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Assessment of the Status of Farmers' Induced Land Degradation and their Response to Conservation Practices: A Case Study of Jima Arjo Wereda, East Wellega Zone of Oromia Regional State, Ethiopia

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Abstract: ***Land degradation was a major global issue during the 20th century and will remain high on the international agenda in the 21st century. Land degradation is the major challenge in Ethiopia. The study focuses mainly on farmers' status imposing land degradation and consequences of land degradation. Land degradation may occur through different physical, chemical and biological processes induced directly or indirectly by human activities like deforestation, shifting cultivation, overgrazing, steep slope farming, overuse of chemical fertilizers and forest resources. The main objective of this study was to evaluate the farmers' status of induced land degradation. The data for this study was collected through Questionnaire, Interviews, Focus Group Discussion and Field Observations and secondary sources. 272 households used as sample respondents. In the Ethiopian highlands overgrazing, over cultivation and deforestation have been identified as the predominant causes of land degradation. The findings also showed that there was a negative association between farmers and their awareness on the causes and consequences of land degradation and conservation practices. The study identifies the major cause of land degradation. The challenges have been human activities, largely induced by the imposition of land use classification. Deforestation, accelerated soil erosion, and land degradation are serious problems in general. It was found that although different introduced farmland conservation methods are put in practice. In Jima Arjo traditional management practices take the dominant share with respect to their intensive implementation. Based on the finding of this empirical study at household level, all concerned bodies such as governmental, non-governmental organization and the farmers should give emphases to give solution for those factors which critically affected the existing environment.***

Keywords: biodiversity, conservation, deforestation, ecosystem, erosion, land degradation

1. Introduction

Land degradation is defined as the loss of utility or potential utility through the reduction of or damage of physical, socio, cultural or economic feature, and/or reduction of ecosystem diversity Land degradation problem is a global issue and almost it affected the whole earth though variation exists in intensity, and it is more severe in developing countries. According to the Global Assessment of the Status of Human-induced Land Degradation (GLASoD, 1990), 65% of the world land resources are degraded to some extent. Moderate and severe land degradation are defined as a reduction in potential yield of 10-50% and more than 50 %, respectively that affects 40% of agricultural land in Africa and 44% in Asia. In respect to this environmental degradation and their consequential results have been the major problems facing many developing countries in the world (Oldeman, 1991).

In order to withstand such changes a wide range of techniques of natural resources management (NRM) have been used. Nonetheless, degradation of soils and other natural resources proceeds at a high rate in much of Africa, reflecting low rates of adoption of sustainable NRM strategies, especially among the poorer subpopulation of smallholder producers. Thus, in the rural area of Africa, where people today are employed in agriculture with acute poverty maintaining sustainable agricultural intensification to address the universal objective of reducing poverty and vulnerability is so challenging (Barrett, 2002).

One of the major challenges facing Ethiopia in its strive for development is land degradation, which is manifested in the form of land and water resources degradation as well as loss of biodiversity (Demel, 1997). Deforestation, accelerated soil erosion, and land degradation are serious problems in Ethiopia. This Thesis discusses about the status of farmers on land use and management practices in the study area and try to identify the causes of land degradation there. Increasing public awareness through education about forestry and natural resource conservation is vital if Ethiopia wants to maintain the remaining natural forests and biodiversity (Badege, 2001).The diversity of land-use practices reflects the complex interaction of physical and human factors. It is evident that, currently, a large area of formerly productive land has been rendered unproductive. It is related to the unsustainable use of the resources that involve destruction or disturbance to the natural or semi natural ecosystem. A major consequence of ecosystem destruction and disturbance is that of soil degradation. The present land use practices in many agriculture-based developing countries (like Ethiopia) are resulting in soil, forests, water and living organisms' degradations. Soil erosion, soil nutrient depletion, and soil moisture stress are the major land degradation problems faced by the Oromia region (Ellis and Mellor, 1995).

The severity and rate of land degradation in the area currently is indeed alarming. With the aim of providing a valuable input for plan land conservation strategies in the study area as an important aspect is identified and targeting specific high priority areas for the implementation of best management. This research was carried out to alleviate land degradation in the study area and to assess how fertility of the soil and agricultural production increases. Nonetheless, such factors operate in different manner in different socio-economic and demographic context and context of specific exploration give precise information for future intervention. This in turn implies studies such as this research is inevitable to provide future feedback for farmers' status imposing land degradation. This benefits rural households to improve their agricultural productivity and contribute improvement of food security and economic growth in particular for the area and the country in general (Solomon, 1994).

2. Methodology

Study Area

Jima Arjo woreda is found in East Wollega Zone of Oromia region, Ethiopia. The Woreda is located **8^0 33' to 8^0 55'N** Latitudes and **36^0 22' to 36^0 44'E** Longitudes and has a total area of 773 sq Km (77,258 hectares (JAAO, 2002).

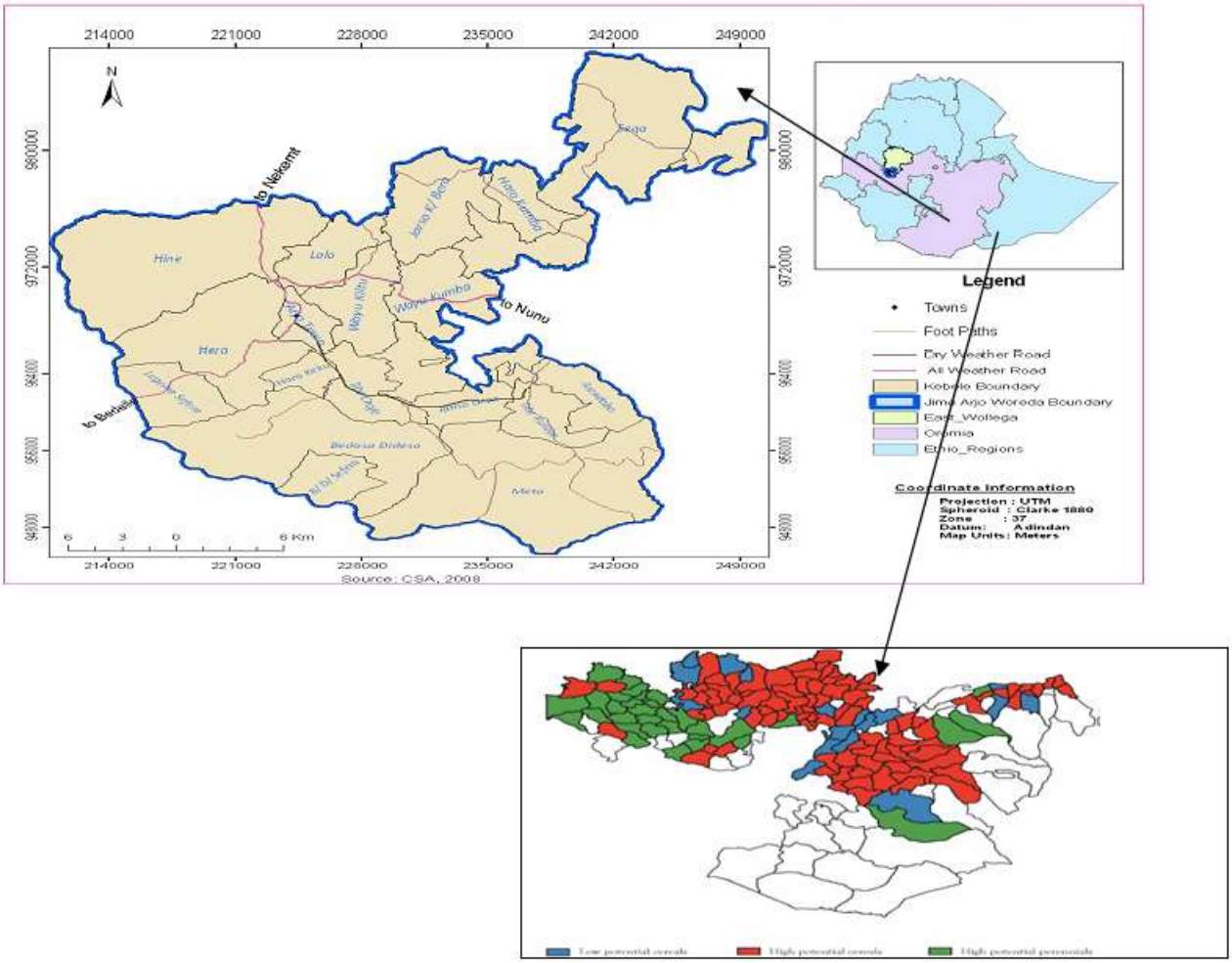

Figure 1: Physical setup of Jima Arjo Wereda

In order to achieve the main objective of the study the researcher used descriptive survey design. For administrative purposes, Jima Arjo woreda (woreda: District) is divided in to twenty Kebeles (kebele: lowest administrative division), out of twenty kebeles four of them were purposely selected based on their administrative patterns as a sample. The four kebeles were Wayu Kiltu, Hara, Lalo and Tibe Chaffe. The total households of the four kebeles were 2250 and 12% of them were used as samples. The study used both primary and secondary data sources. The primary data was obtained through field survey, questionnaire and personal interview. Descriptive statistics, severity index calculations and spear man's rank correlation co-efficient were used in this study.

3. Results and Discussions

3.1. Attributes of Sample Households

Data were collected from 272 respondents (12 %) and 16 those who selected for FGD and Interviews out of the total of 2250 households who were invited to participate in the study**.** The attributes of sample households such as

age, sex, language and literacy were found to play pivotal roles on land conservation practices. The total participant rates of the households participated in the study were 272, of which 187(68.755%) were male and 85(31.25%) were female households, respectively. Sample distributions of the study kebeles were 12% and 3.2% from Wayu Kiltu, 2.33% from Lalo and 3.35% from Hara, 3.12%from Tibe Cheffe.

3.2. Farm size

In Ethiopia, agriculture forms the back bone of the country's economy. According to table 1, the land holding of farmers in the study area varied from less than 0.25 hectare to more than 2.0 hectares with an average holding of 0.488hectare per households. Depending on the farm size, they use the land for various purposes like cultivation, grazing, wood lots and homestead. The size of the farmland is expected to influence farmers' attitude towards environmental problems. This is due to land is the key and finite resource for most human activities including agriculture, forestry, settlement and other human needs(GFRA,2005).

As it can be seen from table 1, the households with less than 0.25 hectare make up 13.60% household, with 0.26 hectare to 0.5 hectare constitute 22.42%; households with 0.51 hectare to 1.0 hectare members make up 14.36%. Those households with 1.0-1.5 have 14.36%. The household possessing more than 2.0 hectare constitute 6.25%. Most of the farmers have less than 1.0 hectare, which constitute 50.38% of house hold heads from the total. In Ethiopia, the ratio of people per hectare of land under cultivation as of 1998 was about 0.14 hectare. This means a family with seven members has only a hectare of land (Sisay, 2003). Hence, pressure on land at household level has been increasing as long as the population size is increasing.

Farmers with larger farm sizes are expected to practice better land management practices. This is because when farmers have larger farm sizes, they can plan different management practices because they have alternative of land to practice deferent methods. Earlier studies conducted by EPA (2005) indicate that farmers with larger farm size were less likely to be engaged in long-term land management practices. Insecurity feeling of farmers with greater holding was presented to be justification for the negative effect of large farm size. Another previous study indicates farm size to have positive and significant influence on adoption of introduced terraces and other conservation practices, but the same study identified farm size to have significant negative influence on continued use of introduced stone terraces (Aklilu, 2006).

As land is further fragmented, it becomes uneconomical and left with little for implementing structural soil conservation measures. Land size and practice of structural soil conservation measures have strong positive relationship. The small farm-size holders have negative attitudes towards structural soil conservation measures. These farmers lack trust on structural soil conservation measures as they were poorly participated in the planning and designing of soil conservation program.

The following table highlights percentage distribution of respondents by farm size in the study area.

Table 1: Percentage Distribution of Respondents by Farm Size

Farm Size (In hectare)	Frequency	Average in hectare	%
< 0.25	37	9.26	13.60
0.26-0.5	61	14.63	22.42
0.51-1.0	39	19.11	14.36
1.0-1.5	86	43.0	31.61
1.6-2.0	32	12.8	11.76
>2.0	17	34.0	6.25
Total	272	123.8/272=0.488	100.0

3.3. Information Services of the Households

Table 2, shows the information sources o f the respondents on land conservation practices. The result shows that extension agents were indicated by all respondents' as a most significant source of information accounts about 56.25%. About 27.57%% of the respondents used training as a source. While a significant number of the respondents (4.04%) use friends and relatives as a source of information. Small number of the respondents followed radio, schools and print media as a source of information which account for 5.14%, 4.41%, 2.59% respectively. The rise in farmers preferring other farmers as a first-hand information source may be due to the apparent ineffectiveness in the public extension in developing countries. Extension agents and training have been mentioned by most of the respondents as source of information in land conservation practices.

Access for information has a role on the practice of environmental conservation measures. Having good relation with concerned bodies' helps farmers in reducing hazards associated with land and conservation structures by providing information. Among assessed farmers contact with development agents they have practiced structural soil conservation measures on their land and the rest of farmers were taking experiences from these farmers on their fields without the assistance of DA(DA:Development Agent). These findings are supported by the view of Shibru (2003).

The following table presents Percentage Distribution of Respondents in their Information sources about land degradation and its management practices.

Table 2: Respondents Information sources about land degradation and its management practice

Sources	Frequency	%
Friends and relatives	11	4.04
Development Agents	153	56.25
Radio	14	5.14
Trainings	75	27.57
Schools	12	4.41
Print media	7	2.59
Total	272	100.0

Source: Field Survey, 2014

3.4. Training on Soil Erosion and Conservation Practices

According to Table 3, while the courses offered are of good nature, their minimal implementations seem to focus on farmers' ability to apply sound land degradation and its management practices. From the sample households the frequency of their training is different: Always 34(12.5%), Sometimes 221(81.25%), Never 17(6.25%). In the study area most sample households are not aware of training for practicing structural soil conservation measures because they were participating some times in the course of their application to implement.

According to interview results, farmers have knowledge on causes, extents and consequences of soil erosion on their living with varying levels. But training and education on soil erosion and conservation need to be provided to create further awareness on resources conservation. Farmers require training on soil, forest and water conservation, crop production and yield maximization, yield storage system, enhancing soil fertility, land tenure and land use. The construction of structural soil conservation requires relatively frequent training and appraisal.

The following table presents training of farmers on soil erosion and conservation practices.

Table 3: Training on Soil Erosion and Conservation Practices

Training	Participants of the training	
	Frequency	Percent
Always	34	12.5
Sometimes	221	81.25
Never	17	6.25
Total	272	100.0

3.5 Socio-economic and Demographic Characteristics of Farmers about Land Degradation

According to Table 4, farmers' impact on socio-economic and demographic characteristics of soil and land degradation is mostly responded 'yes'. Those farmers practicing kind of indigenous soil and environmental conservation practices are 161(59.19%), soil and conservation practices increase crop production 266(97.79%), the kinds of conservation measure under taking to solve this problems are terracing, contour ploughing, trees planting and others 219(50.52%) all parts of land plots are (very steep slope ,gentle slopes, the lowlands and others) are covered by using soil and forest conservation techniques164(60.29%), Lack of proactive land management is the main problem158(58.08) The result of declining yield is land degradation and methods of plotting 263(96.69%). 203(74.65%) of local communities are standing together to construct terraces.

As discussed, high population has caused the unsustainable use of land, water and forest resources. The ever growing energy demand for domestic fuel has resulted inexpensive use of crop residues and cow-dung for fuel. Forest resources are also being depleted fast because of high demand for fuel wood and timber, this directly cause for degradation of land and its resources. More and more land is being deprived of its plant cover because of the ever increasing demand for crop land. The depletion of top soil has meant reduced water retention capacity of land, erosion of plant genetic resources and loss of habitat. This conclusion is supported by the findings of (Sisay, 2003). So, for this cause kinds of conservation measure to solve these problems are terracing, Contour plowing, trees planting in order to increase crop production.

Table 4: Farmers' impact on socio-economic and demographic characteristics of land degradation

Factors(variables)	Potential adverse for impacts		
	alternatives	frequency	percentages
Farmers are practicing kind of indigenous soil and environment conservation practices	Yes No Not at all	161 69 42	59.19 25.36 15.45
Soil and conservation practices increase crop production	Yes No Not at all	266 6 -	97.79 2.2 -
The extent of natural vegetation in your local area is increasing,	Yes No Not at all	136 108 28	50 39.8 10.29
Kinds of conservation measure are you taking to solve this problems are terracing, Contour ploughing, trees Planting and others	Yes No Not at all	219 53 -	80.52 19.48 -
Carrying out routine maintenance on physical soil is the best way of conservation methods	Yes No Not at all	203 61 8	75.36 22.40 2.24
All parts of your land plot(Very steep slope ,Gentle slopes, the lowlands and others) are covered by using soil and forest conservation techniques	Yes No Not at all	164 101 7	60.29 37.13 2.57
You have commitment to solve the problems of land degradation	Yes No Not at all	255 17 -	93.75 6.25 -
Degree of erosion problem on the plot is on alarming rate	Yes No	264 8	97.06 2.94

	Not at all	-	-
Lack of proactive land management is the main problem	Yes No Not at all	158 111 3	58.08 40.8 1.3
Local communities are standing together to construct terraces	Yes No Not at all	203 39 30	74.65 14.33 11.02

3.6. Assumption of Farmers about Soil Degradation and its Consequences

Severity index analysis conducted on the sample data to rank the problems according to their relative importance. Severity indices were used since the data were ordinary in nature. In this procedure, frequency analysis was first carried out to obtain the percentage rating of different selecting factors. Then, a severity index was calculated via the following formula (Idrus and Newman, 2002).

$$\text{S.I.} = \frac{\{\sum wifi\}}{n} \times 100$$

Where **S.I**. is Severity Index
fi is frequency of the response
wi is the weight of each rating
n is the total number of response

Based on the magnitude of the severity index, the problems were analyzed in descending order as shown in table below.

$$\text{Severity Index (S.I.)} = \frac{\{\sum wifi\}}{n} \times 100$$

$$= \frac{4+6+8+83+855}{272} \times 100 \quad \text{when}$$

fi=5x171=855

$$= \frac{956}{272} \times 100 = 3.5147 \times 100 =$$, thus the severity index for No.1 is 351.47 which is ranked as first factor compared to other factors.

According to the severity index table 5, ranking for all 272 respondents, problems of soil erosion resulting decreasing crop yields in the study kebele areas are stated in order of their rank. The work of farmers can affect the environment. The main constraints in agricultural production are: Inadequate rain fall, lack of arable land, soil erosion, insufficient quantity of manure, reduced crop yields (productivity), plot fertility and degree of erosion problem on the plot land are the top five factors that hinder the development of the study area.

Table 5, indicates land degradation problems' related to soil fertility and crop yield in their land farm and factors affecting growth and development in the area are identified.

These are the work of farmers that can affect the land, the main constraints in agricultural production such as inadequate rain fall, lack of arable land and soil erosion, the number of years farmers cultivated land affects crop yield, the result of declining yield is land degradation, methods of plotting, unimproved, soil conservation structure on the plot are additional constraints and results of land degradation (Taffa, 2002).

The following table discuss valid percentage, severity index and ranking for all 272 respondents.

Table 5: Valid percentage, Severity index and Ranking for all 272 respondents

Factors	Valid percentages					Severity Index	rank
	1	2	3	4	5		
Degree of erosion problem on the plot is high	5	8	31	111	117	257.35	5
Plot fertility	20	18	33	87	114	267.64	4
unimproved soil conservation structure on the plot	28	43	37	57	100	233.45	10
There are any soil fertility declination you observed through time on your farmland	13	28	58	78	95	239.7	8
The main constraints in agricultural production are: 1/Inadequate rainfall 2/ Lack of arable land 3/ Soil erosion 4/Insufficient quantity of manure	2	3	21	93	153	325	2
You have observed about the major causes of erosion on your farm plot(s) (You can provide more than problems answer)	6	27	71	77	91	233.82	9
the result of declining yield is land degradation, methods of plotting	4	18	51	96	103	251.4	7
The number of years you cultivated land affects crop yield	15	13	48	91	105	254.4	6
The work of farmers can affect the environment	4	8	6	83	171	351.4	1
Loss of habitats and biodiversity resulted from land degradation	4	37	67	79	85	225	11

3.7. Land Conservation Practices with Relatively Long-term Effects

According to Table 6, only 77 (28.3%) of the respondents' applied terraces on farm land to avoid soil loss and to improve productivity of land and that 41(15%) of the respondents practiced manures in the land, 44(16.27%) reported planting trees, check dams 39(14.33%), cut off drain 26(9.56%) and 18(6.61%) were leaving crop residues on farm land. This indicates little practicing of these measures in the study area. Focus Group Discussions further reiterated that the low level of crop residue application is not due to lack of knowledge of its importance, but that it is now a primary source of livestock feed with the increasing scarcity of grazing land. It was further revealed that manure is now gradually becoming more used as a source of fuel than for use in fields due to shortage of firewood.

Farmers' training is among important institutional supports that are likely to significantly improve farmers' land resources management practices. In line with this assumption, farmers' training is observed to have predictive power in terracing, check dam construction, planting trees more. By taking odds of terracing among farmers with no training as a reference, farmers with training have higher chance of applying terracing. Farmers with training were found to have increased land conservation by a larger number when compared to previous management practices**.** Farmers' awareness is also observed to have predictive power in manure application and how to conserve their land resources. The small percentage of respondents mentioning land conservation in their kebeles could be attributed to that the kebeles are surrounded by a protected forest previously and is generally less degraded compared to the other kebeles. However, the fact that more than half of the respondents indicated that terrace application has so well for regenerating soil which is inherently infertile. As they suggests that productivity has declined significantly within living memory and that people were unaware that their yields were probably rather low from the outset (MoARD, 2003).

Table below show land conservation practices with relatively long-term effects in the representative kebeles.

Table 6: Land conservation practices with relatively long-term effects

Land Management Practices	Frequency	Percentage
Manure application	41	15.0
Terrace application	77	28.3
Check dam construction	39	14.33
Cut off drain	26	9.56
Leaving crop residues on farm land	18	6.61
Ditch	27	9.93
Planting trees	44	16.27
Total	272	100.0

3.8. Responses Related to Impact of Soil and Land Degradation

Table 7, revealed that 100% farmers believed soil erosion has a serious impact in farm land and soil fertility. The respondents were also asked to rate the impact of soil erosion on crop yields. The impacts were rated as 'severe' by 79.41% of respondents, 'moderate' by 20.59% of respondents. Comparing the number of respondents who rated the impact of soil erosion on crop yields as 'moderate' to the number of respondents who rated the intensity of erosion as 'severe', it can be stated that the link between soil erosion and the decline in land productivity is a massive problem for farmers to reduce the impact. Because, soil erosion can reduce crop yields by reducing organic matter content, plant nutrients, rooting depth, and water retention capacity of the soil(Wakene,2001).

All the interviewed farmers perceived soil erosion as a problem constraining crop production. They reported that the most important top soil for crop production activity was deteriorating over time due to erosion processes. Hence, they observed frequently how the loss of soil from cultivated fields has been reducing the depth of the topsoil through time and the number of stones in their farmlands has been increasing over time. They were identified major cause of erosion by rainfall being too much (33.8%), Up lands being too degraded (20.22%), Run off from up slope areas (18.01%, and slope being very steep (16.91%). As they responded on the conservation practices, they are organized by local leaders (77.57%) and about (22.43%) of them responded that they are organized by DAs.

According to Table 7, the majority of the farmers reported that the occurrence of soil erosion was the dominant problem of land degradation resulted from deforestation. 100% of them responded as it is the main problem on their farmlands that resulted high erosion. The percentage of respondents also compared rill erosion problem as the highest with other erosion features. From all respondents, 100% of the farmers rated the extent of the problem as severe. Farmers were asked to response how did they know soil erosion occurs on their farmlands in open-ended question part. Some of the responses were; when there is overflow of constructed ditches and damage their crops; when there is siltation in and out of their field mostly at the lower field border; when rills appeared on their fields, when the color of soil in the upper part of the field goes to red whereas the lower part goes to black. From these responses, it can be concluded that farmers have good perception of erosion as a problem that limits soil productivity. Once farmers perceive soil erosion as a problem having negative impacts on soil quality and land productivity and expect positive returns from soil erosion control, it is highly likely that they decide in favor of adopting available conservation technologies. On the other hand, when farmers do not acknowledge soil erosion as a problem, they cannot expect benefits from controlling the erosion process and it is highly likely that they can decide against adopting any conservation technologies (Eyasu, 2007).

The following Table explains about farmers' perception of land degradation and its conservation.

Table 7: Impact of soil and land degradation and its conservation

Farmers perception of land degradation and conservation practices	Frequency	percentages
1.Is soil erosion a serious impacts in your farm land 1/ Yes 2/No	272 -	100.0 -
2.Severity of the soil erosion, if yes to the above question 1/Severe erosion problem 2/Moderate erosion problem 3/Minor erosion problem 4/No erosion problem	216 56 - -	79.41 20.59 - -
3.Observed change in erosion severity over the past years 1/Has become more severe 2/Has became less sever 3/ No change of soil erosion severity	261 11 -	95.95 4.05 -
4. The identified major cause of erosion 1/Slope being very steep 2/Rainfall being too much 3 /Run off from up slope areas 4/Up lands being too degraded	76 92 49 55	16.91 33.82 18.01 20.22
5. Is there any deforestation in your kebele? 1/Yes 2/No 3/ I don't know	272 - -	100.0 - -
6. Who organized the work? 1/Local leaders 2/ DAs 3/ NGOs	211 61 -	77.57 22.43 -

4. Conclusion

Land degradation or conservation is an outcome of many proximate and underlying causes. The current status of land resources and its use patterns are the result of many highly inter-linked factors including natural, socio-economic, policy and those related to conservation practices**.** The study identifies the major cause of land degradation. The challenges have been human activities, largely induced by the imposition of land use classification. Deforestation, accelerated soil erosion, and land degradation are serious problems in general. Factors that are identified by this study are resulted land deterioration in the study area. The major consequences of land degradation could indeed be a potentially serious threat to food production and rural livelihoods by the years, particularly in more densely populated pockets of rural areas. Loss of forest and other vegetation cover over time due to population pressure and expansion of farmland has contributed greatly to enhance erosion rates over a large part of the study area. Excessive tillage for some crops, e.g. teff (the main grain crop in the study area), tilling sloping land, reduction of fallow and overgrazing of pasture and cropland are some of the agricultural practices that also have enhanced erosion. Farmers' trainings and community discussions are predominantly not taken place with the help of field works and demonstrations. The discussions are, moreover, concentrated only among dwellers of a single locality where integration and sharing of different experiences and knowledge cannot in advance be developed. Needs for sources of fuel energy, animal feeding systems, grazing are the other factors resulting bare lands to expose for erosion problems. These results loss of soil fertility, declination of yield, land degradation and ecological disturbances. If these problems continue the area under study remain in poverty and droughts may happen in few years.

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