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Environmental and economical impact of soil conservation: Case study of Boset, Ethiopia

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Abstract – Ethiopia faces agricultural deficit and poverty. Decrease in agricultural productivity is due to many reasons: frequent drought and also land degradation. Land degradation is a serious threat for environment and socio-economic situation for rural population in many countries in the world and particularly in Ethiopia.
In this research we carried out the area frame of Boset in the East Showa zone (Oromiya Region in central part of Ethiopia). This research provides a description of the adopted methodology. It aims to study the environmental impact of soil and water technique at first and then to assess their economical impacts on farmers livelihood.
It sheds some light on reliability and practicability of the survey design. The design also serves as a reference for other researchers anticipating to conduct or compare similar studies. In the current research, erosion estimation at some farmlands plots has been elaborated. For that reason, previous measures were accomplished in order to assess the soil loss at the visited farmlands in Boset Wareda (North East Shewa) using USLE methods.
Furthermore, this study presents household heads' socioeconomic findings. Descriptive statistics based on two-way ANOVA for Net Margin analytical methods was used. For the economic assessment, we visited small family farming in order to conduct an inquiry with the local farmers. The comparison between two different groups of farmers (users and non-users of conservation technique) is indispensable for the economical study to confirm the advantage of natural resources conservation on farmer livelihood.

Keywords: Ethiopia, farmers, land degradation, USLE, Benefit.

1. Introduction

It is stated that crops require enormous quantities of water for their growth but when erosion occurs, the amount of water runoff increases, so that less water enters the soil matrix and becomes less available for the crop. The undulating topography and heavy rainfall make land vulnerable to degradation. This latter is exacerbated by population pressures that have led to farming new marginal areas not suited to agriculture. In Ethiopia, cultivation on steep slopes and clearing of vegetation has accelerated erosion in the highlands (Bhan, 1988). This is the case of Boset Wareda, the study site of this research is. It is a located in East Showa zone, Oromiya Region in central part of Ethiopia and faces a threat of land degradation leading to rural poverty however soil and water conservation strategy are practiced in some farmlands.
Hence, this study is divided on two parts. The first part is about a technical analysis and is entitled: "Soil loss assessment in farmlands in Boset Wareda". In this part a soil erosion analysis was established in order to estimate the amount of soil loss in two groups of farmers: farmers who adopted conservation techniques (CTs) in order to conserve soil and reduce the effect of erosion (these farmers were called 'users') and farmers who did not adopt any conservation techniques (these farmers were called 'non-users). A second part was devoted for an economic analysis in order to compare the net margin between

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the two groups of farmers. This part is entitled "Economic assessment of farmers' livelihood in Boset Wareda". In both parts we followed the pecking order of: Methods, Results, followed by a general conclusion.

2. Soil loss assessment in farmlands in Boset Wareda

2.1. Methods

2.1.1. Selection of the study site of Boset

Boset Wareda is small area in East Shewa zone located in Oromiya region in Ethiopia. Figures 1, 2 and 3 show the location of the study site of this research.

Figure 1. Ethiopia map (East Shewa zone at the center)

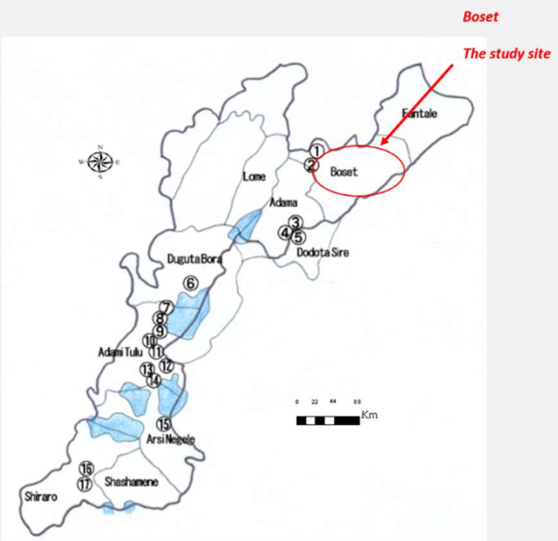

Figure 2. East Shewa zone map (Boset region in the north-east)

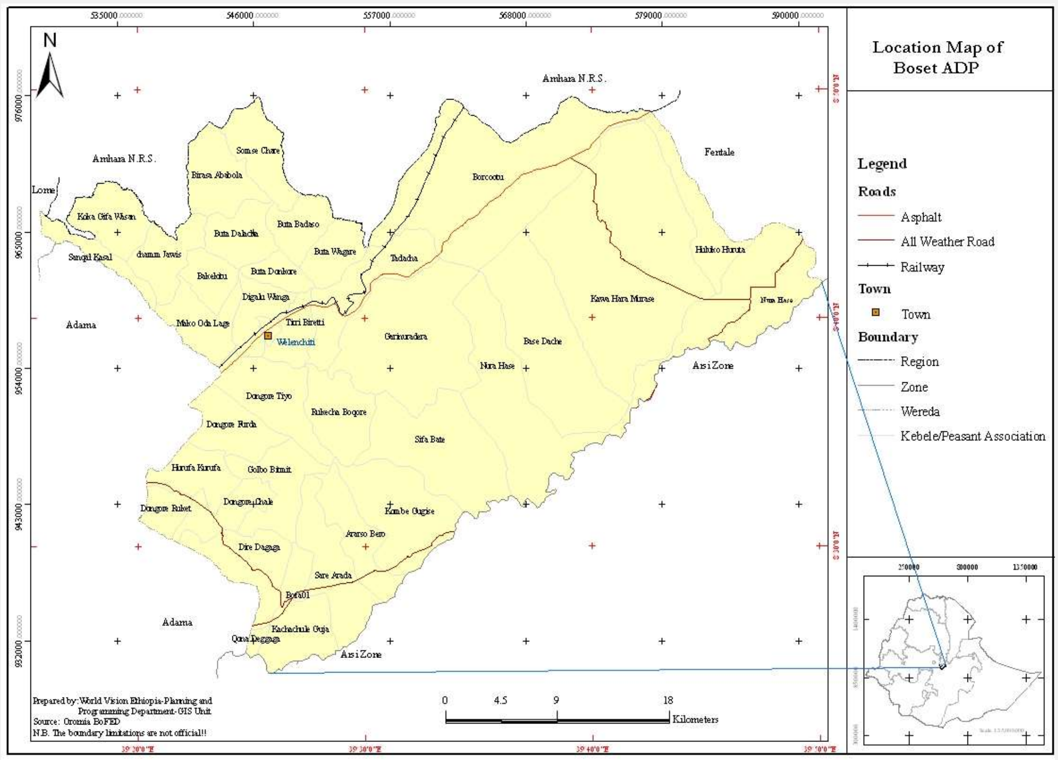

Figure 3. Map of Boset Wareda (at East Shewa, Ethiopia) (Source: Adama Agricultural Office, Ministry of Agriculture of Ethiopia)

According to Gara A, et al. (2009), GIS studies showed that Boset has middle to high elevation (<1600m) and gentle slope (<10%) and mainly covered by cultivation, grassland, shrublands. According to Gar A, et al. (2011), USLE studies showed that erosion in Boset is high, severe and very severe (between 10 to more than 80 tonnes/ha/yr) as shown in the following figure (fig.4) who points up the results of land cover and soil loss in Boset and illustrates the reason of selection of Boset as a frame work area of CTs (conservation techniques) profitability at the farmer's level.

2.1.2. Description of the Study Area

Boset area is about of 1,224,860 ha with annual average temperature between 20ºC and 28ºC and average annual precipitation between 600-900 mm. The topography of the area represents elevations ranging from 1,500 to 2,400 m a.s.l. Thus, the Landscape of the study area is harshly undulating with sparse vegetation and highly covered with stones. In fact East Shewa Zone is located at the Great Rift Valley. The agricultural production are mainly teff, barley, sorghum maize, café, haricot beans, fruit trees such as mango, papaya, etc. The major soil types are andosols, lithosols, cambisols, luvisols and fluvisols. The conservation techniques observed in the study area are: soil bunds, fayina-jou, stones walls, contour cultivation, vegetation band strips, mulching (from crop residues), afforestation or fruit trees plantation, water catchment, Cut of drain (water way), tillage practices (no till, no disking, no cultivating: direct seeding).

2.1.3. Process

We used USLE (Universal Soil Loss Equation) as a mathematical model to describe soil erosion processes. The USLE is considered as a main model used around the world to measure soil erosion. The USLE is a multiple-factor equation (Equation (1)) in which four non-dimensional parameters (*L, S, C, P*) are used to modify a potential soil loss equal to the product of two dimensional parameters which respectively represent the erosivity of rainfall (*R*) and the erodibility of a particular soil (*K*). The USLE has the following form as defined by Wischmeier and Smith (1978):

$$A = R \cdot K \cdot L \cdot S \cdot C \cdot P \quad (1)$$

Where: A: soil loss (t $ha^{-1}yr^{-1}$); R: rainfall erosivity factor (MJ mm $ha^{-1}h^{-1}yr^{-1}$); K: soil erodibility factor (t h $MJ^{-1}mm^{-1}$); L: slope length factor (unitless); S: slope steepness factor (unitless); C: cover and management factor (unitless); P: support practice factor (unitless)

We estimated USLE results at 20 plots located at 20 different farmlands. 10 farmlands are protected with soil and water conservation structures and 10 others are not. Observed conservation activities are terraces construction such as soil bunds, stones bunds, Funyaju, etc, (Fig.5) corresponding at P factor equal to 0.5. As for no conservation activities P is equal to 1.

While C factor is ranging between 0.4 to 0.9 as farmlands are covered by crops such as Teff, barley, sorghum, maize, café, haricot beans, and fruit trees such as mango, papaya, etc. For sake of simplicity, we did not consider the rotation applied by farmers. Moreover, soils are clay and clay loam. This would correspond to K value equal to 0.3. We measured the slope length and degree (in percentage) using clinometers to obtain LS factor values. Length slopes was varying from 60 m to 210 m. As for slope degree, it is ranging between 5% and 10%. We calculated R factor values using the Renard and Freimund equation (1994). Monthly total rainfall of Boset area -from 1999 till 2008- was obtained from national meteorological service academy at Adama branch.

2.2. Results of erosion estimation in Boset Wareda

The comparison between the two groups gave the evidence of advantageous impact of soil and water conservation structures on soil protection. In fact, estimation of eroded soil amount at both types of farmlands showed that plots without any conservation structures have higher erosion rate than farmlands provided with CT (Table 1 and Fig.6).

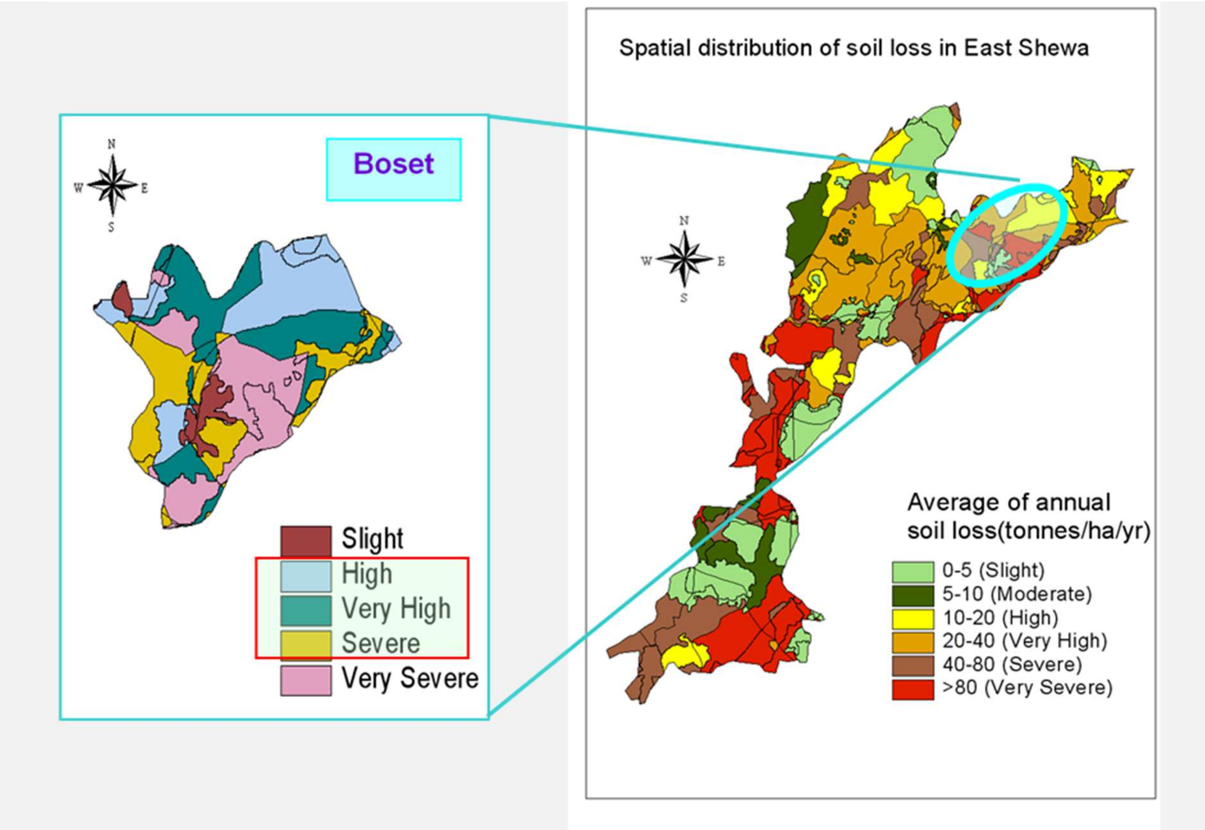

Figure 4. Erosion rate and land cover at Boset (Gara, A. 2011)

Figure 5. Types of soil and water conservation techniques applied in Boset Area (water ponds soil bunds, stone bunds, from up to down) (own source)

Table 1. Soil erosion rate at two groups of plots: with and without conservation techniques

	Plots num.	Soil loss (t/ha/yr)		Plots num.	Soil loss (t/ha/yr)
With Conservation activities	plot-1	160	**Without conservation activities**	plot-11	220.8
	plot-2	122.8		plot-12	176.64
	plot-3	82.8		plot-13	220.8
	plot-4	39.1		plot-14	319.2
	plot-5	36.8		plot-15	273.6
	plot-6	58.7		plot-16	420
	plot-7	55		plot-17	180.36
	plot-8	82.8		plot-18	235.2
	plot-9	70		plot-19	140.4
	plot-10	72		plot-20	273.6

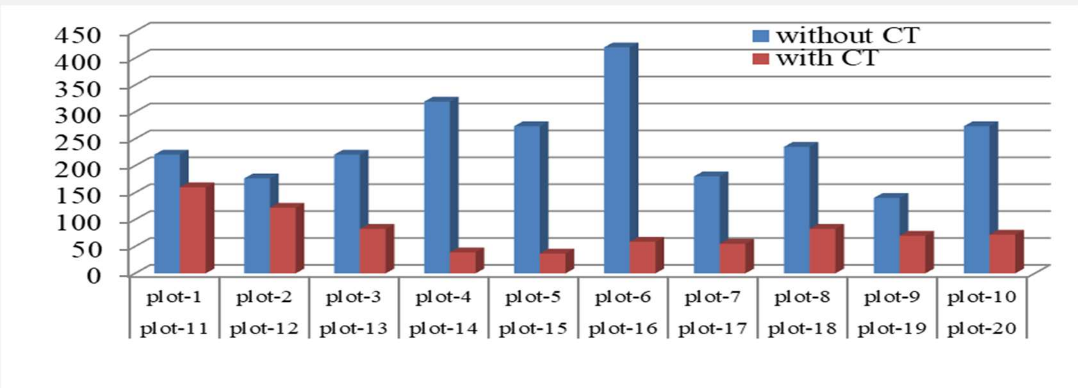

Figure6. Soil erosion trend for both groups of plots: with and without conservation techniques

The photos belowshow a soil protected with stone bunds contrasted with a degraded soil without any conservation (Fig.7).

Figure7. Terraces of stones bunds (left), degraded soil (right) (own source)

3. Economic assessment of farmers' livelihood in Boset Wareda

3.1. Methods

3.1.1. Selection of Study Site

The study site was selected purposively for the study because conservation techniques in farming activities have been growing practices in the area of Boset. The sites were commonly characterised with both socioeconomic and agricultural issues representatives and some threat of: water and soil erosion or vulnerability exists and lead to desertification and drought; a site where food and seed security is of major concern and obstacle of the welfare of rural population; and a site where some socioeconomic and agricultural practices have impact on poverty.
One of the main criteria used in selecting the site for the case study was to identify areas with variation over time and space in CTs and with good potential collaborators to conduct the study. To study the impact of CTs on farm productivity, it was necessary to look for situations where some identifiable difference in CTs adoption was evident. Three steps were followed: look at areas where there had been adoption of CTs from initiative and payment of farmers or government or NGOs; choose the adoption of CTs done with the initiative and budget of farmers; and comparison of socioeconomic situation of farmers who adopted CTs with farmers in the same area without adoption.

3.1.2. Sampling procedures and data collection

In order to meet the objectives and the statistical requirement, multi-stage sampling procedure was used until the final target sample units (FTSU) were selected on purposive sampling technique in order to avoid biasness and the possible chances to missing those presumably decided target units and moreover to remain within the thematic restricted area of study, chosen upon the conditions mentioned before and after many CTs site visits. To eliminate personal and statistical biasness and also enhance viability of the outcome, a control group was formed out of the ultimate sample unit who have not done any soil and water conservation measures on their plots. In doing so, the heterogeneity of the sample size units was reduced to acceptable minimum level and been able to find 2 homogeneous groups characterised by one common denominator. These two groups are the users and the non-users. In other words, one of the most important factors that affect the sample size is the extent of variability of the population.
However, a consideration that might present the limitation of this work is the 'confidence in the inference mode'. In fact, the large the sample size, the higher is the confidence and hence minimum sampling error. But, in real situation and in many interview studies as it is the case of this study, the budget constraint and time inhibited the possibility of large sample size. Nevertheless, the method was preferred because close monitoring of farmers (e.g., measurements of GPS coordinates) were necessary for every farmers in order to identify his/her position, useful task for the GIS analysis in the anterior chapter. Besides, difficulties to access the farmers in their localities to take GPS points and to interview them, also constraint of time and budget and beginning of rain season limited the sample size. List of

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survey area population collected from District Office was used as a sampling frame for selecting the farmers target sample units. The list was adapted and prepared for the desired purpose. The sample size was therefore fixed at 145 farmers.

In fact, household sample size was determined by using Equation (2) in which N_1 is the required sample size without finite population correction factor (FPCF), Z is the confidence level at 95% (standard value of 1.96), p is an estimated proportion of an attribute and Φ is the margin of error at 5% (standard value of 0.05). It was estimated that about 95% of the population in the study area are engaged in farming activities and taking into account number of farmers in all villages of Boset area with potential to adopt CTs (N_2) being equal to 9000, according to Kothari (2006), it followed therefore that:

$$N_1 = \frac{Z^2 p(1-p)}{\Phi^2} = \frac{(1.96)^2(0.95)(1-0.95)}{(0.05)^2} = 72.9904 \qquad (2)$$

Given sample size provides proportionately more information for a small population than for a large population, therefore, applying the finite population correction factor (Kothari, 2006) resulted in the actual sample size N_3 computed in Equation (3).

$$N_3 = \left(\frac{N_1 N_2}{N_1 + (N_2 - 1)}\right) = \frac{(72.9904)(9000)}{72.9904 + (300-1)} = 72.41119 \qquad (3)$$

The survey was designed as a cluster sample (a representative selection of villages), not a simple random sample, hence to correct for the difference in the design, the sample size was multiplied by the design effect (D) in Equation (4). The value of D was assumed to be 2 for village surveys using cluster-sampling methodology as IFAD (2003) and FAO (1997) attest.

$$N = (D)(N_3) = 2(72.41119) = 144.8224 \approx 145 \qquad (4)$$

Sample size of 145 households was purposively distributed to all the villages by equal allocation of 29 households. A total of 120 households usable questionnaires were recorded (representing a village survey response rate of 82.76%) which was satisfactory for this study. Among the 120 farmers, 66 farmers were users i.e. they adopted CTs and 54 are non-users i.e. they did not adopt any.

A visit of the whole area was essential to have an overview on the different types of CTs. It was noted that different kind of farmers' organisations to establish these CTs in groups, community or individual basis existed in the study area. For the purpose of this study, we selected farmers who have done the CTs by their own budget and individually. Structured household questionnaire was used for collection of primary data. The questionnaire was designed to capture both quantitative and qualitative data. Both closed and open-ended questions were used.

The questionnaire was divided into 7 sections to capture data related to demographic, crop and livestock activities, conservation techniques, soil, water resources, and non-farm activities. The questionnaire was pre-tested in order to test the appropriateness of the data collection instrument, the extent to which households would cooperate and respond to it, the extent of the field researchers' understanding in gathering the required information and to get feedback from households to minimise the possibility of systematic errors of interpretation. The preliminary study was also used to determine the approximate time required in completing a questionnaire and experience the field situation. The testing was very useful and resulted in substantial improvements of the design.

Secondary data were obtained through literature of many previous researches done on environmental, rural household's economics and conservation strategies in particular. A checklist was prepared to obtain background information necessary as tertiary data collected from the Boset Wareda District, Rural Development Zonal Office of Adama, Adama Meteorological Service Agency and others.

The checklist comprised both physical and socioeconomic information. These included the distribution of rainfall, soil types, land forms, temperature, vegetation types, land use patterns, area coverage, demographic characteristics, formal and informal institutions operating in the respective Wereda and their objectives and activities, crop types, yield potential, livestock types and number, soil fertility management practices, soil-conservation practices already in place, and others. The data was then analysed and lead to choose the study site.

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Other useful information (e.g., maps and carts) were sourced from the Ethiopian Mapping Agency and the Ministry of Agriculture. Supplement and complementary information were collected from Adama University in Ethiopia.

3.1.3. Data Analysis

Data entry and analysis began shortly after the fieldwork. Completed questionnaires were coded, entered and edited by data processing personnel by using SPSS. Two-way ANOVA sample independent *t*-test was used to test the differences in Net Margin between CTs users and non-users (i.e., CTs adopters and non-adopters). Senkondo (1988) pointed out that, a unit net margin can be examined by testing the difference between two means of the two different groups of growers (i.e., users and non-users) using two sample independent *t*-test as specified in Equation (5). Whereby, $\overline{X}_1$ and $\overline{X}_2$ represent two means being compared, S_1^2 and S_2^2 represent sample variances of the two populations whereas N_1 and N_2 are sample size.

$$T = \frac{\overline{X}_1 - \overline{X}_2}{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}} \approx t(N_1 - 1, N_2 - 1) \tag{5}$$

It should however be noted that although Net is widely used in farm business management as a good indicator of enterprise profitability of an investment as soil conservation is considered as an investment in this case. Therefore, the difference between production costs and returns were analysed using the equation below to obtain Net margin per ha in order to examine the relative profitability between CTs users and non-users production systems.

$$NM_{ij} = \left(\frac{\sum (GP_i - TC_i)}{\sum (A_i)} \right) = \left(\frac{\sum (P_{Y_i} Y_i - P_{x_i} X_i)}{\sum (A_i)} \right) \tag{6}$$

NM_{ij} refers to Net margin (measured in birr per ha) of household head *i* of household *j*, *GP* is a total gross product, *TC* is a total cost, $P_Y(P_x)$ is a unit price of output (input), *A* is a size of farm under cultivation in ha, *X(Y)* represent quantity of inputs (outputs). (6).

3.1.4. Tested Hypothesis

Based on the specific objectives designed for this study, theoretical framework and empirical literature review, the following testable hypothesis was constructed and tested: The average Net margin per ha between CTs users and non-users in farm business are the same (i.e., *Ho*: $\mu_1 = \mu_2$) and there is no profitability differences before (i.e., 1996-2000) and after (i.e., 2001-2008) CTs adoption (i.e., *Ho*: $\gamma_1 = \gamma_2$).

3.2. Results of ANOVA and Net Margin for conservation techniques users and non-users

To test the hypothesis *VI* that Mean net margin generated by CTs users are higher than those by CTs non-users, two sample independent *t*-tests at 5 percent level of significance were used to determine the mean total revenue difference between the two groups. The first output Table 2, labelled *Group Statistics*, displays descriptive statistics. The second output is labelled Independent *Samples Test (table 3)*, it contains the statistics that are critical to evaluating the current research question. This table contains two sets of analyses: the first assumes equal variances and the second does not. To assess whether we should use the statistics for equal or unequal variances, we use the significance level associated with the value under the heading, *Levene's Test for Equality of Variances*. It tests the hypothesis that the variances of the two groups are equal. A small value ($p<0.050$) in the column labelled *Sig*. (2-tailed)[1] indicates that this hypothesis is false and that the groups do indeed have unequal variances. In the above case, the

[1] The choice between a one- and two-tailed significance tests in the *test for significance* is determined by whether the hypothesis being tested is making a prediction about the direction of effect between the two variables (Landau and Everitt, 2004). In our analysis, we specified and tested hypotheses without making a directional prediction. Therefore, in both cases we used two-tailed test.

value <0.05 in that column indicates that the variance of net margin generated from crops over time for the two groups, (i.e., CTs non-users and users), are not equal during some growing seasons (e.g., 1997, 1998, 2005 through 2008) and equal in other seasons (i.e., 1996, 1999, 2000 and 2001).

Thus, we use the *t*-test statistics in the row labelled *Equal variances not assumed* and *Equal variances assumed* respectively. The former uses separate variances instead of a pooled variance to construct the standard error and reduces the degrees of freedom to account for the extra variance estimated (Everitt and Rabe-Hesketh, 2001).

We obtained an output of a *t-statistic* and *degrees of freedom* for all *t*-test procedures. Every unique value of the *t*-statistic and its associated degrees of freedom has a significance value. In this case in which the hypothesis is that CTs non-users and CTs users do not differ in their net margin generated from crops, the *t*-statistic under the assumption of unequal variances has a value of -4.509, -3.714, -2.052, -2.471, -3.683, -4.343 and the degrees of freedom has a value of 72.493, 69.519, 65.128, 101.168, 77.256 and 64.363 with significance level of <.050 in 1997, 1998, 2005, 2006, 2007 and 2008 respectively.

The significance level tells us that the probability that there is no crop net margin difference between CTs non-users and CTs users is very small: specifically, less than one time in a thousand would we obtain a mean difference of 2,107.96 birr, 19,265.38 birr, 2,000.93 birr 2,520.69 birr, 9,126.18 birr and 7,460.66 birr, or larger between these groups if there were really no differences in their net margin in the respective years.

Further output gives an estimate for the mean difference in net margin between CTs users and non-users (e.g., 7,460.66 birr), and uses the standard error of this estimator (1,717.98 birr) to construct a 95 percent confidence interval (CI) for the mean difference (from 10,892.33 birr to 4,028.98 birr) in 2008. On the other hand for the rest of years (i.e., 1996, 1999, 2000 and 2001) *Equal variance assumed* (homogeneity of variance) is used and description of results follows the same suit.

The conclusion from the test is that there is strong evidence of a difference in the net margin structure under the two farming system in the study area. CTs adopters recorded higher net margin than their counterparts and that the evidences were more supportive in the latter years of CTs use. However, in the early years (e.g., 1997 and 1998) before CTs adoption only farmers with good background in agriculture education cultivating large size with low average cost of production reaped higher net margin. In the table below we present average net margin of different farmers showing comparison between users and non user of CT.

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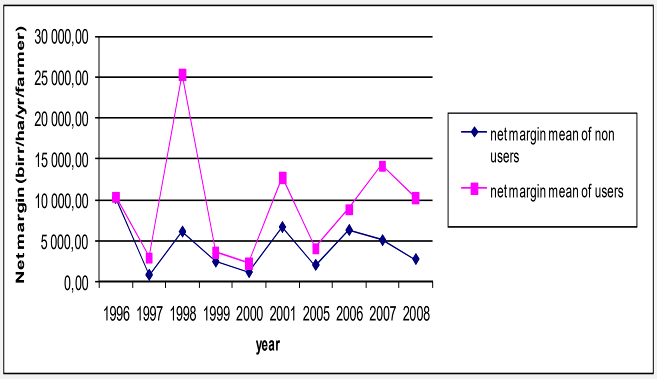
Table 2. Group Statistics[2] showing Net Margin mean (in birr/ha/year) between conservation techniques users and non-users

Year[a]	Num.	Mean Net Margin	Std. Deviation	Std. Error Mean
1996	66	10,255.9848	9,601.98426	1,181.92256
	54	10,346.6111	11,886.48274	1,617.54542
1997	66	804.3394	1,503.73638	185.09715
	54	2,912.3019	3,154.79186	429.31280
1998	66	6,112.3939	15,508.37322	1,908.94878
	54	25,377.7759	35,438.27949	4,822.53901
1999	66	2,413.9197	3,433.70444	422.65980
	54	3,527.2463	2,929.57220	398.66428
2000	66	1,139.3000	3,730.05789	459.13839
	54	2,188.2926	3,639.88883	495.32613
2001	66	6,676.5152	16,435.35619	2,023.05250
	54	12,699.0389	23,505.04707	3,198.63176
2005	66	2,024.4545	2,538.96890	312.52547
	54	4,025.3889	6,789.26338	923.90172
2006	66	6,302.2303	4,888.93767	601.78663
	54	8,822.9167	6,053.58289	823.78829
2007	66	5,068.0455	8,765.23136	1,078.92540
	54	14,194.2222	16,390.48632	2,230.46267
2008	66	2,750.1212	4,341.79165	534.43761
	54	10,210.7778	11,998.09333	1,632.73370

[a]Note that the first and second row in each year constitutes conservation techniques users and non-users respectively. The exchange of currency in 2010 is approximately as follow: 1000 Ethiopian Birr = 60 US Dollars = 5000 Japanese Yen = 550 TND.

Chart 2. Trend of Net Margin mean (in birr/ha/year) of conservation techniques users and non-users



[2] Independent samples test output tables begins with a number of descriptive statistics for each group (i.e., Table2). Note that in contrast to the common descriptive statistics output tables, the standard errors of means are given (i.e., the standard deviation of cost divided by the square root of the group sample size). The second part of the display (i.e., Table 3) gives the results of applying two versions of the independent samples *t*-test; the first is the usual form, based on assuming equal variances in the two groups (i.e., homogeneity of variance), the second allows the variances to be different (Everitt and Rabe-Hesketh, 2001).

Table 3. Independent Samples Test for Net Margin (in birr/year) generated from crops per ha

Year[a]	Levene's Test for Equality of Variances		t-test for Equality of Means					95% CI of the Difference	
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
1996	1.148	0.286	-0.046	118	0.963	-90.62626	1,961.30210	-3,974.53839	3,793.28586
			-0.045	101.184	0.964	-90.62626	2,003.34573	-4,064.63776	3,883.38524
1997	63.862	0.000***	-4.805	118	0.000***	-2,107.96246	438.69545	-2,976.69888	-1,239.22604
			-4.509	72.493	0.000***	-2,107.96246	467.51517	-3,039.82863	-1,176.09628
1998	73.216	0.000***	-3.978	118	0.000***	-19,265.38199	4,842.85746	-28,855.55821	-9,675.20576
			-3.714	69.519	0.000***	-19,265.38199	5,186.61430	-29,611.01776	-8,919.74622
1999	0.401	0.528	-1.886	118	0.062*	-1,113.32660	590.31108	-2,282.30325	55.65005
			-1.916	117.777	0.058*	-1,113.32660	581.01163	-2,263.91040	37.25720
2000	3.515	0.063*	-1.549	118	0.124	-1,048.99259	677.06167	-2,389.75903	291.77385
			-1.553	114.363	0.123	-1,048.99259	675.39324	-2,386.89589	288.91071
2001	2.357	0.127	-1.647	118	0.102	-6,022.52374	3,655.84480	-13,262.09175	1,217.04428
			-1.591	91.894	0.115	-6,022.52374	3,784.70429	-13,539.38918	1,494.34170
2005	17.003	0.000***	-2.214	118	0.029**	-2,000.93434	903.68202	-3,790.47078	-211.39791
			-2.052	65.128	0.044**	-2,000.93434	975.32895	-3,948.72840	-53.14029
2006	4.400	0.038**	-2.524	118	0.013**	-2,520.68636	998.74974	-4,498.48275	-542.88998
			-2.471	101.168	0.015**	-2,520.68636	1,020.18346	-4,544.41514	-496.95759
2007	21.198	0.000***	-3.896	118	0.000***	-9,126.17677	2,342.58746	-13,765.13770	-4,487.21584
			-3.683	77.256	0.000***	-9,126.17677	2,477.70938	-14,059.66600	-4,192.68754
2008	31.265	0.000***	-4.694	118	0.000***	-7,460.65657	1,589.54417	-10,608.38678	-4,312.92635
			-4.343	64.363	0.000***	-7,460.65657	1,717.97639	-10,892.33609	-4,028.97704

4. Conclusion

The farmers are producing for subsistence and exerting an increasing erosion of the land. Nevertheless, soil and water resources degradation addicted by natural and anthropologic activities are usually controlled by soil conservation techniques and water harvesting constructions. Soil erosion can be limited with proper management of vegetation, plant residue and tillage (Lee, 2004). In fact, the soil and water conservation techniques have shown a positive impact or reducing erosion amount. USLE calculation showed that farmlands with conservation techniques are less eroded than the lands with any. That is why it was useful to estimate financially the advantage that procure the conservation practices in increasing the farmers' benefits and preventing erosion, in zones under desertification threat in order to explain how environment degradation could lead to socioeconomic deficiency. In fact, ANOVA study has shown that CTs adopters recorded higher net margin than their counterparts.

In conclusion, we can say that the two general approaches (known as the two- stage approach and the parallel approach) were formulated by the FAO framework (FAO, 1976) to be followed with respect to the natural resources assessment and socio-economic analysis. In the two-stage approach, a quantitative land evaluation is elaborated in parallel with a socioeconomic analysis and hence contribute to an interrelation between the two stages the bio-physical one (in this research it assess the eroded soil due to water erosion) and the economical one (the current research calculated the mean net margin/ha/yr/farmer). In the parallel approach, the assessment of bio-physical factors runs simultaneously with the socio-economic analysis.

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5. References

Bhan, C. (1988) Spatial analysis of potential soil erosion risks in Welo Region, Ethiopia: a geomorphological evaluation. Mountain Research and Development 8, 139-144.

Everitt, B.S. and Rabe-Hesketh, S. (2001) Analysing Medical Data Using S-PLUS. New York: Sringer.

Food and Agriculture Organization (1997) Conducting Small-Scale Surveys: A Field Manual. Rome

Food and Agriculture Organization (2016) Online scientific information on food and agriculture for poorest countries.

Gara, A., Shimada, S., Toyoda, H. (2009) Relationship between vegetation and topography for an erosion management in Ethiopia. Journal of Arid Land Studies, 19-1, 257- 260

Gara, A., Suzuki, S. (2011) Soil Erosion Assessment Using USLE in East Shewa, Ethiopia, Journal of Agriculture Science, Tokyo University of Agriculture; Vol. 56, No.I: p.1-8

International Fund for Agricultural Development (2003) Agricultural Marketing Companies as Sources of Smallholder Credit in Eastern and Southern Africa: Experiences, Insights and Potential Donor Role. Eastern and Southern Africa Division.

Kothari, S.P., Loutsina, E. and Nikolaev, V. (2006) Agency theory of overvalued equity as an explanation for the accrual anomaly. Social Science research network.

Landau, S. and Everitt, B.S. (2004) A Handbook of Statistical Analyses using SPSS. Chapman and Hall/CRC Press LLC.

Lee, S. (2004) Soil erosion assessment and its verification using the universal soil loss equation and geographic information system: A case study at Boun, Korea. Environmental Geology, 45, 457–465.

Mhede, E.P. and. Likwelile, A.K. (2006) Statistical Package for Social Sciences: Research Improvement Program for MIMT Professionals. Dar Es-Salaam, Tanzania.

Ministry of Agriculture, Addis Ababa, Ethiopia (1986) Guideline for development agents on soil conservation in Ethiopia, Ministry of Agriculture.

Ogawa, S., Saito, G., Mino, N., Uchida, S., Khan, N.M., and Shafiq, M. (1997) Estimation of soil erosion using USLE and Landsat TM in Pakistan (ACRS 1–5). Retrieved from GIS development.net.

Nedesa, B. (2002) Homestead Development, National Food-for-Work Project Service Unit, Ministry of Agriculture, Addis Ababa.

Otsuka, K. , Estudillo, J.P. and Sawada, Y. (2008) Rural Poverty and Income Dynamics in Asia and Africa. Routledge Studies in Development Economics. Great Britain.

Pagiola, S. (1992) Estimating the yield effect of soil degradation. Journal of Soil and Water Conservation 47:486-490.

Pagiola, S. (1992) Quantifying the returns to soil conservation in Kenya. Paper presented at the annual meetings of the Soil and Water Conservation Society. Baltimore, Maryland, August 10-12, 1992.

Renard, K.G., Kenneth, G. and Freimund, J.R. (1994) Using monthly precipitation to estimate the R-factor in the revised USLE. Journal of Hydrology, 157, pp. 287–3006

Senkondo, E.M. (1988) Economic analysis of Tanzanians Sugar Industry: The case study Kilombero Company. MSc Dissertation. Nairobi University, Nairobi, Kenya, 194pp.

Wischmeier, W.H. and Smith, D.D. (1978) Predicting Rainfall Erosion Losses. A Guide to Conservation Planning. Agriculture Handbook No. 537, U.S. Department of Agriculture.

Woreka, B.B. (2004) Evaluation of soil erosion in the Harare region of Ethiopia using soil loss models, rainfall simulation and field trial.