International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 7.328
Peer Reviewed Bi-Monthly
Vol.10 No.3 Jan – Feb 2023

Implication of Land Degradation and Conservation Practices: An Exploratory Study

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DOI- 10.5281/zenodo.7638725

Abstract
Land degradation is a global phenomenon that endangers the livelihoods of farmers. Recognizing this fact, different land management practices were introduced to combat the problem but effectiveness of these practices was below expectations. This paper focused on implication of land degradation and conservation practices in purposively selected three villages. Data was collected through interview schedule, focus group discussion, key informant interview and personal observation from 178 households selected by simple random sampling. Descriptive statistics like frequencies, percentages, mean and standard deviation, were used to analyze the data to arrive the results. In addition, inferential statistics like paired sample t-test and ordered logistic regression were used to assess the consequences and to identify the determinants of land degradation respectively. The findings indicate that the degree of land degradation is increasing due to over-cultivation, over grazing, animal trampling and soil erosion. Education, distance of land, slope steepness, training, credit and soil conservation practices were found to be significant variables. The consequences were low productivity, diminishing livestock, loss of soil fertility, increase weed infestation, unemployment and migration. To prevent this, physical and biological conservation practices were carried out.

Key words: Land degradation, Soil erosion, Conservation practices, Consequences

1. Background of the Study

Depletion of natural resources is the crucial problem faced by the world today. World Resource Institute of the United Nations Environment Program estimated that millions hectares of land are degraded and completely disappeared with their original biotic functions and 1.2 billion hectares (10%) of the earth's vegetative surface are moderately degraded of which about one fourth is found in Africa and Asia and the rest three-fourth in North America. Undoubtedly, environmental degradation (soil erosion and climate change) has direct effects on agricultural productivity and food security (Mulugeta Demelash and Karl Stahr, 2010).

Land degradation is one of the major challenges in agricultural production in developing countries like Ethiopia in the form of soil erosion, sedimentation, depletion of nutrients, deforestation, and overgrazing in the highlands. It also increases farmers' vulnerability to food shortages and becomes a threat to the survival of the people. The population in the rural areas is increasing and more food is required to feed this population, on the other hand the land size used by farmers is reducing. These situations forced the farmers to use the land intensively throughout the year that resulted in land degradation and encompasses mineral depletion, poor physical (low water retaining capacity) and biological conditions of soil (Bekelech Tolla, 2010).

Major agricultural problem in central highlands of Ethiopia is due to improper land management practices. It is understood that it is impossible to achieve food security in the country without overcoming the problem of nutrient depletion (Tegene, 2014). The immediate consequence of land degradation is reduced crop yield followed by economic decline and social stress (Melkie, 2016). Different factors including labor constraints, cash constraints, lack of appropriate conservation technologies, high costs and inaccessibility of inputs such as fertilizers and better seeds and land tenure appear to

be responsible for the continued land degradation.

Even though a number of soil and water conservation measures were introduced to combat land degradation, mainly because of high construction cost and lack of skilled manpower, adoption of these practices remains below expectation. But acceptance and farm-level adoption of the newly introduced conservation measures by the farmers is the decisive element for the success of soil conservation activities (Tekalign, 2011).

In the study district, production and productivity deteriorated gradually and has become difficult for farmers to feed their families and the living standard of the population is worsening year after year. The cultivated land in the study area is highly prone to sheet and rill erosion due to lack of soil and water management practices. In depth studies have not been carried out so far to find the impact of land degradation and conservation practices in the study area. Hence this paper focused on this.

2. Specific Objectives

- To assess the extent of land degradation in the study area.
- To identify the determinants of land degradation in the study area.
- To examine the consequences of land degradation in the study area.
- To understand the soil and water conservation practices take place in the study area.
- To study the effects of soil and water conservation on degraded land in the study area.

3. Methodology Adopted

The study employed a cross-sectional survey research design and mixed research approaches with quantitative and qualitative methods have been adopted for triangulation. To achieve the objectives, primary data were collected from sample households, village representatives, and agriculture office. The secondary information was obtained from different reports, bulletins, websites and literatures, which are relevant to the paper. In order to select the district, villages and sample households, multi stage sampling procedure was adopted. At first, Boricha district was selected purposely since land degradation is a severe problem. Secondly, out of 23 villages in the district, three villages were selected purposively since they were severely affected by land degradation. To arrive the sample size of 184 from the total (1902) household heads (HHs), Yamane (1967) formula was used. The collected data were analyzed using SPSS (version 21) and statistics like frequencies, percentages, mean, standard deviation and paired sample t-test were used to arrive the meaningful results. In addition, ordered logistic regression analysis was carried out to identify the determinants of land degradation. In this model, dependent variable is the land degradation and 12 explanatory variables were considered.

4. Results and Discussion

4.1. Socio-economic profile of Respondents

Sex of the Respondents: Sex refers to the physiological difference between male and female. This character included in this study to show the household respondents either male or female in natural resource management in their respective land. The assessment results indicate that about 80.3% of the respondents are males, while 19.7% female. The results of focus group discussants also indicated that soil and water conservation activities were mainly carry out by male members because women are more involved in regular household activities.

Marital status of Respondents: Marital status has certain individual commitment to involve in social, economic and environmental issues and communal benefits. Most of the time those who married are likely to be involved in various issues rather than single and married are responsible and committed for their family, community and environment. Study results show that 84.8% of them are married and 15.2% widowed.

Age of Respondents: Age is a number of years someone who live since s/he was born. If the age increases, due to vast exposure and experience, they have the opportunity to actively participate in soil and water conservation practices. It is an important factor for technology adoption because aged HHs are assumed to be resistant to new technologies compared to young farmers which are most likely educated.

Table 1: Age and Family Size of Respondents

Variables	Categories	Frequency	Percentage	Mean (SD)
Age	25-34	18	10.1	44.5 (10.05)
	35-44	95	53.4	
	45-54	36	20.2	
	55-64	16	9.0	
	65-74	13	7.3	
	Total	**178**	**100**	
Family size	3-4	51	28.7	5.54 (1.45)
	5-6	74	41.6	
	7-8	53	29.8	
	Total	**178**	**100**	

According to this study results, majority (53.4%) of the HHs are in the age group of 35-44 years and the average age is 44.5 years and middle age groups of respondents have able to manage natural resource in good manner.

Family size of Respondents: Large family size is normally associated with a higher labor endowment that will enable households to accomplish various agricultural activities on time. As it is evidence in Table 1, 28.7% of the HHs have a family size of 3-4 members, 41.6% have 5-6 members and 29.8% have 7-8 members. This showed that the majority of the sample HHs has large family size and the average family size is 5.54. The existence of a large number of family members with limited resource could affect land degradation positively. This might be due to the relation between large family size and the corresponding higher demand for food in the households with limited land size.

Educational level of households: Education is an individual level of learning that either s/he attended formal way. It is the process of receiving level of knowledge and awareness on land degradation and conservation practices. It determines the readiness of the HHs to accept new ideas and innovations assumed and increase the ability to obtain process and use agriculture related information and innovations in a better way.

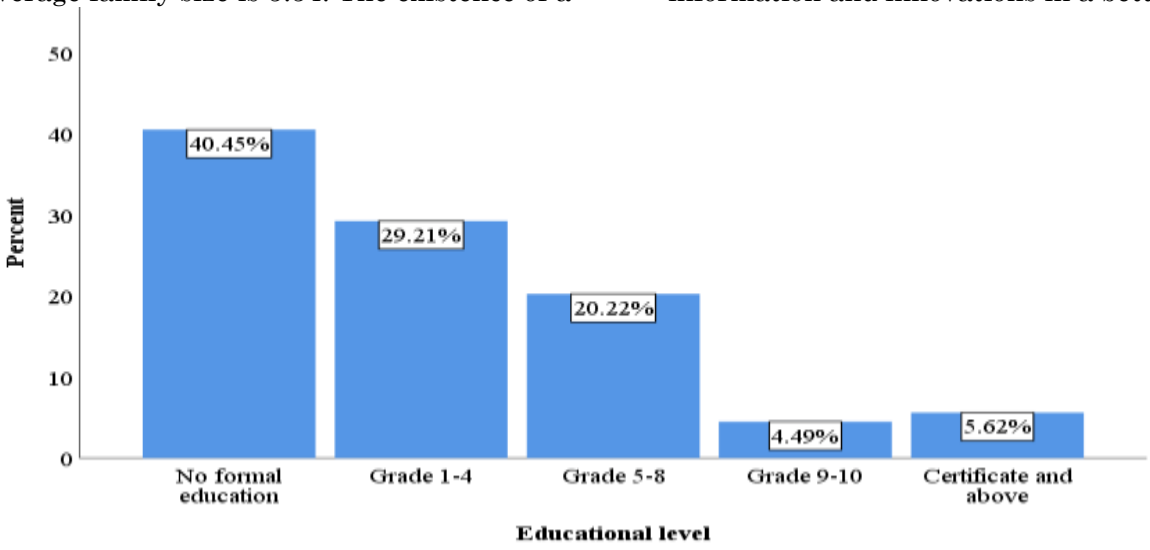

Figure 1: Educational Level of Respondents

According to figure 1, 40.45% of the sampled HHs did not attend formal education whereas, HHs having grade 1-4 are 29.21%, grade 5-8 are 20.22%. Education level is hypothesized to be associated with improved awareness and knowledge regarding conservation measures and the productivity, and effects of erosion may persuade them to choose particular soil and water conservation practices.

Farm land holding: Land is most important for agricultural production and farm fragmentation leads difficult to practice land management practices. The livelihood of the study population is almost entirely depending on land. which in turn resulted in expansion of farm land to fragile forest land and this has aggravated the degradation problem.

Table 2: Farm and Degraded Land Size (in Hectare)

Variables	Categories	Frequency	Percentage	Mean (SD)
Total farm size	>0.50	43	24.2	0.86 (0.43)
	0.51-1.00	91	51.1	
	1.1-1.50	32	18.0	
	1.51-2.00	12	6.7	
	Total	**178**	**100**	
Damaged land size	>0.50	162	91.0	0.29 (0.28)
	0.51-1.00	12	6.7	
	1.1-1.50	4	2.3	
	Total	**178**	**100**	

Land holding size of sample households varied from less than 0.5hectare to 2 hectare with mean of 0.86 hectares. As table 2 results show that, 51.1% of the sample own from 0.5-1 hectares. According to FGD, farmers who have large size of farm land positively significant related to soil conservation measures whereas those who are holding small size of farm land have negative attitudes towards soil conservation measures. This intention of farmers was realized by the finding of (Assefa, 2009).

Degraded land size: A degraded land is the land that lost its productive potential through the process of soil erosion, deforestation, pollution and related incidents. As shown the result in table 2, 91% of the sample HHs have less than 0.5 hectares and 6.7% have 0.51 hectares to 1hectares of degraded land.

Distance of farm land: It refers the walking distance of plots from the farmers' residence, measured in minutes is expected to influence the decision of the farmer. In this study, the distance of plots from home assumed to have a positive relationship with land degradation. Farmers whose farming lands are nearer to their residence apply organic matter to substitute soil nutrient loss and build soil conserving structures to minimize soil erosion.

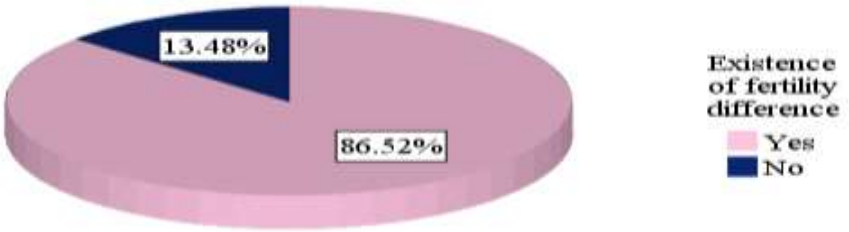

Figure 2: Distance and fertility of land

As figure 2 result shows, about 86.52% respondents stated that farm land near to home has more fertility, while 13.48% replied that long distance and has less fertility. As key informants stated that distance between the farm land far from home and near homestead is an important factor to create an interest in managements practices by farmers which in turn increases vegetation cover. Likewise, farmers practiced mixed cropping system in their homestead by soil and water conservation techniques. Famers having land far from their residence usually do not visit to their field except during harvesting and planting season.

4.2 Extent of Land Degradation in the study area

The Ethiopian highlands have an adequate fauna and flora, dependable soils, and climatic conditions. Due to the high degree of degradation, important natural resources such as soil, water, forest and biodiversity are highly deteriorating. In the study area, soil become resistant to fertilizer for plant growth and absorbing water with fertilizers thus resulting in low crop yield. Complex topography, geographical position, rainfall, temperature and broad altitudinal variation contribute to the existence of land degradation.

Indicators of land degradation: Land degradation occurs due to overgrazing, over cultivation with extensive clearing of vegetation for agriculture and fuel wood; extensive cultivation of marginal lands; the use of inappropriate technology; poor management of arable land; topography and soil characteristics among others. As the results show in table 3, the respondents list

down the indicators of land degradation like weak growth of crops (42.1%), yield decline (87.7%), color change on leaves (25.3%).

Table 3: Indicators and Extent of Land Degradation

		No. of Respondents	Percentage
Indicators for land degradation	Weak growth of crops	75	42.1
	Yield decline	155	87.1
	Color change on leaves	45	25.3
Degree of land degradation	Low	8	4.5
	Moderate	140	79
	High	28	15.7
	Total	**178**	**100**

It is understood from the survey that that awareness among the sample farmers on the existence of land degradation is very high. Land degradation is an important problem, yet the majority was not willingly participated in the different conservations practices. In similar to this idea the finding of Tegene (1992) indicated that majority of farmers were aware on land degradation problem but not willing to utilize the introduced technologies.

Degree of land degradation: The degree of soil erosion, nutrient depletion and deforestation in high land areas of the country has different causes behind it. This problem is further aggravated by the expansion of agriculture to marginal areas (Gete, 2002). According to 15.7% of respondents, land degradation on their farm field was severe and 79% of respondents mentioned that moderate. As key informants explained, land degradation is increasing in strong and moderate rate due to over-cultivation, population growth, overgrazing, rugged topography, poor farming practices and animal trampling.

4.3. Determinants of Land Degradation in the study area

In this study, since dependent variable (Land Degradation) is order in nature, ordered logistic regression model was used to identify the determinant factors that influence the land degradation and twelve explanatory variables were included; educational level, family size, farm land size, farming experience, total livestock units (TLU), income, grazing land usage, distance of crop land from the residence, slope steepness, credit access, training and soil conservation practices. Among twelve variables included in the model, six of them were found to be significance and they are discussed as below.

Table 4: Results of Ordered Logistic Regression Analysis

Variable	Estimate	Std. Error	Wald	Sig.	Odds Ratio
Education level	-.492*	.206	5.717	.017	0.611
Family size	.020	.187	.012	.914	1.020
Farm land size	1.779	1.022	3.029	.082	5.924
Farming experience	-.016	.025	.426	.514	0.984
TLU	-.197	.160	1.507	.220	0.821
Income	-.576	.327	3.107	.078	0.5621
Distance from crop land	.067*	.028	5.566	.018	1.069
Grazing land usage	.040	.195	.043	.836	1.041
Slope steepness	3.277***	.765	18.342	.000	26.496
Extension services	-1.266*	.564	5.035	.025	0.282
Credit	1.201*	.517	5.406	.020	3.323
Soil conservation practice	-2.100*	.909	5.333	.021	0.122
LR $Chi^2(12)$	101.3				
Prob > Chi^2	0.000				
Pseudo R^2	0.538				
Number of observations	178				

Note: *p<0.05, **p<0.01, ***p<0.001

Education: As the results show that education has negative relationship with land degradation (B= -492, sig. < 0.05). It was expected that education helps to enlighten people on the importance of land conservation practices and increases their capability to seek information and get necessary support from government and non-

government organizations. Educated farmers can understand, analyze, and interpret the advantage of different technologies more easily and farmers who have greater year of schooling are expected more likely to use soil and water conserving technologies.

Distance of Land from Home: Farm plots around home have always supplemented with farm yard manure and better in soil fertility than fields away from home. Plot distance has been found to be positively related with land degradation and the relationship is significant (B = .067, sign. < 0.05). It is in line with the hypothesis and a plot which is far away from the residence demands much time and effort while plots near the residence of the household get frequent supervision and application of organic fertilizer.

Slope of the land: As the slope steepness increases, the velocity of runoff increases and the probability of using improved soil conservation and land management technologies increase. This means that on sloppy plot the impact of soil erosion would be more visible to the farmers and this force them to construct appropriate measures and take remedial action. Steeper slope has found to have a positive effect on land degradation (B = -3.241, sign. < 0.001). This suggests that conservation efforts should target areas where expected benefits are higher, like on the steeper slopes, in order to encourage use of conservation technologies (Assefa, 2009).

Extension services: It represents the access of information, assistance and visit to the farmers by the development agents. Increasing the number of visits made by the development agents have negative relation with the land degradation (B = -1.266, sign < 0.05) which results from accelerated effective dissemination of soil and water conservation information to the farmers.

Credit access: It was hypothesized that access to credit would have positive influence on land degradation (B =.-1.201, sign. value < 0.05). The farmers get credit services do not prepare compost and animal manure for farm land in order to increase the fertility of soil and simply expected for fertilizer credit. Also do not work any soil and water conservation practices to reduce soil erosion.

Soil conservation practices: Soil conservation practices involve the use of biological and physical measures to offset the effect of land degradation, which is widely used by farmers. It reduces the erosive effects of surface run off on farming plots. Soil conservation practices involves in various methods to reduce soil erosion and prevent depletion of soil nutrients by runoff enrich the nutrients status of the soil, (B = -2.100, sign. < 0.05) while, conservation practice has negative significance because by reduce the volume of runoff increase infiltration of water. Study by Shibru (2010) indicates that soil and water conservation measures increased crop yield, prevent soil erosion and improved soil-water retention capacity.

4.4. Consequences of land degradation in the study area

Land degradation accelerated soil erosion causes adverse effects on agronomic, ecologic, environmental, and economic both on-site and off-site. Not only affects agricultural lands but also quality of forest, pasture, and rangelands. The onsite consequences involve primarily the reduction in soil productivity, while the offsite consequences are mostly due to the sediment and chemicals transported away from the source into natural waters by streams and depositional sites by wind. Land degradation not only result in decreasing food production but also drought, ecological imbalance and consequents of degradation of the quality of life.

Table 5: Consequence of Land Degradation in the study area

Statements	SDA	DA	N	A	SA	Total
Low crop production	02 (1.1)	09 (5.1)	12 (6.7)	22 (12.4)	133 (74.7)	178 (100)
Loss of Livestock production	03 (1.7)	05 (2.8)	111 (62.4)	18 (10.1)	41 (23.0)	178 (100)
Loss of soil fertility	04 (2.2)	09 (5.1)	14 (7.9)	20 (11.2)	131 (73.6)	178 (100)
Farm land out of cultivation	04 (2.2)	07 (3.93)	20 (11.2)	91 (51.1)	56 (31.5)	178 (100)
Increase weeds infestation	05	09	34	120	10	178

	(2.8)	(5.1)	(19.1)	(67.4)	(5.6)	(100)
Create unemployment	02 (1.1)	04 (2.2)	28 (15.7)	140 (78.7)	04 (2.2)	178 (100)
Increase Migration	04 (2.2)	04 (2.2)	44 (24.7)	115 (64.6)	11 (6.2)	178 (100)

Note: Figures within brackets indicate percentages
SDA- Strongly Disagree; DA-Disagree; N-Neutral; A-Agree; SA- Strongly Agree

Low crop production: It is obvious phenomenon of land degradation due to inappropriate land management practices. Peasants are using cow dung for cooking food rather than using for compost particularly poor farmers. This breach in the soil nutrient cycle seriously depletes soil quality, increases erosion, and eventually reduces soil productivity. As results (Table 5) show, 87.1% of respondents have agreed that low crop production is the result of land degradation. Key interview and FGD revealed that farmers in the study area were observing the decline of crop yields as an indicator of land degradation. Crop yields gradually declining and the resulting income reduction, and the progressive price increment of fertilizer due to elimination of the subsidy could explain the low application rates of purchased input (Shibru, 2010).

Loss of Live stocks: Land degradation leads to decrease of both quality and number of livestock; the declining of grazing land highly affects the productivity of livestock. Livestock are integral components of the farming system since cash crop is less produced and insufficient for generating additional income, majority of the rural farmers depends on livestock production. Table 5 results show that 33.1% respondents agreed that loss of livestock, while 62.4% neutral. However, as FGD participants explained that when the fertility of land decline, grass and other plants which are used for feeding decreased.

Loss of soil fertility: Continuous farming practice of land without any improvement of management has led to soil infertility. Cultivation of cereal crops which requires fine-tilled soil bed, as a result of erosion, water could not percolate into the soil; instead, it is caused for removal of nutrients in the form of runoff. Therefore, the soil cannot maintain the required soil moisture and finally resulted into depletion of soil nutrients. About 84.8% respondents agreed on loss of soil fertility rapidly. As key Informants explains that soil fertility decline due to deterioration of physical, chemical and biological properties leading to decline in biological activity; degradation in soil physical properties and adverse changes in nutrients.

Farm land out of cultivation: Inappropriate land use management, steep slopes land cultivated by landless poor, gradually forms small rills and accumulation of silt at the bottom of farm land or road side after rain. Farmers lack trust on conservation measures as they were poorly participated in the training, planning and designing of soil conservation program. 82.6% of respondents agreed on farm land out of cultivation. In addition, FGDs and KIIs described that there is lack of support from developmental agents and district agricultural office. Due to this farm lands gradually out of use and the water ways (rills) are occupied with big gullies expanding year after year.

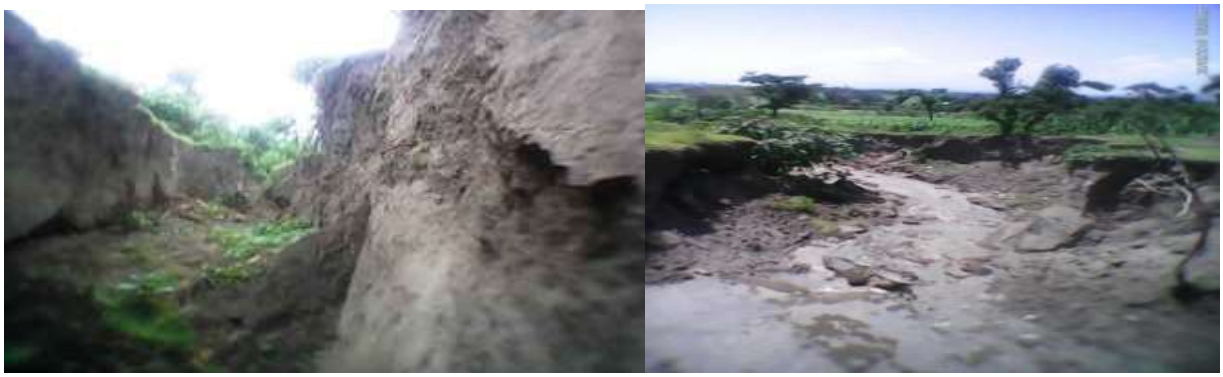

Figure 3: Farm land out of cultivation due to land degradation

Creates Unemployment: In the study area where agricultural and livestock production reach very low level leading to shrinkage of average farm size and in turn creates unemployment. Land degradation derived a number of critical environmental, economic, and social issues in the area and caused stress and shock in life. Majority (80.9%) of the respondents agreed that land degradation creates unemployment.

Increase weeds infestation: Weeds are unwanted plants grow on farm land and grazing land. On poorly drained soils, it can result in water logging and nutrients decline. Degraded land has less resistant for pest and disease and susceptible to weeds growth. About 73% of respondents agreed on increase weeds infestation.

Increase Migration: Soil erosion and concomitant factors like deforestation, overgrazing, and intensive use of marginal lands without replenish and rainfall variability were the major causes for farm size reduction and declining of yield. Too much rain fall was responsible to remove fine and fertile soil which is responsible for diminishing production and productivity and difficult for the farmers to feed their families. Due to this, migration take place in order to search conducive environment and majority (70.8%) respondents agreed on this.

4.5. Soil and water conservation practices in the study area

Soil and water conservation practices refer to the practices, which improve the physical properties of the soil for establishment and crop growth. Physical conservation practices reduce runoff and increase infiltration of water. Whereas the biological soil conservation practices contribute to the restoration and maintenance of soil properties. Soil conservation is the combination of appropriate land use management practices that promote the productive and sustainable use of soils, thereby minimizing erosion and other forms of land degradation. According to the Table 6 results, 91.6 % of respondents agreed that they have undergone soil conservation practices which indicate that most of sample farmers have positive perception towards the importance of soil conservation methods on their own farm plots and communal land to prevent soil erosion and enhance soil fertility.

Table 6: Soil Conservation Practices by the Respondents

Variables	Categories	Frequency	Percentage
Soil conservation practice	Yes	163	91.6
	No	15	8.4
	Total	**178**	**100**
Types of soil conservation practice	Crop rotation	103	57.87
	Inter cropping	155	87.0
	Agro forestry	45	28.3
	Contour plough	167	93.8
	Cut of drains	95	53.4
	Bunds	63	35.4
	Terracing	35	19.7
	Check dams	43	24.1
	Waterway	22	12.4
	Fanaju	38	21.3
	Hill side terrace	13	7.3

Key informants reported that in order to participate the community fully on natural resource management, the government should support financially and supplying material, providing training and experience sharing.

Contour plowing: This consists of cultivating the land on or close to the contour instead of up and down the slope or round the field. It needs no extra labor and time for construction. Majority (93.8%) of the respondents were practiced contour farming on their field. According to focus group discussants, each furrow acts as a small dam, catching water as it runs down the hill and soak into the soil.

Cut off drains: Cut off drains is one of the physical structures constructed by digging

the soil deep in order to divert the runoff before reaching the farmland. It was constructed during dry season to avoid impediment to land preparation for main cropping season and 53.4% of respondents practiced this. Such structures prevent loss of seeds, fertilizer and soil due to excessive runoff coming from uplands and disposed excess water from the field.

Crop Rotation: This is a practice of growing different crops one after another on the same piece of land, season after season or year after year. It is a valuable traditional practice, which plays an important role in maintaining ecological stability and improve agricultural productivity. If the same crop is grown year after year, the soil nutrients deplete as a result yield decreases. The use of crop rotation is another phenomenon in the area where maize and haricot bean. 57.87% of respondents practiced for different reasons to increase soil moisture, soil fertility and weeds and diseases control thus improved crop yield. Tolera (2011) found that the use of crop rotation helps to increase soil organic matter, reduce erosion and bring biological diversity back to the soil in order to maximize the production.

Intercropping: It is the practice of growing two or more crops at the same time on the same piece of land. While the principles and objectives of intercropping and mixed cropping are the same, the patterns are different. It is not difficult to distinguish the rows of the main crops from that of companion crops. Intercropping follow specific arrangements where haricot bean grown in rows between the main maize crops and 87% of respondents were used this practicePest levels are often lowered in intercrops, as the diversity of plants hampers movement of certain pest insects and in some cases encourages beneficial insect populations (MoARD, 2012).

Agro-forestry: Agro-forestry is the practice of planting and management of trees/ shrubs in crop land/ pasture land to get both economic and/ or ecological benefits. Trees help to preserve the fertility of the soil through the return of organic matter and the fixation of nitrogen. It improves the soil's structure and help to maintain high infiltration rates and greater water holding capacity and 28.3% of respondents practiced the same.

Improved Soil and Water Conservation practices: The improved type of soil and water conservation practices refers to the recommended type of structures, which have standard length, width, and height. These structures were introduced with the objectives of conserving, developing and rehabilitating degraded agricultural and grazing land in order to maximizing production and productivity to increase food security.

Soil (stone) bund: It is an embankment or ridge built across a slope along the contour. Bunds are made of soil or stone. It is constructed 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 they are constructed in fields that have slope less than 10%. But most of the time farmers used stone bund structures instead of soil bund because soil bunds easily destruct and only 35.4% of respondents practiced this. According to World Food Program (2005), they are effective in controlling soil loss, retaining moisture and ultimately enhancing productivity of land.

Figure 4: Soil bund constructed in the study area

Check Dams: Check dams are an obstruction wall across the bottom of a gully or a small river to reduce the velocity of the runoff and prevent deepening or widening of the gully to harvest water and sediment. About 24.1% of the respondents participated on construction of check dam. In the study area rill and gullies are very common and the community use stone, soil, gabion and cement to construct the check dams.

Figure 5: Check dam constructed on degraded communal land

Area closures: It is closure of areas and restricting access to all human and livestock activities and allowing it to recover through natural process. Water is retained during storms and runoff is reduced. Natural vegetation grows with better competition between plants because there is no more selective grazing by livestock. Key informants explained that these areas have been closed to improve land that are affected by severe erosion, and seriously damaged areas. In order to facilitate the natural process, such areas have been planted with different species of trees and treated with other physical conservation structures like micro basin, basin, eye brow and half-moon structures.

Hillside terraces: A hillside terrace is a structure along the contour, where a strip of land is leveled for tree planting. Hillside terraces are up to 1 m wide and constructed at about 2–5 m vertical intervals. Hillside terraces help to retain runoff and sediment on steep sloping land and to accommodate tree seedlings planted on them. It is also effective for conserving water on bad land and areas with low rainfall. These physical structures constructed on steep degraded areas and shallow soils along contours and only 12.4% of respondents practiced. In the study area most of the land management structures and aforestation were recommended to the farmers to protect land degradation.

4.6. Effects of soil and water conservation practices

Soil and water conservation practices have promising effect on reducing soil loss, trapping a significant quantity of sediment at early stage, improving soil moisture and soil property. It is concerned with maintain the usefulness of the land and return the land to previous natural condition or to maintain its utility for farming, depending on the intended use of land.

Table 7: The Effect of Soil and Water Conservation Practices in the study area

Statements	Categories					
	SDA	**DA**	**N**	**A**	**SA**	**Total**
Prevented soil erosion	04 (2.20)	07 (3.9)	11 (6.2)	21 (11.8)	135 (75.5)	178 (100)
Improved water retention	0 3 (1.7)	06 (3.4)	10 (5.6)	62 (34.8)	97 (54.55)	178 (100)
Nutrient back in to the soil	10 (5.6)	12 (6.7)	20 (11.2)	98 (55.1)	38 (21.4)	178 (100)
Increase crop yield	02	08	12	65	91	178

	(1.1)	(4.5)	(6.7)	(36.5)	(51.1)	(100)
Keeping crop healthy	17 (9.6)	28 (15.7)	22 (12.3)	86 (48.3)	25 (14.1)	178 (100)
Assuring long term production	05 (2.8)	08 (4.5)	13 (11.2)	137 (77.1)	15 (8.4)	178 (100)
Reduced fertilizer use	18 (10.1)	22 (13.4)	30 (16.4)	90 (50.7)	20 (11.2)	178 (100)

Note: Figures within brackets indicate percentages
SDA- Strongly Disagree; DA-Disagree; N-Neutral; A-Agree; SA- Strongly Agree

Prevent soil erosion: The major benefits of soil and water conservation practices are conserving water, retaining of soil nutrients and organic matter, maintaining soil depth and soil structure. The prevention of erosion, which means reduce the rate of soil loss to approximately that which would occur under natural condition, relief on selecting appropriate strategies for soil conservation and this in turn, requires a thorough understanding of the process of erosion. 87.3% of the respondents agreed, while 6.1% disagreed on this. Focus group explained that increased crop production in the area as a result of conserved soil and moisture.

Improve soil water retention: Soil and water conservation practice improve soil water retention and increase of soil fertility which is agreed by majority (89.3%) of respondents. It reduces the volume of run off by infiltration and silting of soil come from upper part of the cultivated land and increase the fertility of soils bottom located land.

Bring back nutrients in to the soil: Soil and water conservation bring back nutrients in to the soil by improving soil structure, reduced erosion, improved root penetration, soil moisture, emergence of seedlings, increase water infiltration and retention. In this idea, 76.5% of respondents agreed while 12.3% disagreed. Shibru (2010) found that soil and water conservation help to sustain soil fertility by improving retention of mineral nutrients, flora and fauna.

Crop yield increase: Soil and water conservation interventions and strategies leading to the achievement of effective conservation practices, which improve agricultural production, help in the attainment of food security and poverty alleviation. 87.6% of respondents agreed that soil and water conservation practice increased crop yield. The farmers perceived that integration of biological with physical structures was more successful for controlling erosion, improving soil fertility and increase crop production. When runoff is trapped and allow infiltrating, soil moisture increases and crops can withstand during dry spells and droughts leading to higher yields.

Keep crops healthy: If conservation measures properly maintained soil fertility increase, increase water holding capacity, reduce soil erosion and keep crops healthy. Regarding this, 58.4% of respondent agreed, whereas 6.1% disagreed. The improved soil structure results in well-developed plant root system and healthier, more disease resistant crops (Tolera, 2011).

Assuring long term productivity: Most of the time soil and water conservation is paramount to assure productivity of land by preventing nutrient loss and reduce of velocity of runoff. Biological conservation measures maintain long-term soil productivity depend largely on the management of cropping systems, which influence the magnitude of soil erosion and soil organic matter dynamic. Majority (85.5%) of respondents reported that the practice assured productivity while 7.3% disagreed. In addition, the key informants also supported that it could assure long-term productivity.

Reduces fertilizer use: Soil and water conservation structure when constructed on the farm land reduce erosion and fertilizer waste. Moreover, poor farmers have no capacity to make manure and compost to enhance the fertility of their own agricultural field. But some amounts of fertilizers could be taken up by crops; most of the fertilizers could be washed away due to soil erosion. Based on the data, 61.9% of respondents agreed that soil conservation measures reduce fertilizer waste. Soil fertility improvement on sloppy lands without soil conservation is unlikely as both mineral fertilizers and organic matter applied can be lost with erosion. Soil and conservation measures changed colour of soil to black and organic matter content was increased.

5. Conclusion & Recommendations

In the study area the degree of land degradation is increasing in strong, moderate and low rate due to over-cultivation, over grazing, animal trampling and soil erosion problem. However the indicators for land degradation are weak growth of crops, yield decline and color change on leaves due to this problem declining of crop yields, the resulting income reduction and live stock production decrease the farmers were inability to afford food for consumption. The solution for minimizing land degradation is to create awareness about the outcomes of degradation who made agriculture as a main source of income for livelihood. Moreover, different conservation practices applied on degraded area to enriched lands, better crop yields, good financial returns and a balanced environment by supplying material and financial support to those depend on these activities. Promoting new technology, formulating and implementing polices to protect land degradation as well as soil and water conservation are need of the hour. Based on the findings the following recommendations are forwarded

- Many biological and physical soil and water conservation structured have been done specially on communal land but less maintenance, management and follow up in the study area so that district agricultural office should give appropriate attention by closing the area, watering and hoe the seedling which plant on degraded land and maintain damage structures.
- Farmers training centers in the study area were built, yet training not provided and the institution not fully functional to give training on natural resource management and other related activities due to lack of training materials. In this regard district agricultural office should hardly follow up by preparing necessary things need for training like demonstration site, manual, black board, chair etc.
- In the study area most of the farmers expected fertilizer credit rather than preparing compost. So development agent should give training to the farmers regarding the use of compost and its preparation in order to increase crop productivity on their farmland.
- The problem of land degradation alarming issue in the study area due to population increase and farmers plough the land on steep slope across the contour line so development agent should actively provide training on how to plough their land and conserve soil from erosion.
- In order to reduce the land degradation, area closure is the main technique for rehabilitation of degraded lands. Hence district agricultural office should actively participate and persuade the local community to close degraded area and planting of different trees and construct different conservation structures.
- In the study area most of the farmers use indigenous conservation practices and district expert and development agents should integrate in order to introduce modern soil and water conservation practices to improve the indigenous knowledge and to increase the effectiveness of soil and water conservation practices by giving training and create awareness of the community.
- Farmers were not getting appropriate services from Development Agents because they reside in town that is far from the residence of farmers due lack of facility and district agricultural office should arrange the facilities like home, water and electricity for the development agents.

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