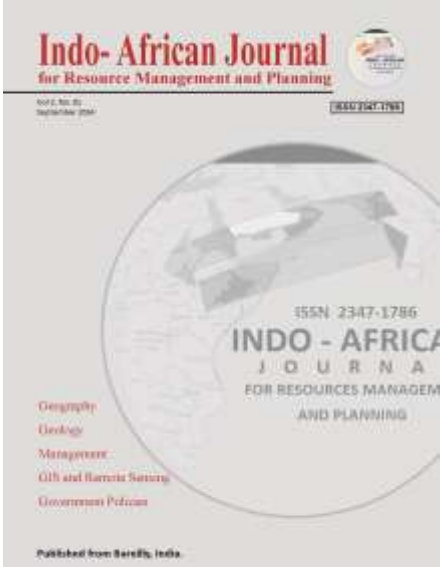

Indo - African Journal for Resource Management and Planning
(An International Peer Reviewed Research Journal)

ISSN 2347-1786.
VOL 2. NO. 01
September 15, 2014

Article info
Received on March 10, 2014
Published on September 15, 2014

India

Causes of Soil Erosion in Keya Gebriel District, Ethiopia

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ABSTRACT

There are various factors responsible for soil erosion. The aim of this paper was to identify the different factors that cause soil erosion in Keya Gebriel District in Ethiopia. For this study, data were collected through Questionnaires, interviews of farmers, focus group discussions and field observations. A total of 270 farmers were taken as sample population for questionnaire. For interview, a total of 45 samples were taken. In six groups a total of 72 farmers were participated in the focus group discussion. Data collected through questionnaire were analyzed quantitatively using frequency distribution and percentages. The responses from focus group discussions, and interviews were compiled, summarized and interpreted qualitatively by cross checking with questionnaire's responses. The results of the study reveal that steepness of the slope, over-plowing without fallowing the land due to scarcity of the land, land fragmentation, tenure insecurity, lack of erosion controlling practices, lack of contour plowing, over-grazing, lack of cooperation among farmers in flowing the water that drained from sloppy watersheds through their farmlands, and the shift of farming season from *belg/*winter to *kiremit/*summer due to the scarcity of *belg/winter* rainfall are the major causes for soil erosion in Keya Gebriel District.

Key words: Soil Erosion, Land Degradation, Land Management, Soil Conservation

1. Introduction

Soil erosion has had both positive and negative effects throughout the history of human civilization. For example, erosion has positively contributed to the early civilization that lives in the basin of Euphrates, Tigris, Nile, Indus, and the rivers of China (Wild, 1996). More than 98% of Egypt totally dependent upon the Nile Rivers and Nile is literally the life-artery of the country (Oestigaard, 2010). In contrast to this, other countries like the highland parts of Ethiopia, Greece and Italy are suffered by erosion due to deforestation, cultivation of the cleared land and overgrazing (wild, 1996).

It is known that Ethiopia is one of the most well-endowed countries in sub-Saharan Africa in terms of natural resources (Gete *et al*, 2006). However, these resources are in danger. Because natural resources such as soil, water and vegetation are degraded in its quality and quantity. From these problems, soil erosion is the most serious environmental problem (Million and Kassa, 2004).

The major types of soil erosion in Ethiopia are: water induced and wind induced. It is possible to understand that the major and prominent soil erosion type the Ethiopian highlands is water erosion (sheet erosion, rill erosion, gullies or gully). In the Ethiopian highlands, soil erosion is caused by combination of rainfall erosivty which is determined by energy; intensity and duration of rainfall; absence of structures such as terraces, grass strips, field bunds etc.; slope gradient and length, which is determined by topography and cover and density of vegetation; and steepness of the land and human impacts such as deforestation (Fitsum *et al*, 2002).

In Ethiopia, the cause of soil erosion is also associated with surface run-off draining to neighboring countries by transboundary rivers (EPA, 1998); lack of technology, low adoption and/adaptation SWC technology, topographical factor, the increasing of population and institutions and policy issues (Gete *et al*., 2006; Gizachew, 1994; Gizaw., 2009); land cover change (Woldeamlak, 2002); civilization expansion into new areas for better soil (Hurni, 1998); Land degradation was largely neglected by policymakers until the 1970s (Genanew and Alemu, 2010) and through the components of climate (Bezuayehu *et al*, 2002).

Due to the above factors, soil erosion results one third of the world agricultural soil or roughly two billion hectares of land were being affected by soil degradation in the world (Hurni, 2002); milk yields decline about one to fourth of the average for all developing countries in each year due to decline in grazing land (Peder *et al*., 2002) and in Ethiopia results crop yield per year is expected to decline by one to three percent (Mitiku *et al*., 2006).

Soil erosion is a widespread problem throughout the world and creates several limitations to sustainable agricultural land use. Land degradation in general and soil erosion in particular is the most serious challenging environmental problems of Ethiopia. In addition, declining agricultural productivity and poverty are severe and interrelated problems in the country (Temesgen *et al*, 2014). Particularly degradation of farmlands due to soil erosion is a widespread phenomenon in the highlands, which account for about 45 percent of Ethiopia's total land area and about 66 percent of the total land area of Amhara state. Studies reveal that exceeding 200 t/ha per annum soil losses had been recorded on steep hillsides (Kappel, 1996). Various natural human induced factors are responsible for erosion based on the various agents that cause land degradation.

Land degradation is caused by many factors such as rapid population increase, deforestation, step topographic features, intensive rain fall, unbalanced crop and livestock production to mention few of them. Several

researchers identified that there are various interrelated causes of soil erosion. For example, Peder *et al* (2000) explained that the major causes of soil erosion are production on fragile environment and steep slope areas without adequate soil conservation and vegetation cover investments, erratic and erosive rainfall patterns, declining use of fallow, limited recycling of dung and crop residues to the soil limited application of external sources of plant nutrients, limited access to agricultural inputs, deforestation and overgrazing. Erosion is related to rainfall which would be normally expected to increase with the steep slope and slope length (Morgan, 2005). The decreasing of the carrying capacity of the land due to large number of population the country is one of the major causes of soil erosion. Like most countries in sub-Saharan Africa, Ethiopia is experiencing rapid population growth. Currently, the country's population is growing at a rate of 3%, one of the highest rates (Beekle and McCabe, 2006). With a population of nearly 96.5 million in 2007, Ethiopia is the second most populous country in Africa next to Nigeria (CSA, 2007, OPHCC, 1999).

In Ethiopian highlands soil erosion is caused by combination of rainfall erosivity, which is determined by energy, intensity and duration of rainfall; absence of structures such as terraces, grass strips, field bunds etc.; slope gradient and length, which is determined by topography and cover and density of vegetation; and steepness due to rapid tectonic uplift during past Cenozoic era and human impacts such as deforestation (Fitsum *et al*, 2002; Nyssen *et al*, 2007; Abineh, 2015). Lack of proper utilization of farmlands due to absence of tenure security is also cited as a major cause of soil erosion. If farmlands are titled, then farmers' confidence on their land will increase and hence they may practice appropriate soil and water conservation and management methods to reduce soil erosion (Ayele, 2015; Ayele and Tahir, 2015; Ayele *et al*, 2015).

However other studies in Amhara state reveal that, land degradation in the state has not focused on the economic, social or institutional factors that affect how farmers manage their land. The biophysical dimension of the problem has been favored (Lakew *et al.*, 2002). Though the state is naturally endowed with beautiful landscapes and soils with good potential, it has been continuously exploited for centuries and its present condition is very alarming (Gete and Hurni, 2001). Therefore, the occurrence of soil erosion makes the issue of soil conservation not only necessary but also a vital concern if the country wants to achieve sustainable development on its agricultural sector and its economy at large (Abera, 2003). The aim of this paper is to assess the major causes of soil erosion in Keya Gebriel District in Amhara state of Ethiopia.

2. Materials and Methods

2.1. Site description

Keya Gebreil is one of the Districts of Amhara State in Ethiopia. It is located in the North Shewa Zone. Keya Gebreal is bordered on the southeast by Menz Lalo Midir, on the southwest by the Jamma River which separated it from Moretna Jiru, on the west by Merhabiete, on the northwest by the Qechene River which separates it from the Debub Wollo Zone, and on the northeast by Menz Gera Midir District. The administrative center of this District is Zemero. Keya Gebreil was part of the former Gera Midirna Keya Gebriel District, but now it is a separate District.

The District comprises 12 *Kebele* administrations (KAs), having one urban *KA and* 11 rural *KAs*. Demographically, the District has a total population of 46,219, of whom 22,965 are men and 23,254 women; 2,623 or 5.68 percent are urban inhabitants. The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 99.64 percent reporting that as their religion (CSA, 2007).

Rugged terrain is the characteristics the District which resulted in the decline of severe erosion and decline of crop productivity year to year. Forests with indigenous trees are almost vanished due to: uncontrolled harvesting for fuel wood and charcoal, construction and farm implements, and uncontrolled grazing due to lack of government control (KGDARDO, 2010).

Agro-ecologically, the District is categorized as *Wurch* (Alpine), *Dega (*Temperate), *Woina Dega* (Sub-tropical) and *Kolla* (Tropical). The rainfall pattern of the District is bimodal; unpredictable in nature and its distribution most of the time extends from June to August. The average annual rainfall ranges from 700mm to 1300 mm per annum. The mean annual temperature of the area is 11.5ºc.

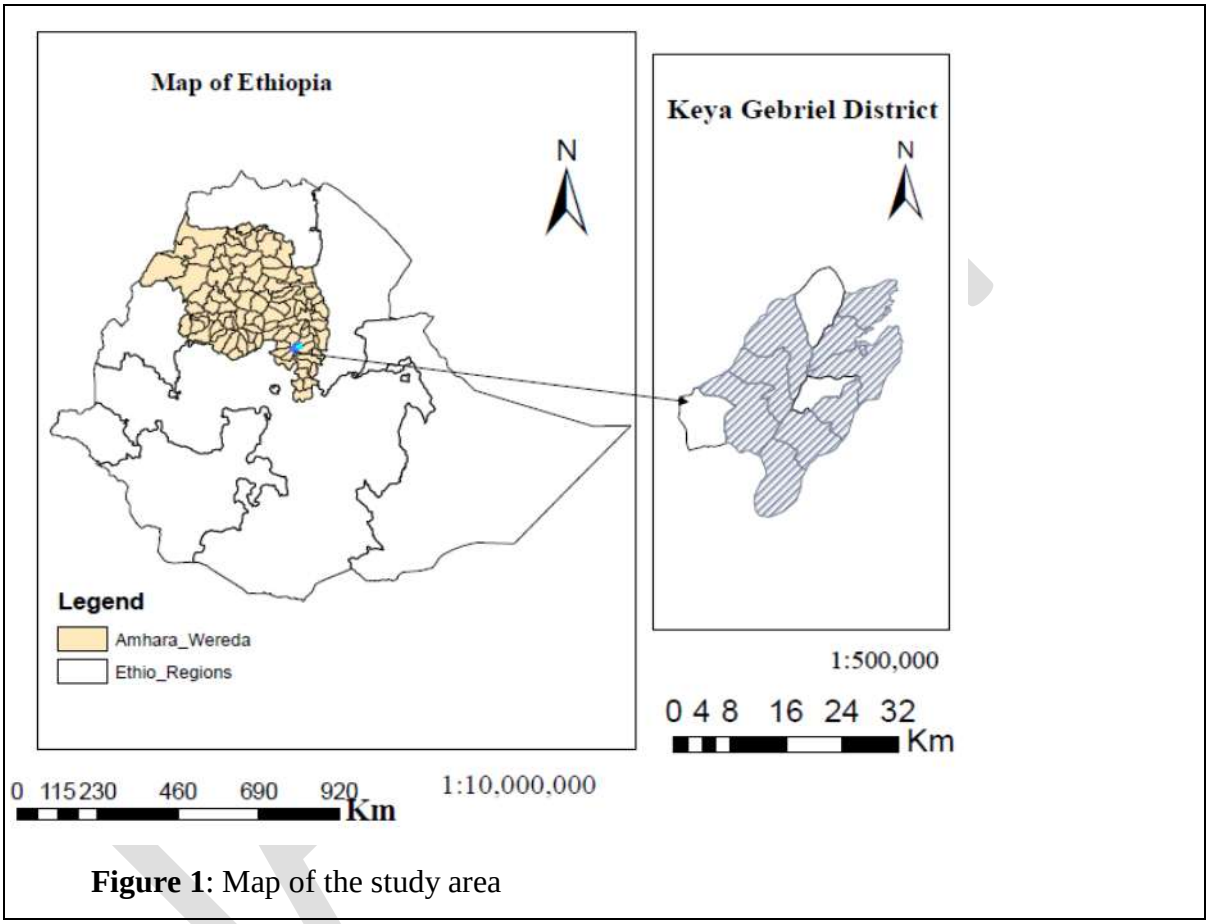

Figure 1: Map of the study area

2.2. Methods of Data Collection and Analysis

In order to realize the intended objective of the study, data from the primary sources, questionnaire survey, in-depth interviews, and focused group discussions (FGDs) were employed. District and *kebele* officials, were interviewed.

For the study three kebeles/sub division of Disrict namely Amebat-Mesno, Nide-Kera, and Siter-Dega were taken as sample *kebeles* out of twelve rural *kebeles* of the District. About 90 households from each *Kebele, and* a total of 270 households were taken as sample population. For the study I applied systematic sampling method in which I had taken the n^{th} element of the sample frame. But, first lottery method was used to select the first

element; with a specified gap I had picked samples from the sample frame. The sample frame from was taken from KA offices of the respective *Kebeles*.

FGD has been employed with the objective to capture feelings, experiences and diverse perspectives of the residents of the District through group interaction that might not have been articulated in the one-to-one interview. The FGDs were organized in each sample *kebeles* with eight participants. From each *kebele* three groups having eight members and a total of seventy two farmers were participated in the FGDs. Semi-structured questions were prepared to guide the discussion process. For interview, about 15 individuals from each *kebele* and a total of 45 samples were taken. Besides to interview and FGDs, field observation was also part of the primary data source. The data analysis process was done after all the necessary data were collected from different data sources. Data collected through questionnaire were analyzed quantitatively using frequency distribution and percentages. The responses from FGDs, and interviews were compiled, summarized and interpreted qualitatively by cross checking with questionnaire's responses.

3. Result and Discussion

The responses of farmers that they perceive the cause of soil erosion on their farmlands are presented as follows. Farmers had chosen more than one choice (multiple alternatives) that they perceive being causes of soil erosion. Therefore, 100 percent of farmers of all sample *kebeles* perceive that steepness of the slope of the land is the major cause of soil erosion in the area. On the other hand, more than 87 percent of farmers responses of all sample *kebele* farmers reveal that over plowing of the land without fallowing is another cause for soil erosion in their area. Whereas 70 percent of farmers' responses show that the previous limited land management works contributed to the erosion becomes a serious problem of the environment. In addition to that more than 65 percent of the respondents' response shows us that that absence of contour plowing is one of the major causes of soil erosion in the area. On the other hand, 69 percent of farmers had replied that long duration and erratic

rainfall contributed a lot to soil erosion.

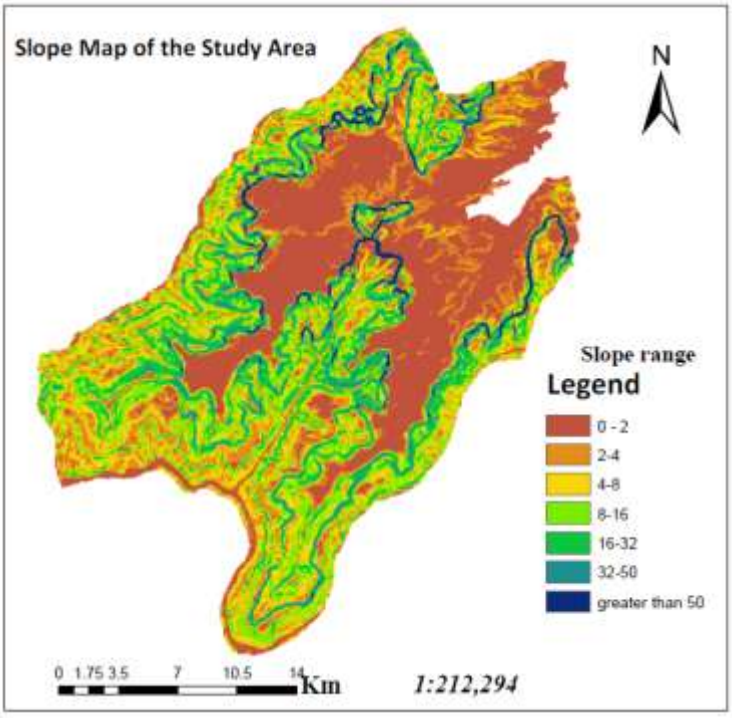

Figure 2: Slope Map of the District

Interview and focus group discussion results of farmers reveal that the major causes of soil erosion in the sample *kebeles* are described as follows: Steepness of the slope of the land, because the *District* in general and the sample *kebeles* in particular are topographically mountainous in nature as it is shown in figure 2 below, it is very vulnerable to erosion; the shift of farming season from *belg/* winter to *kiremit*/summer due to the scarcity of *belg/winter* rainfall, and hence farming system of *kiremit* season by itself due to high *kiremt* rainfall enable soil erosion very severe in the

kebeles; up and down plowing instead of contour plowing; over-plowing without fallowing the land due to scarcity of the land; land fragmentation; lack of sense of ownership due to tenure insecurity, absence of strengthened erosion controlling works in the past, and lack of cooperation among farmers in flowing the water that drained from mountainous or sloppy watersheds on their farmlands, and over-grazing. During the field observation, it was possible to interview farmers on their farmlands. Most farmers during the observation explain that most conservation measures (such as stone bunds, soil bunds planting of grass strips etc.) a re not older than five years.

4. Conclusion

Soil erosion is a serious problem in Ethiopia in general and in Keya Gebriel District in particular. There are different factors that cause soil erosion in the District. These are steepness of the slope of the area, the shift of farming season from winter to summer due to the scarcity of *winter* rainfall, and hence farming system of *summer* season by itself due to high *summer* rainfall enable soil erosion; lack of sense of ownership due to tenure insecurity, up and down plowing instead of contour plowing; over-plowing without fallowing the land due to scarcity of the land; land fragmentation; absence of strengthened erosion controlling works in the past, and lack of cooperation among farmers in flowing the water that drained from mountainous or sloppy watersheds on their farmlands, and over-grazing. Hence, government should concentrate on the land conservation activities those feet to the area, and also aware farmers regarding contour plowing.

5. Recommendations

As per the finding of the study, the following recommendations are forwarded:

- Since the study area is mountainous and rugged, both structural (like terracing) and agronomic (like afforestation and reafforestation of trees) conservation methods should be practiced.
- Creating awareness for farmers regarding practicing contour plowing instead of up and down plowing will highly reduce soil erosion in the area. Agricultural extension experts are expected to do a lot in creating awareness and motivating farmers to practice soil conservation activities.
- The government should implement population policy of the country, because population pressure is one of the causes of soil erosion in the area. Hence policies like family planning should be implemented. In addition to this, the government should create off-farm job opportunities.
- Using energy saving stoves will reduce soil erosion problem. Because, cutting of trees for house consumption causes reduction of land cover so that it will hasten soil erodibility.
- The government should strengthen a land policy to ensure land tenure security for farmers to protect their rights, in which farmers' landholdings should be registered and user certificates should be given to them to start soil conservation activities in combating soil erosion.

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