

The impact of soil and water conservation for improved agricultural production in Ethiopia

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Ethiopia is among the sub Saharan belt countries with degradation problem. Environmental degradation, including soil erosion with gully formation, decrease in soil fertility. Sustainable agriculture is a balance between social, environmental and economic priorities. The balance secured with production of sufficient amount of food with affordable price and also with keeping the quality of the food. Protecting the environment and biodiversity to ensure farming is economically viable, which contributes to the well-being of local communities. Particularly in Ethiopia

soil loss through water erosions one of the serious environmental problem which is affecting the economy. The problem is due to mismanagement of land and poor agricultural practices. Thus, the this seminar review was carried out to review the impact of soil and water conservation measures in improving ecosystem services in general and sustainable agricultural in specific. The review focuses on semi-arid areas of the country with resource constraints. Finally, it recommends adaptive strategies that use and encourage for sustainable agriculture by increasing the ecosystem service.

Keywords: Sustainable agricultural practices, Ecosystem service, Conservation

INTRODUCTION

Ethiopia is among the sub Saharan belt countries facing environmental degradation. The country is suffering land degradation in the form of soil erosion, resulting in gully formation, loss of soil fertility and severe soil erosion [1]. The severity of the soil erosion in the country attributed by intense rainfall and also dissected nature of the topography which is nearly 70% of the highland having sloppy landscape. The sloppy topography intern fosters erosion in addition to this reduced in the vegetation cover also plays its role for degradation of soil. To overcome the existing problem of soil and water erosion, massive reforestation and soil and water conservation schemes were launched in Ethiopia. Including many NGOs and GOs various conservation strategies have been introduced to enhance agricultural development and rural livelihood. Annually around US \$ 20 billion was allocated for the successful conservation process in different part of the country during 1980s and 1990s [2].

Even if the results exhibited were very much promising the outcome was not as expected, that the problem can't be resolved once and for all in the country different parts [3] for the failure different reasons were mentioned by Ethiopia Journal of environmental studies and management (EJESM) intervention [4]. Among the problems the firsts was communities Involvement in the planning and implementation is very low. The second was failure to incorporate the local knowledge on conservation and farming practice and in many cases did not. The activities w were not coast effective such as hillside reforestation, terrace, and construction etc. which generally characterized by high cost which create discomfort in low income household as farmers could not afford to invest much money time and energy. The main problem was lack of integration and taking all agro ecology zones as one and designing similar conservation techniques with high coast. In addition the concept of conservation goes with resource renewability and non renewability and its impact for sustainable agriculture [5]. The benefit from the conservation was not clearly awarded by the society.

For sustainability of agriculture there should be balance between social, economic and environmental priorities [6]. In addition to balance it is also useful for conservation of biodiversity and sustainable use of resource for the well-being of the society [7]. Sustainable agricultural practices ensure that all farms operation is safe to humans, animals and the environment

[8]. Sustainable agriculture has been defined as an integrated system of plant crop production and animal husbandry [9]. This review deals on identifying the problems related to sustainability of agriculture faith focus to factors related to soil and water relation and come up with conservation solutions. Also deals on the role of water and soil conservation for sustainable agriculture for increasing agricultural productivity in Ethiopia.

LITERATURE REVIEW

Soil Erosion and Soil Productivity Decline in Ethiopia

Soil erosion: Soil erosion generally refers to the activity process of detachment transport and loss of the soil and soil materials by water, wind, ice and gravity. Erosion involves both the losses of the soil itself and loss of organic and material nutrients found in the soil [10]. Soil erosion results in the loss of soil organic matter and plant nutrients removal of soil from one part to another usually downhill by the action of water is known as water erosion. For such removal to occur it is necessary the soil practical are detached from the land surface and then Tran sported [11].

Soil can be eroded away by wind and water. Soil erosion is the removal of the top soil and particles from the surface which includes removal of including inorganic minerals and organic matter [5]. Erosion by wind is related with slop of the surface. Soil erosion affects an estimated 1,100 million hectare of land worldwide resulting the transport of 2.0-2.5 10 Mg of soil to the oceans each year [12]. Erosion removes the most productive portion of the soil, that is, the chemically active part such as organic matter and clay fraction. It also cause a deterioration of soil structure, moisture holding capacity through lowering soil depth, incising bulk density, soil crusting, and reducing water infiltration Similarly soil erosion is one of the principle environmental problems in Ethiopia and Eritrea resulting in decreasing productivity of farmlands [1] and 2 million hectares of land in Ethiopia has been severely degraded [2]. A Due to degradation of soil through wind the country face annual yield reduction of 1-2%is estimated due to soil erosion in Ethiopia [1].

A typical family in Ethiopian with 6 family members produces less than one throne of grain which is less than the for subsistence diet required. Annual yield is declining due to erosion and lose of soil fertility [12]. Hence, such condition calls for strong conservation activities to take place

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in rural parts of the country. The conservation activities were planned with packages of conservation measure developed with building terrace, trench formation, tree planting and closure of degraded areas [13].

Cause of Soil Erosion and Soil Productivity Decline in Ethiopia

The cause of soil erosion is related with complex cultural intuition, socio-economic and environmental factor [5] classified the causes of soil erosion as natural and anthropogenic.

Anthropogenic Causes

Besides the natural agents there are some human activities, which cause soil erosion

Deforestation: The forest are cut down for timber, or for farming purpose, then the soil no longer protected from the effect of fall in rains consequently, the top soil, washed away into river and ocean.

Poor farming system: It is described as an improper tillage and improper ways of harvesting which exposes the land to erosion and decreases the water holding capacity of the soil. During the sunny season the soil exposed so become dry and can be blown away as dust easily [7].

Over grazing: Over grazing by flocks of cattle, goats, and sheep leave very little plant cover on the soil. Their hooves make the soil and can be blown away easily. This cause vulnerability to soil erosion on which force soil to low productivity [2].

Natural Causes

Erosion of soil takes place due to the effect of natural agents like wind and water. High velocity winds over lands which have no vegetation carry away the loose top soil [5]. Similarly in area with no or very little vegetation the pouring rain drop carry away the soil.

The states of Soil and Water Conservation in Ethiopia

In any developing country understanding the Farmers' willingness to use soil and water conservation practices is mandatory. Their willingness is highly dependent on their knowledge of the problem of soil erosion [5]. Local communities knowledge of soil and water conservation practices has been ignored or underestimated by researchers, conservationists and government staff [13]. Having ample knowledge and understanding of both methods helps for better design of the strategies. An understanding of farmers way of thinking about the intervention and conservation practices will invite the other parties to design on prior knowledge. In different parts of Ethiopia different techniques of erosion control method used including plantation of trees, application manure, cut of drains, soil (stone) bunds, fallow, contour ploughing, drainage ditch and leaving crop residues on the field [2,10,12,13-15].

Soil Conservation

The prevention of erosion on cultivated land and other areas depends essentially on the reduction of soil detachment and runoff on the maintenance of adequate vegetation ground cover [14]. Soil conservation involves the various methods used to reduce soil erosion to prevent depletion of soil nutrients and soil moisture and to enrich the nutrients status of the soil. The conservation techniques include terracing and other.

Physical Soil Conservation

A physical soil conservation practice is applicable of soil management using knowledge or art with the goal protection of soil resource from exploitation. In addition, among those different applications, different structures applied in different farm lands [2]. However, these conservation applications depend on climate, soil type, vegetation cover and level of economy [2].

Contour farming: is a conservation technique that involves creating even terraces and tilling perpendicularly to the slope this method used as conservation technique for water and soil because it increases the infiltration of water [6].

Check dams: are techniques that help trap runoff water and washed soil in the runoff water this also increase infiltration and decrease the velocity of runoff water [16].

Proper soil management: with increase in organic matter of the soil the soil structure will be kept and retained. This is highly encouraged for soils that are excessively tilled and with poor structure its due to the soils tendency to easily eroded by surface runoff water [9].

Biological Soil Conservation

Biological soil conservation practices are vegetation strips, protective tree stands, natural drainage way and rotated by permanent grass cover and afforestation [7].

Soil vegetative cover: it can help to reduce soil erosion as it reduce the impact of rainwater droplets hitting the soil, increasing water infiltration and slow down the speed at which runoff flows through the field [12].

Crop residues cover: farm yard with minimum of 30% surface crop residue cover is considered beneficial for minimizing soil erosion erosion mulching crop residue which helps to slow down surface runoff velocities, improve water infiltration, increase soil organic matter levels and improve water holding capacity [2].

Reforestation and afforestation: reforestation is the planting of trees on land previously forested, but from which the trees have been removed by natural causes or human causes. Afforestation refers to the planting of land not formally so covered with trees to make of forest for commercial and other purpose. Both are used to protect soil from erosion and other losses [15].

Water Conservation

Due to regular and limited rainfall, water is one of the scarce resource while it is years round necessity for people, livestock and plant (vegetation). Its availability influences the nature and extent of human settlement and grazing patterns as well as plant production. The ever increasing demand for water and the high cost of the water development is main constraint to agricultural development.

Physical Water Conservation

Physical water conservation measures are structures built for water conservation. This protect against damage due to excess runoff [1].

Contour ploughing: It is ploughing across the slopes rather than up which helps in order to reduce runoff and water loss. It is simplest way to prevent soil erosion. This water conservation practices is useful on gently slope soil [8].

Terracing: It involves building level of surface at right angle to the slope to retain water and reduce amount erosion. Since it require moving of soil and stone to construct the level areas. It is expensive method of water conservation [5].

Biological Water Conservation

Biological measure for water conservation work by their protective impact on vegetation cover. In a dense vegetation cover the roots and organic matter stabilize the soil aggregate and increases infiltration [1].

Crop residues in the field: leaving crop residues in the field will reduce the wind speed from the farm yard also uses to reduce evapotranspiration so that conserve moisture because it acts as a wind break and soil cover of the soil surface

Choosing water conserving species: growing crops species which are with least evapotranspiration potential and with less water usage so that the moisture of the soil kept.

Wind breaks: allows the movement of air to be limited with decreased velocity. This allows. The best wind break has the 50% porosity means and is planted across the direction of the predominant wind [15]. The reduction in speed affects crop growth and reduces moisture of the soil.

Community participation on soil and water conservation

In Ethiopia where almost everybody survival is related to soil the difference to soil participation and conservation has contributed persistence of the problem [5]. Conservation measures are in the interest of both in individual and community participation. Thus the support and corporation of community are needed whenever and where conservation measures applied.

Importance of soil and water conservation for sustainable agriculture in Ethiopia

For sustainable agriculture one of the major steps is effective soil and water conservation. Sustainable agriculture can be practices by reducing negative measures and technology [14]. To bring sustainability is on the basis of soil and water conservation, natural resource management, land management, integrated pest management using new technology, economic viability and food security on household level.

Soil and water conservation (SWC) practices in highland areas can foster the production of various kinds of ecosystem services that have both upstream and downstream benefits. With consciences with the farmer if proper implementation of techniques that maintain or restore the capacity of soil to retain water with the inorganic nutrients and organic matter increases. Farmers can dramatically reduce agricultural water demand, reduce vulnerability to climate extremes drought and flooding, and also increasing soil carbon storage, as well as productivity. By reducing runoff and inorganic fertilizer input, downstream water quality improves [12]. As the supply of any of the services becomes more limiting, human well-being will increasing depend on an acceptable balance between the trades off [17]. The agriculture achieves sustainable benefits through minimal soil disturbance (i.e. zero or reduced tillage farming here after conservation tillage), permanent soil cover, and crop rotation.

CONCLUSION AND RECOMMENDATION

Conclusion

In this paper the role of SWC measures for the improvement of ecosystem services was reviewed. Ecosystem services associated with SWC can be distinguished as provisioning (productivity), regulatory, and supporting. According to [12] soil erosion is a threat to the economic development of Ethiopia as it affects the agricultural sector of the country significantly. With increasing dependency on the agricultural sector for economic development, sustained use of the land resource has become very important.

Enhancement of sustainable agriculture through soil and water conservation needs the awareness and concern of community (farmers) towards soil and water conservation. Soil conservation needs to be considered in line with the soil erosion control measures [5]. Thus for effective soil conservation a good soil cover needs a protected soil from erosion factors, a good soil cover which in turn increases the fertility of the soil leading to sustainable agricultural development. Sustainable use and management of water leads to developed agriculture which in turn leads to sustainable agricultural production and development [13]. Therefore soil and water conservation plays a major role in sustainable agricultural production as the conservation of the two is necessary for wise resource development especially in agricultural sector.

Recommendation

On bases of the review, the following recommendations forwarded; most of soil conservation structure practices in Ethiopia are not depend on standard techniques so need to follow the standard techniques. The agricultural office and farmers (community members) have responsibility to develop conservation measure which fit soil and climate character of land. Farming system of steep slope area of country shall follow proper water and soil conservation techniques with slop preferred farming practices which reduces soil erosion. Thus, government and agricultural office should develop continuous awareness about the impact of up and down farming through education, and formal training for awareness creation should be given to all farmers. During planning for conservation local knowledge of the farmers (community) shall be considered to start the conservation from their prior knowledge.

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