

# Soil Degradation and Conservation Practices: the case of Darimu and Chewaka woredas, Illu Ababora Zone, Ethiopia

Mengie Belayneh \*, Alemayehu Abera \*, Gashahun Tadesse \*

\* Lecturers at Department of Geography and Environmental Studies, faculty of Social sciences and Humanities, Mettu University, Mettu, Ethiopia

**Abstract-** This study was aimed to assess soil degradation and conservation practices in Darimu and Chewaka Woredas of Illu Ababora Zone. Through purposive and simple random sampling methods a total of 331 respondents were selected from the woredas. To achieve the objectives of the study both qualitative and quantitative methods of data analysis were used. Descriptive statistics such as percentage distribution, bar graphs, charts, tables were used and more of qualitative analysis was used. According to the major findings of the study, the major factors that exposed the area for soil erosion was topography, land use/cover change, continuous farming without fallowing, population pressure, attitude and perception of farmers, knowledge and use of soil conservation practices. The survey result reveals that there are various indigenous and adopted soil conservation practices in the area. Among these, fallowing, manure, contour plowing, crop rotation, waterways are indigenous soil conservation practices and terracing, soil bund, fugn juu, grass strip, chomo grass and elephant grass are some of the adopted soil conservation practices. The result of the study also reveals that the major challenges of adopting structural soil conservation mechanisms in the area includes; geographical aspect, land tenure, educational level, farmer access to extension services, sex of the household, awareness of farmers about soil conservation methods and off farm activities. Finally, suggestions have been forwarded based on the findings of the study.

**Index Terms-** Indigenous Conservation, Soil Erosion, Structural Conservation,

## I. INTRODUCTION

### Background of the study

The natural environment consists of various valuable natural resources such as air, water, soil, land, forest, flora and fauna which are basic for human life and development. Any change brought about in one of these components is counter balanced by some other changes in another component of the environment (Agele et al, 2000). In order to withstand such changes a wide range of techniques of natural resources management (NRM) have been used. Nonetheless, degradation of soils and other natural resources proceeds at a high rate in much of Africa, reflecting low rates of adoption of sustainable NRM strategies, especially among the poorer subpopulation of smallholder producers (Kassie et al., 2008).

Soil is the most important natural resource all over the world. It is a place from which human beings are exploiting a

number of crops (Taffa, 2002). Soil which is an integrated part of vegetation is the immediate focus of most local, regional, and international protocols, and conferences that are meant to pave the way to sustainable development. Farmlands are the components and homelands of the basic natural resources of the globe and in which the various ecosystems interact with their environment. Thus, soil resource management significantly determines the sustainability of NRM, and agricultural practices and productivities of a country, mainly where agriculture is the leading economic activity like in Africa in general and Ethiopia in particular.

The soil is the soul of a farm. Proper soil management will maximize forage and crop production. However, this precious resource, mainly in the developing world, has been deteriorated and lost in an alarming rate as a result of poor management practices (Yohanis, 1989). In Ethiopia soil resource degradation has become a serious problem affecting all spheres of social, economic and political life of the population. It is one of the major challenges to agricultural development and food security of the country. Such problem is also common in the case of Darimu and Chewaka woredas' which are one of the victims of the problem. In light of this, it is important to assess practices and aspects of adopting structural soil conservation techniques in Darimu and Chewaka district.

### 1.2. Statement of the Problem

Soil is an important resource, which needs much attention in its use and management. It is the soil which nourishes and provides with required needs for the whole of nature. In Ethiopia soil conservation has been carried out with limited success. There is less-willingness to accept and maintain the extensively introduced practices of soil conservation. Besides, soil erosion is a major contributor to the prevailing food insecurity of Ethiopia. Thus, soil conservation is vital to the achievement of food security, poverty reduction and environmental sustainability in the country (Woldeamlak, 2007). Soil resource degradation is one of the major challenges in agricultural production in many parts of the world, especially in developing nations, such as Ethiopia in general and Darimu and Chewaka woreda in particular.

Darimu and Chewaka are one of the 180 woredas in Oromia Region of Ethiopia. A large part of the woredas' land is exposed to severe soil erosion, land fragmentation, deforestation and land pressure. As a result, the soil becomes unable to satisfy the rapidly growing demands of population. The district has been exploited and degraded continuously. As a result, majority of rural inhabitants are suffering from food insecurity. This is

mainly because of that the soil is incapable to support cultivation caused by soil erosion and its related problems. In the area, erosion problems and measures to tackle were rarely investigated. Although structural soil conservation methods are widely represented as having significant environmental, economic, social and political benefits for both individual landholders and the wider community, adoption of such measures is commonly perceived to be slow. Consequently, severe erosion continues to affect the farmers' livelihoods. The rich top-soils have been washed off by runoff and the remaining sub-soils are exposed and generally deficient in available minerals. The study areas are characterized by steep and undulating terrain and susceptible to soil erosion. The area also receives heavy rain, which is concentrated in few months of the year. Hence, the main objective of the study was to assess soil

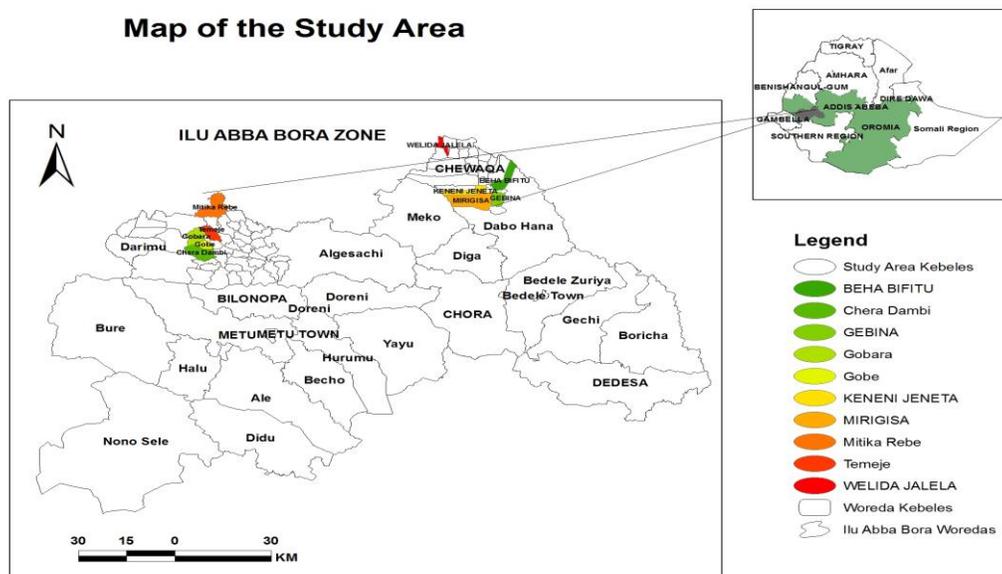
degradation and conservation practices in Darimu and Chewaka Woredas of Illu Ababora Zone.

## II. MATERIALS AND METHODS

### 1.1. Study Area description

The study was conducted in Oromia Regional state, Illu Abba Bora zone, in Darimu and Chewaka woredas. Specifically, the study was carried out in the ten selected rural kebeles of the Darimu and Chewaka woredas (i.e 5 kebeles from Each Woreda). Chewaka and Darimu woreda is located in the south western of Oromia regional state, Illu Ababora Zone. Chweaka is located 190 kms from zonal town (Mettu town).

Figure 1: Administrative map of the study area



Source: Ethio GIS and CSA, 2007

### 1.2. Research Design

The particular research design employed for this study will be descriptive type of study utilizing survey method. This is because the study requires description of how the response of households looks like in light of contemporary environmental problems.

### 1.3. Sample Size and Sampling Techniques

In this study, two types of sampling techniques were employed. These were purposive and stratified random sampling methods. Darimu and Chewaka woreda were purposefully selected as a research setting due to the fact that there are severe soil resource degradation problems in the districts, especially in the ten kebeles of the Woredas. In addition to this, in the area, research works are very little and there are no studies done so far on such issues in the area. Consequently, the study was partially intended to fill this gap. Purposive selection of the topic is due to the fact that in order to ensure sustainable soil resource conservation in the woreda, assessing such issue is important from development perspectives.

In order to obtain the sampling units or respondents the researchers' employed stratified simple random sampling

method. Because it was believed that this method would not affect the representation of the samples as Head of households represent from each kebeles and this method gives equal chance of being selected for each households. Head of Households will be stratified according to their *goti* to conduct the survey in the area. All in total 331 of the total Household heads /respondents of the total head of the households will be randomly selected by applying proportional sample allocation method from the "*gotis*."

The sample size in each stratum is proportional to the size of stratum. This was determined by the following formula:  

$$nh = (Nh / N) \times n$$
 where,  $nh$  = Sample size of the stratum  
 $Nh$  = Total population of the stratum  
 $N$  = Total population (i.e. total HHs)

$n$  = Total sample size  
 Source: (Kothari, 2004)

### 1.4. Data Sources and collection instruments

In order to get reliable and valid data so as to achieve the objectives of the study, the researchers collected data from both

primary and secondary sources. The primary data were collected through household survey questionnaire, interview, field observation and Focus Group Discussion (FGD). To supplement the primary data, secondary sources of data were collected from various documents, books, journals, reports, electronic media (internet), etc. To collect primary data for the study, the researchers used above mentioned data collection instruments for their own advantage one over the other and for the purpose of their complementarities.

### 1.5. Method of data Analysis

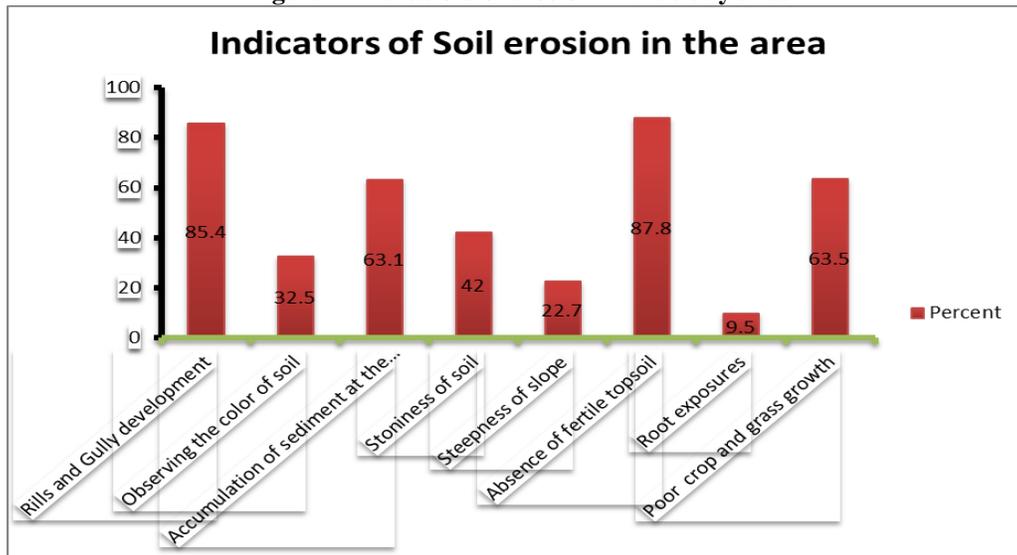
The data Collected via various methods of data collection instruments were analyzed, summarized, and presented through qualitative and quantitative methods. The data collected through questionnaire were quantitatively tabulated, interpreted and presented by using certain Stastical methods such as percentages and mean; the analysis will be made by using *SPSS version 20* and Ms Excel. Besides, the data collected through interview, personal observations and focus group discussion were analyzed qualitatively. In addition to this, maps, figures, pie chart, and cross tabulations were used.

## III. RESULT AND DISCUSSION

### 1.6. Soil Degradation in the study area

There are different indicators that verifies the existence of sever soil erosion in the area which is indicated by the farmers, DAs and also the researchers personal observation. The development of rills and gullies and removal of fertile top soil are the major indicators of existence of prevalent soil erosion in the area and the researchers also verified though observation. As indicated in figure 2 below there are differences on the perception of farmers on the indicators of existence of soil erosion on their farms. The variation on the expression of indicators of erosion was the result of the difference on the intensity and degree of erosion on their farmlands. Those farmers who choose the severity level as high understood and related the existence of soil erosion on their plots to loss of topsoil and development of gullies and rills in their farms. Hence, 85.4% and 87.8% of the farmers suggested that, absence of fertile topsoil and rills and gully development, respectively to be the major indicators of the existence of moderate to severe soil erosion problem on their cultivated fields. 63.1% of the farmers explained the occurrence of soil erosion in the study area in general and their farms by the presence of accumulated soil at the bottom of conservation structures and lower positions. Some sample respondents use the color of soil (32.5%), Steepness of slop (52.5%), stoniness of soil (42%), root exposure (9.5%) and poor crop and grass growth (63.5 %) as indicators of erosion occurrence.

Figure 2: Indicators of erosion in the study area



Source: Field survey, 2015

### 1.7. Major Causes of soil degradation in Darimu and Chewaka woreda

The major causes of soil erosion mentioned by farmers included erosive rains (existence of intensive rain fall), steep slope (topography), and little use of soil conservation practices, damaged conservation structures, and tillage, which makes the soil loose and bare. Rainfall leads to significant soil loss mainly at times of seedbed preparation. Over half of the farm plots managed by the total respondents were located on slopes having more than a 10% gradient. Farmers also recognized the effects of slope on soil erosion. Yet, few respondents indicated that

damaged conservation structures escalated the problem. Farmers' did not refer to crop types when mentioning the causes of soil erosion. The result in this study also confirms that soil degradation by water is the major challenge for agricultural land/ soil/ degradation. The result from focus group discussion about the major land degradation is that sometimes unexpected intensive rain comes and washes the top fertile and prepared agricultural land for cultivation.

Even though, type of erosion which exerts influence on soil erosion is caused by water /rainfall/, there are different root causes that makes the land in general and agricultural land in

particular more vulnerable for erosion and low productivity. The major causes identified by farmers, DA and woreda agricultural office workers of the Chewaqa and Darimu woredas are the following:

- ✓ Population pressure
- ✓ Topography/slope of the area
- ✓ Farmers' perception and attitude
- ✓ Land Use/Cover Dynamics
- ✓ Knowledge and use of conservation techniques
- ✓ Intensive cultivation and absence of fallowing

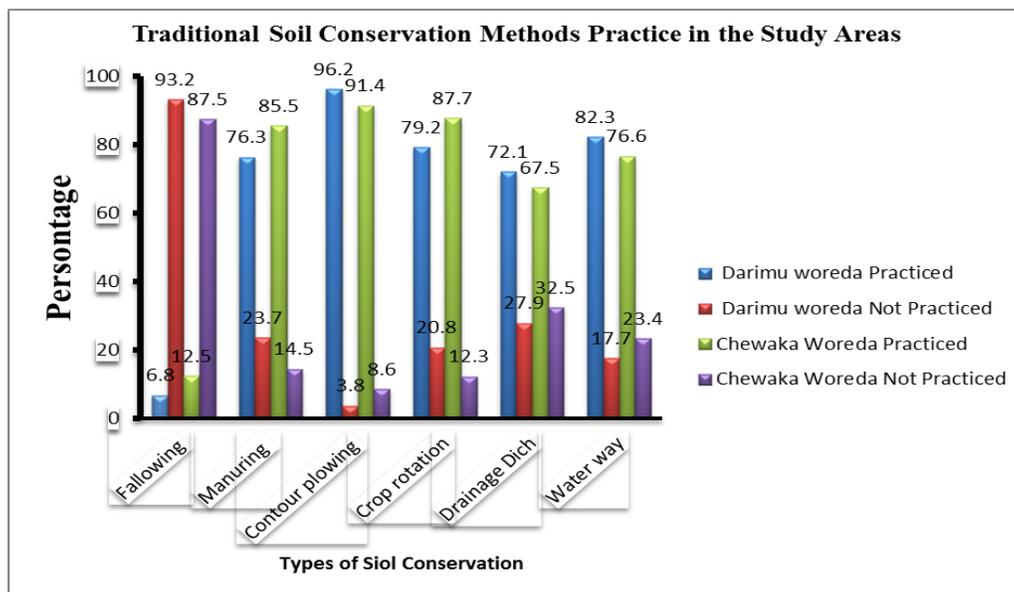
Now a day's indigenous knowledge (indigenous soil and water conservation practices which is created by the local community) are getting high attention in soil and water conservation. However, different adopted technologies to conserve soil and water is also playing greater role in addition to the indigenous. Thus the survey result indicates that, the study area farmers are using different types of indigenous and adopted soil and water conservation practices.

Several traditional soil fertility maintenance techniques have been identified in the area. These include "*Kosii fi dikee naquu* (*manuring*), *Lafa baasuu* (fallowing) and *Bo'oo baasuu* (traditional water way). In the past since farmers used to have a large number of cattle and area of land, *Kosii fi dikee naquu*, (*manuring*) and *Lafa baasuu* (fallowing) were the major practices for soil fertility maintenance in the area under study.

Traditional soil conservation techniques are better practiced in the study area as compared to the adopted modern technologies in both study woredas. As the survey result indicates that the reason behind is farmers perceived that they are free from any disadvantage and they do have positive attitude for them. As the same time they perceived that it is more practical and they can construct in the way that they perceived is better. Specifically the survey result reveals contour plowing (96.2% in Darimu and 91.4% in Chewaka), crop rotation (79.2% in Darimu and 87.7% in Chewaka) and water way (82.3% in Darimu and 76.6% in Chewaka) have been better practiced by the local community in the study area.

### 1.8. Indigenous and Adopted Method of Soil Conservation in the study Area

Figure 3: traditional soil conservation methods



Source: Field survey, 2015

- ❖ **Bo'oo baasuu: (Traditional water way and ditches):** This structure is constructed mainly by oxen drawn plough, but depending on the runoff expected, which depends on the slope length and gradient, intensity of rainfall and the type of crop planted upstream of the field, reinforcement by hoeing may be necessary. This

conservation measure is constructed alongside the farm plots for the safe disposal of runoff.

- ❖ **Lafa baasuu (Fallowing):** It is a practice of abandoning land for upgrading when the nutrients are exhausted. Fallow land is commonly used as a grazing ground for five to seven years depending on land holding of the farmer and the nature of the land to recover. However,

due to population pressure, which resulted in reduced land holding and hence limited grazing ground, leaving a land fallow have gradually become difficult.

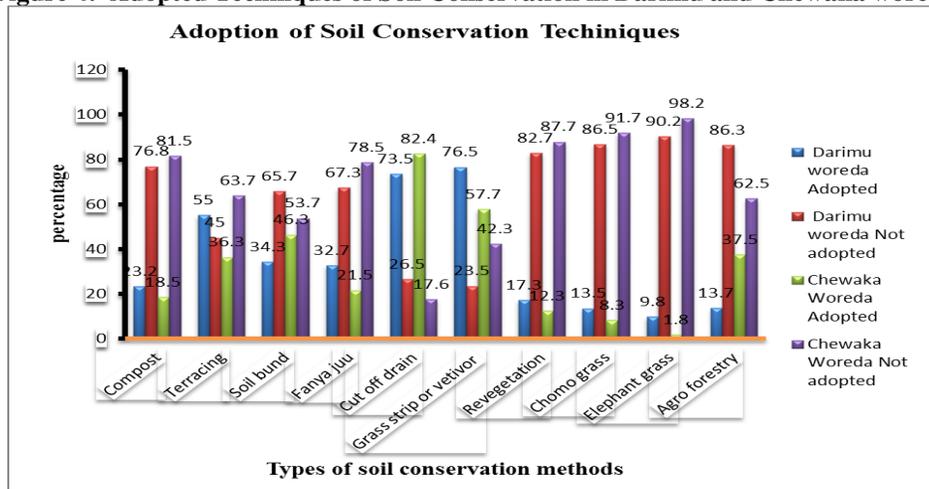
- ❖ **Kosii fi dikee itti naqu (Manuring):** It is a practice of spreading households' wastes to the field for soil fertility maintenance. 'Kosii, which literally means waste, consists of all kinds of human and livestock residues in and around the residence. This practice undertake mainly in those house hold that have many livestock.
- ❖ **Lafa irran gadee dalga qotuu/Contour Plowing/:** Contour plowing is intensively applied in both study woredas by many of the farmers (i.e. 98.46%). These farmers have stated that contour plowing is practiced to minimize the energetic downward flow of floods and facilitates rain water percolation.
- ❖ **Crop rotation; this is** planting of a series of different crops in the same field over a period of time alternatively, so that the soil fertility is maintained. In

the study area, 97.69% of the respondents agree that they apply crop rotation on their farmlands. Cereal crops are grown at a given farm plot after two or more years of production leaving the preceding and succeeding production seasons for other crops so as to enable the soil to replenish and restore fertilizing nutrients taken up by the produced crops during the preceding production season(s).

- ❖ **Drainage ditches:** The drainage ditches are one of the most widely used SWC practices in the watershed area. They are transitory water channels used to drain off excess water from the cultivated fields. The drainage ditches are low-cost measures in which their construction is part of the normal ploughing activity.

On the other hand, there are various adopted soil conservation technologies in the area.

**Figure 4: Adopted Techniques of Soil Conservation in Darimu and Chewaka woreda**



❖ *Source: Field survey, 2015*

As it indicated in the figure above the adoption of new/modern soil conservation practices are in a very low stage. Only some of the techniques are practiced better by some farmers like terracing (55 % in Darimu and 36.3 % in Chewaka), cut off drains (73.5 % in Darimu and 82.4 % in Chewaka), grass strip (vetivar grass) (76.5 % in Darimu and 57.7 % in Chewaka) and some others are little practiced like soil bund, compost agroforestry and others.

**Soil bund and Stone bund:** soil bund is an embankment constructed from soil along the contour with water collection

channel or basin at its upper side. It is constructed by throwing soil dug from basin down slope. It is used to control runoff and erosion from cultivation fields by reducing the slope length of the field which ultimately reduces and stops velocity of runoff. Usually it is constructed in fields that have slope greater 10%. Figure above shows that (34.4% in Darimu and 46.3 % in Chewaka) adopted the structure on their farm plot.



**Figure 5: Soil bund: photo by researchers, 2015**

The soil bunds are made of soil or mud. On moderately sloping areas the farmers construct the soil bunds for erosion control.

**Fanya juu:** (a Swahili term meaning “to throw up”) is a soil bund type where in a ditch is dug along the contour and the soil is thrown up to form a ridge above; a natural bench terrace will subsequently form over the next few years. They are usually constructed in the fields sloping above 10%. The survey result shows that about 87.7% adopted fanya juu on their farm plot. Even though, it is an important method of soil conservation, its adoption and practice in the study area is very low only 32.7% in Darimu woreda and 21.5% in Chewaka woredas. Therefore, more efforts should be done to increase its adoption and conserve the soil better.

**Grass strip:** Grass strip helps to reduce run off and filter out sediments carried by runoff and stabilize fanya juu and soil bund in farm plot. If grass strips grow, it will effectively build up into terrace and provide cattle fodder. An important type of grass strip method practiced in area is the vetivar grass technology. Unlike any other modern soil conservation methods vetivar grasses are more visible the majorities of the farmers plot.



**Figure 6: Grass strip (vetivar grass): photo by researchers, 2015**

**Cut off drain and Water way:** They are channels used to collect run off from the land above and to divert it safely to a water way or river; thus protecting the land below from excessive erosion. This structure is adopted by the majority of farmers 96.2% of farmers this could be due to the structure is ease to construct and applied to all cultivated land.

**Terracing:** it is also among the better adopted soil conservation techniques in the study area. However, farmers stated different challenges related to the practice and implementation of terracing on their plot.

In addition, there are also different types of soil conservation mechanisms in the study area, even though the practice and adoption is insignificant. Some of them are composting, chomo grass, elephant grass, agroforestry etc.

### **1.9. Factors Affecting Adoption of Soil Conservation techniques in the area**

Adoption and implementation of structural soil conservation techniques could possibly be influenced by different factors (Aklilu, 2006). Some influence practice of structural measures negatively whereas other factors affect the practice positively. In the study area the following factors that

influence adoption and implementations of soil conservation techniques are identified in this research.

- ✚ Slope of the area or Geographical aspect of the area
- ✚ Land tenure status of the farmers
- ✚ Educational attainment or Education Level of the farmers
- ✚ Access to Extension services and Other Natural resource Expertise
- ✚ Gender or sex of the households
- ✚ Size of land/ farm land holding size of the farmers'
- ✚ Off farm activities /income

## **IV. CONCLUSION**

Soil erosion is one of major threat to the agricultural economic development of Ethiopia. Soil erosion contributes to the prevailing of food insecurity in a country. It is sever in the high lands and land cover is low in Ethiopia where largest portion of population mainly dependent on agricultural production. There are different factors that cause such an alarming increase in the soil erosion and loss of agricultural productivity in the area. As the survey result indicates the major factors for the occurrence and increment of erosion in the area are: Population pressure, Topography/slope of the area, Farmers' perception and attitude, Land Use/Cover Dynamics, Knowledge and use of conservation techniques, Intensive cultivation and absence of fallowing.

As a result, a range of conservation measures were introduced with the objective of conserving, developing and rehabilitating degraded agricultural lands and increasing food security through crop production with the cooperation of Zonal and Woreda agricultural and rural development office. Farmers in the study area were using different indigenous and adopted soil conservation technologies. Even though, they used indigenous and adopted soil conservation methods, farmers are more dependent on traditional or indigenous soil conservation methods. Some of the indigenous soil conservation methods are Bo'oo baasuu: (Traditional water way and ditches), Lafa baasuu (Fallowing), Kosii fi dikee itti naquu (Manuring), and Lafa irran gadee dalga qotuu/Contour Plowing /, Crop rotation, and Drainage ditches.

Adoption and implementation of structural soil conservation techniques could possibly be influenced by different factors such as: Slope, Land tenure status, Educational attainment or Education Level of the farmers, Farmers' Access to Extension services, sex of the households, farm land holding size of the farmers' Off farm activities /income.

## **V. RECOMMENDATION**

Based on the findings of the study the following recommendations are forwarded for the betterment of the soil conservation method in the area:

- ✚ Creating awareness on the farmers about soil erosion, conservation and its importance for soil fertility and productivity through the cooperation of the DAs, woreda and zonal agricultural and natural resources

management office and other stockholders should be delivered.

✚ Farmers in the area use indigenous soil conservation mechanisms more than the adopted and since they are traditional farmers by themselves are constructing the structure without any advice and it affects the farm land and the young crops like water ways. This implies that information about ineffectiveness of traditional conservation measures has to be disseminated mainly for farmers that heavily rely on traditional conservation measures. It should also be made part and parcel of training programs. Especially, FTCs should focus on merits and demerits of traditional conservation structures when they teach about soil conservation.

✚ The major and recent challenge for the occurrence of soil erosion in the area was the conversion of vegetation land to agricultural land or forest degradation. Thus, the government and other stakeholders should work to minimize forest degradation and to create some off farm activities.

#### Acknowledgements :

Above all to Almighty God is the glory for giving us all the patience and strength to complete our study against all odds. Secondly, we wish to thank Mettu University for providing us financial requirement and encouragement to conduct and accomplish our study. Thirdly, thanks are owed to all individuals who contributed for this research namely enumerators, all key informants, household heads and participants of focus group discussions for their kindly support in providing us with necessary information for our study and for all kinds of assistance provided during data collection.

#### REFERENCES

[1] Agele, S.O. Iremiren, G.O. Ojeniye, S.O. (2000). Effects of tillage and mulching on the growth, development and yield of late-season tomato

(Lycopersicon esculentum L) in the humid south of Nigeria. Journal of Agricultural Science 134:55-59.

- [2] Aklilu A. (2006). Caring For Land, Best Practices In Swc In Baressa Watershed High Lands of Ethiopia, Wageningen University Netherlands
- [3] Joyce M, Siacinji-Musiwa. (1999). *Conservation Tillage in Zambia*; Some Technologies, Indigenous Method and Environmental Issue, Kaumbutho PG and Simalenga publishers , Harare Zimbabwe. Available at <http://www.atnesa.org>.
- [4] Kassie M, M Yesuf, and G. Kohlin. (2008). *"The Role of Production Risk in Sustainable Land- Management: Technology Adoption in the Ethiopian Highlands," Environment for Development Discussion Paper 08-15.* Washington, D.C.
- [5] Kothari, C.R. (2004). *Research Methodology, Method and Techniques*, New Age International Private Ltd. Publisher, New Delhi.
- [6] Sanders, D. (2004). Soil Conservation, in Land Use ,Land Cover and Soil Sciences, Encyclopedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford
- [7] Taffa T. (2002). *Soil and Water Conservation for Sustainable Agriculture* Mega publishing enterprise, Addis Ababa.
- [8] Woldeamlak B and Geert, S. (2003). Farmer's participation in soil and water conservation activities in Chemoga watershed, Blue Nile Basin, Ethiopia Tropical resource management papers. NO 44,Wageningen University, Netherlands
- [9] Yohannes G.M. (1989). Crop production and conservation methods in Andit Tid area, Northern Shewa. Soil Conservation Research Project, Addis Ababa.

#### AUTHORS

**Mengie Belayneh**, [mengie1980@yahoo.com](mailto:mengie1980@yahoo.com), Lecturers at Department of Geography and Environmental Studies, faculty of Social sciences and Humanities, Mettu University, Mettu, Ethiopia

**Alemayehu Abera** [alemayehuabera21@yahoo.com](mailto:alemayehuabera21@yahoo.com), , Lecturers at Department of Geography and Environmental Studies, faculty of Social sciences and Humanities, Mettu University, Mettu, Ethiopia

**Gashahun Tadesse**, [gash-buna@gmail.com](mailto:gash-buna@gmail.com), Lecturers at Department of Geography and Environmental Studies, faculty of Social sciences and Humanities, Mettu University, Mettu, Ethiopia