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Farmers' Perception on Soil Erosion and Biological Soil and Water Conservation Practices. In Case of Assosa Woreda, Benshangul Gumuz Regional State, Ethiopia

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Abstract
Soil erosion is one of the major causes for low agricultural productivity in Ethiopia and particularly in Assosa Woreda. The study was carried out in Assosa Woreda, in Benshangul Gumuz Regional state to assess farmers' perception on soil erosion and biological soil and water conservation practices. In this study, both primary and secondary data collection techniques were used. These include interviews, focus group discussions, field observations, and questionnaires were the source of this research. The sampling technique employed in this study were stratified, purposive and simple random were applied to select sample *kebele* and representative households heads. A sample of 150 heads of households was used to gain insight into soil erosion perceived by farmers and conservation practices in the study area. The finding of the study shows that almost all farmers of the study area had good perception on the causes, indicators and problems of soil erosion. The main causes of soil erosion perceived by farmers in the study area were high intensity of rainfall, continuous cultivation, topography and inappropriate soil conservation practices. The major biological soil and water conservation practices implemented by farmers in the study area were vetivers grass, elephant grass, desho grass, savanna grass, bamboo plantation and other local grasses. This research finding also concludes that the main constraints to implement biological soil and water conservations in *Assosa Woreda* were mainly related to socioeconomic and biophysical factors such as uncontrolled (free) grazing, distance between homestead and their farm land and farmers' low level of the economic capacity. Therefore, any concerned bodies need to investigate the issue and take appropriate measures.
Keywords: Farmers' perception, soil erosion and biological soil and water conservation practices

1. Introduction

Soil erosion in Ethiopia can be seen as a direct result of past agricultural practices in its highlands (Badege, 2001). Some of the farming practices within the highlands also encourage erosion. These include cultivation of cereal crops such as *Teff* and wheat, which require the preparation of a finely tilled seedbed, the single cropping of fields, and down slope final plowing to facilitate drainage. On the other hand, socio-economic and political influences, especially insecurity of land and tree tenure have discouraged farmers investing in soil conservation practices (Badege, 2001). As a result of this, soil erosion is the most immediate environmental problem facing the nation at present time. The pressure on arable land is growing and this forces people to convert more marginal, available forest and grazing lands to arable lands. Hence, forest resources are very few and continuously decreasing both in quantity and quality. These results in firewood shortage and people are forced to use animal dung as a fuel wood substitute. The major source of organic matter is thus not brought back to the soil but used for other purposes. Soil erosion is the most significant ecological restriction to sustainable agricultural production, mainly under subsistence agricultural production system like Central Ethiopian highlands (Gete and Huni, 2001). Soil erosion is triggered and become a principal obstacle for sustained and integrated socio-economic development of the nation. As a result, the present status and rate of soil erosion in Ethiopia call for immediate action to reverse soil erosion. Hence, to protect soil resources from erosion different remedial action should be taken with the help of soil conservation mechanisms to sustain the productivity of the land. This study was conducted in Assosa Woreda (North-Western Ethiopia). The Woreda, as one part of Benshangul Gumuz regional state, it is affected by land degradation particularly soil erosion. Farmers' attitudes towards soil erosion and biological soil conservation practices are decisive in protecting soil losses from erosion. Hence, farmers' perception of soil erosion is a key social factor that is also important in deciding options for controlling soil losses (Graaff, 1993). However, for many years, soil conservation programs in the highlands of Ethiopia were premised on the notion that farmers did not perceive erosion and had no interest in combating it (Mekuria, 2005). As a result, conservation programs and approaches performed poorly (Yohannes and Herweg, 2000). In *Assosa Woreda* farmers practices different biological soil and water conservation measures with different proportions. For selecting and implementing appropriate conservation methods, it is important to identify constraints that affect farmers to be appropriate biological soil conservation practices. Therefore, this study was designed to assess farmers' perception about soil erosion and biological soil and water conservation practices in *Assosa Woreda*, North -western Ethiopia. A number of empirical studies have been undertaken on perception of farmers on soil erosion and biological conservation practices; the existing soil conservation

practices adopted by farmers on their farms and pasture lands and the socio-economic, bio-physical, policy and institutional related constraints influencing farmers' perceptions to implement different soil conservation practices in the Ethiopian context. However, nearly all of them have been addressing issues of adoption in relation to improved production technologies. Available evidence shows that studies on the determinants of adoption of biological soil and water conservation measures are few and far between. Therefore, this study was conducted in view of over passed gap. The objectives of this study were to assess how farmers' perceive soil erosion problems and the causes that trigger soil erosion problems, identify the existing biological soil and water conservation practices adopted by farmers on their farms and pasture lands and examine the socio-economic, bio-physical, policy and institutional related constraints influencing farmers' perceptions to implement different biological soil and water conservation practices in the study area.

2. Materials and Methods

2.1. Description of the Study Area

The study was carried out in *Assosa Woreda*, Benshangul Gumuz regional state. *Assosa* is situated at 661 km North West of the capital city of Ethiopia, Addis Ababa. The annual average temperature and total annual rainfall of the Woreda ranges between 15.4^{o}C and 29.6^{o}C and 1132.9 mm, respectively. On the basis of altitudinal variation, the Woreda has been categorized into two traditional climatic zones i.e., *Kolla* (Tropical) and *Woinadega* (Sub-tropical). The topography of the Woreda contains mountainous (30%), plain (52%) and depressions (18%). The altitude ranges from 558 to 2,729 meters above sea level. The Woreda is characterized by rugged terrain and plain surfaces. *Assosa Woreda* has various types of vegetation in response to the variation of soils, climate and human activities. Based on *Assosa Woreda* agriculture and rural development office (2016), the total area of the Woreda was estimated to be 4767 hectares. The cultivated land is the dominant land use type, which accounts 51.17%, while 25%, 15% and 8.83% were covered by settlement and construction, grazing land, and unused (wasted) land, respectively.

2.2. Sampling Techniques

The sampling techniques were stratified, purposive and simple random sampling techniques. Based on the information obtained from *Assosa Woreda* agricultural and rural development office and preliminary field survey the Woreda has two agro-ecological zones. Then in the first stage the rural administration *kebele* of the Woreda were stratified into two strata based on their agro-ecological zones i.e., *kola* (Tropical) and *Woinadega* (sub-tropical). After that, the researcher purposely selected one kebele from each agro-ecological zone by simple random sampling from the total *kebele*. 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 150 household farmers' were selected by using simple random sampling techniques from their available list of names of rural *kebele* administration office. The reason for deciding on this sample size was the homogeneity of the households in their social and cultural aspects is more representative to the rest of the population, and considering time and cost of the research work.

2.3. Methods of Data Analysis

In order to address the specified objectives of the study, both qualitative and quantitative data were analyzed, summarized, and presented in the form of tables and percentage by using appropriate descriptive statistics.

3. Results and Discussion

3.1. Farmers' Perception on Causes and Indicators of Soil Erosion in the Study Area

All over the farmers' perception on the causes of soil erosion were very recognizable. Farmers of the study area reported that some of the main causes of soil erosion problems perceived by farmers were the slope of the land, deforestation, improper farming practice and high intensity of rainfall and absence of appropriate biological soil conservation practice.

Moreover, based on the focus group participates and key informants of the study area farmers perception of soil problems refers to the perception to relationship and processes of soil erosion, and fertility of the soil. The respondents were asked about the indicators of soil erosion problem on their own farm plots, 73.3% of farmers reported that the decline of agricultural productivity of their farm plots and 20% of respondents reported that presence of gullies and rills as a major indicator on their cultivated plot and communal grazing land. The rest, 2.6% and 4%, of farmers also reported that the decline of soil depth and the change of soil color were the indicators of soil erosion, respectively (Table 1). This perception of the farmers is most closely associated with the scientific finding of most researchers.

According to the survey result, soil erosion was severe on farm plots and communal grazing lands at rainy season. This explains a major cause of soil erosion in the study area is water erosion.

The study showed that the majority (65.3%) of farmers' stated that uncontrolled grazing or free grazing

have contribution for soil erosion process, although 21.3% of household farmers reported that deforestation have contribution for soil erosion process(Table 1).

Table1: Farmers perception on causes and indicators of soil erosion in the study area

Assessing variables on soil erosion	**Description**	**Respondents (n=150)**			
		Yes	%	No	%
Soil erosion problem in farm plot		115	76.6	35	23.4
The degree of soil erosion in farm plot	Low soil erosion	61	40.6	-	-
	Moderate soil erosion	59	39.3	-	-
	Sever soil erosion	30	20	-	-
Indicators of soil erosion on farm plots	Decrease production	110	73.3	-	-
	Visible rills	30	20	-	-
	Decrease soil depth	4	2.6	-	-
	Soil color changes	6	4	-	-
The main causes of soil erosion on farm plot	Free grazing	98	65.3	-	-
	Deforestation	32	21.3	-	-
	Heavy RF	5	3.3	-	-
	Improper plough	5	3.3	-	-
	Steepness of land	10	4.1	-	-
The consequences of soil erosion in farm plot	Loss of soil fertility	45	30	-	-
	Loss of fertilizer	12	8	-	-
	Loss of seeds	3	2	-	-
	Loss of crop land	90	60	-	-
The productivity of their farm land over time	Decreasing	79	52.6	-	-
	The same	42	28	-	-
	Increasing	29	19.3	-	-
Reason for decreasing productivity	Frequent cultivation	81	54	-	-
	High price of fertilizer	23	15.3	-	-
	Un reliable rainfall	12	8	-	-
	Soil erosion	34	22.6	-	-

3.2. Biological Soil and Water Conservation Practices in the Study Area

According to the finding of the survey, majority of the respondents agreed that soil conservation practices are important to minimize the rate of soil erosion on farm plots and communal grazing lands. This shows that all respondents had good perception towards the importance of soil conservation practices on farm plots and communal grazing lands. Majority of the respondents stated that they use biological soil and water conservation practices on their own farm plots to prevent soil erosion and enhance soil fertility. According to the survey results, there are various soil and water conservation practices applied by farmers on their own farm plots and grazing lands erosion control methods used. The most important biological soil and water conservation practices widely used in the area include vetiver grasses, elephant grasses, savanna grasses, bamboo plantation, Crop rotation and other local grasses for soil and water conservation purpose on their farms and degraded land rehabilitation. Crop Rotation- the use of crop rotation is another widespread phenomena in the area where wheat, *teff*, maize, soybean, and sorghum.

Crop rotation is used by the farmers important for different reasons including soil moisture and soil fertility, thus improved crop yield. The farmers of the area know that as of the scientific method improved soil fertility can be achieved by alternating high residue producing crops with the growing low residue producing crops.

Figure 1: Most common biological soil and water conservation practices in the Assosa Woreda

3.3. Constraints related to biological soil and water conservation in the Study Area

Worldwide, soil erosion associated with agricultural land is more widespread than that associated with other land uses. Erosion control is therefore strongly influenced by the factors that encourage or discourage farmers from adopting soil conservation practices (Morgan, 2005). According to Aklilu (2006), the adoption of soil conservation practice is influenced by farmers' age, farm size, perceptions on technology profitability, slope, livestock size and soil fertility, and the decision to continue using the practice is influenced by actual technology profitability, slope, soil fertility, family size, farm size and participation in off-farm work.

Woldeamilak (2002) also stated that perception of soil erosion as a hazard to crop production and sustainable agriculture is the most important determinant factor for adoption of conservation measures and understanding and recognition of soil erosion as a problem in their own farm plots, and its causes and impacts on crop yields is the first step towards searching of and adoption of remedial measures.

Thus, the implementation of biological soil conservation practices by respondents on their own farm plots is influenced by a combined effect of socio-economic, bio-physical, institutional and policy related factors.

3.3.1. Socioeconomic factors

Based on the research finding the socio-economic constraints affecting farmers to use biological soil and water conservation in the study area were livestock, farm experience, lack of economy to sustain their life and farm size of farmers had. According to the research finding these factors affect farmers both positively and negatively to apply biological soil and water conservation practices. As the key informants of group discussion participants stated that farm experience of biological soil and water conservation works makes a difference doing either in the farmers' perception of soil erosion problem. Furthermore, this finding asserts that farmers with experiences of one or more of the biological soil and water conservation practices (e.g vetiver grass, elephant grass, desho grass, savanna grass and crop rotation, etc.) already had the experience and they were more aware of soil erosion problem than farmers who did not have any experience of doing biological soil and water conservation practices. According to the interviewee conducted with the Woreda agricultural and rural development head he thought that farmers who had adequate farm experience have better knowledge than farmer who had fewer farm experience concerning the influence of run off on agricultural field and how they control so that experienced farmer could use appropriate biological soil conservation practices at appropriate time and place compared with less farm experienced farmer. Based on the data obtained from focus group participants of the study area when they asked how economy determines farmers to implement biological soil and water conservation practices on their farm plots and grazing lands, they explained that economically low farmers who have low capacity to buy artificial fertilizer and who do not have ox to plow their own farm area rent sometimes for share cropping for other economically better farmers.

Therefore, the rental farmers do not apply biological soil and water conservation practices on the rented

and share cropping farm plot to use farms in a sustainable way because they only assumed the short term production of a particular year and do not be concerned about the long term effect of absence of biological soil conservation practices on farm plot. Moreover, economically poor farmers have no capacity to make manure and compost to enhance the fertility of their own agricultural field. This is similar to the investigation of Elni (2006), the researcher examined that rich farmers are more involved in the maintenance and implementation of conservation methods than farmers who have low income.

3.3.2. Bio-physical factor

The other factor that affect farmers in the study area to implement biological soil and water conservation practice is related to bio-physical factors such as topographic nature of the land, distance between home area and farm plot, high intensity of rainfall and free grazing. Most of the Focus group participants thought that farmers who had more farms did not use soil conservation structures. As they stated farmers who hold more farm area expect more production from large farm size so that they do not give emphasize to a particular farm plots to conserve effectively and to use in a sustainable way. Moreover, most of their farm plots are located at different or scattered places and the distance between farm plots is far away from their home. As a result of this, they do not have a chance to observe their farm plot daily or even for week. Hence, the unnoticed cultivated plot could be eroded by sudden run runoff if the soil conservation practices destroyed by run off at the time of high intensity of rainfall due to absence of biological soil and water conservation to stabilize the physical structures.

Table 2: Households response regarding to bio-physical factors that influence them to apply biological soil and water conservation practices

Constraints to apply biological soil and water conservation		**Respondents(n=150)**			
		Yes	%	No	%
1	Topographic condition	90	60	60	40
2	Distance of farm plot from residence	120	80	30	20
3	Intensive rainfall	89	59.4	61	40.6
4	Uncontrolled or free grazing	132	88	18	12
5	others	-		-	

4. Conclusion

Based on the above findings, soil erosion is a threat to the economic development of Ethiopia in general and in *Assosa Woreda* in particular. As farmers are dependent on the agricultural sector for their livelihood, assessing farmers perception on soil erosion and biological soil and water conservation practices has become very considerable. Regarding this, the researcher analyzed the farmers perception on soil erosion problem and causes of soil erosion, the major biological soil and water conservation practices implemented by farmers and factors influencing farmers to use biological soil and water conservation practices on their farm plots and communal lands of *Assosa* Woreda.

During the discussion, perception of farmers on the causes of soil erosion were very recognizable from the finding as farmers of the study area understood that some of the main causes of soil erosion problems of *Assosa* Woreda perceived by farmers were the slope of the land, deforestation, improper farming practice and high intensity of rainfall and absence of appropriate soil conservation practice.

The respondents were asked about the indicators of soil erosion on their own farm plots, 73.3% of farmers reported that the decline of agricultural productivity of their farm plots, 20% of farmers reported that presence of gullies and rills as a major indicator on their cultivated plot and communal grazing land. The rest, 2.6% and 4%, of farmers also reported that the decrease of soil depth and change of soil color were the indicators of soil erosion, respectively. The study identified that farmers of the study area applied the biological soil and water conservation practices on their own farm areas. The major biological soil and water conservation practices which have been applied by farmers were vetiver grass, elephant grass, desho grass, savanna grass, bamboo plantation and crop rotation. Accordingly, most farmers of the study area have not applied other type of soil conservation methods such as fallowing, strip-cropping, compost and manure on their cultivated plots.

On the other hand, these had not been applied by farmers on their own farm areas rather they were used on communal or grazing areas enforced by the extension workers.

As stated by farmers response, focus group participants and key informants, the main determinant factors for farmers' decision to apply biological soil conservation practices on their cultivated plot and grazing lands were related with socio-economic, bio-physical and institutional and policy issues. These included low level of economy, farm size, topographic condition of the land, distance between home area and farm plot, high intensity of rainfall and uncontrolled or free grazing. As revealed by focus group participants, farmers who cultivated their own land implement biological soil and water conservation as compared to those who rented or cultivated land for share crop. This could be due to the fact that farmers who cultivated their own farmland were more secured to implement sustainable biological soil and water conservation practices compared to those who

rented.

5. Recommendations

To understand the aim of achieving sustainable use of the land in general and the soil resource in particular in the study area, imminent gained from the study suggest a number of issues to be considered in the area of soil erosion and biological soil and water conservation practices.

The following important points need to be considered. Any concerned body such as Woreda agricultural and rural development office, extension worker supervisor, development agents should distribute education to the whole farmers about the biological soil and water conservation practices to promote the perception and awareness of farmers about the effect of soil erosion on the whole lands (both on farm areas and communal grazing lands), which enabled the farmers to adapt and implements biological soil and water conservation practices effectively.

Economically poor farmers in the study area rent their own farm lands for other economically better farmers. This in turn influenced the implementation of biological soil and water conservation practices negatively. Thus, the concerned bodies need to investigate the issue and take appropriate measures.

The Woreda agricultural and rural development and other sector officers, local administrative leaders and farmers should draw rules and regulations that govern farmers to protect soil erosion, uncontrolled grazing and deforestation to use the farm plots and communal grazing lands by applying sustainable biological soil and water conservation practices

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