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Farmers' Perception on Soil Erosion and Their Response to Conservation in Debre Elias District, Ethiopia

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Abstract:

Soil is one of the great natural resources which are usually exposed to erosion in different circumstances. Due to the unfair interference of man in nature, the problem has been ignited from time to time. Therefore, this study was conducted in Debre Ellias district, in Northwestern highlands of Ethiopia to assess the perception and response of farmers towards soil erosion. In this study, both primary and secondary data were used. The sampling techniques used in this study were purposive and simple random. The household heads were drawn proportionally from three kebels'. The study focused effectively on 384 household heads. Among these subjects of the study, 82.2% perceived the existence, causes and indicators of soil erosion in the study area which in turn brings decline of agricultural production. With regard to the response of farmers to soil erosion, out of those 316 respondents mentioned on the above, 87.3% gave response to soil erosion in different ways such as terracing, tree planting, contour plowing, traditional ditches, check dams and others. In fact, the perception & response of farmers to the problem is highly affected by the socio economic and demographic factors. The study tried to see whether there is a significant association between those dependent variables (perception &response) and independent variables (age, sex, marital status, family size, education, Occupation, land size and income level) using chi square tests. Based on this, except age all independent variables showed that there is a significance association

with the perception of soil erosion. Concerning on farmers' response to application of different conservation measures, the test showed that there is a significant association of age, sex, household size, marital status, literacy status, farm size with soil erosion but house hold income has no significant association.

Key words: soil erosion, farmers' perception, response, and north western highland Ethiopia

1. INTRODUCTION

Each year in Ethiopia, it is estimated that 1.5 billion tones of soil are washed away from their original location, which is an average of about 30 tons per hectare in the highlands, and 40 tons per hectare from cultivated land [11]. Indeed, from a hectare, up to 300 tons of soil losses have been recorded in the cases of sloping fields ploughed to a fine till for the finny - seeded traditionally cereal, Teff. The typical Ethiopian farmer households of about six persons now harvest less than a tone of grain in a year, which is less than enough for the barest subsistence diet due to erosion [6].[10] also stated that daily diet and crop yield are steadily declining due to erosion and exhausted fertility.

In rural areas of Ethiopia, environmental problems, particularly soil erosion is strongly related to the socio-economic and demographic characteristics of farmers. Due to farmer's actions the already existing natural environment has been transformed in to cultural landscape [13].

Hence, Currently, Ethiopia is one of the most severely affected countries in sub-Saharan countries. Particularly, soil erosion and degradation of agricultural land are very common and serious problem in most part of the high land of Ethiopia [19].

Regarding to soil conservation in Ethiopia, since the early 1970s & 1980s, the Ethiopia government with the aid

from international agencies has been participated actively in conservation work. A peak of conservation measure has been developed usually employing terraces, earth bunds, tree planting, closure of grazing areas etc. Between 1976 and 1988, for instance, using Food-for-work (FFW) program funded for the construction of 800,000km of soil stone bunds on cultivated land, 600,000km of hill side terrace were built and 80,000 hectares were closed for regeneration & for forestation of steep slope [8].

One thing that should be remained is that the study area and its surrounding "Gojjam" which is found in Amhara[1] region were known as a bread basket of Ethiopia. That means the region was considered as one of the region's major grain production area and it regularly make major contribution to the national food grain supply [18]. However, in recent years significant expansion and production of many grains in the region including the study area seem to be more difficult because of soil erosion. The volumes of food production and yields per hectare have shown a significant decline. Man-land ratio reduces which in turn brings an intense impact on soil by exposing it to erosion.

The study area is found in North West central highland part of the country. It is one of the districts in Amhra regional state. As it is known most highland parts of the country are exposed to what we call soil erosion due to their topographic arrangements and other socio-economic factors.

Debre Ellias, the study district, is the place where we find similar problem as mentioned on the above. Rural and agricultural office of the district has also justified that there is high rate of soil erosion in the district. According to the office estimation, a gross soil loss from the high land part of the district is much serious than the low land part of the area that accounts for about 60% in which cropland constitutes the largest proportion that accounts around 22% [5].

[1] A name given to one of the Ethiopia regions

Most people may not understand the significance of soil losses expressed in tons or other measurements per unit area. Nevertheless, almost everybody will be alarmed if the degree of the damage caused by those losses is expressed in monetary terms or in term of production loss. Thus, citing one tangible example is mandatory. If the present (1984) rates of soil erosion are allowed to continues, the national loss due to degradation (including soil erosion) in the high lands alone would rise up to an estimated 15,261 million EB[2] in each year up to the year 2010 AD, of which 77.8% would be due to decreased crop production and 22.2% due to decreased livestock production [3]. Similarly, other study indicated that in economic term soil erosion at national level, in 1990 was estimated to have cost (in 1985 prices) nearly Birr 38 thousand in lost agricultural production [14].The major cause for soil erosion in the district are an excessive deforestation, overgrazing, farming practice on steep hillsides, continuous tilling of the land with little or no fallowing and over cultivation with no input.

The implication of this arrangement is that, environmental problems particularly soil erosion and degradation is principal constraints to sustained and integrated socio-economic development of the country.

Concerning on response to soil erosion, studies show that soil conservation activities in the district were started in the past governments. For instance, soon after the Wollo drought had occurred, there was an attempt of implementing different erosion protection mechanisms to tackle the problem by the aid of WFP and the government [17].

With an off and on ways, the activities of soil conservation in the district comes to this time. According to the report of the office (2008) until the time mentioned terracing has been made on 10441.88ha of lands. However out of this, 1903.25ha remains under this protection where as the other 7824.13ha (74.93%) of the land is exposed to the problem due to

[2] Ethiopian Birr(currency)

the destruction of the terrace and other conservation mechanism [5].

And now a day because of the existence of the problem at each house hold plots, the local governments of the district together with the concerned bodies (District agricultural office, farmers and DAs[3]') have been carrying out the conservational activities. However, still there is a great gap between the conservation activities and its result that comes in each house holds plots.

This is because soil erosion protection and maintenance of soil fertility is crucial to the achievement of sustainable agriculture as the soil contains the nutrient, stores the water and provides the rooting medium essential for plant growth. Consequently, the manner in which soils are managed has a major impact on productivity and sustainability [8].

Therefore, unless there is a transformation of farmers' attitude and practice towards the effect of soil erosion and the conservation method against of which might to be caused by different socio-economic activities, the natural resources are going to be degraded much worse than at present. Farmers' perception and response to the impact of socio-economic and demographic characters on soil erosion is indeed decisive to sustainability to their environment serves as a basis for any future intervention strategy.

It is obvious that there is a lot of erosion problem in rural areas, but the research is mainly concentrated on the study area's problem. Hence the study is intended to see or assess farmers' perception on soil erosion and their response to wards soil conservation which has a direct or indirect relation or impact on soil fertility, productivity and above all sustainability.

[3] Development Agents

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was conducted in Debre Ellias district, East Gojjam zone, Amhara regional state. The district is found at a distance of 342kms north west Addis Ababa laying 17.6kms away on the left side of the main road on the way from Addis Ababa to Bahir Dar and 42kms south west of Debre Markos town that is the capital of East Gojjam Zone .The total area of the district is about 101000ha with the total population 86123 and above. According to the district Agriculture and Rural development office and [4], there are 15 farmers' kebeles and one town administrative kebele[4] with 74208 people in rural and the remaining 7925 people are living in urban and sub-urban areas. According to the traditional climate zone classification, as a result of the effect of altitude, two major vertically stratified temperature zones are found in the district. These are Woina Dega (sub tropical) and Kolla (tropical) having elevation 1500-2500m and 1000-1500m respectively. However, the study area is largely found in the traditional agro-climate Zone of Woina Dega (subtropical), which covers 86% from the total area. The remaining part, that is about 14% of the area, is belonging to kola (sub tropical). According to the district agricultural and rural development office, some area may belong to Dega (temperate) and Berha (desert) in fringe parts of the district. The altitude of the study area ranges from 776meters to 2220 meters above sea level. This range of altitude enables the study area to have different amount of temperature and rainfall throughout the year. According to the National metrological service agency, the mean annual temperature and mean annual rainfall is estimated to be 18.45^{O}c and 181.88mm respectively [5].

[4] A peasant association and lowest administrative unit in rural Ethiopia

The identification of representative soils by their physical and chemical properties is based on the FAO/ UNDP classification. According to FAO/UNDP soil classification, the most common type of soil in the study site is Vertisols, Acrisols, Nitrosolos, Lithosols, and Cambiasols.

Regarding on vegetation of the study area, according to the traditional classification of climatic zone, the lower latitude of the district which is mostly under the classification of "Kolla" has bush and stunted acacia vegetation whereas the majority part of the district which is classified as "Woina Dega" is covered with deciduous vegetation, Bisana (*Crotonmacrostachyus*), Eucalyptus (the red one) (*Eucalyptus camaldulesis)*, Tid (*JuniperusProcera*) and Girar (*Acacia nilotica*) trees. The capital of the district is hidden in a dense Eucalyptus and "Senssel" trees [5].

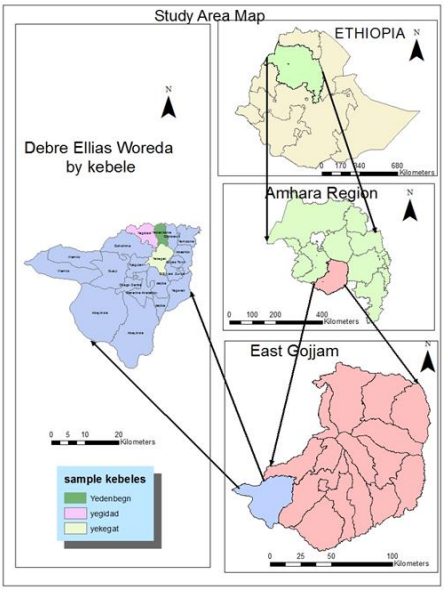
2.2. Sampling Techniques

The sampling techniques employed in this study were purposive and simple random sampling techniques. Based on the information obtained from Debre Ellias district agricultural and rural development office and preliminary field survey the district has categorized in to most venerable and relatively non venerable area to soil erosion (kebels).Three of the most eroded kebels were taken as part of this study. After having the list of household (HH) of the farmers' in these selected kebele, sample size was determined proportionally to its number of kebele households. Hence, a total of 384 household farmers' were taken as a subject of this study by using simple random sampling techniques from their available lists of the respective kebeles.

The rationale behind the use of this sample size and techniques was the homogeneity of the households in their economic activities and cultural aspects which make it more representative to the rest of the population, and considering time as well as cost of the research work.

2.3. Methods of Data Analysis

In order to address the specified objectives and to answer the given research questions, the study analyzed, summarized, and presented the data both qualitatively and quantitatively. The qualitative method was employed to analyze the views of farmers and validate the quantitative data obtained through questionnaires. Specifically, the quantitative data were analyzed, summarized, and presented in the form of tables, frequency and percentage by using appropriate descriptive statistics like chi square taste in order to see whether there is significance relationship between the dependent and independent variables or not by using SPSS version 20.



3. RESULTS AND DISCUSSION

3.1 Farmers' perception to Soil Erosion and its causes

During the field survey, the respondents were asked different questions regarding on the perception to soil erosion. Among the interviewed 384 sample household heads, 316 (82.2%)

perceived the existence of human induced soil erosion being one of the environmental problem in their area. To measure the perception of the respondents' alternative choice were included in each question. And their answer confirms that the perception of the sample population on this environmental problem is similar with the above one. They gave different reasons for the occurrence of this problem depending upon the current situation of their demographic and socio- economic characteristics. The data presented in table 1 shows the percentage distribution of farmers' perception to the causes of soil erosion. About 19.3%, 24.1%, and 13.5% of the respondents replied that land fragmentation, overgrazing and deforestation were identified as the cause of soil erosion respectively. About 15.9% and 20.6% of respondents perceived that expansion of cultivated land and over cultivation as the cause of soil erosion. The remaining 6.6% of the respondents perceived other causes.

Table 1 Respondents' perception to the causes of soil erosion

Respondents perception to the causes of soil erosion	Number	Percent	
		Perception	cases
Land fragmentation	100	19.3	31.6
Over grazing	126	24.1	40.0
Deforestation (for various purposes)	70	13.5	22.1
Expansion of cultivation into marginal land	82	15.9	25.9
Over cultivation	107	20.6	33.8
others	33	6.6	10.4
Total	518	100	153.5

Focus group discussion was also held with selected discussants. The purpose of farmers' focus group discussion is to ensure or cross check the results of house hold survey and to explore what they know or think about the research problem.

During the discussion with the participant, they said, that the land of the area has been under continues tension between local people needs and available land resources. According to the discussants, rapid growing of the rural population had resulted in changing of the land use and cover

pattern. They also mentioned that the problems were occurred as results of number of factors which are related to the demographic and socio-economic changes that occurred in the area. According to focus group participants, farmers' knowledge about soil erosion is widening through the usual contact of farmers with conservation development agents. Some of the most commonly causes of soil erosion were shortage of arable land, fire wood, grazing lands & others. The discussants suggestions agreed to the factors which are mentioned in the table above.

Although farmers show high level of perception about soil erosion there is a wide gap by demographic and social economic factors. To see this, chi square test was employed for further analysis and only those respondents who have perceived the existence of soil erosion in their locality (316) were taken in to the analysis. The result is demonstrated in the table below.

Table 2 Result of chi square test of farmers perception to soil erosion

Back ground Variables	Perception to soil erosion				Total		X^2	P-value
	Yes		No					
	Number	%	Number	%	Number	%		
Age								
15-39	123	86.6	19	13.4	144	100	2.90	0.09
40+	181	79.7	49	20.3	242	100		
Sex								
Male	304	83.1	62	16.9	366	100	7.01	0.03
Female	12	75.0	6	25.0	18	100		
Marital status								
Never married	109	68.9	49	31.0	158	100	32.61	0.00
Ever married	207	91.5	19	8.4	226	100		
House hold size(in number)								
≤5	211	88.3	28	11.7	239	100	15.60	0.00
>5	105	72.5	40	27.5	145	100		
Literacy status								
Illiterate	102	72.8	38	27.2	140	100	13.46	0.00
Literate	214	87.7	30	12.3	244	100		
Farm size(in hectare)								
≤1.0	144	86.4	21	13.6	165	100	12.60	0.04
>1.0	172	79.4	47	20.6	219	100		
Work status								
On farm	299	83.5	59	16.5	358	100	5.47	0.02
Off farm	17	65.4	9	34.6	26	100		
Household income(Birr/year)								
≤4000	148	91.3	14	8.7	162	100	15.81	0.00
>4001	168	75.6	54	24.3	222	100		

As mentioned in many literatures, the majority of the background variables have a significance association to the

perception of farmers on the given issue. For instance, according to [7] as well as [1] women and men have difference in perception of soil erosion. This difference in perception between the sexes is perhaps a reflection of the roles that the two sexes play in the society and the limited opportunities available to woman in terms of such information.

Similarly, other writers stated that educational level of farmers has a great impact on the general awareness of the adverse effects of environmental degradation, particularly soil erosion [16].However, among the demographic factor, age of respondent did not show a significant association with farmers' perception to soil erosion. The variation between the young and old farmer in perception is occurred due to chance other obscured reasons not because of age difference.

3.2 Farmers' Response to Soil Erosion and management practices

During the Survey, farmers were asked to identify among the number of listed strategies those they adopt to mitigate this environmental problem and their response presented in number and percentage distribution.

In the field, the target populations were asked questions regarding to their response to this problem. Among the interviewed 316 respondents who perceived soil erosion as problem, 276 (87.3%) were explaining their different ways of responding mechanism. The data presented in table 3 shows the number and percentage distribution of target population response and type of management practice for the problem of soil erosion. About 33.4 %, 20.6%, 23.2% and 14.3 % of the respondents were used to conservation techniques to terracing, tree planting, contour plowing, and traditional ditches and respectively. Conservation techniques of respondents about check dams and other were about 6.1 %and 2.4 % respectively.

The background variables of the respondents were also analyzed by applying the Chi-square of independence test to

examine the existence of association with dependent (response to soil erosion) variable or not.

Table 3 Responses to the problem of soil erosion by farmers

Respondents response to the problem of soil erosion	Number	Percent	
		Perception	cases
Terracing	157	33.4	40.9
Tree planting	97	20.6	25.3
Contour plowing	109	23.3	28.4
Traditional Ditches	67	14.3	17.5
Check dams	29	6.1	7.6
Others	11	2.4	2.9
Total	470	100	122.6

Furthermore, to check the above figures where it is valid or not the respondents were invited to open discussion and the discussants were asked whether or not they participated in conservation activities.

During the discussion time, they said that the cultivated land is limited and is so scarce because of population growth. They also forced to share their limited land to their sons when they form families. These conditions forced the farmers to manage and care for the remaining land properly. A farmer of study area is endowed with various types of traditional knowledge and skill to mitigate soil erosion and low soil fertility. Traditional soil conservation and agro-forestry are the widely used techniques in the study area. This traditional land use practices involving combined production of trees and agricultural species on the same piece of land.

According to key informants, farmers of study area have mastered soil conservation practice through stone bunds, graded terraces and laying crop residue on farms. Regarding to framers response to soil erosion, the information obtained from the focus group participants supported the farmers' response to soil erosion as indicated in table 4.The Chi-square independence test was used to examine the possible association of each of independent variables with the dependent variable.

Here, only 276 respondents who reacted to the problem were taken into the analysis in each variable.

Table 4 Result of chi square test of farmers' response to soil erosion

Back ground Variables	Response to soil erosion				Total		X^2	P-value
	Yes		No					
	Number	%	Number	%	Number	%		
Age								
15-39	94	74.4	26	27.6	120	100	14.20	0.00
40+	182	92.8	14	7.2	196	100		
Sex								
Male	265	88.6	34	11.4	299	100	7.77	0.00
Female	11	64.7	6	35.3	17	100		
Marital status								
Never married	86	75.4	28	24.6	114	100	22.85	0.00
Ever married	190	94.1	12	5.9	202	100		
House hold size(in number)								
≤5	168	90.8	17	9.2	185	100	4.85	0.02
>5	108	82.4	23	17.6	131	100		
Literacy status								
Illiterate	82	77.4	24	22.6	106	100	6.58	0.01
Literate	194	92.3	16	7.7	210	100		
Farm size(in hectare)								
≤1.0	113	83.7	18	13.8	131	100	9.06	0.03
>1.0	163	90.1	22	11.9	185	100		
Work status								
On farm	168	82.7	35	17.3	203	100	167.51	0.00
Off farm	8	61.5	5	38.5	13	100		
Household income(Birr/year)								
≤4000	102	84.4	19	9.4	121	100	1.64	0.20
>4001	174	89.2	21	14.9	195	100		

As one infer from the above table, response to the problem of soil erosion has significant association with most back ground variables of the respondents. It is only one variable (income) that did not show significant association with the response of farmers in related to soil erosion. The existence of relation between those background variables and response to soil erosion is of course mentioned by many researchers as like as perception. To mention some,[2],higher experience of farming (old age group) is positively correlated with higher degree of farmer's perception and knowledge about the soil erosion processes and associated problems and long period of farming experience had a great impact on farmers respond to this problem.

[7] Confirmed that women farmers (sex based) tend to adopt and response at lower rate than men farmers because of limited access to information and resources. [20] Identified lack of interest in soil and water conservation measures to be

explained by shortage of labor. This indicates that the number of family size is one of the determinant factors for the adoption of conservation techniques.

Literacy status of farmers is also expected to have an immense impact on responding to soil erosion. [15] Stated that education enhances farmer's willingness to adopt even new management practices by improving the managerial capacity of farmers. In their model [9] & [12] predicted positive and significant association between education and response and use conservational methods.

Studies in different areas showed mixed results on the relationship b/n plot size & conservation practices. [9] found the farm size operated to be positively correlated with adoption of soil conservation practices. Studies made in different part of Ethiopia also supported the above findings.

Work Status of farmers is also mentioned as another Socio- economic parameter assumed to influence the application of conservation techniques in a positive. Therefore, all these and other literatures support the finding of this case study conducted in the area mentioned above.

4. CONCLUSION

The following conclusions are drawn on the basis of the results obtained from this research problem. The conclusion of this study is focused on the study population perception and response of environmental degradation, particularly soil erosion and deforestation.

Currently, the level of soil erosion and the perception of it are varied from place to place depending up on the type and the nature of resources base and complex interaction effects of farmers' different demographic and socio-economic characteristics. These conditions have an impact on the level of farmers' perception and responses to soil erosion. Those socio-economic and some of the demographic factors played an

important role on the perception of farmers' to soil erosion. Except the respondents' age also the other independent variables have a significant association with this issue.

Responding to the existing problem was there by the farmers using different mechanisms which include terracing, tree planting, contour plowing, traditional ditches, Check dams and others though their response varied because of demographic and socio-economic variables. As like as perception, here, the response level of the respondents is governed by their demographic and socio economic variable. This is true that except income all the other independent variables haves showed as there is associations with response of farmers' to the soil erosion.

RECOMMENDATION

Soil erosion problem is linked with many obscured demographic and socio-economic status of the people as well as the natural calamity. There is no single self governing factors that causes the over depletion of the existed limited natural resources at local level; rather it is the cumulative effects of manmade and natural phenomena. On the bases of the results from this study, the following points have to be taken in to consideration.

1. Currently rural population is growing at an alarming situation and the existed cultivated land is limited. This leads to the farmer to move faster onto marginal areas there by the vulnerability of the farmlands to soil erosion and has been progressively increased. Thus, creating of an alternative income source and employment opportunities to farmers may partly reduce complete domination of resources of soil.

2. Propaganda on soil erosion education should be disseminated to farmers by concerned organization, which enabled the farmers to adapt and implements soil conservation techniques.

3. Giving priority attention for females' farmers to be participated in local community affairs, indecision making process and socio-economic plans. This paved the way the females to get more information about soil erosion and they can give a response to this problem.

4. Local administrative leaders and farmers should draw laws that govern them to protect soil erosion and to use this resource wisely.

5. Expansion of incentives program (such as social value, financial and material support) for those farmers who are participating in conservation activities of soil erosion individually or in groups.

Generally speaking, from the empirical finding of this study, multidimensional factors of demographic and socio-economic characteristics had responsible for farmers' differential in perception and response to soil erosion. Moreover further research in this area should be conducted widely at micro level.

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