Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.5, No.24, 2014


# Farmers' Perception and Adoption of Soil and Water Conservation Measures: the case of Gidan Wereda, North Wello, Ethiopia

Birhan Asmame Miheretu
Department of Geography and Environmental Studies, Wollo University, Ethiopia
P.O.Box: 296, Dessie
E-mail: birhan1050@yahoo.com

**Abstract**
Agriculture is the mainstay of the Ethiopian economy upon which the livelihood of the vast majority of the population depends directly or indirectly. Soil erosion is the serious problems in many part of Ethiopia threatening the very life supporting system of the country. To reverse this problem, soil and water conservation (SWC) technologies were introduced in some degraded and food insecure areas mainly through food for work incentives in the country. The major objective of this study was to assess farmers' perception on indigenous and introduced SWC measures and identify factors affecting the adoption of introduced SWC measures in Gidan Wereda, North Wello. The study was based on information collected through a questionnaire survey of 100 systematic randomly selected household heads, a focus group discussions, key informant interview and field observations as well as secondary sources. Data collected were analyzed using descriptive and qualitative technique. The findings have shown that the newly introduced SWC measures have got good perception, acceptance and widely practiced by farmers. The major factors that were encouraging the farmers in adopting the introduced SWC measures on their plots of land were found to be perception of soil erosion as a critical problem, availability of labor, small land holding size, access to extensions service, land tenure security, participation and positive attitude of farmers towards introduced SWC measures. In general, the study concludes by recommending that the project should integrate the indigenous and biological measures with the physical measures to ensure further sustainability of the introduced SWC measures.
**Keywords**: adoption, gidan wereda, indigenous swc, introduced swc, perception

## 1. Introduction

Agriculture is the dominant economic sector in Ethiopia that accounts for about 45% of the gross domestic product, 85% of the employment and 90% of the foreign exchange earning. About 85% of the population lives in rural areas and derives its livelihoods directly or indirectly from agriculture (Wagayehu, 2003). Most of the agricultural land is located in the highlands and is operated by farming households. According to the Ethiopian Highlands Reclamation study (EHRS), the Ethiopian highlands contributing only about 50% of the total area of the country, accommodate approximately 88% of the total population of the country, and account for over 95% of its regularly cropped lands, about two-third of its livestock, and over 90% of the national economic activity (FAO, 1986).

The agriculture of Ethiopia is characterized by low productivity. Studies indicate that the national average yields of major crops for smallholder sector is less than 1.2 metric ton per hectare (CSA, 1992). These yields are among the lowest in the world and indicate the low productivity of the agricultural sector (Assefa, 1995). Hence, the sector is not able to meet the basic food requirements of the population. Annual agricultural production cannot keep pace with the growing number of the population (World Bank, 1995) and this exposed the country's farmers to food insecurity. Food self-sufficiency remains an unattained objective, and per-capita food production has been falling over the decades. Currently, an estimated 50 to 60% of the country's population is food insecure or live below the poverty line (Mulat, 1999). This in turn is caused by a number of factors and soil erosion being the major one.

Soil erosion in Ethiopia has been a concern for many years. According to Woldeamlak (2002), soil erosion by water constitutes the most widespread and damaging process of land degradation in Ethiopia. The potential threat of this environmental damage to the country's insufficient and fragile food security system is already indicated by the fact that approximately 88% of the populations live in the highlands and that this region contains more than 90% of the regularly cropped land. The amount and impact of soil erosion in Ethiopia is damaging both to the economy and the environment.

The impact of soil erosion is particularly severe in the highlands of Ethiopia especially in Northern and central highlands of Ethiopia. The Ethiopian Highlands Reclamation Study (EHRS), which contains one of the earliest major studies of land degradation in Ethiopia, puts the total crop production loss due to erosion at 120,000 tones per annum in 1985 (FAO, 1986). According to the results of this study, one-half of the highland area was significantly eroded and over one fourth was seriously eroded, and over 2000 $km^2$ of farmlands have reached the

 

point of no return. Moreover, Hurni (1988) estimates that erosion is most severe on cultivated lands; average 42 tons per hectare per year on currently cultivated lands. The problem of population increase on the one hand and the limited availability of arable land coupled with severe soil depletion on the other makes intensification of agricultural production while maintaining the resource base imperative.

The Ethiopian government has for along time recognized the serious implications of continuing soil erosion. To mitigate environmental degradation and as a result large national programs were implemented in the 1970s and 1980s. Soil and water conservation (SWC) technologies were introduced in some degraded and food insecure areas mainly through food-for-work incentives. Despite the Ethiopian government's more than two decade effort to conserve natural resources very little success has been achieved, particularly a result of the top-down approach to design and implementation. Many farmers were compelled to participate in the food-for-work conservation programs implemented in the 1980s and consequently failed to maintain the physical structures adequately. The process of involving farmers and the rural community in general in the design, layout, construction and maintenance of respective soil conservation measures was, in the past, inadequate. In fact, much more committed efforts at both policy and executive levels are required by ensuring people's active participation (WFP, 2005).

Gidan Wereda is one of the erosion prone areas in North Wello. In order to mitigate the severity of soil erosion, different soil and water conservation measures have been introduced since 1996 through WFP's Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods (MERET) project and the farmers have also employed indigenous swc measures. Therefore, the objective of the present study was to assess farmers' perception on indigenous and introduced SWC measures and identify factors affecting the adoption of introduced SWC measures in Gidan Wereda, North Wello,Ethiopia.

## 2. Material and methods

### *2.1 Description of the Study area*

Gidan Wereda is located in North Wello Zone, Amhara Regional State.It is located between $11^0$ 53'-$12^0$ 16' North and $39^0$10' - $39^0$35' East (Figure 1). Muja is the administrative capital of the Wereda and is situated at about 595 km from Addis Ababa. The total area of the Wereda is about 1,110.93 $km^2$.

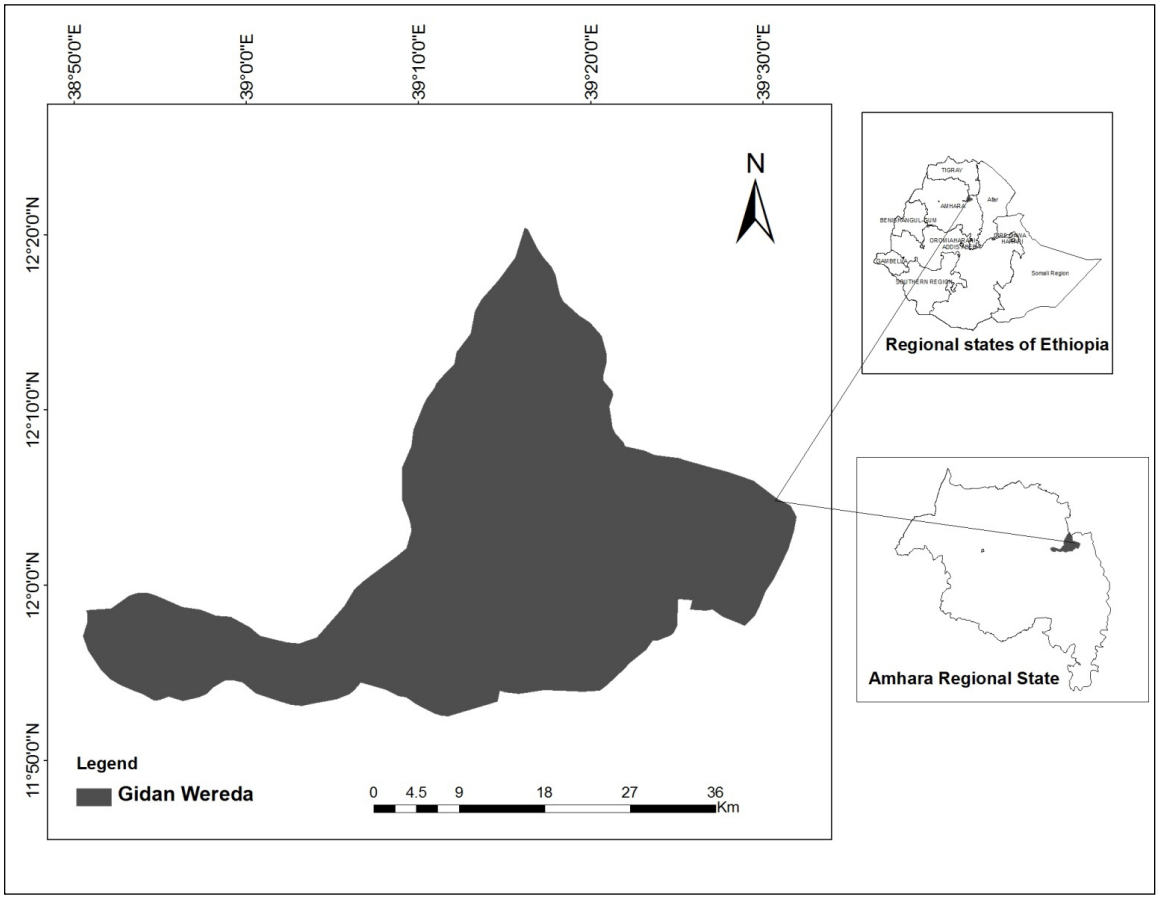


Figure 1: Location of the study area

The topography of the area is mountainous having steep slopes. It is full of hills, mountains and deeply dissected gorges. There are large altitudinal variations in Gidan Wereda. The altitude ranges from below 2000 m.a.s.l in the Tekeze valley to 4000 m.a.s.l at Abuhoy Gara.

According to the meteorological records of Muja and Kulmesk station, the average annual rainfall of Gidan Wereda is about 600 mm. A bi-modal nature characterizes rainfall in the Wereda. The short rainy season (spring),which occurs between February and April and long rainy season (summer), which occurs between June and September. In most cases, the highland areas (Dega) area mainly dependent on spring rain whereas, the Woina Dega and Kolla areas are summer rain dependent for crop production in the study area. The principal feature of rainfall in the Wereda is its seasonal character, poor distribution and variability from year to year. For the past three decades, an intermittent and erratic rainfall patterns have been the major climatic factor affecting crop yields in the Wereda and then the people have been on relief assistance.

The study area is identified as a mixed farming zone where crop and livestock enterprises are interacting in the system. The prevailing farming system is thoroughly dominated by small scale, and still predominant, subsistence agriculture with traditional strategies of production with little change even in current times. The farmers prefer to cultivate cereals. The major types of crops grown are tef, barley, wheat, *'Aja",* sorghum, chickpea, lentil, field pea, horse beans and maize.

*2.2 Data source and analysis*

The relevant data to the study include both primary and secondary sources. The socio-economic data that have relevance for the study were collected during the field survey. Both indigenous (that is traditional dithes (*boyi)*, traditional waterway (*Gorf Mekided*), mixed cropping, contour ploughing, crop rotation and *dib)* and introduced SWC (that is soil bunds, stone bunds, stone faced soil bunds, hillside terracing, check dam, SS dam and micro basin) were also explored with plot level observations. The primary data obtained from the field survey was also supplemented with data obtained from secondary sources in order to substantiate the study. Secondary sources of information used for this study include both published and unpublished materials.

The nature of the study necessitated the use of both quantitative and participatory (or qualitative) data collection techniques. The main data collection methods employed in this study include questionnaire survey, key informant interview, focus group discussions, discussion with the Development Agents (DAs) and field observations.

Quantitative data were collected through a questionnaire survey exercise. Both open and close-ended questions were developed. The questionnaire format for farmers includes landholding size, land tenure security, perception on soil erosion and soil and water conservation measures. High school graduate enumerators administered the questionnaires in 2007. A brief orientation was given to them concerning the content of the questionnaire and how to extract reliable answers.

The WFP's MERET project in Gidan Wereda was carried out in eight kebeles out of 27 kebele of the wereda ( Kebele refers to the lowest administrative political unit in the Ethiopian government political structure) . Within these kebele the project worked on watershed level. So each kebele has its own watershed covered by MERET project. The households of the watershed in these kebele, therefore, considered as the survey population in this study. Moreover, the units of analysis from which information is collected were heads of households.

At the beginning two watersheds, namely Tigremender (kebele03) and Kulmesk (kebele09), were selected through a purposive sampling technique. These two watersheds were selected based on two criteria. Firstly, the two watersheds are the areas where the WFP's MERET project was first implemented. Secondly, the two watersheds represent the two agro-ecological zones covered by the MERET project: Tigremender found in Woina Dega and Kulmesk in Kolla agro-ecological zone. After identifying the two watersheds, the interviewees were selected using systematic random sampling technique based on the sampling frames. The list of all households in each watershed was considered as the sampling frame. This list of households was obtained from the kebele administration. A total of 100 household heads were assumed to be adequate for the study. The reasons for deciding on this sample size were the homogeneity of the households in their physical-environmental, social and cultural aspects as well as resource endowments. To make the allocation of the total sample size into two sample watershed is proportional, 56 percent of the sample population were taken from Tigremender , which has the greater number of households while 44 percent of the sample population were taken from Kulmesk which has smaller number of households .

The qualitative assessment method of data collection added useful depth and perspective in understanding issues that cannot be obtained from the quantitative survey. The focused group discussion was the most important qualitative data collection method used in this research. The group discussion was held with three focus groups (i.e. youth, women and elders) concerning soil erosion, indigenous and introduced swc measures, each comprising of ten persons both in Tigremender and Kulmesk. Total numbers of individuals covered in the group discussion in the two watersheds were 60. In addition, individuals knowledgeable about the local situation were identified and interviewed individually concerning soil erosion, indigenous and introduced swc. The key informants interviewed in the study area were development agents, Gidan Wereda MERET project coordinator and elderly people. Total numbers of key informants covered in the two watersheds were 20. Field observation was conducted throughout the whole process of the research in order to ensure the validity of information obtained and photographs were taken on the site and their conservation measures under existing conditions.

The data from households survey were analyzed in mind the pertinent issues to be investigated on farmers' perception and adoption of SWC measures. The portion of data that is readily quantifiable (information from the close ended questions of the questionnaire) has been entered into the SPSS Version 13.0 programme and the output has been discussed using percentiles. Readily qualitative data (information from the open ended questions of the questionnaire, key informants interviews and focus group discussion) have been discussed through qualitative description.

## 3. Results and Discussion

### *3.1 Indigenous soil and water conservation measures in the study area*

Farmers in Gidan Wereda have been practiced different indigenous soil and water conservation technologies to maintain the stability of their environment and to improve soil productivity from which they obtain their livelihoods. The majority of respondents (85.7% in Tigremender and 88.6% in Kulmesk) stated that they have been using different traditional soil and water conservation measures before the introduction of new SWC technologies (promoted by WFP's MERET project) to minimize the rate of soil erosion on their plots of land. Some of these practices are discussed below.

**Traditional Ditches (*Boyi)***

The traditional ditches *(Boyi*) are the widely practiced structural soil and water conservation measures in the area. This is deeply, rooted and widespread practice in Ethiopia (Yohannes, 1999). They are constructed in every cropping season by using a "*Maresha*" plough pulled by a pair of oxen immediately after sowing the seed. They are a diagonal water way prepared on plots of land parallel to the slope. Farmers in the study area have been used the traditional ditches (*boyi)* for three reason: 1) to protect the washing away of seeds 2) to protect soil from erosion and 3) to drain excess water in the water logging plots which are dominated by vertisols *(Walka*). According to Yohannes (1999), the potential of this technology is that it demands less labor, and being flexible, it can be easily established by any farmer; competition with the crop area is minimal, as it does not exceed 4%; and the structures are not fixed (their position changes seasonally) so they do not easily develop into gullies, except the slope angle of some ditches are less than 2% or greater than 5%, which creates fast deposition and breakage respectively development of big gullies.

**Traditional waterways** *("Gorf Mekided")*

The traditional waterways are also the widely practiced structural soil and water conservation measures in the area. They are constructed at the top of the cultivated lands like cut off drain. They are used for to collect run off from the surrounding and then drain safely to the natural or artificial waterways. Therefore, it protects the cultivated land from being washed away by run off. However, it needs frequent maintenance and high labor.

**Mixed Cropping**

Mixing of safflower with tef is a widely applied traditional technique in the low land area of Gidan for example in Kulmesk. During the survey some farmers mentioned that they usually combine different types of legumes with maize and sorghum. This method increases crop density, diversity and ground cover and hence protects the soil from erosion and it also minimize risk of crop failure due to limited rain and pests.

**Contour ploughing**

To minimize the risk of erosion, farmers have been practiced contour ploughing in the study area. When the land is ploughed horizontally, the contour furrows are important to minimize surface run off and hold rainwater until it infiltrates. During land preparation the land is ploughed several times depending on the type of crop.

**Crop Rotation**

This is one of the traditional practices used for improve soil fertility and conserving the soils. The major crop rotation practiced by the farmers in the study area is from cereals to legumes. For instance, Barley/Wheat chickpea. It was learnt during group discussion with the farmer, they are well a ware that the role of crop rotation to improve soil productivity by rotating crops. As legumes provide considerable soil cover and improve soil structure, and thus enable soil erosion control. It also improves the fertility of the soil because the leguminous plant maintaining the nitrogen status.

However, currently due to population increase and the smallness of land holding size proper rotational practices decrease and hence households face serious problems in soil fertility maintenance. Animal manure seems to be an obvious resource and thus the amount of manure produced is nearly all used for fuel to cook. Moreover, manure has never been much used in the past for soil fertility maintenance; traditional rotation practices were sufficient.

***"Dib"***

This refers to small strip of uncultivated fallow land, which either serve as a boundary between plots of two households or a strip that is left uncultivated by some individuals. Usually, the strip is in staggered discontinuous, conditioned by individual landholdings and soil condition. On farm fields, the uncultivated fallow strip serve as a barrier (i.e. by reducing the slope length) to run off and erosion process and facilitates bench terrace formation. Since grass grows on flat strips, forage from the grass strip is used for livestock grazing.

 

Resource poor households cultivate the uncultivated grass strips provided there is an accumulation of fertile soils. Indeed, it neither involves earth moving nor consumes labor force.

*3.2 Introduced Soil and Water Conservation Measures in the Study Area*

Different types of soil and water conservation measures were introduced in the study area under MERET project. A large amount of money and effort has been put to introduce and implement SWC structures in the area. The main components of the newly introduced soil and water conservation measures were dominantly physical structures. The SWC measures that are newly introduced and widely applied on the study area are soil bunds, stone bunds, stone faced soil bunds, hillside terracing, check dam, SS dam and micro basin.

*3.3 Farmers' Perception of MERET Based Conservation Practices*

The introduced soil and water conservation structures in the study area are believed to serve the purpose of slowing down the runoff; water harvesting and trapping eroded soil. Particularly the soil bund, stone bund, and stone faced soil bunds on cultivated lands are reduce erosion by decreasing the slope length and preventing or reducing damage caused by surface run off. Their major impact is to reduce sediment delivery from a plot of land. This retained sediment gradually forms a level leading to reduced water velocity and reduced erosion.

Farmers have mentioned the changes that they have observed and the benefits gained after they have used the introduced soil and water conservation measures in their plots of land. As indicated by the farmers, the dominantly perceived benefits gained from using the MERET conservation measures are reduced soil erosion, increase in soil productivity, better growth of crops a long the SWC structures due to soil deposition and new land reclaimed along gullies as a result of the soil sedimentation dams. Clearly one expects the increase in soil deposit and added fertility to ultimately contribute to enhance yield.

However, yield increases vary depending on the specific relief and soil conditions found. The soils directly above the structures receive more moisture and fertile soil materials and are more productive than other segments of the interstructural options of the slope. Yields are consequently, expected to increase markedly over the long-term as soil fertility and topsoil increase over time. According to DA in Tigremender, even though large sum of money and effort put in the last ten years to conserve soils, the productivity of land not so for changed because the project was entered in the area after the soil is heavily degraded. But the response from farmers in the group discussion indicated that crop yields have been declining over the past ten years, largely attributed to low rainfall. The perceptions of farmers of the yield increase on account of the soil and water conservation were interrupted by the trend of low rainfall.

Farmers were also asked the rate of erosion on their plots of land over the last ten years, 71.4% and 65.9% of the respondents in Tigremender and kulmesk indicated that the rate of erosion was decreased over the last ten years on their plots of land due to soil and water conservation work which is under taken by MERET project.

*3.4 Farmers' Evaluations of the Introduced and Indigenous Conservation Measures*

The response received from the individual and group discussion show that the main problems related to the structural bunds were: (a) spacing between consecutive bunds were so narrow that farmers faced a difficulty in oxen ploughing; (b) losses of cultivated land and hence taken out from production because the narrow spacing has a bearing on reducing the cultivated land; (c) harbouring rodents and (d) the structures were too technical particularly SS dam. On the other hand, the farmers stated that these problems were insignificant in comparison with the use fullness of and benefits from the conservation structures. Moreover, the problem was resolved through training and awareness creation and some cases widely spaced bunds were used to avoid too many bunds taking the land out of production. Farmers recognize the need for conservation and are well aware of the short and long-term benefits. As a result they take good care of the structure and maintaining them. As indicated by the response of farmers, regarding using stone based structures is that stones need to be cleared from cultivated land and this produces benefits realized through more ease cultivation practices and facilitating crop growth. However, according to Yohannes (1999) plots with a lot of stone cover have multiple functions such as controlling the splash effect and run off, conservation of soil and moisture. In addition, farmers realize the benefits of combinations of measures including soil bunds on lower lands, stone based structures on sloping lands supplemented by cut off drains, check dams and SS dams.

Farmers reported that the indigenous soil and water conservation practices were flexible and fitting into the farming systems. They also clearly reported that the indigenous conservation practices were very cheap and simple to construct. Particularly contour ploughing is incomparably the cheapest as well as the simplest conservation measures that do not require much labor and expense. However, the LLPPA is assuming to integrate indigenous SWC practices but the researcher found out that there was not given much emphasis on indigenous SWC measures. This was confirmed during the group discussion and personal interview.

Farmers were also asked to compare the indigenous soil conservation measures with the introduced ones regarding in tackling the soil erosion problem. About 71.4% and 68.2% of the respondents in Tigremender and Kulmesk indicated that the indigenous soil conservation measures are less effective than the introduced ones in tackling the soil erosion problem. Where as only 28.6% and 31.8% of the respondents in Tigremender and Kulmesk considered that the indigenous soil conservation measures are effective. In addition, more than 85%

 

and 77% of the respondents in Tigremender and Kulmesk perceived that the ability of the introduced conservation measures to improve yield were better than the traditional ones.

*3.5 Factors Affecting the Adoption of the Introduced Physical Conservation Measures*

It is generally accepted that, the success of any soil conservation practice depends on the farmers' acceptance, which depends on the suitability of the newly introduced conservation measures to the agro-ecological condition and its effectiveness in tackling the problem. Moreover, the technologies that were using should be economically attractive to farmers. For this, it is important to understand the needs perceived by the farmers and knowledge of their socioeconomic conditions. Therefore, in this section attempt has been made to explore the factors that affect the adoption of introduced structural conservation measures from farmers' point of view.

**Farmers' Perception of Soil Erosion**

According to Woldeamlak (2002), perception of soil erosion as a hazard to crop production and sustainable agriculture is the most important determinant factor for adoption of conservation measures, and he further asserts that understanding and recognition of soil erosion as a problem in own farm plots, and its causes and impacts on crop yields is the first step towards searching for and adoption of remedial measures. The majority of farmers indicated that there was soil erosion problem on their plots of land and they mentioned the indicators, causes and consequences of soil erosion in their area. They also indicated that soil erosion could be controlled. As it was observed in the field, the area was highly affected by erosion and the out crop of rock had been seen easily on the field. In order to protect the land for further erosion of the land, the farmers were adopting the SWC measures in the area. During the group discussion, the farmers were asserted that soil erosion was very severe in the area that is why we were forced to adopt the MERET based SWC measures. They said that we were protecting our soils from erosion by using the introduced SWC structures. It appears that the introduced soil and water conservation measures were widely practiced.

**Labor Availability and Land Holding Size**

The availability of family labor is one of the most important pre-conditions needed for successful implementation of the SWC measures by farmers. Almost all respondents indicated that they depend on family labor for both agricultural activities and conservation tasks although there are other types of labor arrangements like sharecropping ("*Megazo"),* hired labor and "*debayet"*.

The majority of household seem to have adequate supply of labor that would be needed for the farming operation on their small holdings and for SWC activities. About 46.4% and 47.7% of the total households in Tigremender and Kulmesk respectively had 4 to 6 members. On the other hand, 51.8% and 47.7% of the households in Tigremender and Kulmesk respectively possess only 0.5 ha of land. Taking the average household sizes and average land holdings of the sample watershed, the per capita holding was 0.12 ha and 0.11 ha in Tigremender and Kulmesk respectively. From the landholding conditions and family sizes, it is possible to say that there is labor availability in the area which is important for undertaking the labor intensive introduced SWC measures such as stone and soil bund construction. To see the availability of labor, the farmers were asked whether family labor sufficient or not to undertake SWC activities. About 69.6% and 68.2% of the farmers in Tigremender and Kulmesk responded that they do have sufficient family labor to undertake SWC activities. Moreover, 60% of the sample households did not engaged in off farm activities so that they could devote their time and energy on SWC activities. During the group discussion farmers were expressed their commitment on SWC work that is they said that we were go to plots of land at least one day per week to undertake SWC work without incentives.

The size of land holding of an individual farmer in the study area is one of the smallest. The average land holding size of the sampled households in Tigremender and Kulmesk are 0.63 ha and 0.58 ha of land respectively. As it was observed in the field, every plots of land has the introduced SWC measures such as stone and soils bound. These structural conservation measures are in a good condition. The smallness of farmers landholding size in the study area could not hindered in using the introduced SWC structure in their plots of land. During the group discussions, farmers clearly reason out regarding the effective using of the introduced SWC structures (adopting newly SWC technologies) in their small holding. It was said that what matters is not loss of cultivated land by the introduced SWC structures, rather the effectiveness of the structure to protect the soil from further soil erosion. The only opportunity that they had is that using the newly SWC structures in their small plots of land in order to reverse the soil erosion problem and maximize the benefits gained from using this structures. They were very aware of these structural measures occupied certain portion of the cultivable land and hence this cultivated land become out of production, but the loss of the cultivated land is insignificant as compared to the benefits being get from adopting of the introduced SWC measures. Therefore, the findings of this study, for example, was not in line with the finding of Belay (1992 ) who found out that farmers with smaller land holdings are more likely to reject conservation structures than those with larger ones. The difference between findings of the present study and those in some of the previous studies in Ethiopia might be: 1) In areas where the previous studies were conducted, the farmers might have destroyed the structure with out actually perceived their impacts in the long-term or the studies might have been conducted before the full adoption of technologies by majority of farmers. 2) Be in relation to how the physical structures have been put on plots of

land. The physical structures are uniformly constructed according to the norm sets. But as it was observed in the field and as the DAs indicated, most of the physical structures are put in their plots of land according to the agreement made between the conservation expert and the farmers.

**Access to extension service**

It is a recognized fact that the diffusion of information on introduced SWC measures is an important element that contributes positively for the adoption and sustained use of a given SWC technology. Unless there is an adequate mechanism for transmitting information, the adoption of any new SWC technology would not be successful. In the study area, like the rest of Ethiopia the widely used means of disseminating information is through extension services. Currently, the Development Agents assigned to a group of farmers to provide extension services, one of the aspects covered by the extension services is soil conservation and land management practices. In the study area, the DAs play a great role in giving training to the farmers regarding SWC practices. Adequate and timely information has a positive impact on the adoption decision of SWC measures. Farmers were asked about the number of times they meet the extension agents and the majority of farmers reported that they meet the local Development Agent at least one day per week. As it was understand in the group discussion, they have close relation with the Development Agents and hence they have got a lot of information regarding SWC practices. Therefore, the farmers are full of information that is they know the benefits of SWC technologies, probably that is why the farmers in the study area were using the newly SWC measures in their plots of land. Thus, farmers were willing in adopting SWC measures.

**Land tenure Security**

In Ethiopia, land is a public property and farmers have only usufruct right. Also, redistribution of land is a common practice. Woldeamlak (2002) argued that the land users must have secured property ownership rights of the land they cultivate if they are to invest in SWC works in anticipation of long-term benefits and hence secure ownership of the land operated increases the sense of responsibility and lengthens the farmers' planning horizon and thus they will be more concerned about the proper use and management of the land. This section explores farmers' opinion on the current land tenure system.

Given the above arguments, attempts have been made to see what the farmers of the study area feel about the security of land tenure and its implications on their decision to invest on SWC measures. About 67% and 68% of the respondents in Tigremender and Kulmesk respectively confirmed that there will not be land redistribution in the future and hence they feel secure in their present day land holding.

It was also learned from discussion held with farmers, most of them felt secured under the existing land tenure system and it is no constraint in most cases. The farmers feeling of security of land might have occurred due to two main reasons. The first is that this study was conducted when the farmers received the current land certification card. In relation to land certification, the majority of farmers (89.3% in Tigremender and 86.4% in Kulmesk) asserted that the current land certification give a guarantee to invest on SWC measures in their plots of land. The second justification may be in relation to the 1983 E.C land redistribution which was undertaken in the study area by EPRDF. Each farmer in the study area owned their land for more than 15 years. This longer period of possession of their land could give the farmers to feel secure. In addition, significant number of farmers (85.7% and 77.3% in Tigremender and Kulmesk respectively), in the study area, reported that the periodic land redistribution does not affect their investment decision of SWC in their plots of land. Therefore, with the above empirical information, it can be concluded that farmers were adopting the introduced SWC measures because of the feeling of land tenure security in the study area.

**Participation**

Community participation is one of the factors assumed in this study as influencing the degree of adoption of SWC technologies by farmers. If one needs to achieve success in rural development activities such as sustainable soil conservation, farmers' active participation should be ensured from the beginning. In the study area, the MERET project was identifying the farmers' priorities by using LLPPA. About 89% and 82% of the respondents in Tigremender and Kulmesk respectively reported that they have been given a chance to participate and take decision concerning the introduced soil conservation measures.

Table 1: Farmers participation in the SWC activities, % of respondents*

| Roles | Tigremender | Kulmesk |
|---|---|---|
| Identification of conservation technologies | 71.4 | 71.5 |
| Selection of conservation technologies | 67.9 | 61.4 |
| Prioritizing of conservation technologies | 66.1 | 61.4 |
| Implementation of conservation technologies | 89.3 | 81.8 |

Source: field survey

- The percentages do not add up to 100 due to multiple responses

As clearly shown in table 1, the majority of respondents in the study area participated in SWC activities. Probably more participation of the farmers attributed to the local level participatory planning approach (LLPPA) adopted by the MERET project. The LLPPA is a planning tool where the community is the major actor in the

 

process of identification and prioritization of the activities to be implemented. As it was confirmed by group discussions with farmers, they were actively participating from the beginning up to implementing of the MERET based SWC technologies.

**Attitude**

Attitude of farmers towards MERET SWC intervention is an important factor that influences the degree of adoption of SWC technologies. More explicitly, the farmers were asked about whether they are interested in MERET project based SWC technologies or not. All (100%) of the respondents agreed that they are interested in MERET project based SWC technologies. Because of their interest and positive attitude towards the SWC technologies, the majority of respondents (88% of the total) stated that they are willing to implement the newly introduced conservation measures in the rest of plots (outside the project). As it was confirmed during group discussion, personal interview and field observation, they implemented and used the introduced SWC measures in the rest of plots (outside the project site) without using incentives.

The farmers were also asked whether they were willing to carryout swc measures in their plots of land in the event the project stops support or not. Almost all farmers (99% of total) confirmed that they would continue to carryout swc measures in their plots of land in the event the project stops support. This partly indicated that the sustainability of swc activities in the study area because of their positive attitude towards swc measures.

To strengthen this finding, about 98% of the total respondents stated that they did some maintenance work on newly introduced SWC measures on their plots of land before they started ploughing. Moreover, as it was observed in the field, some maintenance work on some of structures was under taken by the farmers in their plots of land. According to the DAs in the study area, the attitude of the farmers towards MERET SWC intervention is positive because they have seen certain benefits from the conservation structures. Therefore, since farmers acknowledge positive attitude of and benefits from the project SWC intervention, they tend to adopt the structures.

## 4. Conclusion and Recommendations

**Conclusion**

A large number of indigenous SWC measures are practiced by farmers in the study area. They have been using different indigenous SWC measures before the introduction of new SWC technologies (promoted by WFP's MERET project) to minimize the rate of soil erosion on their plots of land. These measures are traditional dithes (*boyi)*, traditional waterway (*Gorf Mekided*), mixed cropping, contour ploughing, crop rotation and *dib*. It was the farmers who reported that the indigenous soil and water conservation practices were flexible, fitting into the farming systems, cheap and simple to construct. However, the majority of farmers indicated that the indigenous soil and water conservation measures are less effective than the introduced ones in tackling the soil erosion problem.

The WFP's MERET project has been implemented in the study area since 1996 with the objective of conserving and rehabilitating the degraded lands and improving the livelihood and food security situation of the households. It follows the Local Level Participatory Approach (LLPPA) which is a bottom up participatory approach using various PRA (Participatory Rural Appraisal) techniques and watershed management principles, which encourages land users to develop their own plans for land rehabilitation and assets creation. This approach is also assuming to integrate indigenous SWC practices but it was found out that this was not given much emphasis on indigenous SWC measures.

MERET project uses food for work incentives. However, almost all farmers (99%) confirmed that they would continue to carryout SWC measures in their plots of land in the event the project stops support. This partly indicated that the sustainability of SWC activities in the study area.

The SWC that are newly introduced in the study area are soil bunds, stone bunds, stone-faced soil bunds, hillside terrace, check dams, sediment storage dams (SS dams), micro basin and cut off drain. These are physical soil conservation measures. In the study area, it was found out that the MERET project did not give much emphasis on biological measures. Farmers had a favorable perception about the introduced SWC measures. They stated that the dominantly perceived benefits gained from using the introduced SWC measures are reduced soil erosion, increase in soil productivity, better growth of crops along the SWC structures and new land reclaimed along gullies.

The introduced SWC measures seem to be accepted and widely practiced by farmers. They were implemented and using the introduced SWC measures in the rest of plots (outside the project) without using incentives. In addition, the majority of the sampled farmers did some maintenance work on the newly introduced SWC measures on their plots of land before they started ploughing. This indicates in part at least the sustainable adoption of the introduced SWC measures in the study area. The major pull factors for adopting the introduced SWC measures on their plots of land were found to be perception of soil erosion as a critical problem, availability of labor, small land holding size, access to extension service, land tenure security, participation and positive attitude of farmers towards the introduced SWC measures.

**Recommendations**

In order to achieve sustainable land management in the foreseeable future in the study area the following points will be critically considered.

1. The MERET project's LLPPA assumes to integrate the indigenous SWC measures but in reality the project did not give much emphasis on indigenous SWC measures of the study area. Therefore, there is a need to critically evaluate their advantages and disadvantages of the measures, take a lesson from their advantages, and hence selecting and integrating them to introduced SWC measures could ensure further sustainability of the project as it is highly adapted to the changing condition of the past. This could also complement the conservation effort made.
2. The study clearly indicates that the main emphasis of the project has been placed on physical measures. Biological measures have an advantage over physical measures, as they are less technical, can be undertaken by individual farmers and take much less land out of production. Then, more attention needs to be placed on biological measures to stabilize the physical structures on cultivated land since this makes the measures more adoptive and profitable.
3. It is also recommended the promotion of yield enhancing inputs together with conservation activities need to be integrated.

**Acknowledgments**

I would like to forward my earnest thanks to the interviewer and farmers for their willingness to participate in the study. My special thanks to Gidan Wereda administrative office workers (cabinet) for their financial support and facilitating the data collection process. Finally, I also would like to thank Addis Ababa University School of Graduate Studies for the financial support for the study.

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