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Towards Integrated Soil Erossion Management in Elfeta District, West Shoa Zone, Oromia Regional State, Ethiopia

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Abstract
Soil degradation is one of the most serious environmental problems in Ethiopia. The prevalence of traditional agricultural land use and the absence of appropriate resource management often result in the degradation of natural soil fertility in the country. This has important implications for soil productivity, household food security, and poverty in major areas of the country. The main objective of this research is to assess farmers' soil erosion management practices and forward integration of these practices. Primary data utilized were mainly collected from 144 sample respondent's selected using systematic random sampling from two rural villages of Elfeta district, West Shoa zone of Oromia regional state. Semi structured interview schedule, Focus group discussion, personal observation and life history method were used to collect primary data. Moreover, secondary data were collected from review of various literatures, office reports, journals and manuals. Simple descriptive statistics like, mean, percentage and frequencies as well as comparative statistics like chi-square were used for analytical purpose. The result of the study indicate that 39%, 27% and 11% of sampled respondents implement contour plowing, cultural ditches and cut off drain respectively. These measures were more of traditional type of soil conservation and the effort to implement integrated soil erosion management practice were reported to be minimal. Government effort in addressing soil erosion problem since 2011in the area were little bit worrisome as the intervention shows no change in soil conservation among local farmers in the area. Forestation and reforestation, which have curative and protective value; farming system which conserve the natural resource base and at the same time raise productivity like intercropping and relay or sequential cropping; crop rotation; integration of livestock farming with arable cultivation; the cut and carry method of using degraded pasture, controlled grazing and tethering; widespread use of semi-permanent crops like enset (false banana) and volunteering crops, such as legumes and sweet potatoes were few of integrated soil erosion management practices should be given special attention in the area
Keywords: Soil Erosion, Integrated, soil erosion management practices, Elfeta District

Introduction

Soil is the second most important for life next to water (Gebrelibanos & Abdi, 2012). This shows as abundant growth of life is found in areas with good soils. The same author contends as from the record of past achievements, history tells us that civilization and fertility of soils are closely interlinked. However, the loss of soil through land degradation and soil erosion has been a great threat for this valuable resource in most developing countries like Ethiopia. The declination of the fertility of soil has been occurred due to accelerated erosion caused by human interference. Today soil erosion is almost universally recognized as a serious threat to human wellbeing (Feoli *et al*., 2013; Wolka, 2014).

Soil erosion is one of the most challenging environmental problems in the highlands of Ethiopia (Beshah, 2003; Moges & Holden, 2006; Bewket, 2010). The prevalence of traditional agricultural land use and the absence of appropriate resource management often result in the degradation of natural soil fertility. This has important implications for soil productivity, household food security, and poverty in major areas of the country (Teklewold and Kohlin, 2011; Gebrelibanos & Abdi, 2013). Witness from various literature depict as serious soil erosion is estimated to have affected 25% of the area of the highlands and now seriously eroded that they will not be economically productive again in the foreseeable future (Paulos, 2002). The average annual rate of soil loss in the Ethiopia is estimated to be 42 tons/hectare/year which results to 1 to 2% of crop loss (Hurni, 1993), and it can be even higher on steep slopes and on places where the vegetation cover is low.

Natural and environmental resources conservation in Ethiopia in general and in the study area particularly, specifically soil, is therefore not only closely related to the improvement and conservation of ecological environment, but also to the sustainable development of its agricultural sector and its economy at large. To this end, efforts towards soil conservation were started in the country since the 1970s and 1980s. Since then a huge amount of money has been invested in an attempt to introduce soil and water conservation measures particularly in the areas where the problem of soil erosion is threatening and food deficit is widespread. The conservation measures were in most cases physical measures and undertaken through campaign using Food-for-Work (FFW) or Cash-for-Work (CFW) as an instrument to motivate farmers to putting up the conservation structures both on communal holdings as well as on their own plots (Habtamu, 2009; Hurni, 1988; Gebrelibanos

& Abdi, 2013). The conservation activities were given attention again and politicized by government throughout the country through participatory community watershed management in 2011 and continues for the last five years as part of first GTP plan. Nevertheless, the achievements have fallen far below expectations. The country still loses a tremendous amount of fertile topsoil, and the threat of land degradation is broadening alarmingly (Yeraswork, 2011). This is mainly because farmers' perception of their environment has been misunderstood partly in the country. It is misunderstood partly because outsiders, both scholars and policy makers, who write about farmers and formulate polices, often have limited understanding about the farmers' attitude towards environment (Paulos, 2002; Kibemo, 2011). Furthermore, the farmers' view of the environment is often ignored without due consideration of the condition he/she faces between survival and environmental exploitation (Yeraswork, 2011). So far, conservation practices were mainly undertaken in a campaign often without ascertaining the involvement of the land user (Shiferaw & Holden, 2000; Odendo *et al*, 2010). This doesn`t mean there is no hope for soil conservation in Ethiopia. The problem would have been rather, the campaigns that have been undertaken in the area for soil conservation practices have failed to consider local peoples' participation in planning stage and implementing integrated soil erosion management practices. This motivates that, there is a need to study on farmers` soil erosion management and forward integrated soil erosion management practices with active participation of local people.

Hence, the main objective of this paper is therefore to assess farmers soil erosion management practices and forward integration of these practices. The paper has a paramount importance in identifying commonly practiced soil erosion management practices and recommend effective mechanism in conserving soil resources in the study area.

Research Methodology

Area Description

Elfeta District is one of the 18 West shoa Zone districts which are located 120 Km South West of Addis Ababa; capital of the country and 68Km form Ambo to the North. Elfeta District has total land area of 39,342 hectares out of which 66% hectares used for farming, 19.57% are used for grazing, 9.3 %hectares are covered by forest, 2.5% are covered by river and water bodies and 2.78 % hectares are unusable land. The District has 17 PAs out of which 15 PAs are Rural and the remaining 2 are Urban (Elfeta District Agricultural development office, 2013). The district has the population of 75,902 out of which 37,649 are male and 38,253 are female (CSA, 2008). The economic activity of the district is mostly agriculture plus very small percent of trade and others.

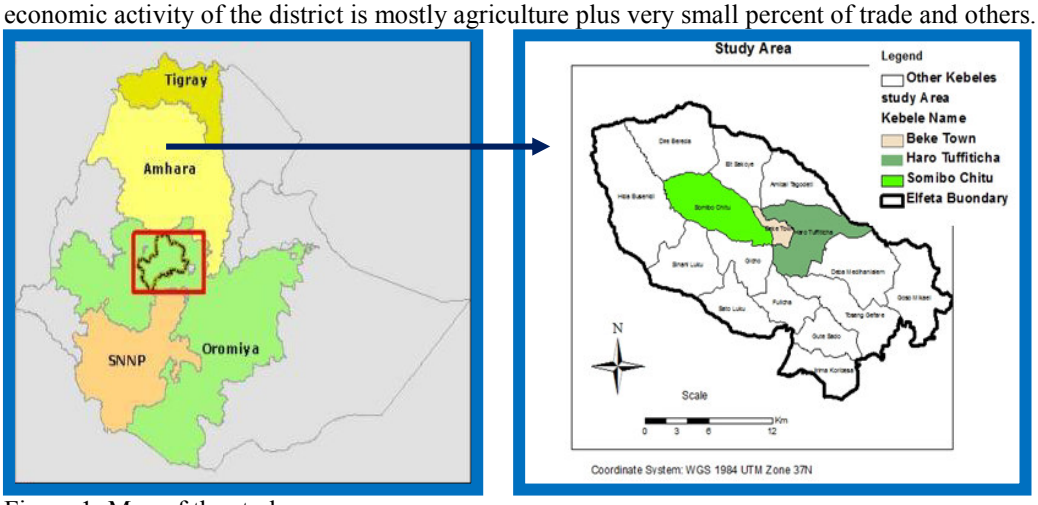

Figure 1: Map of the study area

Sampling Methods and Procedures

Both purposive and multi-stage sampling techniques were used to collect primary data. In the first stage, Two Peasant administrations were selected purposively in consultation with District agricultural development office based on degradability of these Peasant administrations. Accordingly Sombo Chitu and Haro Tufticha were selected. Secondly, from the sampled Peasant administrations, sample representative were selected using simple random sampling method. Accordingly a total of 144 sample sizes were identified using Yamane formula.

Methods of Data Collection

To address the specific objectives of the study both primary and secondary source of data were used. Accordingly primary data were collected through semi structured interview schedule, Focus group discussion, personal observation and life history method were employed. Moreover; secondary data were collected through review of various literatures, office reports, manuals and magazines among the other.

Methods of Data Analysis

To address objectives of the study data collected through semi structured interview schedule were analyzed using descriptive statistics (frequencies and percentage) by the help of Statistical Package for Social Sciences (SPSS) software (version 20). Data collected through focus group discussion, personal observation and life history were analyzed through narration and description. Finally, the results were presented using tables.

Result

Socio economic Characteristics

Surveyed result shows that about 76.4% of sampled respondents are male headed and 23.6% of respondents are female headed. Mean years of schooling for sampled respondents were 3.47 having the standard deviation of 3.36. Mean years of schooling of Haro Tufticha farmer were little bit greater than that of Sombo Chitu (3.73 and 3.14 respectively). Overall average land holding size was 2.03 hectare, having standard deviation of 1.2. Minimum and maximum land holding size was 0.25 hectare and 5.5 hectare respectively. Mean land holding size of both PAs was nearly comparable (2.09 and 1.98 respectively).

General Overview of Farming System in the Area.

A. Sources of current Land Holding

Farmers` in the area were asked from where they their current land and nearly half (44%) of their current land from share cropping. This was followed by inheritance, given by local governor (PA administrative) and rent which account 38%, 13% and 5 % respectively.

Table 1: Farmers Sources of Current Land

SN	Sources of Current Land	Frequency	Percent
1	Rented	7	4.9
2	Share Cropping	63	43.8
3	Inheritance	55	38.2
4	Given by PA Administrative	19	13.1
	Total	**144**	**100**

[Source: Field Survey, 2015]

B. Perceived Soil Fertility status of Farmers Field

Surveyed result indicate that majority of farmers (94%) in the area opted for decrement in fertility of their fields. The remaining percentage opted for increasing and constant which accounts 5% and 1% respectively.

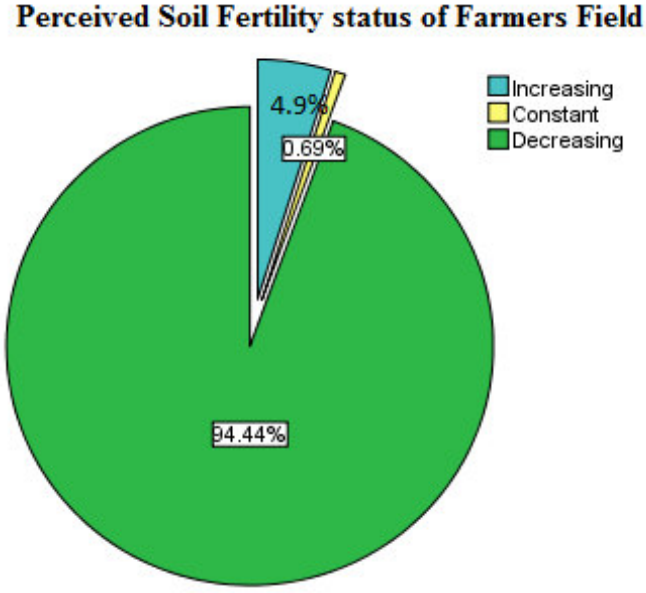

Figure 2: Perceived soil fertility status of farmers` field

Majority of farmers in the area (96%) also witnessed as crop productivity were decreasing as the result of soil depletion. The remaining 3% and 1% opted for increasing and constant respectively.

C. Reason for Decreasing Crop Productivity

As indicated in table 2, nearly 90% of sample respondents attribute decrement of crop productivity to soil erosion. This was followed by absence of fallowing, and over cultivation both of which accounts 6% and high

cost of fertilizer and unreliable rain fall both of which account 4%. As depicted by focus group discussants in the area, before few decades the rate of erosion were not as such problematic and as population growth and land pressure increases soil erosion and other related natural disasters like flood increased. These create severe limitation in on farmers land for increasing their productivity.

Table 2: Perceived Reason for Decreased Productivity in the area

SN	Causes of Decreased Productivity	Frequency	Percent
1	Soil Erosion	129	89.6
2	High cost of Fertilizer	2	1.4
3	Unreliable rainfall	2	1.4
4	Absence of Fallowing	3	2.1
5	Over cultivation	3	2.1
6	Any Other	5	3.4

[Source: Field Survey, 2015]

D. Farmers Field Slope, Severity of Soil Erosion and Farmers Awareness on SWC in the Study Area

As depicted in the following table more than half (60%) of sample respondents witnessed as the slope of their land is gently undulating. The remaining 23% and 17% opted for flat and moderately steep slope respectively. Meanwhile, perceived severity of erosion indicate that nearly half (49%) of sample respondents indicated more than high (high and very high).

Table 3: Farmers Field Slope, Severity of Soil Erosion and Farmers Awareness on SWC in the Study Area

Variables		Freq.	%
Farmers Field Slope	**Flat**	33	23
	Gently Undulating	87	60
	Moderately Steep	24	**17**
Severity of Soil Erosion	**Very High**	46	32
	High	25	17
	Moderate	65	45
	Low	8	6
Farmers Awareness on SWC	**Yes**	133	92.4
	No	11	7.6
Farmers Access to training on SWC	**Yes**	129	90
	No	15	10
Farmers Extension Contact	**Yes**	117	81
	No	27	19

Farmers` awareness on soil and water conservation survey also indicates that 90% of sample respondents have awareness on the issue. Still 81% of sample respondents have extension contact. If so what are major challenges in the implementations of improved soil and conservation measures? Detailed discussions are presented hereunder

Farmers Soil Erosion Management Practices in the Study Area

Surveyed result indicates that, 39% and 27% of sampled respondents exercise contour plowing and cultural ditches to reduce soil erosion respectively **(table 4).** About 11% of sampled respondents confirmed as they implement cut off drain and Water ways. Additionally, the other 7% and 6% implement soil bund and stone bund respectively. Still only 5% confirmed as they implement mulching (**see table 4**). Fallowing was rarely implemented due to lack of inadequate land.

Table 4: Farmers Soil Erosion Management Practices and PAs

SN		Sampled PAs		
	Soil Erosion Management Practice	Sombo Chitu %	Haro Tufticha %	Total %
1	Contour plowing	40	37	39
2	Cultural ditches	24	30	27
3	Cut off drain and Waterways	10	12	11
4	Stone Bund	10	5	7
5	Soil Bund	8	5	6
6	Mulching	5	5	5
7	Agro forestry	3	3	3
8	Fallowing	0	4	2
9	Grass strips	0	0	0
	Total	**100**	**100**	**100**

Source: Field Survey, 2015

Agro-forestry accounts only 3% and this shows that farmers in the study area focus only on physical conservation practices rather than biological measures. Farmers in both PAs implement almost similar soil erosion management practices and chi square test also shows no statistically significant difference between these two PAs soil erosion management practices ($\chi^2 = 4.842$, **P>0.05**).

Current Implementation Strategy, Approaches and Challenges of Soil Conservation by Agricultural Office in the Study Area

Currently land degradation prevailing at national level accounts for 8% of global total (Takalign, 2008). To overcome this problem, Ethiopian government has spent significant efforts on micro- watershed rehabilitation and development. With the intention of replicating success in few watersheds, roughly thirty day public campaign to undertake SWC (soil and water conservation) based rural watershed management has been considered as strategy and launched early 2011 at national level. The activity has been well publicized and politicized in some regions (Oromia, Tigray, Amhara, Southern Nation, Nationalities and Peoples Regional state) of Ethiopia (Wolka, 2014). Different group of society; teenager school boys and girls, women, men, etc participate in the activity. It has been undertaken during dry season when the farmers where comparatively less busy with their cropping activities. The selected time is a favorable period for protecting the soil from rain fall which is expected after the dry season and has more eroding possibilities as the land is bare.

In the study area also campaign were well publicized since 2011 and development agents assigned at PA level takes part in designing and identifying areas where SWC (soil and water conservation) is being implemented. District cabinets assigned at every PAs to mobilize community to participate in watershed campaign. District agricultural expert and development agent's sew all the activities from watershed planning to deciding types of soil and water conservation practices to be implemented in their PA. The areas selected for implementing Soil and water conservation practice could be communal land or farmer's field depending on prior selection made by experts. As noted in FGDs big challenge in soil conservation planning are mainly; low participation of local community in planning stage, little consideration of local farmers knowledge of soil conservation and qualitative aspect of past soil and water conservation practices implemented at PA level among the other.

On the days of campaign, farmers work with their development team organized prior based on their neighborhood. Until the final date of campaign each and every member of development team were obliged to be involved in the work. Development agents and district agricultural expert oversees qualitative and quantitative aspect of soil and water conservation structures performed. As noted in FGDs there would be a big challenge if structures are built on individual farmers' field. As noted in field survey, majority of sampled farmers confirmed as one source of failures of past soil and water conservation activity were low level of awareness and little persuasion of individual farmers when (Soil and water conservation) SWC were built on their fields. In the other case as noted in FGDs and life histories, there is misconception in the community as physical soil and water conservation are labor intensive, takes more land and hence most challenging to implement on individual farmers` field.

As noted from FGDs, field observation and from researches personal experience as an agricultural expert in the study area, experts might have accumulated sufficient technical and theoretical lessons and experiences. However, it appeared that building the structures with any approach is not the challenge, but shifting farmers` minds or convincing them to replicate and the technology are still much further behind than they should be. Farmers claimed as these problems are bottlenecks in mass campaign soil and water conservation practices in the study area. In many areas, reports and field observation confirm that structures are rarely

maintained when damaged or broken by livestock, floods, etc. The campaign work annually focuses on building new structures but not auditing or monitoring the previous labor and time investments of similar activities.

In a nutshell, most of soil and water conservation activities in the study area were not successful due to lack of effective community participation, limited sense of ownership over asset created, and inefficient implementation technologies, inadequate policies, lack of integration among stakeholder, conventional planning, ineffective monitoring and evaluation and etc.

Discussion

Farmers` Soil Erosion Management Practices

As indicated in the result section, the identified soil and water conservation measures in then study area lacks integration. The commonly practiced measures are contour plowing and cultural ditches which account 39% and 27% respectively.

As noted from group discussion, personal observation and life histories this measure was commonly used not only to conserve soil from erosion but also to decrease traction power of animals during plowing. As SWC (Soil and Water Conservation) measure, it is an efficient technique for reducing runoff mainly in moderately and gently sloping areas. On steep slopes, as farmers noted, contour plowing only may not be effective; it needs other techniques like bunds to do with effectively control erosion.

Commonly practiced soil and conservation measures in the area like ditches demand less labor and low cost and short time to construct compared to other newly introduced conservation measure. However, they underlined that for sustainability of the land, ditches have little importance compared to other conservation structures like bunds and others. This shows that though farmers have awareness for conservation structures to sustain land productivity, they are still using conservation measures, which are important for short span of time. This indicates that efforts of educating and training farmers towards the newly introduced SWC (Soil and Water Conservation) technologies are very important in the study area.

As depicted in FGDs, life stories, personal observation as well as from researches experience in the area, soil erosion were hidden secrets behind decreased productivity through time horizon. The efforts of farmers` to cope-up with the problem were below expectations. The efforts of using integrated soil and water conservation measures were not this much common farming system in the area. Literatures in the field advocate two very important integrated techniques to achieve sustainable reduction of soil erosion among agrarian communities.

Integrated Soil and Water Conservation Measures in the area

A. Forestation and Reforestation

Vegetation has a curative and protective value (Adugnaw, 2014). Degraded land may regain importance as a result of a carefully planned and efficiently administered scheme of forestation. Literature in the area affirmed as the most important measure to restore the disturbed rural ecology is the implementation of forestation and reforestation... on a scale large enough to cope with the problems of soil erosion and water wastage (Girma, 1988).

Recent report from Ethiopian ministry of agriculture ; natural resource directorates indicate that an estimated 500 million tree seedlings were planted and about 80,000 hectares of hillsides closed for regeneration between 1976 to 1985 and three to four double between 2010 to 2015 (MoA, 2015). Despite these and other massive intervention and regulation, natural resource and environmental degradation continued unabated and the survival rate of these seedlings are at less than 25%. The report clearly recommends as all efforts to be made in the future in forestation and reforestation in the country must be viewed in conjunction with continuing deforestation consultation of local communities. But literature depict as no effort that aims only at the physical environment will be successful “as long as the lives of the peasants remain impoverished and precarious” (Aklilu, 2010).

Accordingly, successful implementation of forestation and reforestation schemes requires an ability to form pressure groups in the community or involve existing local groups (follow bottom up planning approach or participatory). Most decisive and crucial activities like starting nurseries in each and every villages, planting and protecting multipurpose trees along roads, on farms, and around houses, etc., for instance, call for an ability to garner the knowledge, support, and energy of rural people (Postel & Heise, 1988; Adugnaw, 2014).

B. Integrated Conservation Oriented Farming

Conserving soil recourse in a particular farm land involve not only a few new inputs but also provide farmers with short-term economic benefits (Wood, 1990; Nair & Muschler, 1993). This method appears to integrate the three broad techniques of controlling soil erosion referred to by Belay, (1992): agronomic methods, which aim at controlling erosion by improving the vegetative cover; soil management techniques, which try to control erosion by improving the aggregation of the soil particles; and structural soil conservation methods, which control erosion by shortening the length and minimizing the gradient of the ground slope. This technique involves construction of tied ridges, bunds, fanya juu terraces, bench terraces, hillside terraces; diversion ditches (cutoffs)

waterways and special water harvesting structures (Thomas, 1984; MOA, 1986).

Certain farming practices which are believed to conserve the natural resource base and at the same time raise productivity like intercropping and relay or sequential cropping; crop rotation; integration of livestock farming with arable cultivation; the cut and carry method of using degraded pasture, controlled grazing and tethering; widespread use of semi-permanent crops like *enset* (false banana) and volunteering crops, such as legumes and sweet potatoes were frequently cited successful means of conserving soil resources at micro level (Blackwell, 1991; Wood, 1990; Adugnaw, 2014). It is not surprising that emphasis has now been put on agro forestry (MOA, 1986; Blackwell, 1991; Nair & Muschler, 1993) which, in broader terms, includes most of the land management practices described above.

Unfortunately, in the study area, the attention is mostly given to the number/quota of interventions but not their quality, standard, sustainability, and integration with other soil and land management practices. Research finding from Gete *et al.,*(2006), witness as these 'mistakes' have sparked disillusionment among local experts and development agents as well as resentment among farmers so that both develop a tendency to disregard professional opinions.

Conclusions and Recommendations

In this paper an attempt has been made to review soil erosion and farmers' soil erosion management practices with particular emphasis on integrated soil erosion management practices. Identifying all the causative factors for soil erosion is critical to find alternative solution for economic and social development of the country. However, the country continues to face environmental degradation unless we put together our handprints to our surrounding for improving environment in a sustainable way through integrating legal instruments, economic instruments and education. Legal and economic instruments have often been proposed and accordingly implemented to manage the environment. In recent years more focus seems to have been put on education, public awareness and training as an instrument with proven capacity to shape people's attitudes in such a way that they would use environmental resources without damaging the resource base and compromising the ability of next generations to make use of the same resource base (Aklilu, 2010, Adugnaw, 2014).

In the study area implementation of certain farming practices which are believed to conserve the natural resource base and at the same time raise productivity like intercropping and relay or sequential cropping were given low consideration and local experts are illuminated as their attention is mostly given to the number/quota of interventions but not their quality, standard, sustainability, and integration with other soil and land management practices. Thus integrating soil conservation techniques suitable for the specific geographic features and ensuring stockholder participation in planning, implementation, motoring &evaluation phase of soil conservation should deserve special attention in the area.

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