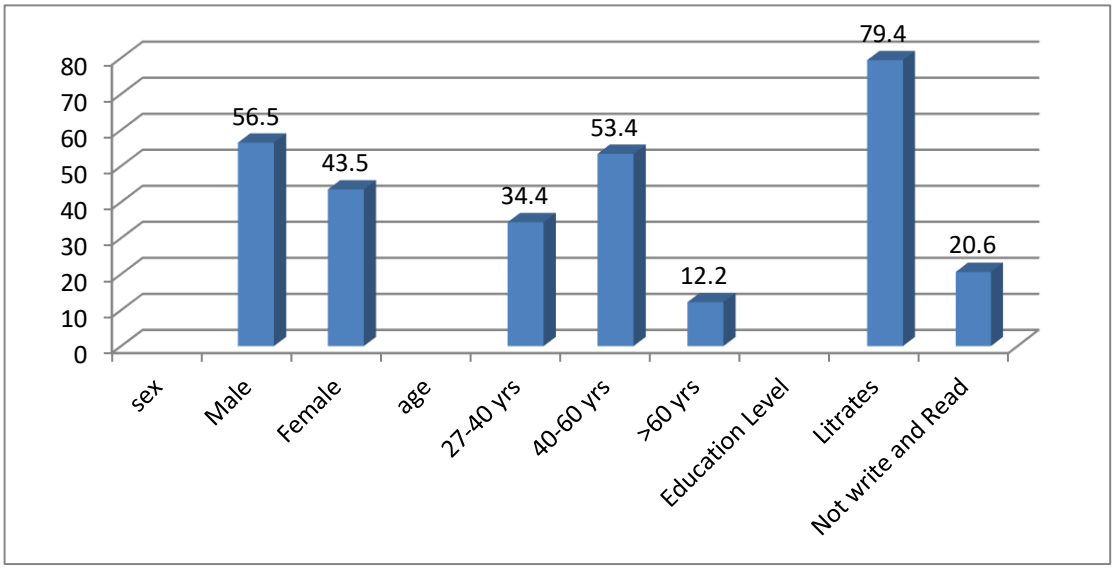

Fig. 2: Demographic and Socio economic characteristics of sample house holds

3.2 Cultivated land overtime

Majority of sampled household heads, which account 87.8% respondent, said that the size of agricultural land decreased over time and 12.2% said that no changes. I hypothesize that as population number increased the size of cultivated land was decreased. About 96.52% and 3.48% of respondent said that cultivated land was decreasing over time, because of population increasing shared their farm land to their children and families and land degradation and gully expansion respectively in Fig.3.The size of cultivated land shrinking/decreasing, due to increasing of population and shared to families and land degradation (CSA, 2008). These agree with my results and hypothesis.

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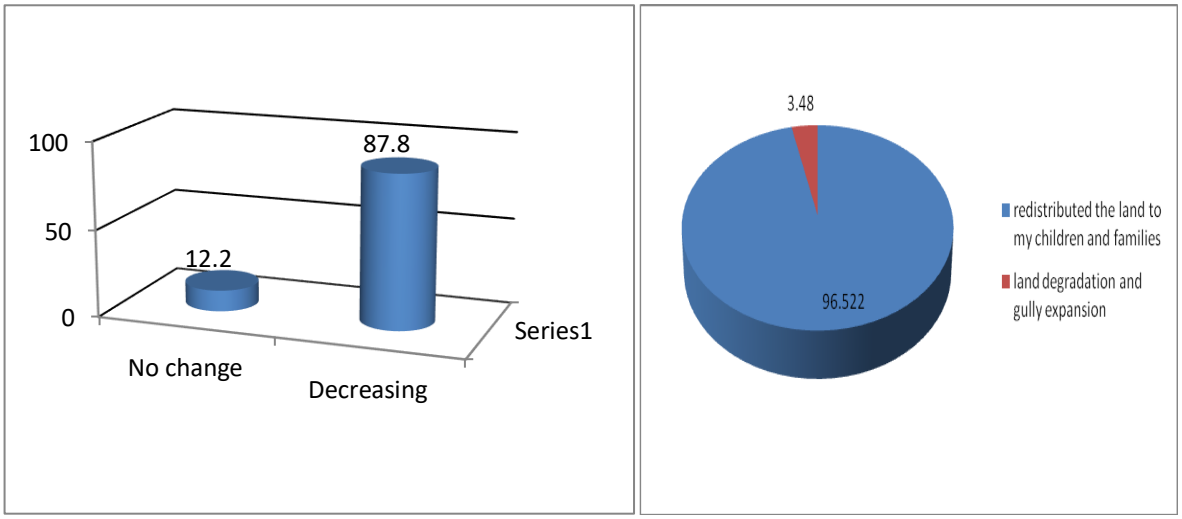

Figure 3: Cultivated land overtimes and the reason for decreasing cultivated land

3.3 Farmers' perception towards soil erosion problem

Perception of soil erosion problem is considered vital for farmers' conservation decisions. Soil erosion lowers the productivity of land by depleting its resources through various agents. Therefore, it is necessary to understand farmers' perception towards soil erosion and its impacts (Chizana, 2007). The 50.4%, 44.3% and 5.3% of respondents were said that, major causes of soil erosion were absences of soil and water conservation and deforestation, absences of soil and water conservation and overgrazing and ploughing along slope respectively (Fig 4). Theoretically, those farmers who perceive soil erosion as a problem having negative impacts on productivity and who expect positive returns from conservation are likely to decide in favor of adopting soil and water conservation measures (Gebremedhin and Swinton, 2003). On the other hand, when farmers do not acknowledge soil erosion as a problem, they would not expect to benefits from controlling erosion and it is highly likely that they will decide against adopting soil and water conservation structure. Many studies in Ethiopia attributed the widespread poverty, structural food insecurity and recurring famine partly to the environmental degradation problem in general and soil degradation in particular because of lack practicing soil and water conservation measures (Bewket, 2003).

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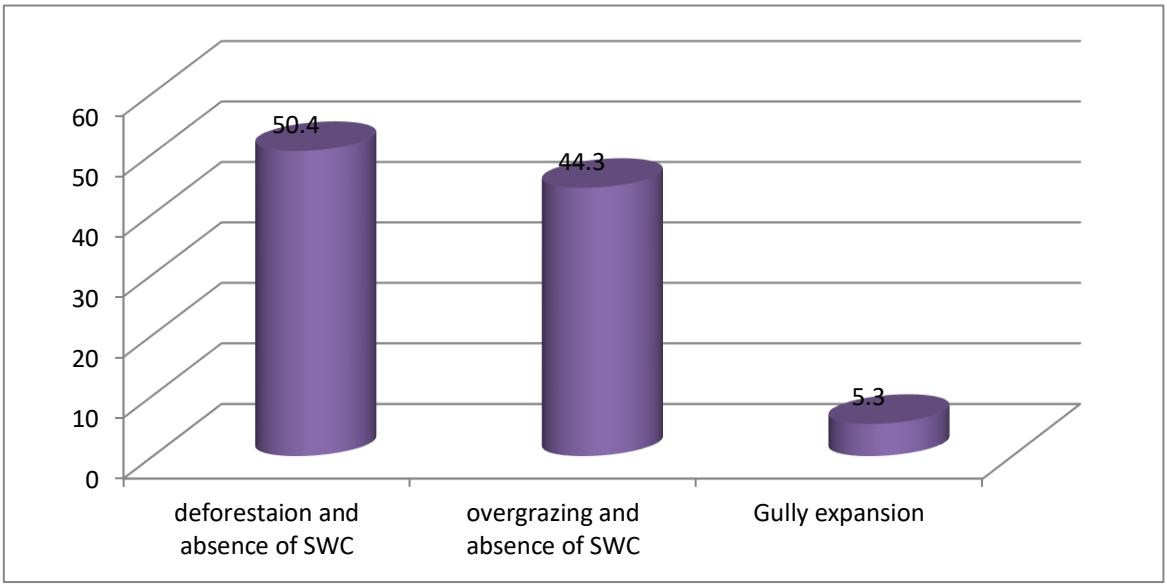

Figure 4: Major cause of soil erosion

3.4 Perception of farmers on soil and water conservation

3.4.1 Benefits obtained from soil bund

The survey results showed that 63.4 % of sampled households were benefited (yield, moisture and soil fertility is increased) from practicing of soil and water conservation on their farmland, whereas 36.6 % of respondents said that they were not benefited from practicing of soil bund on their farmland. This implied that most of respondents were know the benefit of the soil bunds. From field observation soil bunds were safely discharge excessive rainwater (Fig 5a).In contrary, on un-conserved farmlands, there were deeply incised erosion marks (Fig 5b). The households benefitted from the adaptation soil and water structures as they observed changes in soil fertility, land productivity and water holding capacity of soil. In a similar study in northern Ethiopia (Alemayehu, 2007), the majority of the interviewed farmers responded that terraces increased soil fertility, improved moisture status and increased crop yield. Furthermore, in the Gunono area of Wolaita in southern Ethiopia, 80% of the farmers were of the opinion that soil bunds increase yields (Esser, 2002). The study conducted by Nyssen (2006) in northern Ethiopia showed that 75.4% of the farmers were in favour of stone-bund building on their land, which is a clear indication that the local community perceives this conservation measure as beneficial. Another survey in Hagere Selam, Tigray by Esser (2002) also showed that 80% of farmers responded that investments in SWC were profitable, and 68% were of the opinion that conservation practices led to increased yields in normal years. Eleni (2008) also indicated that soil bund practices were

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widely acknowledged as being effective measures in arresting soil erosion, moisture and as having the potential to improve land productivity.

Figure 5: The benefit obtained from soil bund construction (a) and loss of soil from un-conserved plot (b)

3.4.2 Reasons of damaging soil bund on the farm land

As respondent said 38.2% soil bund that done on the farmland was completely or partially damaged because of hindered oxen ploughing, poorly designed and constructed, structures consumes space and put too much cultivable land out of production and 25.2% of respondent said that structures were damaged, because of structures consumes space and put too much cultivable land out of production. Whereas, 36.6 % of respondents were not practicing of soil bund on their farmland. The most dominant problem why the farmers completely removed or partially removed the soil bund from their farm land were hindered oxen ploughing, poorly designed and constructed, structures consumes space and put too much cultivable land out of production. Conservation structures need to be maintained regularly. Nevertheless, I observed from some fields that the practice of maintaining conservation structures is minimum and this eventually lead to the collapse of the structures.

3.5 Institutional Characteristics of Sampled Households

3.5.1 Extension services on soil and water conservation activities

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Technical advices were important for constructing soil bund structures. As the survey result, showed 63.4% of respondents were got technical advices concerning soil bund technologies from DAs and district Agricultural experts. Whereas, 36.6% of respondents were not got technical advices concerning soil bund (SWC) technologies (table). Training is an important aspect of disseminating a given agricultural technology. It equips farmers with new knowledge and skills, which help them to perform new practice properly.

The contact between farmers, DAs and agricultural experts were important to accept the technologies. Thus, as survey result showed that 48.1% of respondents were said that the contact is good, 18.3% of respondents were said that the contact is limited and 33.6% of respondents said that no contact. Most of respondents were a good contact between farmers, DAs and agricultural experts. Extension advice was important to overcome soil erosion problem and understanding the benefit of soil bund or SWC structures. This agrees with priori expectation and confirms the study conducted by Anley (2006), who found that level of extension visit were important variables affecting the probability and intensity of using improved soil bund technologies. When there is a good contact with extension agent, the greater is the probability of farmers being influenced to adopt agricultural innovations. Similarly, Bekele and Drake (2003), Kipsat (2007), Sisay (2009), and Petros (2010) were reported that farm households who have close contact with development agents have positive relation with adoption soil and water conservation practices which results from effective dissemination of SWC information to the farmers.

Table 2: Institutional Characteristics of Sample Households

From where did you get technical advice concerning SWC technologies	Frequency	Percent (%)
DAs and district experts	83	63.4
no technical advice	48	36.6
How do you describe the contact you have with Das		
No contact	44	33.6
Limited	24	18.3
Good	63	48.1
Total	131	100.0

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4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The study area, due to fragile ecosystem and inherent erodable nature of the soils, location in the rift valley, population pressure, deforestation and overgrazing coupled with unsound land management system have been contributed for severe land degradation and soil erosion. Thus this research work was focused on identify the benefits of soil bunds structures and its impact on soil physical and chemical properties and assessing the perception of farmers on soil bund structure and soil erosion in the study area.

Not only construction of this structure is not enough, it should be maintained. The DAs and agricultural experts should taught the farmers on the benefits of soil bund structure on soil properties and effects of soil erosion on soil properties and productivity in the absence of soil bund on the farm land. The age, education level and extension services have a positive impact on understanding the impact of soil erosion and adopt soil bund technologies. The districts agricultural experts and DAs do not impose the farmers in some villages in order to do soil bund structure on their farmland. Thus, the technology that was applied without willingness of farmers or to fill quota did not meaning fully even it was important. Development strategy and program interventions designed to enhance agricultural productivity through promoting soil bund in land management in the study area need to take in to account. In generally, the soil bund construction a mandatory to obtain sustainable development unless the fertility of soil is eroded and the land became degraded.

4.2 Recommendations

- The soil and water conservation should be recommended to reduce soil from loss.
- Field visit is recommended in order to assess the status of structures and training is necessary to understand more about soil erosion and benefit of soil bund.
- Awareness creation should be provided to community at every schedule time.
- Make the community to participate from identifying problem to the benefit obtained by doing soil and water conservation measures and did not enforce the farmers to construct soil and water conservation structures. The farmers must do the conservation measures by their interest unless the work will be unsustainable.
- In general, the future study should be focused on impact of soil erosion and soil and water conservation on soil properties and crop production.

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REFERENCES

Abebayehu A and Eyassu E.2011. Soil nutrient Stock Evaluation under different land use types in the smallholder farming systems of Jimma Zone, Ethiopia International Journal of Agricultural Research 6(9);707-713.

Adimassu, Z., Mekonnen, K., Yirga, C. and Kessler, A. 2012a. The effect of soil bunds on runoff, losses of soil and nutrients, and crop yield in the central highlands of Ethiopia. Land Degradation & Development. DOI: 10.1002/ldr.2182.

Alemayehu, A. (2007). *Impact of Terrace Development and Management on Soil Properties in Anjeni Area, West Gojam*. Addis Ababa University. Retrieved from

Aklilu Amsalu and J. Graaff, 2006. Farmers Views of Soil Erosion Problems and their Conservation Knowledge at Beressa Watershed, Central Highland of Ethiopia.

Anley, Y., Bogale, A., and Haile-Gabriel, A. 2006. "Adoption decision and use intensity of soil and water conservation measures by smallholder subsistence farmers in Dedo District, Western Ethiopia", Land Degradation & Development, 18 (3): 289-302

Bartlett, J. E., Joe W., Kotrlik and Chadwick, C., Higgins. 2001. Organizational Research: Determining Appropriate Sample Size in Survey Research, Information Technology, Learning, and Performance Journal, 19 (1):43-50.

Bekele, W., and Drake, L. 2003. Soil and Water Conservation Decision of Subsistence Farmers in the Eastern Highlands of Ethiopia: a Case study of the Hunde-Lafto. Ecological Economics 46(3): 437–451.

Bewket, W.2003. Land Degradation and Farmers' Acceptance and Adoption of Conservation Technologies in the Digil Watershed, Northwestern Highlands Ethiopia. Social Science Research Report Series 29:1-57. Addis Ababa.

Chizana, C.T., Mapfumo, P., Albrecht, A., Van Wijk, M. and Giller, K., 2007. Smallholder farmers perceptions on land degradation and soil erosion in Zimbabwe. African Crop Science Conference Proceedings 5, 1485-1490.

CSA, 2008. Agricultural Sample Survey 2007/08, Addis Ababa, Ethiopia. Available at: http://www.csa.gov.et/available%20survey.htm

ISSN: 2455-6939

Volume:04, Issue:04 "July-August 2018"

Descorois L., Barrios G., Viramontes D., Poulenard J., Anaya E., Esteves M., Estrada J., 2008. Gully and sheet erosion on sub-tropical mountain slopes: Their respective roles and the scale effect. Science Direct 72 325-339.

Eleni Tesfaye (2008).Determinants for Continued Use of Soil and Water Conservation Practi ce: The Case of Productive Safety Net Program in Tulla District, Ethiopia.

Esser, K. (2002). Soil Conservation in Tigray, Ethiopia. Agricultural University of Norway.

Gebremedhin, B., and Swinton, S.M. 2003. Investment in soil conservation in Northern Ethiopia: The role of land tenure and public programs. Agricultural Economics, 29(1): 69-84.

Hurni, H. (1987). Applied soil conservation in Ethiopia. Department of Agricultural Engineering, Nairobi University, Kenya. 15 pp.

Kessler, CA (2006) Decisive key factors influencing farm households' soil and water conservation investments. Applied Geography 26:40–60.

Kipsat, M.J., Okalebo, P.M., Nyangweso, M.K., Krir, A.K., Serm, H.K., Martim, and B.J., Kanule.2007. Factors affecting farmers' decision to abandon Soil conservation once external support cease. The case of Kericho District, Kenya. African Crop Science Conference Proceedings vol.8. Pp.1377-1381

Krishana, R., Bicol, K., Ingrid, 1. P., and Giridhari, S. 2008. Determinants of Farmers adoption of improved soil conservation technology in a Middle Mountain watershed of Central Nepal. Environmental Management. Springer New York.

Long, L. 2003. Conservation Practices Adoption by Agricultural Land Owners. PhD Dissertation. Northern Illinois University.117p.

Nyssen J, Poesen J, Veyret-Picot M (2006) Assessment of gully erosion rates through interviews and measurements: A case study from northern Ethiopia. Earth Surface Process and Landforms 3:167–185.

Petros T (2010). Adoption of Conservation tillage technologies in Metema Woreda, North Gondar Zone, Ethiopia. An M.Sc.Thesis Presented to School of Graduate Studies of Haramaya University.102p.

ORS (2004).The Oromia Regional State government: Socio Economic Profile of East Shoa Zone.

ISSN: 2455-6939

Volume:04, Issue:04 "July-August 2018"

Sisay, B .2009. Factors Affecting the Adoption of Soil and water conservation practices in North Ethiopia. An M.A Thesis Presented to School of Graduate Studies of Addis Ababa University.93p.

Titola T (2008. Environmental degradation and its implications for agricultural and rural development: The issue of land erosion. Journal of Sustainable Development in Africa, 10(2):131

