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Review Paper

FARMERS' PERCEPTION ON SOIL EROSION AND ADOPTION OF SOIL CONSERVATION MEASURES IN ETHIOPIA

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ABSTRACT

Soil erosion is becoming one of the most serious problems affecting the well-being of the human beings and disturbing the environmental sustainability. Moreover, the problem is accelerated in developing countries of the world such as Ethiopia where agriculture based economy of the country. Farmers perceived indicators of the existence of erosion and soil fertility loss differently. For many farmers, gully development and stoniness of soil are the main indicators to soil erosion on their land. Others recognize by observing soil color. They also perceived well the causes of soil erosion in their lands as slope steepness of cultivation fields, ceaseless cultivation and absence of fallowing with many time preparations of soil for cropping; still other causes have great roles. Practices of structural soil conservation measures are influenced by many factors. Aged farmers have practiced structural soil conservation less likely than young farmers. Female farmers also showed high interest towards structural soil conservation, yet they invested little and rarely practiced. On the contrary, educated farmers, farmers involved in off farm jobs, perceiving soil erosion well, having contact with DA and training provide a fertile ground for increased practice of structural soil conservation measures.
Key words: Farmers' perception, soil erosion, soil conservation measure, adoption behavior.

1. INTRODUCTION

1.1. Background

Soil is an important resource, which needs much attention in its use and management. It is the soil which nourishes and provides with required needs for the nature. The whole creation depends on the soil which is the ultimate foundation of our existence (Kibemo, 2011). Soil with the potential to nurture crops is an invaluable resource that results from nature's efforts over tens or hundreds of thousands of years. Human activities can destroy this resource in only a few years (John, 1999).

About 80% of agricultural land in the world is suffering from moderate to severe soil erosion, and 10% suffers slight to moderate erosion (Pimentel *et al*., 1995). Ethiopia is not an exceptional; it is facing severe and continuous soil erosion. Soil erosion is a root cause of land degradation and the most dangerous ecological process in the country (Ludi, 2004). In Ethiopia the impact of soil erosion was recognized after the 1973 famine occurred in the country. Since then, the Government of Ethiopia initiated a massive program of soil conservation and rehabilitation in the highly degraded areas, which involved the mobilization of over 30 millions peasants' workdays per year (Hurni, 1986).

In protecting soil erosion, as many studies indicate, soil conservation activities in Ethiopia are an old history (Gedeno, 1990). The indigenous soil conservation practices have been practiced in various parts of the country. An interesting example is the terracing activity of Konso farmers in Southern Ethiopia. Other soil conservation measures including fallowing, crop rotation, strip cropping, manuring, ditch building are practiced extensively.

In Ethiopia soil conservation has been carried out with limited success. There is less-willingness to accept and maintain the extensively introduced practices of soil conservation. Besides, soil erosion is a major contributor to the prevailing food insecurity of Ethiopia. Thus, soil conservation is vital to the achievement of food security, poverty reduction and environmental sustainability in the country (Woldeamlak, 2007).

Ervin and Ervin (1982) declared that farmers' perception affects positively the adoption and efforts of soil conservation. Farmers' perception to use soil conservation measures, especially in low-income countries, can be influenced by a complex set of socio-economic, demographic, technical, institutional and biophysical factors (Feder *et al*, 1985). Various studies (Ervin and Ervin, 1982; Bekele and Holden, 1998; Pender and Kerr, 1998; Lapar and Pandy, 1999; Makoha, *et al*., 1999) have identified the factors that affect farmers' adoption of practices that control erosion and enhance long-term production and productivity. For instance, technologies that conserve soil may not be compatible with the socioeconomic settings of the farmers. Some technologies may be expensive because they require the limited resources the farmer has and end up with little success. Still other technologies may control erosion but do not result in fulfilling the immediate needs of the farmers (Ervin and Ervin, 1982).

2. Farmers' perception on soil erosion and adoption soil conservation measure

2.1. Definition of Soil erosion

The definition of soil erosion given by the EU Commission of Land Management and Natural Hazards as the "wearing away of the land surface by physical forces such as rainfall, flowing water, wind, ice, temperature change, gravity or other natural or anthropogenic agents that abrade (erode), detach and remove soil or geological material from one point on the earth's surface to be deposited elsewhere" (EU, 2007).

2.2. Soil Erosion in the World

Much of the world has been facing increasingly serious soil erosion of various degrees caused by both natural and human factors as well as its consequent environmental deterioration. The loss of soil through land degradation processes particularly by erosion is one of the most serious environmental problems (Kibemo, 2011). Soil erosion is a global environmental and economic problem causing loss of fertile top soil and reducing the productive capacity of the land there-by putting global food security at risk. It has also negative impact on the natural water storage capacity of catchment areas or service of man-made reservoirs and dams, quality of surface water, aesthetic landscape beauty and ecological balance in general (Woldeamlak and Ermias, 2009). Globally, about 80% of the current degradation of agricultural land is caused by soil erosion (Angima *et al.,* 2003).

More than 80% of land degradation is due to soil erosion out of which 56% is due to the water induced soil erosion (Oldeman, 1992). During the last few decades, nearly one-third of the world's arable land has been lost by erosion and continues to be lost at a rate of more than 10 million hectares per year (Pimentel *et al*, 1995).

Erosion by water is a primary agent of soil degradation at the global scale, affecting 1094 million hectares, or roughly 56% of the land experiencing human induced degradation (Oldeman, 1992). Likely, soil from the world's croplands is being swept and washed away 10 - 40 times faster than it is being replenished. Even, one rainstorm can washes away several millimeters thick soil. When we consider a hectare, it would takes 10s tons of topsoil - or several decades and even centuries if left to natural processes - to replace that loss (Pimentel *et al*, 1995). Water erosion not only removes nutrients but also reduces thickness and the volume of water storage and root expansion zone (Abiy, 2007). Under extreme gully erosion, farm activities are extremely affected.

Since 1945 moderate, severe, extreme soil degradation has affected 1.2 billion hectares of agricultural land globally, an area size of China and India combined. Some 80 percent of this degradation has taken place in developing countries (Hawken *et al*, 1999, cited in Melville, 2006).

2.3. Soil Erosion in Ethiopia

Natural resource degradation is the main environmental problem in Ethiopia. The degradation mainly manifests itself in terms of lands where the soil has either been eroded away and/or whose nutrients have been taken out to exhaustion without any replenishment (Million and Kassa, 2004).

Soil degradation is one of the most serious environmental problems in Ethiopia (Hurni, 1993). In Ethiopia, erosion averages 42 metric tons per hectare per year on currently cultivated lands and 70 metric tons per hectare per year on formerly cultivated degraded lands (Hurni, 1988) with losses as high as 300 tons/hectare/year (USAID, 2000). About 45% of the total annual soil loss in the country occurs from cultivated fields, which accounts for only 15.3% of the total area (EPA, 2003).

A study by Bekele and Holden (1998) shows that the problem of soil erosion is compounded by the fact that some farmers dismantled the conservation structures built in the past through food for work incentives. Consequently, in Ethiopia land degradation in the form of soil erosion and declining fertility is serious challenging agricultural productivity and economic growth (Mulugeta, 2004). As Johnson and Lewis (1995) stated that the most ubiquitous cause contributing to agricultural land degradation was soil erosion. EFAP (1994) also made clear that measures of land degradation usually focus on the severity of soil erosion.

In Ethiopia, erosion averages 42 metric tons per hectare per year on currently cultivated lands and 70 metric tones per hectare per year on formerly cultivated degraded lands (Hurni, 1988). About 45% of the total annual soil loss in the country occurs from cultivated fields, which accounts for only 15.3% of the total area (EPA, 2003). The latest land degradation estimates indicate that out of the 52 million hectares of land making up the highlands of Ethiopia, 14 million hectares are severely degraded, 13 million hectares are moderately degraded and two million hectares have practically lost the minimum soil cover needed to produce crops (DCI, 1997). According to Girma (2001), Ethiopia loses annually 1.5 billion metric tons of topsoil from the highlands by erosion.

2.4. Causes of Soil Erosion

According to Tripathi and Singh (2001) erosion can be either geological natural erosion, a steady and slow process of nature which is non-destructive therefore which is not detrimental to man's well being and is wholly beyond his control; or it can be human induced that is caused by disturbance of nature's balance by human activities like large scale cutting of forests, leveling and cultivation. Soil erosion is a natural process, occurring over geological time, but most concerns are related to accelerated erosion, whereby the natural rate has been significantly increased by human action (Robert *et al*., 2003).

2.4.1. Natural/Geological Soil Erosion

Natural erosion has sculpted landscapes for millions of years. For instance, many natural land features we observe today are the result of erosion (USDA, 2000). Soil erosion is a naturally occurring process involving the mobilization and deposition of soil particles, mainly by water and wind (Alex, 2006).

2.4.2. Human-induced/Accelerated of Soil Erosion

Accelerated soil erosion, in excess of natural geological rates, is caused by anthropogenic activity. Human activity is a major factor in shaping the landscape. Land use and management are the results of these human activities as such are the most important factors that influence soil erosion (Robert *et al*., 2003). Although soil erosion is a physical process with considerable variation globally in its severity and frequency, where and when erosion occurs is also strongly influenced by social, economic, political and institutional factors. Conventional wisdom favors explaining erosion as a response to increasing pressure on land brought about by a growing world population and the abandonment of large areas of formerly productive land as a result of erosion (Morgan, 2005).

Soil erosion has accelerated on most of the world, especially in developing countries, due to different socio-economic, demographic factors and limited resources. Reusing *et al.* (2000) specified that increasing population, deforestation, improper land cultivation, uncontrolled grazing and higher demand for fire often cause soil erosion. Excessive numbers of livestock on a given area of land can cause significant soil erosion problems due to overgrazing and poaching of the soil which can lead to high rates of soil exposure, capping and increased overland flow (Alex, 2006).

2.5. Consequence of Soil Erosion

Soil erosion is one of the biggest global environmental problems resulting in both on-site and off-site effects. Soil erosion has accelerated in most parts of the world, especially in developing countries, due to different socio-economic and demographic factors and limited resources (Bayramin *et al*., 2003).

Soil erosion which manifests itself in the form of gullies, rills and sheet wash is an immensely complicated process involving the interaction of many biological, social, economic, environmental and political factors. It varies in its occurrence both spatially and temporally. The ultimate result of soil erosion is that it reduces crop yields and ruins agriculture, though the exact extent of soil erosion and land degradation is not known (Gamira and Makwara, 2012).

Soil erosion is the main form of land degradation, caused by the interacting effects of factors, such as biophysical characteristics and socio-economic aspects. Degradation resulting from soil erosion and nutrient depletion is one of the most challenging environmental problems in Ethiopia (Aklilu and De Graaff, 2006). The impact of soil erosion is complex leading to reduction in soil depth and moisture storage capacity together with soil-nutrient losses, and ultimately results in reduced agricultural production and productivity (Vancampenhout *et al.*, 2006). In addition, soil erosion is a threat not only to agriculture but also to the economy, as the country´s economy depends on agriculture.

Soil erosion creates severe limitations to sustainable agricultural land use, as it reduces on-farm soil productivity and causes food insecurity (Alonal, 2008). Erosion results in the degradation of a soil’s productivity in a number of ways: it reduces the efficiency of plant nutrient use, damages seedlings, decreases plants’ rooting depth, reduces the soil’s water-holding capacity, decreases its permeability, increases runoff, and reduces its infiltration rate (Davis and Lawrence, 2006).

The problem of soil erosion has been a problem ever since land was first cultivated. The consequence of soil erosion occurs both on- site and off-site. In Ethiopia, the on-site impacts of soil erosion are most frequently studied, typically by estimating the productivity losses as economic cost of soil erosion. Less well known and documented are the off-site costs of soil erosion (Eyasu, 2003).

2.6. Farmers’ Perception on Soil Erosion

2.6.1 Farmers’ perception in Ethiopia

In Ethiopia, soil degradation due to erosion is recognized as a major problem for agriculture productivity and food security (Betru 2002; Tesfaye, 2003; Woldeamlak, 2007). Farming in Ethiopia is practiced under diverse farming systems and cultural contexts, and farmers’ varieties play a very vital role in the agricultural productivity as a whole. As a matter of fact, the highest portion of the country’s genetic resource wealth essential for food and agriculture is still being conserved and improved on small-scale farmers’ fields, and farmers’ practices in these regards are essential to meet their livelihood needs (Regassa, 2006).

Farmers’ perception of land degradation by erosion is a key social factor that is also important in deciding options for controlling soil losses. Understanding farmers’ knowledge and their perception and factors that influence their land management practices are of paramount importance for promoting sustainable land management (Alonal, 2008). Understanding farmers’ perception of soil erosion and its impact is important in promoting soil and water conservation technologies (Chizana and Albrechi, 2006).

In considering farmers' perception on soil erosion, it is necessary to evaluate whether they distinguish between indicators of erosion and fertility loss. For instance, studies conducted in different areas have shown that farmers have knowledge of soil conservation measures (Awdenegest and Holden, 2006). The question to be asked is: 'if farmers have knowledge of soil erosion, why not apply conservation?' Identifying where implementation problems may arise is also very important (Mebrahten, 2014).

As study made by Assefa (2009) indicates farmers perceived soil erosion as a problem constraining crop production. The most important topsoil for crop production activity was deteriorating over time due to erosion processes. Hence, they observed frequently how the loss of soil from cultivated fields has been reducing the depth of the topsoil through time and the number of stones in their farmlands has been increasing over time. Some farmers perceive the effect of soil erosion when it reaches some critical level, which is very difficult to reverse the degradation at the subsistence farmer level. In other cases, farmers will not be interested to invest in conservation and bear associated risks if they do not perceive significant threat posed on productivity due to soil erosion (Wagayehu and Lars, 2003).

2.7. Adoption Trend of Soil Conservation Measures in Ethiopia through time

Prior to the 1974 revolution, soil degradation did not get policy attention it deserved (Hurni, 1986). The famines of 1973 and 1985 provided a momentum for conservation work through large increase in food aid (imported grain and oil). Following these severe famines, the then government launched an ambitious program of soil and water conservation supported by donor and non-governmental organizations (Hoben, 1996). The use of food aid as a payment for labor replaced voluntary labor for conservation campaigns (Campbell, 1991). The conservation measures were in most cases physical measures and undertaken through campaign using Food-for-Work or Cash-for-Work as an instrument to motivate farmers to putting up the conservation structures both on communal holdings as well as on their own plots (Abera, 2003). Supporting this inspiration, Pender (2004) stated that soil conservation measures have relied largely on food-for-work programs as an incentive/encourages or bonus to work harder and have been oriented toward labor-intensive activities such as terracing, bund construction and tree planting.

With this, Ethiopia became the largest food–for-work program beneficiary in Africa and the second largest country in the world following India (Campbell, 1991). A total of 50 million workdays were devoted to the conservation work between 1982 and 1985 through food-for-work. Between 1976 and 1988, some 800,000 km of soil and stone bunds were constructed on 350,000 ha of cultivated land for terrace formation, and 600,000 ha of steep slopes were closed for regeneration (Wood, 1990). These conservation structures were introduced with the objectives of conserving, developing and rehabilitating degraded agricultural lands and increasing food security through increased food production/availability (Adbacho, 1991). Soil and water conservation (SWC) measures have been extensively carried out during the past three decades under various packages by governmental and non-governmental organizations to lessen the problems of soil erosion (Wagayehu and Lars, 2002). For the last 30 years, considerable efforts were made since then to reverse land degradation. Among the efforts, various soil and water conservation innovations such as stone terraces, check dams, waterways, and grass strips were introduced and as a result of these efforts some degraded lands have been restored (WFP, 2004; Betru, 2002).

Soil erosion poses a serious threat to national and household food security (Bekele and Holden, 1998) and therefore its management is essential for improving food security in seriously affected areas of Ethiopia (Awdenegest and Holden, 2006). Initially, most of the soil conservation works included construction of the stone and earth embankments, which the farmers believed took extra land from their small land holdings and sheltered rodents. Available evidence shows that the adoption of soil and water conservation measures has been very limited (Girma, 2001). A study by Bekele and Holden (1998) shows that the problem of soil erosion is compounded by the fact that some farmers dismantled/removed the conservation structures built in the past through FFW incentives.

Until the early 1990s, farmers were not allowed to remove the conservation structures once built on their land. This shows that the conservation efforts have also neglected the pronounced regional disparities within the country and have frequently been implemented in a top-down manner, excluding the participation of the local community (Herweg, 1993).

Conservation practices have been mainly undertaken in a form of campaign and quite often farmers have not been involved in the planning process (Herweg, 1993). This shows that soil conservation projects implemented in the country failed to consider local people's economic, demographic, institutional and technical factors from their very inception. Obviously, the adoption of soil conservation technologies considerably is influenced by different factors. Among other influences, the characteristics of farmers such as age, education, household size, farm size and experience are some major influence for the decision of application of soil conservation. Age of the farmers tends to influence negatively the conservation decision in that it decreases participation on environmental protection (Belay, 1998).

2.8. Farmers' Perception towards Adoption of Soil Conservation Measures

Soil erosion is a dangerous and slow process therefore farmers need to perceive its severity and the associated yield loss before they can consider implementing soil and water conservation (SWC) practices (Chizana *et al*., 2007).

Perception of soil erosion as a hazard to agricultural production and sustainable environment is the most important determinant of effort at adoption of conservation measures. Theoretically, those farmers who perceive soil erosion as a problem having negative impacts on productivity and who expect positive returns from conservation are likely to decide in favor of adopting available conservation technologies (Semgalawe and Folmer, 2000; Berhanu and Swinton, 2003). On the other hand, when farmers do not acknowledge soil erosion as a problem, they will not expect benefits from controlling erosion and it is highly likely that they will decide against adopting any conservation technologies (Mebrahten, 2014)

Despite intensive soil and water conservation activities since more than two decades ago, adoption of the interventions in Ethiopia is considerably rather low. This fact is frequently attributed, among other things, to the top-down approach in extension activities, standard mainly structural soil and water conservation technologies, lack of awareness of land degradation by the land users, and land security issues (Mitiku *et al.,* 2006). The limited success of those efforts highlights the need to better understand the factors that encourage or discourage the adoption and sustainable use of introduced conservation measures.

There are several possible reasons for the failure of past conservation intervention to meet users' expectations. First, the introduction of the measures did not consider local conservation and farming practices and in many cases did not fit in with traditional methods. Second, since interventions normally include such activities as reforestation, terrace construction, etc., they are generally characterized by high initial costs that poor farmers could not afford and by benefits that only become apparent in the long run. The challenge, however, is to come up with a conservation approach that helps to meet the short-term needs of the farmers and long-term conservation objectives simultaneously. Finally, the extensive and uniform application of similar soil and water conservation (SWC) measures disregarded local agro-ecological and socio-economic variations (Aklilu, 2006).

2.9. Factors Affecting the Adoption and Use of Soil Conservation Practices

The whole context in which decisions are made, from individual farmers and even at higher levels varies, spatially and temporally, considerably so between societies to the extent of frustrating generalizations in terms of explanation or conservation recommendations from one place to another (Enock and Baxter, 2010).

Adoption of structural soil conservation technologies is affected by various factors, usually categorized into; farm specific characteristics, technology specific attributes, and farmer's socio-economic characteristics. Examples of such variables that have been found to influence technology adoption include: farm size, farmer's age, education, social networks (e.g. membership of association), dependency ratio, gender, access to agricultural advice and information, land tenure security, soil fertility, soil type, income, input availability, access to markets, risk aversion behavior, technology awareness, farming experience, adequacy of farm tools, technical and economic feasibility of using the technology, agro-ecological conditions, access to credit and presence of enabling policies (Boyd and Turton, 2000;).

Young (1999) indicated in studied various factors that influence on-farm adoption of soil conservation practices, including socio-demographic characteristics of farm operators and physical features of the farm. Physical and environmental characteristics such as farm size, slope length, degree of slope, and soil erodibility also affect the adoption of conservation practices.

According to (Semgalawe, 1998), farmers rather frequently reject newly introduced SWC technologies even when they are aware that adoption of the measures protects and improves productivity of their lands. The newly introduced SWC technologies need to be evaluated not only for their technical efficacy but also for the chances of their sustainable adoption and utilization by the land users. Reasons for the limited success stories of soil conservation measures are related to the extension approach. The direction of the technology transfer in the Ethiopian agricultural extension system is considered linear, from the expert to the farmer (Brehanu *et al*. 2006). In this approach, experts are considered as knowledge producers and farmers as adopters of that knowledge, which lead to overlooking the farmers' indigenous knowledge on soil conservation. Through this approach, the chance of reaching consensus and understanding by all actors has been a difficult challenge and extension messages were simply transmitted from the experts to the farmers just as messages at churches or mosques during religious holidays or other social gatherings (Kibemo, 2011)

The need to promote soil and water conservation was induced by both economic and physical factors that became a common experience of the farmers. Culver and Seecharan (1986) have investigated specific factors affecting the adoption of soil conservation practices as: 1) physical factors, 2) economic factors, 3) personal factors, 4) type of farm, 5) type and form of information, and 6) the availability of an economically and technically feasible solution.

Alemu (1999) estimated the factors influencing the decisions to invest in soil conservation in Tigray and Oromiya of Ethiopia. He found that there is a significant relationship between tenure security and the probability of participating in constructing physical soil conservation. In addition to this, he identified the characteristics of each plot rather than tenures security as important factor influencing the amount of investment that a farmer will make.

Berhanu and Swinton (2003) undertook an empirical study using a probit regression model found that land tenure security was a major factor that significantly conditions the adoption of natural resource conservation technology at household and community level in the Northern Ethiopia region of Tigray.

2.10. Current Adoption of Soil Conservation Practices

The farmers' decisions on whether to adopt SWC technologies at the farm level depend on the fitness of the technologies to their needs and requirements. Some of the most important characteristics of conservation technologies or techniques that influence the farmers' adoption decisions are effectiveness in controlling soil loss, benefits to be obtained from adoption, the ease of adoption and appropriateness to the farming system circumstances. If newly introduced SWC technologies do not appear to be relevant to the farmers in view of these criteria, it is highly unlikely that they will be adopted and, indeed, should not be expected to be adopted (Woldeamlak, 2003).

Appropriate soil conservation practices are very site-specific in nature. Thus, there can be great variability of results in erosion control, crop yields, and farm profits from implementing any number of conservation practices or systems on the variable conditions of the landscape. There is a wide variety of land management practices which are appropriate for soil conservation. These measures range from structural (e.g. terracing, drop inlets, grassed waterways, etc.) to behavioral (e.g. rotations, under seeding, plow down crops, tillage, etc. (Duff *et al*., 1990). Soil and stone bunds are structures commonly built to control runoff and thus increase soil moisture and reduce soil erosion. However, constructing continuous bunds to protect broad tracts of land is costly and often difficult, so alternative methods of erosion control are also employed. These include grass strips and contour leveling, sometimes incorporating trees or hedgerows, to reduce runoff velocity and allow water to infiltrate and trap sediments. In addition, waterways help direct precipitation flows along specified pathways in farm fields; and water-harvesting structures, including dams, ponds, and diversions, ensure water availability in the dry season (Edward *et al*., 2009).

2.10.1. Soil Conservation Activities

Primarily, conservation structures are introduced with the objectives of conserving, developing and rehabilitating degraded agricultural lands and as well increasing food security through increased food crop production (Adbacho, 1991). Major conservation structures are:

2.10.1.1. Soil Bunds

Soil bunds are constructed during the dry season that do not interfere land preparation for cropping. The construction is aimed on reduction and stopping velocity of runoff. It increases soil productivity by capturing moisture and crop yields over time. Soil bunds can easily be integrated with grasses, legume shrubs, growing cash crops such as tomatoes after their development. Grazing animals on bunds damage the structures. Construction of soil bunds is always started from the top of the watershed area/slope and from the waterway. If the bund construction is started from the bottom of the watershed area and if it is not completed in one season, then all water from the top of watershed area will destroy the lower one (Taffa, 1983).

2.10.1.2. Fanya Juu

This is an embankment constructed by throwing the soil dug from basin to uphill and the term was coined from Swahili language; meaning “throwing up-hill (Woldeamlak, 2003). This conservation structure is also constructed during dry season. The aim is to reduce and stop erosion and increase water holding capacity of the soil so as to enhance crop yield. The main benefit of *fanya juu* is its capacity to become bench terrace within few years than soil bunds, yet it has overtopping and breakages (Lakew *et al*. 2005).

Integration with grasses and composting is suitable in *fanya juu* soil conservation measure.

The construction of *fanya juu* takes less space than soil bunds and accelerate bench development, thus, complaint about space can be greatly reduced with *fanya juu* terraces (WFP, 2005).

2.10.1.3. Cutoff Drains

As many of other structural soil conservation measures, cutoff drains are constructed during dry season to avoid impediment to land preparation for main cropping season. This structure is a graded channel constructed mainly in moist area to intercept and divert the surface runoff from higher slopes and protect downstream cultivated land or village. On the contrary, cutoff drains in dry area are used to divert runoff and additional water into cultivated fields to increase soil moisture.

2.10.1.4. Waterways

Waterways can be natural or man-made drainage channel to receive diverted runoff from cutoff drains in upper slope. The waterway carries the excess runoff to rivers, reservoirs, or a gully safely without causing more erosion damages.A vegetative waterway construction has better attention where the stone is absent. This is applicable in all agro-ecological conditions, especially in moist area and area prone to water-logging (Lakew *et al.,* 2005).

3. Conclusion

Soil erosion is one of the most serious environmental problems that affect the wellbeing of community and the sustainability of the ecosystem. Soil erosion is a major contributor to the prevailing food insecurity in Ethiopia. Farmers are aware of declining yields from their farms from year to year, but often unable to regain productivity because of climbing soil erosion.

Farmers are able to distinguish different causes of soil erosion in their land based on knowledge they have through farming conditions. Farmers invest more in soil and water conservation in fields situated near to residences.

It is also to understand the natural and social relations influencing land resource management choices. Farmers' perception to practice structural soil conservation measures can be influenced by different factors. The most important and considered factors include gender, age, education, household size, land size, length of food secured months, off-farm activities, distance from homestead, farmers perception on soil erosion and soil conservation measures, topography, effectiveness and productivity of structural measures, potential to install measures, contact with DAs, training on measures, color and moisture of soil and land tenure security and source of land.

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