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Integrated Watershed Management Practices: Evidences from *Tsegur* and *Kanat* Micro-Watersheds of the Ethiopian Highlands

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ABSTRACT

Land degradation is one of the main confronts in the highlands of Ethiopia. Farm households have been practiced various land management interventions in different landscapes together with government and non-government organizations. Farmers reside in *Tsegur* and *Kanat* micro-watersheds practice mixed farming systems for their livelihoods. Biophysical soil and water conservation measures along with farm activities realize integrated watershed management. Both institutional and technological innovations provide guarantee for sustainable agriculture that can maintain the increasing demands for food, animal feed and fuel.

INTRODUCTION

Conservation and sustainable development presents a variety of innovative ways that have been used to influence policy processes and scientific discourses [1]. In Ethiopia, improved watershed management practices have been initiated since 1971 [2,3]. Watershed management is the interaction of people, land, water and biomass [4,5] and involves judicious use of natural resource with active participation of individuals, institutions and organizations [5]. A watershed is any surface area from which runoff resulting from rainfall is collected and drains through a common confluence point [6]. Land degradation caused by over cultivation, open grazing, high population, and deforestation are main problems in the highlands of Ethiopia [7]. The broad categories of land management interventions include physical and biological conservation measures [5]. Integrated watershed management interventions have been practiced in *Tsegur* and *Kanat* micro-watersheds. Thus, this paper is look at watershed interventions in the two micro-watersheds.

AREA DESCRIPTION

This article is spotlighted on two micro-watersheds-*Tsegur* and *Kanat*. *Tsegur* is located 10 km to the west from Debre Tabor town and lies between the coordinates of 11°32" to 12°03" latitude and 37°31" to 38°43" longitude. The average rainfall was ranging between 1200 and 1800 mm while the annual temperature was between 9.6°C to 21°C. The altitude of the micro-watershed is between 2300 and 3000 m above sea level [8]. *Kanat* micro-watershed is located at 5 km to the east of *Debre Tabor* with the area coverage of 112 ha. The mean annual temperature was 17°C while its rainfall and altitude were 1450 mm and 2630 m above sea level [9]. The distance between the two micro-watersheds is 15 km. A run-off flows from *Kanat* micro-watershed drains to *Gumara* while the run-off created in *Tsegur* drains to Rib Rivers. *Gumara* and *Rib* tributaries are the major contributors of water resources for Lake Tana [10]. The two micro-watersheds are found in *Farta* district of south Gondar zone. A highway asphalt road passes thorough *Woreta-Gayint* crosses the two watersheds. The major land uses of the two watersheds include cropland, grazing land and eucalyptus woodlots. Crop-livestock mixed farming is the common livelihood activity of smallholders in the highlands particularly in the study watersheds [11]. This paper is presented based on personal observation, key informant interviews and desk review.

INTEGRATED WATERSHED MANAGEMENT

Various soil and water conservation interventions have been practiced in the watersheds. Some of the major conventional practices include *feses* and *kab* similar to ditch and terrace.

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Farmers, residing in the watersheds, are familiar with indigenous conservation and plantation activities such as grasses, bushes, shrubs, native trees and terracing. In addition, trash line, cover crops, crop rotation, alley cropping, intercropping, mixed cropping and other agronomic practices are the common conventional practices. On the other hand, governmental and non-governmental organizations have introduced modern conservation measures and innovations such as soil bund, stone bund, cut-off drain, waterway, check dam, area closure and exotic plant species (for instance sesbania, pigeon peas, grevillea, vetiver grass, *Acacia* spp., elephant grass, eucalyptus, and others). Moreover, households have adopted different crop varieties (such as wheat) and improved dairy cows. Thus, crop production, animal husbandry, agro-forestry, growing animal feed and conservation measures are integrated interventions in the watersheds. Tree and shrub species can be integrated in the crop-livestock farming systems [12].

Many watersheds and landscapes throughout the world are under increased pressure from human activities of all types [13]. Likewise, the population density in *Tsegur* and *Kanat* micro-watersheds is about 300 persons/km^2 with declining trends of land holding sizes. Prior to conservation interventions, lands in the watershed were seriously degraded due to high population pressure, crop-livestock competitions for land resources and continuous farming without fallowing. Population growth and intensive production combined with increasing needs for fuel and forage resulted in land degradation. Thus, integrated watershed management was planned and put into action. Among several interventions, check dam is the best practice implemented using various materials and construction designs. In these areas, soil erosion is very severe so that deep gullies are reclaimed. Farmers were supported by NGO's (like German technical cooperation-GTZ) and constructed check dams with brushwood, stone, grass, gabion and cement depending on the slope of the catchment, depth of the gullies, availability of construction materials, run-off flow, and cost of investment. Check dam reduced the velocity of run-off and trap eroded soils [14]. Biophysical conservation practices also used to dispose run-off safely, harvest or retain water, reduce slope of the topography, enhance fertility of the soil, increase biomass and provide multi-purpose species for human food, animal feed and soil fertility.

Formal and informal institutions should be strengthened through bylaws, regulations, and legislations. On top of this, land certification can enhance land tenure security for long-term land-use systems so that implemented conservation practices and integrated farm activities will be sustainable. Different stakeholders, development partners and practitioners in the field of agriculture should support farming communities on livestock management, maintenance of conservation measures and adoption of environmental responsive technologies.

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