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Farmers Perception on SWC practices, and its Implication on Land Degradation in Guduru District, Western Ethiopia

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Abstract

Ethiopia is one of the well-endowed countries in Sub-Saharan Africa in terms of natural resources. However, land degradation is a major problem in the country. The objective of this study was to assess farmers' perception on soil and water conservation (SWC) practices and its implication on land degradation. Data were collected using questionnaires, interviews, and focus group discussions from 117 randomly selected households. The result indicated that the perception of farmers on SWC practices was significantly influenced by age, sex, marital status, household size, educational qualification, farm-size (ha), farmers' experience, distance from the homestead, and household income. Besides, greater than 50% of the respondents were aware of the causes of land degradation by indicating population growth, over-cultivation, overgrazing; soil erosion, poor farming practices, and poverty as the major causes. Furthermore, most of the respondents (>75%) were aware of the consequences of land degradation by pointing out the loss of agricultural productivity, the difficulty of farming, and loss in livestock productivity as the major ones. Moreover, about 72.5% of the respondents indicated that land degradation on their farm-field was severe. The SWC measures practiced in the study area include cutoff drains, contour farming, waterways, check dams, fallowing, application of manures, and soil bunds. Thus, it can be concluded that the perception of SWC practices is affected by many factors. Besides, land degradation in the study area can be deceased first by creating awareness in the society on the consequences of land degradation and then implementing SWC measures.

Introduction

Background

Land degradation is a long-term decline in ecosystem functions caused by disturbances from which land cannot recover unaided (Bai *et al* ., 2008). Land degradation occurs as a result of anthropogenic activities and climatic variations (Ahmed and Pandey, 201. It includes all processes that diminish the capacity of land resources to perform essential functions and services in ecosystems (Hurni *et al* ., 2010). It is caused by the natural ecosystem and the human social system. Interactions between the two systems determine the success or failure of resource management (Berry, 2003).

Land degradation has become an important concern affecting food security affecting peoples' livelihood (Bezuayehu *et al* ., 2002). Over-grazing, deforestation, agricultural expansion and backward agricultural practices are considered as the major causes of land degradation (Stocking and Murnaghan, 2000; FAO 2004; FRA, 2005).

Ethiopia is one of the well-endowed countries in SSA (Sub-Saharan Africa) in terms of natural resources (Gete *et al* ., 2006). However, land degradation is a major problem. The major driver is the conversion of forest into agriculture and inappropriate agricultural practices. The Ethiopian population has been growing at a fast rate from 12 million at the beginning of the 1900s to 74 million in 2007, i.e., at a rate of <1.3% before 1950 and 2.6% between 1994 and 2007 (CSA, 2008) which is now greater than 110 million (FDRE, 2018). Due

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to the favorable climatic conditions, the Ethiopian highlands have a long history of settlement and sedentary agriculture, and as a result, the density of the human and livestock population is high (Sonneveld and Keyzer, 2003). The problem is very serious particularly in steep lands where rain-fed agriculture constitutes the main livelihood of the people (Shiferaw and Holden, 2001). This diminished potential productivity and the economic utility of the land (Mitiku *et al* ., 2006).

Land degradation due to soil erosion and nutrient depletion is considered as the main problem constraining the development of the agricultural sector in Ethiopia (Amsalu and de Graaff, 2007; Tefera and Sterk, 2010). It also directly threatens the long-term growth of agricultural productivity, food security, and the quality of life (Shiferaw *et al* ., 2009).

Efforts to conserve soil and water resources and prevent land degradation date back to the mid-1970s and 80s in Ethiopia (Bekele and Holden, 1998). Since then many public organizations and NGOs have been involved in addressing the widespread problem of land degradation. SWC works have been carried out through campaign. Incentives like food for work or cash for work were used as instruments to stimulate farmers to put up the structures even in their fields. However, the efforts put towards the promotion of the technologies so far seem to have had a limited impact in increasing the sustained use of conservation measures (Eshetu, 2004). The limited success of the efforts highlights the need to better understand the factors that encourage/discourage the adoption and the sustainable use of conservation practices (Belay, 1992). The adoption of improved technology is for the most part affected by farmer characteristics, farm-specific conditions, technology characteristics, and institutional set up in which production takes place (Bekele and Holden, 1998).

The most important reason for the limited use of SWC technologies is farmers' low perception and adoption behavior. According to Kessler (2006), SWC measures fully adopted only when their execution is sustained and fully integrated into the household's farming system.

Soil and water conservation efforts have focused on highly degraded areas with limited production potential in the district. Marginal steep lands have been terraced with a few structural SWC measures (Guduru district agricultural office, 2019). Despite the promotion, the adoption of SWC practices by farmers has been limited. Farmers of the study area have limited information on the management of land degradation and SWC practices. For example, most farmers have not implemented stone bund terraces because they assume it decreases the cropland (Guduru district agricultural office, 2019) as a result, land degradation remains a major threat to agricultural production. Thus, there is a need to assess farmers perception of SWC practices and its implication on land degradation. Therefore, the objective of this study was specifically to assess farmers perception of SWC practices and the causes and consequences of land degradation.

Materials and Methods

Description of the study area

Guduru District is one of the 11 districts found in Horo Guduru Zone in the Oromia region, western Ethiopia. It is 275km far from the capital city of Ethiopia, Addis Ababa. Geographically, it is located between $8^{o}54'0"$N to $9^{0}42'0"$ N Latitude and $37^{o}16'0"$ to $37^{0}40'0"$ E Longitude (**Fig.1**). The major soil type are Nitisols characterized by low pH. The topography of the area is characterized by mountainous (1288.5ha), flat (45,189.70 ha) and undulating (44,177.3 ha) of land (GDANRO, 2019)

The district experiences two rainy seasons, Belg and Kiremt. Belg is the short rainy season and lasts between March and May. Kiremt season (June –August) is very intensive and, hence, the severity of soil erosion is high during these three months. The mean annual rainfall ranged 1500mm-1896mm (Guduru district natural resources management office, 2019). The temperature range is from 10 to 15 in a wet season and 15 to 25 in a dry season and the average temperature is 19 degrees centigrade (Guduru meteorology office, 2005). The

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major land uses in the area are cultivated land (34365ha), forest (20365ha), grazing land (10161.29ha) and the rest are swampy area, water body, and wasteland.

The total population of the district was 98,622 (Guduru district finance economic development office, 2019). Out of this 48,848 were males and 49,084 were females. Besides more than 85% of its population depends on agriculture for their livelihoods and practiced mixed crop-livestock farming systems.

Methods of Data Collection

For conducting the study two main data sources were used. These were primary and secondary sources. The primary data were collected through field observation, focus group discussion, key informant interview, and household survey. The household survey was used to collect qualitative data. Before conducting the questionnaire survey, the draft questionnaire was given considerable attention to develop understandable, unambiguous, and well-targeted questionnaires by avoiding confusing and incomprehensible terms that can erode the confidence of the respondents. The testing of the questionnaire was done in the actual study area to cross-check the relevance of its contents. The secondary data were collected by reviewing the available project documents, reports, and research papers.

Determination of sample size

The basic sampling unit was the farmer's household who derive their livelihood entirely from agricultural activities. The sample households were selected from the sampling frame by using simple random sampling methods. The total population of the three kebeles was 716 households (Table 1). A sample size of 117 households out of the total population was considered for data collection because of their homogenous characters. The estimation of sample size from the total population was done according to Naing *et al. (* 2007)

Sampling technique

Guduru District has 25 kebeles and from these, three kebeles were selected. The selection of the kebeles was based on the severity of land degradation and the implementation of SWC and management practices, and farmers' awareness of land degradation in the area. Thirty-nine (39) household heads from each kebele (i.e., Dilalo Bero, Hula Guto, and Gudane Sirba) which account for a total of 117 sample households from the three kebeles were selected randomly.

Data analysis

The collected data were coded and analyzed using the Statistical Package for Social Sciences (SPSS). Quantitative data was analyzed using descriptive statistics like percentages and means. Chi-square was also used to see the relationship between farmers' perception and the affecting factors.

Results and Discussion

Demographic and Socio-Economic Characteristics of the Respondents

The perception of farmers on the application of SWC and management practices was influenced by different factors (Table 2). These factors include age, household size, and income, educational status of farmers, landholding size, farmers' experience. Besides, lack of information on benefit and cost of SWC measures, distance from the homestead, level of contact with developmental agents (DA's), lack of training on conservation techniques have significant influences on practicing SWC measures.

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Age of household heads

The results in Table 2, showed about 4.27% of household heads were less than 18 years old, about 69.23% were between 18-49 years old and 26.5 % were above 50 years old. The average age of participated farmers was 33, with a minimum age of 20 years and a maximum of 80 years. The study revealed that age had a significant ($p<0.001$) effect on perception and adoption of SWC practices. Households argued that older farmers couldn't make activities that require hard work like soil bund and stone terracing. Thus, the aged farmers have trouble with practicing SWC in their fields. On the other hand, aged persons practice less labor demanding technologies such as simple cutoff drains, contour plowing, planting grasses, and use of other agronomic conservation measures. This supports the works of Taye (2006) and Bekele and Drake (2003) who stated that younger farmers with longer planning horizons are likely to invest more in SWC practices as compared to aged farmers. According to Okoba (2005), older members of households, having longterm interaction with their environment were able to compare past and present production trends when describing the patterns of land degradation.

Sex

As SWC practices is aimed at combating land degradation, it must be implemented on both sexes of a community. As indicated in Table 2, there was a significant ($p<0.001$) difference in practicing SWC measures due to sex. It was found that 85.5% of the households were males farmers and 14.5% were female farmers. Most of the female farmers had less interest to construct SWC practices, but they need help from elsewhere. As a result, the majority of female farmers apply less SWC measures in their farmland. Some practice cutoff drains and waterways. Besides, 25% of females responded that they have much workload and home care despite involvement in farm activities that need much effort and investment to increase production. The adoption of SWC practices is influenced by the sex of household head (Asfaw and Neka, 2017).

Marital status

The marital status of respondents (Table 2) showed that about 86.32% of the respondents were married while, 4.27% of the populations were unmarried, 1.7% were divorced and, 7.69% of the populations were widowed. It indicated that marital status significantly ($p<0.05$) affected the perception and adoption of SWC practices. The majority of the households responded that the SWC practices were left for married household heads. Marital status also had an implication on the size and structure of families in a household and hence on practicing SWC measures (Asfaw and Neka, 2017).

Household size

The household size is one of the determinant factors which affected SWC practices. The chi-square test results (Table 2) indicated that there is a significant ($p<0.05$) relationship between household size and SWC measures. The household with less than 4 members make up 23%, households while, with 5-8 members constitute 52.99%; households with 9-10 make up 14.95% and households above11 constitute the remaining 5.98%. The sample survey of households of the district implies that many rural households (85 percent) had at least 5 members per household head.

The study results revealed that the majority of respondents agreed on having a large number of children or a large family size is important. The size of family members can be seen from two different angles. The first when there is a large family size in which the majority of family members are capable of working and it is very important for practicing SWC measures. On the other hand, having a small number of children requires additional labor to construct and maintain SWC measures and as the result of the shortage of working forces, they reject SWC measures. This is in with the findings of Drake (2003) in eastern Ethiopia.

Educational level

The literacy level of farmers brought differences in awareness about SWC practices and its effect on land degradation. Educational level significantly ($p<0.05$) affected the perception and adoption of SWC practices.

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The result in Table 2, indicated that 52.14% of the respondents were illiterate, 37.60% of the respondents attended primary school and, about 10.26% of respondents attended secondary school (9-12) and above. Level of education is one of the demographic features of households that play a crucial role to increase farmers knowledge about land management practice and give awareness to the causes and consequences of land degradation. As the educational status of a household head increases, it is assumed to increase the transfer of relevant information. This finding is supported by Shibru (2003) who reported education enables farmers to tackle land degradation using various ways of SWC practices.

Household incomes

The data given in Table 2, indicated the percentage distribution sample household heads by income. Accordingly, about 57.26 %t of the respondents had a mean annual income of less than 25,000 birr and about 38.46.5% of respondents had a mean annual income between 25,000 to 35,000 birr. While about 4.27% of the respondents had a mean annual income of 35,000 to 55,000 birr.

This indicated that even the construction of a single soil bund can cost much money and needs a large number of labor forces and give a better role for large family members.

The chi-square result (Table 2) revealed that there is a significant ($p<0.05$) relationship between income and conservation practices. According to the respondents, income is one of the factors which affect soil and conservation practices. Accordingly, farmers who faced labor shortage and no money to pay, reject the construction of physical SWC measures, and then shifted their decisions towards the practice of biological SWC measures that might not compensate the benefit of SWC measures in controlling soil loss. This indicated that even the construction of a single soil bund can cost much money and needs a large number of labor forces and give a better role for large family members. This implied that there was a lack of interest in SWC measures when there is a lack of money and a shortage of labor.

Landholding size

Land size is an important factor that affects the practice of SWC measures. The landholding of farmers in the study area varied from less than 0.25 hectares to more than 2 hectares with an average holding of 0.43 hectares per household. As it can be seen from Table 2, the households with less than 0.5 hectares make up to 65.81%, households with 0.51 hectare to 1.0 ha constitute 24.79% and households with 1.01 hectare to 1.50 hectare make up 4.27%. The household more than 2 hectares constitute 5.13%. Pressure on land at the household level has been increasing as long as the population growth is increasing.

Land size and practices of SWC measures have a significant relationship. According to the respondents, those farmers having a large size of farmland practice SWC measures whereas those with small size of farms have negative attitudes towards practicing SWC measures (Table 2). These farmers lack trust in SWC measures as they have poorly participated in the planning and designing of the SWC program. Hence, farmers in the study area perceived to reject SWC methods because more than half of the farmers had land size below half hectares. The most important reason is those with small land size believe establishing conservation methods occupy space and diminish cultivated land. This intention of farmers was supported by the finding of Assefa (2009). Constructing soil bunds causes for a decrease in farmland size (Shiferaw and Holden, 1998).

Farming Experience

There has been little information on the role of experience or years farming in the literature to date. About 62% of participants responded that when the farming years increase the implementation of SWC measures increased as well. farming years are positively related to the adoption of conservation practices. Norris (1987) found that farmers with more experience were more likely to adhere to SWC practices.

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Distance from homestead

Distance from cultivation land to homestead influence the practice of SWC measures. The chi-square test result indicated that there is a significant relationship between distance from the homestead and practicing SWC measures. It was observed that the majority of the respondents' farmland was far from their homestead. Only 11.11% and 29.06% of the respondents had cultivation land near and moderate to their residence respectively, and 59.83% of respondents' cultivation land was far from their residence. As the distance of farmland increases from farmers' homes, the probability of adopting SWC practices decreases (Asfaw and Neka, 2017).

The feasible explanation is that the nearer the cultivation fields to the homestead, the frequent the land management and SWC practices (Assefa, 2009). When runoff comes, farmers are ready to protect the soil and maintain the damaged bunds and check dams in the nearer fields. However, farmers having land far from their residence usually do not visit their cultivation field regularly except during harvesting and planting season. Thus, if the farm field is located near the farmhouse, it becomes easier to manage and receives better attention (Chomba, 2004).

SWC measures practiced in the area

Cutoff drains

The minimum used SWC measures in the study area were cutoff drains 7.7% and with a mix of contour farming SWC practices. This structure is a graded channel constructed mainly in moist areas to intercept and divert the surface runoff from higher slopes and protect downstream into cultivated land or village. It is constructed during the dry season to avoid barriers to land preparation for the main cropping season. On the contrary, cutoff drains in dry areas are used to divert runoff and additional water into cultivated fields to increase soil moisture but there is a limitation in practicing measures in the study area. The farmers construct such structures to prevent loss of seeds, fertilizers, and soil due to excessive run-off coming from uplands of the terrain. This structure is constructed mainly by oxen-drawn plow, and reinforced by stones, wood blocks of soils with grass. Here the difference is that the structures are maintained by local materials and are not causing serious problems in the area.

Waterways

Waterways can be natural or manmade drainage channels to receive diverted runoff from cutoff drains in the upper slope. In the study area, about 12.0% of the respondents (Table 3) responded that they practice waterway with the integration of other conservation practices. The waterway carries the excess runoff to rivers, reservoirs, or gullies by creating more erosion damage.

Soil Bunds

Soil bunds are constructed during the dry season that does not interfere with land preparation for cropping. It increases soil productivity by capturing moisture and crop yields over time. About 69.2% of the household heads in the study area practice soil bunds (Table 3). However, the disadvantage of this structure as explained by the farmer is that it requires a lot of maintenance in a short period due to being filled with soil immediately after heavy rainfall and did not allow oxen plow. It is mainly implemented on cultivated land with slopes in the range of 8% to 25%, but also on grazing land with gentle slopes at wider intervals (Lakew *et al* . 2005). Since the beginning of introduced SWC measures in 2004, there was a continuous construction of soil bunds, yet there is an interruption in implementation. In 2013, 2014 and 2015 the length of constructed, maintained and preserved soil bund in the study area was 108.42km, 95.5 km and 85.5 km respectively (Guduru district office of agriculture, 2019)

Check dams

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Dominantly, the brush-woods and soils are used to construct check dams and about 29.6 % of the farmers use it with a mix of other SWC measures (Table 2). Diverting runoff from the cultivated field to the main and community road is very common in the study area. Tree branches and grassed soil are traditionally used to construct check dams, and effectiveness is constrained by erosive of rainfall and size of the channel.

Agronomic management practices

Mixed cropping and crop rotation

Farmers were asked why they preferred mixed farming and crop rotation. About 93.2% and 83.7% of the farmers responded that they preferred mixed farming and crop rotation respectively on their farm. This is due to small landholding and large family size. Besides, mixed cropping is important for soil fertility. Finally, for those who have a small size of land, mixed cropping is important to get different types of crops at a time.

Contour Farming

Contour farming is a practice of cultivating the land along the contour line to reduce the runoff on a steep slope area. The study showed that this type of conservation practices were most often used by the farmers. From the sample household heads, 79.49% applied the contour farming with a mix of the other conservation measures including cut off drain, fallowing, waterways, and application of manure. While the farmer plows the land along the contour for the preparation of an appropriate seedbed for production, it serves the purpose of conserving the soil from erosion.

Fallowing

Most of the land under this treatment is highly degraded to the extent of almost reaching a point of no return or recover within a short time. It is a traditional practice of leaving the land out of production for 3-5 years to restore soil fertility and minimize soil loss. Generally, farmers leave the land or fallowing after all the soils removed from the land and the land is unable to produce under normal conditions, and only stones are found exposed on the land. Only 16.24% of the respondents apply fallow as a SWC measure. The farmers learned that through time traditional fallow periods have become very short and rare in the areas as a result of the high population pressure and associated low agricultural productivity.

Application of manure

Farmers didn't apply manure on the soil, which was rather simply thrown near the homestead. During the survey, however, it was found out that since the last 4-5years the farmers used the manure to improve the fertility of soil. The main reason farmers shifted to this practice was attributed to the skyrocketing price of inorganic fertilizers which are unaffordable by the farmer. But currently, only 12.82% of the respondents practice this measure, as there is a very critical shortage of fuelwood and not much livestock in the area.

The practical observations, discussions, and interviews indicated that other management practices are going in the study area. Some of the farmers prepared compost from animal manures, plant leaves as well as crop residues to maintain soil fertility. But it needs knowledge and training to prepare effectively according to the respondents. Therefore it requires trainers who are ready and have a good knowledge regarding the instructions of better compost preparation. Some of the farmers used crop residues maintaining soil fertility through the shifting of animal feeding beds.

Factors that limit the implementation of land management practices

Different factors limit farmers to implement different land management practices in the study area (Table 4). The major factors affecting them were lack of training (78.1%), inefficient support from developmental agents

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(70.0%), limited support from district agricultural office (53.6%), and lack of good relationship between farmers which constitutes 43.1% respectively. According to the respondents, those farmers who lack trust in conservation measures poorly participate in the training, planning, and design of SWC program. Besides, due to inefficient support from developmental agents and limitations from the district agricultural office, farmers were less committed to practice SWC. According to Shiferaw and Holden (1998), the lack of attention on natural resources leads to drought and reduced household income, in turn, affect farmers that entirely engaged in agricultural activities in the Ethiopian highlands.

Institutional factors that influence SWC practice

Source of information

The results (Table 5) showed that friends and relatives were indicated by 80% of respondents as the most significant source of information. About 62.5% of the respondents used *Keble* leaders as a source of information. While about 59.3% and 53.7% of the respondents got information from extension or developmental agents and through electronic media (radio) respectively. Others were aware of the problem of land degradation through interaction with neighbors.

The respondents agreed that land degradation could be minimized in the study area first through creating awareness on the society about the outcomes of land degradation. Secondly, giving material and financial support to those who depend upon these activities. Thirdly, giving land for cultivation which they depend upon crop production and finally formulating and implementing policies to protect land degradation. This is supported by the works of de Graaff (2008) who stated that the underlying cause for the excessive soil loss is unsustainable exploitation of land via poor resources utilization and expansion of cultivated and grazing lands. As the study area is more susceptible and relatively highly populated and increasing intensification and continuous cultivation on sloping lands without fallowing or conservation measures was a serious threat to sustainable land use management.

Lack of adequate training

More than half of the farmers in the study area didn't get training on SWC practices. About 63.5% of the sample households never get training on SWC applications and 31.9% have got only limited training and only 5.6% have received adequate training. Farmers who have not accessed to training have gained experience from their neighbors and traditionally from their elders.

According to focused group discussion farmers require training on SWC for enhancing soil fertility, crop production and yield maximization, and appropriate land use. Training and education on SWC and land management practices need to be provided to create further awareness of resource conservation. The construction of SWC requires relatively frequent training and appraisal. Moreover, giving training on SWC measures improves the relationship between farmers and DAs and encourages them to implement new conservation measures.

Lack of Communication

Access to information and contact with DA has a role in the practice of SWC measures. Communication between farmers and extension agents in the study area was poor and not built up very much. The study revealed that about 37.5% of the farmers had contact with development agents. Of these farmers, 25% have good contact and practiced SWC measures on their land. About 11.8% of the farmers practiced SWC measures on their fields with the assistance of DA (Table 6). However, 62.5% of respondents had poor or no contact with development agents and had poor supervision and support from extension agents. Extension services are important to enhance farmers' confidence in SWC activities and to encourage them take possible risks associated with the initiatives (Biratu and Asmamaw, 2016).

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Having good relations with DA helps farmers in reducing hazards associated with soil erosion and conservation by providing information. This shows that it is not sufficient to have extension support but the aim or purpose of the extension service should also relate to the continuation of expressed satisfaction with the technical support are not more involved in the continued work. This is in line with the study by Chomba (2004) who got a large proportion of farmers who had limited contact with conservation workers.

Farmers' perception on the causes of land degradation

The farmers' perceived that their land is being degraded. About 60% responded that decreased crop productivity was the consequence of land degradation, and about 85% of the respondents agreed the degradation was more severe in the last five years (Table 7). The result indicated that the main causes of land degradation was population growth responded by 77.78% of the population, over-cultivation (76.07%), overgrazing (73.50%), poor farming practices (54.70%), and poverty responded by 51.28% of the sample households. This showed that relatively the majority of the farmers were aware of the causes of land degradation. It is worth that population growth may not be the cause of land degradation but rather the land use activities or practices adopted by that population. It was reported that a high population can be an incentive for SWC practice (Tiffen *et al.* 1994).

Farmers' perception on the consequences of land degradation

The results indicated that most of the respondents were aware on the consequence of land degradation by indicating the loss of agricultural productivity results from land degradation responded by 90.6% of the population, followed by the difficulty of farming (86.2%) and loss in livestock productivity (75.6%) (Table 8). But most of the respondents (78.1%, 75.6%, 71.8%, %, 61.2%) were not aware of drought, desertification, migration, and landlessness were the consequences of land degradation respectively.

Similarly, from the group discussion, farmers responded that land degradation is affecting their living and their socio-economic conditions. The results revealed that most of the farmers living conditions are deteriorating from time to time due to decreasing crop production, resulting from land degradation. According to the respondents, previously crops produced mainly wheat, sorghum, beans, and pea were the source of income in addition to home consumption. But at present, it is challenging to be a source of income and it is not even sufficient to feed their family. Due to the decline in crop yield, and the resulting income reduction and the progressive price increment of fertilizer and the farmer' inability to afford it, farmers are becoming food insecure. The finding is in line with Moges and Holden (2006) who reported land degradation through soil erosion is a major cause of poverty in rural areas of Ethiopia. In many areas, farming populations have experienced a decline in farm income. The immediate consequence of land degradation is reduced crop yield followed by economic decline and social stress (Moges and Holden, 2006).

Conclusion

The dominantly practiced SWC measures in the area include cutoff drains, waterways, soil bunds, fallowing, and application of manure. The majority of farmers in the study area had no enough perception of the unique benefit of different types of conservation structures. Thus, the practice of different types of SWC method is limited. The practice of SWC measures was affected by age, sex, education level, household size, land size, off-farm activities, distance from homestead, contact with DAs, and training on SWC measures. Crop production is deteriorating from time to time due to land degradation and poor SWC practices. To solve the problem there is a need to aware of the society about the causes and consequences of land degradation and then implement SWC practices.

References

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Ahmad N, and Puneeta P. 2018. Assessment and Monitoring of Land Degradation Using Geospatial Technology in Bathinda District, Punjab, India. Solid Earth, 9:75–90. https://doi.org/10.5194/se-9-75-2018

Amsalu A, de Graaff J. 2007. Determinants of adoption and continued use of stone terraces for SWC in an Ethiopian highland watershed. Ecological Economics **61** (2-3):294-302. DOI: 10.1016/j.ecolecon.2006.01.014

Assefa D. 2009. Assessment of upland erosion processes and farmer's perception of land conservationin DebreMewi watershed, near LakeTana, Ethiopia (M. Sc thesis). United States: Cornell University.

Asfawa D, Neka. 2017. Factors affecting adoption of soil and water conservation practices: The case of Wereillu Woreda (District), South Wollo Zone, Amhara Region, Ethiopia. International Soil and Water Conservation Research **5** :273-279. http://dx.doi.org/10.1016/j.iswcr.2017.10.002

Bai ZD, Dent L, Olsson M. 2008. Schaepman. Global assessment of land degradation and improvement. Identification by remote sensing. No. 2008/01 in. ISRIC-World Soil Information, Wageningen.

Bekele W, Drake L. 2003. Soil and Water Conservation Decision Behavior of Subsistence Farmers in the Eastern Highlands of Ethiopia: a Case Study of the HundeLafto Area. Journal of Ecological Economics,**46:** 61-81. https://doi.org/10.1016/S0921-8009(03)00166-6

Belay T. 1992. Farmers' Perception of Erosion Hazards and Attitudes towards SWC in Gunono, Wolayita, and Southern Ethiopia: Ethiopian Journal of Development Research. **14** : 31–58. DOI: 10.1080/15715124.2016.1167063

Berry L. 2003. Land degradation in Ethiopia: its impact and extent in Berry L, Olson J. and Campbell D (ed): Assessing the extent, cost, and impact of land degradation at the national level: findings and lessons learned from seven pilot case studies. Commissioned by global mechanism with support from the World Bank.

Bezuayehu T, Gezahegn A, Yigezu A, Jabbar M, Paulos D. 2002.Nature and causes of land degradation in the Oromiya Region: socioeconomic and policy research working paper 36. International Livestock Research Institute.

Biratu AA, Asmamaw DK. 2016. Farmers' Perception on Soil Erosion and Participation in Soil and Water Conservation activities in the Gusha Temela Watershed, Arsi, Ethiopia. International Journal of River Basin Management. http://dx.doi.org/10.1080/15715124.2016.1167063

CSA (Central Statistical Agency of Ethiopia) .2008. Summary and statistical report of the 2007 population and housing census. CSA (Central Statistical Agency of Ethiopia), Addis Ababa.

Chomba, GN. 2004. Factors Affecting Smallholder Farmers' Adoption of Soil and Water Conservation Practices in Zambia. M.Phil. Thesis, Michigan State University.

de Graaff J, Amsalu A, Bodnár F, Kessler A, Posthumus H, Tenge A. 2008. Factors influencing adoption and continued use of long-term soil and water conservation measures in five developing countries. Appl Geogr. 28(4):271–80. http://dx.doi.org/10.1016/j.apgeog.2008.05.001

Drake L. 2003.Adoption of SWC Measures by Subsistence Farmer in Eastern Ethiopia: Presented at the 17th World Congress of Soil Science, Bangkok, Thailand.

Eshetu Z. 2004. Natural N^{15}abundance in soils under young-growth forests in Ethiopia. Forest Ecology and Management**187** (2-3):139-147.

Eswaran H, Lal R, Reich PF. 2001. Land Degradation: An overview. In Bridges, E.M., I.D, Hannam, and L.R. Oldeman, F.W.T penign de vries, S.J. Scherr, and S.Sompatpanit (eds.).Responses to land Degradation. Proc. 2nd international conference on land degradation and desertification. Oxford: Oxford University Press. Ethiopian Highlands Agro Ecosystems. http://muse.jhv.edu/journals/Northeast.

Posted on Authorea 7 Aug 2020 — The copyright holder is the author/funder. All rights reserved. No reuse without permission. — https://doi.org/10.22541/au.159682275.54499268 — This a preprint and has not been peer reviewed. Data may be preliminary.

FAO. 2003. Towards sustainable agriculture and rural development in the Ethiopian highlands Proceedings of the Technical Workshop on Improving the Natural Resources Base and Rural Well-being. November 25-27, Bahir Dar, Ethiopia.

FRA. 2005. Global forest resource assessment (FRA): 15 key findings. http://www.fao.org/forestry/foris/data/fra2005/kf/common/GlobalForest A4.

Gete Z, Menale K, Pender J, Mahmud Y. 2006. Stakeholder Analysis for Sustainable Land Management (SLM) in Ethiopia: Assessment of Opportunities, Strategic Constraints, Information Needs, and Knowledge Gaps. Environmental Economics Policy Forum for Ethiopia (EEPFE). Pp4-91.

Hurni H, Solomon A, Amare B, Berhanu D, Ludi E, Portner B, Birru Y, Gete Z. 2010. Land degradation and sustainable land management in the highlands of Ethiopia. Journal of American Science **5** (1):58- 69. DOI:10.1002/(SICI)1099-145X(199811/12)9:6<529::AID-LDR313>3.0.CO;2-O

Kessler A. 2006. Moving people-towards collective action in SWC's Experiences from the Bolivian mountain valleys. PhD Dissertation, Wageningen University.

Mitiku H, Karl H, Brigitta S. 2006.Sustainable land management- A new approach to SWC in Ethiopia. DOI: 10.7892/boris.19217

Moges A, Holden M. 2006. Farmers perceptions of soil erosion and soil fertility loss in southern Ethiopia. Land Degradation and Development 18: 543-554. https://doi.org/10.1002/ldr.795

Norris, P.E. 1987. 'Virginia farmers' SWC decisions: Tobit. An application Tobit.

Okoba BO, Sterk G. 2006. Farmers' identification of erosion indicators and related erosion damage in the Central Highlands of Kenya. Catena**65** (3):292–301. DOI: 10.1016/j.catena.2005.12.004

Shibru T. 2010. Land Degradation and Farmers' Perception: The Case of Limo Woreda, Hadya Zone of SNNPR, Ethiopia. MSc thesis, Addis Abeba University, Addis Abeba.

Shiferaw B, Holden S. 1998. Resource Degradation and Adoption of Land Conservation Technologies in the Ethiopian Highlands: A case study in AnditTid, North Shewa. Agricultural Economics **18** : pp 233-248. https://doi.org/10.1111/j.1574-0862.1998.tb00502.x

Shiferaw B, Holden T. 2001. Farm-level benefits to investments for mitigating land degradation: empirical evidence from Ethiopia. Environ. Dev. Econ **6** :335-358. DOI: 10.1017/S1355770X01000195

Shiferaw B, Okello J, Reddy R. 2009. Adoption and adaptation of natural resource management innovations in smallholder agriculture: reflections on key lessons and best practices. Environ. Dev. Sustain**11** :601-619. DOI: 10.1007/s10668-007-9132-1

Sonneveld BGJS, Keyzer MA. 2003. Land under pressure: Soil conservation concerns and opportunities for Ethiopia. L Degrad Dev.**14** (1):5–23. DOI:10.1002/ldr.503

Taye AA. 2006. Caring for the Land Best practices in soil and water conservation in Beressa watershed.

Tefera B, Sterk G. 2010. Land management, erosion problems and SWC in Fincha'a watershed, Western Ethiopia. Land Use Policy**27** :1027-1037. DOI: 10.1016/j.landusepol.2010.01.005

Tiffen M, Mortlimore M, Gichuki F. 1994. More people less erosion' hypothesis: environmental recovery in Kenya. London: John Wiley.

Table 1. Distribution of sample households in the study area

Kebeles	**Total household**	**Sample size**
Dilalo Bero kebele	278	39
Hula Guto	225	39
Gudane Sirba	213	39

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Total		**716**		**117**	

Table 2. Demographic and socioeconomic characteristics of households, and SWC practices

Age of household head	Less than 18 years	5	4.3		
	Between 19-48	81	69.2	171.75	0.001
	Above 50 years	31	26.5		
Sex of household head	Male	100	85.5	173.50	0.001
	female	17	14.5		
Marital status	Single	5	4.3	183.10	0.02
	Married	101	86.3		
	Divorced	2	1.7		
	Widow	9	7.7		
Educational level	Illiterate	62	53.0		
	Primary school	43	36.8	187.20	0.03
	Secondary school	12	10.3		
Family size	1-4	27	23.1		
	5-8	63	53.8	181.03	0.02
	9-10	20	17.1		
	Above 11	7	6.0		
HH income per year	<2500 birr	98	83.8	174.30	0.05
	2500-3500 birr	11	9.4		
	3500-5500 birr	8	6.8		
Major sources of income	Sales of production	85	72.6		
	Sales of animal feed	8	6.8		
	Off-farm income	9	7.7		
	Income from government	10	8.5		
	Income from NGO	5	4.3		
Farm size (ha)	<0.5 ha	86	73.5	180.00	0.04
	0.5ha-1.0ha	12	10.3		
	1ha-1.5ha	4	3.4		
	1.5ha-2ha	6	5.1		
	>2ha	9	7.7		
Distance from homestead	Near (10-30 minute)	13	11.11	186.70	0.02
	Medium (31-35minute)	34	29.06		

	SWC practices	**SWC practices**	**Frequency**	**Frequency**	**Pe**
	Soil bund	Soil bund	81	81	69
	Cutoff drain	Cutoff drain	9	9	7.7
	Waterways	Waterways	14	14	12
	Check dams	Check dams	13	13	11
Agronomic management practices always	**Always Frequency**	**Always %**	**Some times Frequency**	**Some times %**	**No Fr**
Mixed cropping	109	93.2	7	6.2	-
Crop rotation	98	83.7	13	11.2	7
Contour plowing	91	77.5	18	15.0	9
Fallowing	11	9.3	20	16.8	86

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	SWC practices	**SWC practices**	**Frequency**	**Frequency**	**Pe**
Organic manure	26	21.8	51	43.7	40

Table 4. Factors that limit land management practices

Factors	**Frequency**	**Percentage**
Lack of training	91	78.1
Inefficient support from developmental agents	82	70
limited support from district agricultural office	63	53.6
Lack of good relationship between farmers	50	43.1

Table 5. Respondents sources of information on land degradation and SWC practices

Respondents Sources of Information	Frequencies	Percentage
Friends and relatives	94	80.0
Keble leaders	73	62.5
Developmental Agents (DA)	69	59.3
Electronic media (TV, radio, etc)	63	53.7
Trainings on SWC	32	27.5
Schools	15	12.5
Others	13	11.2

Table 6. Farmers contact with DA and practice of SWC

Contact with DA	**Number of responses**	**Number of responses**
Contact	**Frequency**	**Percent**
Good	45	38.1
Very good	13	11.8
Poor	59	50.0
Total	**117**	**100.0**

Table 7. Farmers perception and causes of land degradation (n= 117)

Famers perception	**Response**	**Frequency**	**Percent**
Perceived productivity of land	Increasing	37	31.6
	Decreasing	60	51.3
	Constant	20	17.1
Land degradation severity over the past 5 years	More severe	100	85.5
	Less severe	10	8.5
	No change	7	6.0
Causes	**Response**	**Frequency**	**Percent**
Over cultivation	No	28	23.93
	Yes	89	76.07
Overgrazing	No	31	26.5
	Yes	86	73.5

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Famers perception	Response	Frequency	Percent
Rapid population Growth	No	26	22.22
	Yes	91	77.78
Poor farming practices	No	53	45.3
	Yes	64	54.7
Poverty	No	57	48.72
	Yes	60	51.28

Table 8. Farmers' awareness on the consequence of land degradation

Consequences of land degradation	Aware	%	Unaware	%
Loss of agricultural production	106	90.6	11	9.4
Difficulty for farming	101	86.2	16	13.8
Loss in livestock productivity	89	75.6	11	9.4
Drought and poverty	25	21.38	92	78.63
Landlessness	28	23.93	89	76.07
Desertification	33	28.21	84	71.80
Migration	45	38.46	72	61.54

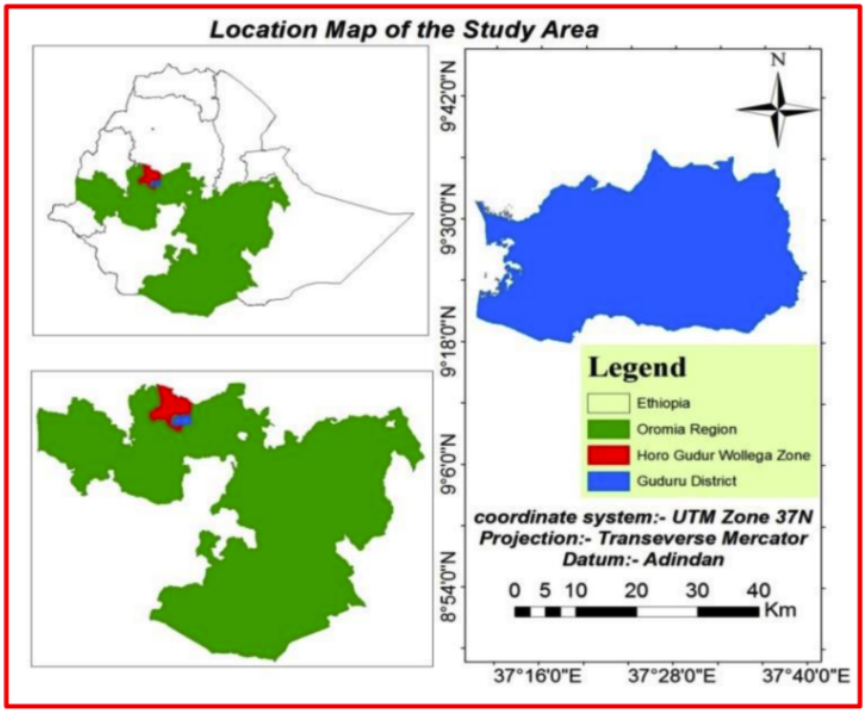

Fig.1 Location map of the study area