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Review Article

Historical Perspectives and Present Scenarios of Watershed Management in Ethiopia

Gadisa Chimdesa

Department of Natural Resources Management, Collage of Agriculture and Natural Resources, Dilla University, Dilla, Ethiopia

Email address:
gadisachimdesa@gmail.com

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Abstract: This paper is aimed to evaluate the historical perspectives and present scenarios of watershed management in Ethiopia. Watershed management is not the new concept of the country because it had highly experienced indigenous peoples those have been practiced from an ancient period. But, it became the prominent after the recurrent malnutrition and famine problems followed the 1970's and 1980's drought and subsequent catastrophic phenomena. Land degradation in the form of soil erosion has been usually considered as the main driving causes of the problem. Thus, the previous governments and other partners have initiated various soil and water conservation activities though they were mostly unsatisfactory or failed. Because there was lack of community participation, sector driven and single medium approach, unsecured land tenure, disincentives and unmanageable planning units. The present government has been taken lessons from the past shortcomings and then it has been initiated participatory community-based watershed management. As a result, it showed positive achievements in rehabilitation of severely degraded land, and it becoming as sources of income for the local communities. Here, it doesn't mean that current watershed management practices are perfect but practically it has various problems that will be solved in the future. For example: working quality, strengthening awareness creation and capacity building, real community participation, equitable and faire sharing benefits between and among upstream-downstream community should be paid attention. In general, watershed management must be evaluated in terms of environmental soundness, economic viability and social acceptability moreover; it should be supported by research and educational institutions.

Keywords: Ethiopia, Historical Perspectives, Land Degradation, Present Scenarios, Soil and Water Conservation, Watershed Management

1. Introduction

Land degradation in the form of soil erosion has been considered as among the major factors responsible for the recurrent malnutrition and famine problems in Ethiopia [51]. Ethiopia is indicated as the highest levels of soil erosion and soil nutrient depletion. It is estimated that more than 50% of the land is affected by soil erosion, 25% being seriously eroded and 4% of it has no longer productive [82]. Even though an absence of regular assessments and lack of detail studies at the national level, a few isolated studies have been conducted in specific parts of the country. For instance, the annual soil loss from Jabi Tehinan district 504.6ton/ha [12]; from Bench Maji Zone 118ton/ha [3]; from Northeast Wolega 65.9ton/ha [5]; from Chaleleka Wetland catchment 45ton/ha [46]; from Lake Tana basin 30ton/ha [60], and from Borena district of south Wollo 26ton/ha [1]. All these exceeded both the suggested soil loss tolerance of 18ton/ha/yr and soil formation rate ranges from 2-22 ton/ha/yr [39]. Even though it mainly depends on the degree of slope gradient, soil types, land cover and nature of rainfall intensity; an estimated soil loss rate in Ethiopia ranges from 16 to 300 ton/ha/year [71]. As a result, the country losses 1 to 2% of crop production per year and this account USD 1 billion per year [64]. Soil erosion has not only on-site effects but also it has off-site effects. Among the most important offsite effects are siltation, flooding and pollution into the downstream areas. Many reservoirs which have been established for hydroelectric power, urban water supply and irrigation schemes are threatened by accelerated sedimentation in Ethiopia. For

example: according to [45] the siltation deposited into Gilgel Gibe-I hydropower dam is 1.2 to 1.3 t/m^3/year and it could be reduced the expected life span of the dam from 50 to 20 year. There was estimation that the Trans-Boundary Rivers originated from the Ethiopian highlands carry about 1.3 billion ton/year of sediment into neighbouring countries, from which the Blue Nile alone carries 131 million ton/year [18]. Consequently; these have been caused water supply shortages, increased costs of maintenance and removing sediment, declined in water quality, loss of aquatic resources and recreational opportunities. There are multiple interacting factors which have been caused land degradation in Ethiopia. Extensive deforestation due to land use change and illegal fuel wood extractions, inappropriate land-use and cropping systems, overgrazing and cultivation of the marginal lands (steep slopes and erodible soils), infrastructure expansion, burning of dung and crop residues are the most proximate causes. Whereas; rapid population growth, poverty, insecure land tenure, climate variability and change, limited access of farmers to agricultural inputs and credits, and lack of knowledge on integrated soil and water management measures are the most underlying contributing drivers of land degradation in the country [29], [46] and [1]. The natural features of the country also highly exposed to land degradation. Ethiopia has land of extremes ranging from 4620 m.a.s.l of the highest point (Ras Dashen Mountain) to 100 m.b.s.l of the lowest point in world too (Dallol Depression). Besides, it has the great geographical diversity with high and rugged mountains, deep gorges, incised river valleys, rolling plains, a wide range of temperature and rainfall events, erodible soil types, a variety of agricultural crop types and land uses can be considered as additional factors affecting the land degradation processes in Ethiopia [6], [69] and [24]. For instance, the highland (above 1500 m.a.s.l.) part of the country was highly exposed to erosion risk than the lowlands because it constitutes about 43% of total area, 85% of human population and 80% of cattle population and 95% of cultivated land in the country [82]. Ethiopia has been considered as one of the countries highly susceptible to climate variability and change because of its economy heavily depends on traditional subsistence rain-fed agriculture. Historically it has been portrayed as a food deficit country with its people and animals suffering from recurrent droughts and floods. The severe food shortages in 1973, and the most memorable disasters and the famine followed the 1984 drought affected 8.7 million people and leading to about one million deaths, and the 2006 catastrophic flood in Dire Dawa can be the crucial examples [59]. Due to these effects, the Government of Ethiopia and non-governmental organizations have initiated soil and water conservation, and watershed development since 1970's and 1980's respectively [48]. Watershed, especially in the developing world has increasingly been managed and developed to conserve natural resources, increase agricultural productivity and thus enhance food security and alleviate poverty [38]. Hence, land and water management in a watershed context is also becoming a central adaptive strategy in Ethiopia [32] and [70]. Watershed can be defined in different ways, but the common definition of a watershed is the area that drains to a common outlet [82]. The term is synonymous with a drainage basin or catchment area. There is no definite scale or size of a watershed because all land everywhere is part of some watershed. Small watersheds together form a large watershed, and they also form unique landscape hierarchies, which are interdependent across several scales. Hence, a watershed refers to any topographically delineated area that can collect water and is drained by river system with an outlet and surrounded by a ridge line. Watershed includes all natural resources (water, soil and vegetation), people, farming system, livestock, and the interaction among the components. So, it is not simply the hydrological unit, but it also a bio-physical unit and a socio-economic-political unit for planning and implementing natural resources management. A watershed is a special kind of common pool resource where optimal management requires coordinated use of natural resources by all users [43]. Besides, watershed management is the process of guiding and organizing land and other resources in a watershed to provide desired goods and services without adversely affecting land resources. It is not only to protect and conserve the environment but also contributes to the livelihood security [47] and [74]. So that, watershed management interventions must need to address the root causes of land degradation, soil erosion, sedimentation and loss of soil fertility in Ethiopia. However, various controversial issues and challenges have been faced on the effectiveness of watershed management in the country. The evidences suggest that Ethiopia has not yet achieved and remained mostly unsatisfactory in watershed management principles since it has begun [48]. Therefore, this seminar paper is aimed to evaluate the historical perspectives and present scenarios of watershed management in Ethiopia. The paper is structured into five main sections which include the history, practices, approaches, lessons learned and the challenges of Watershed Management in Ethiopia.

2. Results and Discussion

2.1. Historical Perspectives of Watershed Management

2.1.1. History of Watershed Management

The history of watershed management was dating back to 5000 years old, since agriculture began. Human beings live in a watershed to meet their needs, and they have been manipulating water and slopes in order to benefit cultivation, control floods and drought. In ancient time, the irrigation system in China on the banks of Yellow River and in the Fertile Crescent around the three major Near East rivers (Nile, Euphrates and Tigris); urban water supply system in Greeks and Romans; and hillside terracing and tree planting on slopes in Mediterranean region landscapes were the forerunners of modern watershed management [82]. The origins of modern watershed management can be traced to several parallel and independent movements in the last quarter of the 19th century. But it became prominent in developing countries in the 1970s and 1980s, when the problems of watershed degradation first

became apparent. During that period, priority was given to protect downstream assets through a top-down planning and engineering-led approach at specific on-site. But, this approach was remained fail due to less attention was paid to the needs of upstream communities. As a result of these comparative failures, a major rethinking of watershed management approaches was undertaken by national and international agencies, particularly following the 1992 Earth Summit of the United Nations Conference on Environment and Development, Rio de Janerio, Brazil. From the 1990s until now, watershed management operations typically targeted resource use productivity, livelihood improvements, and poverty reduction objectives beyond resource conservation. In addition, it aimed to adopt integrated, participatory and demand-driven approaches at grassroots level. This approach is commonly known as a new generation of watershed management programs. The historical perspective of watershed management in Ethiopia was nearly the same to other developing countries. The evidences suggest that history of watershed management initiatives dating back to the 1970s. The need to tackle land degradation in the form of soil erosion problem had been recognized before the severe drought of 1972/73. In 1970, soil and water conservation division was established under the Ministry of Agriculture. After the drought it was gave a greater emphasis on soil and water conservation endeavours in the country. Soil and water conservation division grew into a Community Forest and Soil Conservation Department. With international institutions and NGO's help, extensive soil and water conservation activities such as: stone and soil bunds, hillside terraces, area exclosure, establishment of tree nurseries and tree planting through food for work were extended into many parts of the country. However, at the end it remained fail, because food for work was discontinued, most of the participating farmers became unwilling to maintain those already established and even some of them removed the structures from their lands. In Ethiopia, planning watershed development was started since 1980's followed the 1984/1985 drought. It was aimed to support rural land rehabilitation through implementing natural resources conservation and other development programs within a watershed context. At that time, 116 watersheds covering about 1.5 million hectares treated by different soil and water conservation measures. But, these large-scale efforts also remained mostly unsatisfactory due to lack of effective community participation, limited sense of responsibility over assets created, and unmanageable planning units [48]. The lessons learned from this experience encouraged Ministry of Agriculture and support agencies like FAO initiated pilot watershed planning approaches on a bottom up basis, using smaller units and following community based approaches. In addition, they prepared participatory community based watershed planning guidelines for Development agents. The participatory community based watershed planning guideline published in 2005, which still now used nationally as practical guidance is the crucial example. This was considered as the first step in the evolution of the participatory planning approach to watershed development in Ethiopia. By late 1990, Watershed development in Ethiopia has increasingly been managed and developed for poverty alleviation and environmental conservation. Today there is a massive movement in watershed management in almost all regions of the country. Watershed management has evolved as a comprehensive development concept for sustainable and efficient utilization of natural resources for the benefit of the local community with special attention to the rural poor [70] and [36]. In fact, traditionally, the practices of a watershed management are not new concept in Ethiopia because there were plenty of experienced indigenous peoples those practiced watershed management activities even from the ancient periods. Among the others, some of these indigenous knowledge peoples in the country were described in the following section.

2.1.2. Role of Indigenous Knowledge on Watershed Management

i. Gedeo Indigenous Agroforestry System

Gedeo Zone is the place where great combination of natural and cultural civilization. It is usually known as the agroforestry zone. According to [66] traces, the historical development of Gedeo Indigenous Agroforestry System is back to the Neolithic period (5000 years). It developed through the domestication of natural forest and intensification of agriculture. See figure 1: Gedeo indigenous agroforestry practices. The indigenous agroforestry system is found on the fragmented mountains and hills along the rift valley escarpments and more than 69% was found on very steep slopes up to 107% [19], and the landscape carries 1300 persons/km^2 of among the highest population density in Africa [54]. Surprisingly, the Gedeo people could be sustained and preserved their natural landscapes and culture through their traditional administration known as Ballee system. This system has also benefited farmers for centuries to self-reliant in food and wood security without losing the environmental services. High diversity of trees and other perennial species in the area offers food diversification options to reduce production risks and enhance adaptive capacity of smallholders to climate change. As the same to other agroforestry practices they also have great potential for carbon sequestration and reducing pressure on adjacent natural forest deforestation and soil erosion [37].

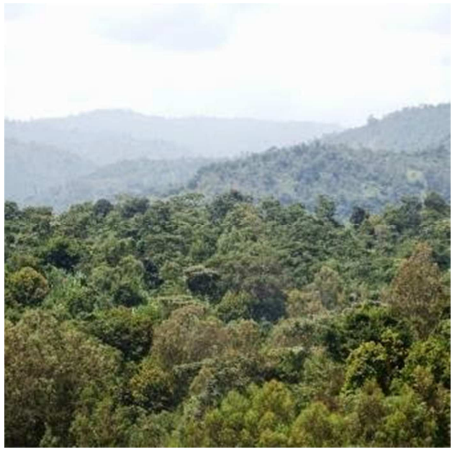


Figure 1. *Gedeo indigenous agroforestry practices.*

In fact, due to various human and natural challenges this indigenous knowledge trends becoming decline. For example: land shortage is overwhelming in the area due to rapid population growth [61] and the rate of parental transmitting indigenous knowledge to youths is declined due to schooling, religion, land fragmentation, etc. [4]. What so ever, Gedeo indigenous agroforestry system can be a best example for the countries with higher population density and mountainous landscapes and make them to learn how to harmonize population pressure with sustainable production and conservation. This is also an indication of how to manage a watershed in rugged landscapes.

ii. Konso Indigenous Hillside Bench Terraces

An endeavour indigenous knowledge of the Konso people with bench terraces is dated back to more than 400 years. They indicated how human being can struggle to use and control the hostile environment. The terraces they have been created are retain soil from erosion, collect and discharge water, and the terraced fields also used for agricultural activities. The indigenous soil conservation mechanisms in the community embodied in their culture as means of their survival strategies in climate change [84]. This creative indigenous and noble work culture has qualified Konso people in 1995 for UN prize, and their landscape was recognized and registered by UNESCO in 2010 as a cultural heritage site. Therefore, this indigenous knowledge can be taken as excellent lessons in watershed management practices specifically hillside terraces. See figure 2: Konso indigenous hillside bench terrace practices.

Figure 2. *Konso indigenous hillside bench terrace practices.*

iii. Borana-Oromo Indigenous Natural Resources Management

The Gada System is an indigenous democratic socio-political system of the Oromo People. There is not known evidences when and how the system was emerged, but the intricately curved stones of Xayyaa (Tiya) are marks the Gada Governance dating back to 1249 BC. In the pastoral communities, especially in Borana there are many elements of the Gada System still existed [13]. The customary laws (SeeraGadaa) on management of natural resources and conflict resolution mechanisms can be the crucial example. Thus, the Borana community has special rules and regulations for managing their water resources and rangelands. Traditionally, every Borana has the right to graze his livestock wherever he wants within their areas, but the accessibility and availability of water sources are the main limiting factors to be defining the grazing areas. Borana clearly define the rights to various water sources such as wells, ponds and rivers [20]. See figure 3: Borana-Oromo traditional deep wells (tulas). There are nine clusters of traditional deep wells (tulas) in area which contain water throughout the year even in very severe droughts.

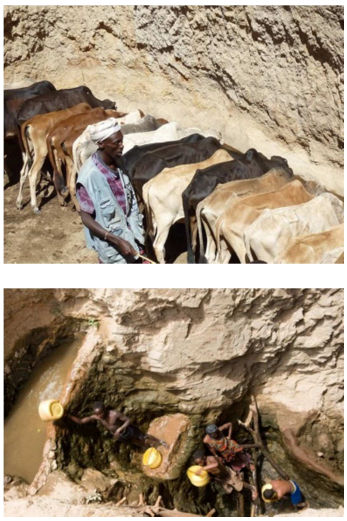


Figure 3. *Borana-Oromo traditional deep wells (tulas).*

This also indicates how these communities could be integrated to mitigate the effects of drought for centuries [40]. The Wells (eelaa) are highly regulated and managed by a council of the clan group, which includes a retired special counsellors or individuals (the hayyuu), a local lineage of clan elder or special messenger (the jallaba), the trustee of each well (abbaakonfii), the coordinator of water use and maintenance (abbaaherregaa) and other members. On other the hand Borana pastoralists' indigenous knowledge and experiences play a great role in managing rangeland by manipulating herds' seasonal mobility and herd splitting strategies in accordance with available fodder and water resources, and herd groups [42]. As the same author indicated Borana pastoralists divide their herd in to two groups known as loon warraa and loon fooraa. The first group mainly includes lactating cows, young calves, weak and sick animals and bulls for mating which the priority is given and must stay around and grazes in their usual residential home area (kaloo), and the second group constitutes the larger percent of this herds include non-lactating cows and other bulls which must leave the usual homestead and move to graze over the distant grazing areas. This strategy of herds' seasonal mobility and

dividing up livestock herd has the important labour, security and ecological implications. Management of grazing resources is principally done by the council of elders (Jaarsa Deedhaa) [22]. Overall, the political system in Borana is made up of assemblies of Kora, which are usually convened at two levels. The first one is convened on clan basis and such assemblies are more binding and decisions reached at such assemblies are more easily enforced. At the same time assemblies could be convened on the basis of territory particularly concerning issues of grazing (Koradheedaa) or on the basis of the users group right on a well (Koraeelaa) at Madda, Reera, Olla and even outside of these areas. Decisions made at each of these levels are enforced once the general consensus is reached. The second level of assembly is the Pan-Borana general assembly of Gumi Gayo which is the supreme juridical, formal and legislative body, which meets once every eight years in the presence of the incumbent as well as all living, retired Abba Gada to promulgate the overall laws of Borana. The customary laws promulgated at Gumi Gayo are binding, implemented and enforced at all levels of Borana territory. Additional laws required to be promulgated and old laws required to be amended are discussed and amended at the Gumi Gayo assembly held every eight years. In general, Ethiopia has extensive historical perspectives on natural resources management in a watershed context. The indigenous knowledge and experiences of communities mentioned above and other communities in the country could be the crucial examples for other countries in the world. Unfortunately, the previous distinctive philosophical and practical variations of government systems in the country created political instability, conflict and uncertainty, psychological obstacles and undermined this decisive indigenous knowledge of the people. Due to the fact, the indigenous knowledge and experiences of the people have been unknown and weakened though some genius communities have been exercised and preserved yet. So that, we have to search, announce and scaling up such like creative works and they must be integrated to the scientific knowledge.

2.2. Present Scenarios of Watershed Management

The word 'present' is to indicate the watershed management points of view since 1991 of the Federal Democratic Republic of Ethiopia (FDRE) government. During the political changes in 1991, a large scale of forest areas and soil and water conservation schemes were highly removed and destroyed by local communities, because the previous approaches has not given attention to the economic viability and social acceptability as the same to ecological soundness and technical feasibility. Because, the previous regimes have introduced elements of land tenure insecurity which greatly impacted on property rights of long term investments and sustainable use of natural resources in the country [30]. By considering these paradoxes, the current government has been tried to develop sustainable natural resources management and utilization. The 1995 FDRE Constitution, Article 40, sub article 3 has restated as 'the right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the State and in the peoples of Ethiopia. Land is a common property of the Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale or to other means of exchange'. However, the constitution and subsequent proclamations allow the rights to access, use, transfer, alienate, bequeath and claim compensation for his/her land possession. Land administration has decentralized into the regional governments and they were affirmed to have their own land Administration and Land Use Proclamations. The government also encouraged the participation of the People in any development initiatives. Agricultural Development Led Industrialisation (ADLI) is a central pillar of the economic policy of the country. Smallholder, rain-fed, traditional and subsistence agriculture in the rural area has been the mainstay of economic performance and poverty alleviation. The agricultural sector accounts 45% of GDP, contributes 90% of exports, employs 85% of the labour force of the country. Achieving food security, productivity enhancement and sustainable natural resource management remains a critical issue of the country. By late 1990, Watershed Development has increasingly been managed and developed for poverty alleviation and environmental conservation. In comparison to previous land rehabilitation initiatives strong emphasis was placed on household income-generating activities and innovative approaches towards conversion of degraded landscapes to productive lands [70]. In 2005 Ethiopia began implementation of a more comprehensive approach to food security through the Productive Safety Net Programme (PSNP), in which more predictable food and cash transfers for chronically food insecure households were returned into labour on public works, particularly through Community Based Participatory Watershed Development. For instance, in 2014/15 (at the end of GTP one), area of land rehabilitated and area of land developed with community based watershed development program has been extended into 11.7million hectares and 12.16 million hectares respectively [28]. In addition to other projects, the current free labour massive social movements on watershed management activities might be the crucial example of natural resources management for sustainable agriculture. Therefore, it is needed to examine the current practices, approaches, lessons learned and the challenges of watershed management in Ethiopia.

2.2.1. Watershed Management Practices

i. Physical Soil and Water Conservation

Physical soil and water conservation are methods which aimed to reduce the velocity of surface runoff and minimize soil erosion by shortening the length and minimizing the gradient of the slope. They also aimed to retain water when it is needed or safely dispose excess runoff. The structures mainly involve different types of bunds, terraces, check-dams, water diversion (cut-off drain, water ways) and harvesting structures (micro basins). These have been traditionally implemented over 400 years and some were introduced as modern technologies since four decades [21]. Moreover, different types of bunds have been widely adopted in all parts of the country. Bunds are embankment like structures: they

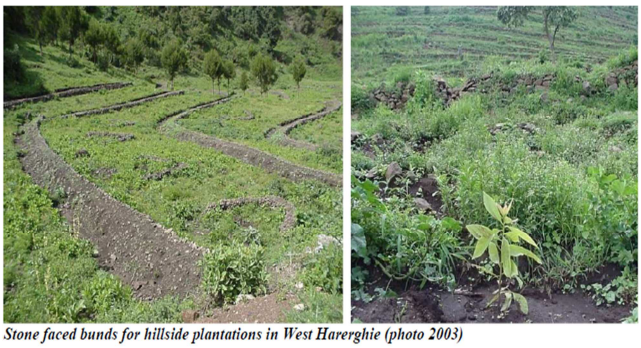
can be contour or graded bunds which aimed to retain water in dry areas or to dispose excess runoff from wetter areas respectively. Based on used materials to construct bunds, they can be soil, stone, and stone faced soil bunds. In addition, bunds can be fanyajuu (it means "throw soil uphill" in Swahili) if the soil is moved upslope with a basin at its lower side. Fanyajuu bunds were the dominant structures under construction in cultivated fields. See figures 4, 5 & 6: different types of bunds (Source: [21]).

Stone bunds constructed on cultivated lands (Photo 2002) *Water stored in ponds protected by stone bunds (Photo 2002)*

Figure 4. *Contour stone bunds (Enderta Woreda).*

Relay cutoff drains place along a pathway to convey runoff (Photo 1994) *Proper land management results in better crop performance (Photo 2004)*

Figure 5. *Graded soil bunds and relay cut-off drains (Lemo Woreda, Hadiya,).*



Stone faced bunds for hillside plantations in West Harerghie (photo 2003)

Figure 6. *Stone faced soil bund (Harerghie, Oromiya).*

Even though different soil and water conservation structures have been extensively introduced over the past decades, sustained implementation and use of the measures has been not as expected. This is due to the miss understandings of the main factors that can influence adoption of these measures. See figure 7: Factors influencing the adoption of soil and water conservation measures adopted from [12]. Low level of perception on erosion problem and technology profitability could be the major factor [7] and [67]. Lack of awareness, less involvement and working experiences, and lack incentives also made the farmers did not put the methods in to practice and to maintain the structures [62]. Moreover, the main constraints to apply soil and water conservation structures are the socioeconomic and biophysical factors. Such as: land tenure insecurity, land fragmentation, labour force shortage, inability, illiteracy and off-farm income are among the major socioeconomic factors whereas; agro-ecological location and slope of cultivated fields, soil type, plot size and distance of farm land from the residence are among the main determinants of the biophysical factors. Access to extension services and education, technical support and resources endowment, access to credit, and the presence of soil and water conservation projects, research and development organizations are the factors also could be influence the adoption of Soil and Water Conservation measures [63] and [8]. Thus, it requires to ensuring sustainable soil and water conservation measures in Ethiopia. As different studies suggested that it should be considered both modern scientific and indigenous knowledge; it should be paid attention to both the biophysical factors and socio-economic characteristics of the targeted groups; and it needs to strengthen awareness creation, capacity building and real community participation at planning, implementation and evaluation phases to ensure sustainable conservation practices [23], [71], [11], [36] and [77]. In fact, various evidences showed that soil and water conservation structures are not only protecting soil erosion and nutrient depletion but also they had significant positive impacts on soil properties. For example: according to [81] study indicated that, Soil organic carbon and total nitrogen are higher, and bulk density was lower under fields with fanyajuu structures than non-conserved farm plots in Goromti watershed, West Shoa Zone, Oromiya region. This could benefit farmers through improving soil nutrient status and thereby sustainable agricultural productivity. Integrated land management program has also significant contribution to increase crop productivity and income of smallholder farmers. For example: on average land management programme participant households earned 8.3 percent more crop production value per hectare and 21.2 percent gross household income than those non participant households in West Hararge Zone, Oromiya region [83]. Due to installing erosion control structures (mainly stone bund), total soil loss was reduced by 63.8% in Central Rift Valley of Ethiopia [24]. In addition, after implementation of fanya-juu bund construction the yield was increased by 22 percent and the land that had not grown any crop, at present it has been yielded about 800 kg/ha of haricot bean in Gununo area of Wolaita Zone in the Southern Ethiopia [2]. On other hand due to soil and water conservation measures the volume of runoff could be decreased and ground water availability has been increased. For example: After integrated soil and water conservation interventions, the volume of runoff was decreased from 26.88 to 17.19 percent while groundwater recharge was increased from 1.43 to 19.04 percent since 1993 in Mendae catchment of Eastern Tigray

region [72]. In general, structural soil and water conservation measures are more effective if they combined with biological or agronomic measures. See figure 7 below: Conceptual framework demonstrating effectiveness of integrated SWC measures in degraded land rehabilitation adopted from [18]. By considering this, substantial afforestation and reforestation practices have been implemented in Ethiopia as described in the following section.

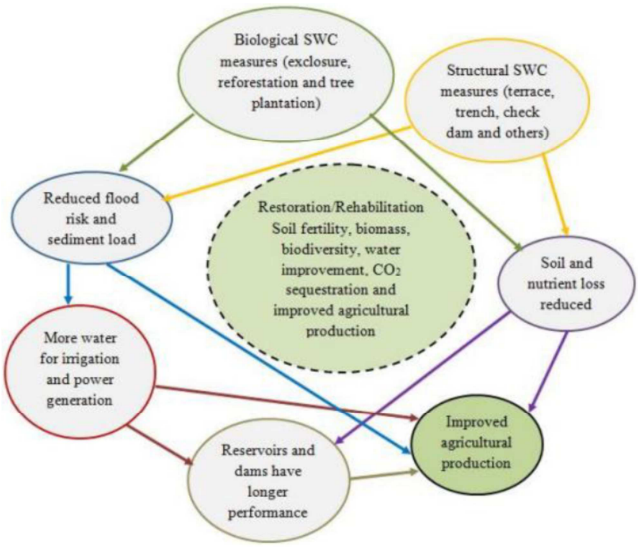


Figure 7. *Conceptual framework of integrated SWC measures.*

ii. Biological Soil and Water Conservation

Biological soil and water conservation measures mainly involve tree planting in the form of afforestation or reforestation. Vegetation has a curative and protective value. Tree planting activities has a long history in Ethiopia. According to historical records, afforestation started in the early 1400s by the order of King Zera Yakob (1434-1468) but modern tree planting using introduced tree species (Australian Eucalyptus) was started when Emperor Menillik II (1889-1913) looked into solutions for alleviating shortage of firewood and construction wood in the capital, Addis Ababa [10]. Eucalyptus species was widely introduced and has made preferable in Ethiopia because its rapid growth and adaptability to a range of conditions, and currently about 70 species of Eucalyptus are available in Ethiopia [56]. There was rapid expansion of large scale and community plantations during the Derge period. At the end of the regime there were about 162,000 hectares of plantation forests and about 36,000 hectares of urban fuel wood plantations mainly exotic tree species. Although the achievements were remarkable, they have been manifested in unsustainable. Due to disincentives, lack of active participation of local communities and tenure insecurity many of these plantations were poorly established, rarely maintained and they were perished at the change of the government [56] and [14]. From these lessons learnt, the current government (FDRE) has adapted different strategies and approaches to enable the users to have greater decision making power on forest resources. In 1995 Constitution and subsequent national economic policy and strategy was recognized natural resources management as a key prerequisite for sustainable development. For example: Article 92 mainly indicates about 'environmental issues'. Even though there is no specific provision concerning to increase forest covers in the constitution, some of the existing policies and laws (rural land, environmental, energy, investment, wildlife, etc) indirectly contributes forest cover increase in Ethiopia [44]. In 2007, the council of ministers adopted a forest policy in the proclamation of No. 542/2007 which gives due attention to forest development and conservation considering its significance to the national economy, food security and sustainable development of the nation [26]. In this policy and strategy document, three policy statements have direct relationship with the increase of forest cover. These are: Private forest development and conservation; Development and dissemination of technologies; and Promotion of forest marketing development. A number of federal and regional offices are involved in projects and programs that are related to forestry. For example: Participatory Forest Management (PFM), Productive Safety Net Program (PSNP), Sustainable Land Management (SLM), and Managing Environmental Resources to Enable Transition to Sustainable Livelihoods (MERET) project, Agricultural Sector Support Program (ASSP), Agricultural Growth Program (AGP), Reducing emissions from deforestation and forest degradation (REDD) and etc. International and local NGO's also have been significantly participated in forest development, namely: GTZ, FARM Africa, SOS Sahel Ethiopia and the others. International agencies like WFP, FAO, SIDA, World Bank, African Development Bank are among the others having crucial involvements in this regard. Thus, the current government has not only taking care of remaining natural forests but it also initiated and encouraged people to plant multipurpose tree species. Moreover, it is identified Forestry as one the four main pillars of Climate Resilient Green Economy (CRGE) strategy of the country. This prioritized strategy was aimed to protect and re-establish forests for their economic and ecosystem services including carbon stocks [27]. An ecosystem approach was emerged early as a central strategy for the Integrated Natural Resources Management that promotes conservation and sustainable use through equitable sharing of benefits [32]. The Activities have been undertaken in a watershed context through afforestation, reforestation and forest management. In doing so, a wide range of biophysical, institutional, socioeconomic and household level factors had a critical influence on adoption of tree growing investment decisions. For example: land holding size, land tenure security, household size, productive labour force availability, education, income and credit access, age, level of perception on deforestation could be the determinants of tree-growing decisions by local land users [8], [16], [9], [86], [78] and [17]. According to recent data, about 11.5 million hectares of Ethiopian land area is covered by forest in which plantation areas have been increased by 47.6% from 509,422 ha in 2000 into 972,000ha in 2015 [25]. Even though there were increased plantation area through massive watershed management program in the country, expansion of

agricultural land, settlement programmes, extensive investments and other development activities are used within expenses of the remaining natural forest land [15] and [10].

iii. Area Exclosure

Area closure involves the protection and resting of severely degraded land to restore its productive capacity. This could be via natural rehabilitation or enhanced by additional vegetative and structural conservation measures. Thus, the establishment of area closures have been promoted in Ethiopia as the strategy to control watershed degradation and restore the natural vegetation. In 2014/15, land area rehabilitated under closure was reached about 11.7 million ha in the country [25]. Various research results indicated that area enclosures are very advantageous, effective and optimistic than other methods of degraded land rehabilitation in Ethiopia [52], [80] and [53]. Because of area enclosure is the fast, cheap and lenient technique. It is effective to improve soil properties and nutrient content [80] and [50]. It is also effective in restoring trees, herbs and grasses species composition and biomass production [41] and [49]. As [33] indicated that area enclosure is an important policy instrument to allow degraded land recovery. After area enclosure with watershed management interventions the total honey yield has increased almost by two fold and the annual revenue increased by 6.5 folds in Galessa watershed of protected area in Dendi district, West Shewa Zone, Oromia [73]. In general, area enclosures have becoming significant contributions to generate ecological and socioeconomic benefits in Ethiopia. But some time they restrict use of communal resources; in a case it highly required ensuring the socioeconomic wellbeing of local community while maintaining natural resources in a watershed [57]. In fact, watershed management in Ethiopia had not without challenges and constraints; it has been developed from lessons and opportunities.

2.2.2. Challenges on Watershed Management

In the present past, there were different challenges, constraints as well as controversies that negatively affect the quality of interventions and scaling up of successful practices for sustainable watershed management in Ethiopia. Some of the important constraints have been described as follows:

Inadequate community participation: the top-down and rigid planning approach was ignored local communities participation in which it mainly focused on technical and physical works alone without giving attention to the economic viability and social acceptability. Lack of awareness and lack of proper integration of introduced practices with indigenous knowledge was limited farmers' willingness to participate and less sense of responsibility over assets created. Due to the fact, during the political changes a large scale of forest areas; soil and water conservation structures were highly removed and destroyed by local communities in the country [55], [62] and [75].

Policy, legislation and implementation constraints: Historically, Ethiopia has been designed a number of important policies and strategies though it was not an end by itself. They must be valued if and only if properly implemented. The poor implementation of policies and strategies remains a major constraint and they are hindering proper implementation of effective and sustainable practices for resource management in Ethiopia [15], [70] and [10]. Weak linkages among various disciplines and concerned institutions: There was single medium focus and sector driven approach they could not be integrated and multi-sectoral approach. There was also poor coordination among researchers, extension centres and educational institutions that adversely affected the development and transfer of technologies from researchers to local experts and local communities, particularly the farmers. In addition, frequent restructuring of government institutions causes staff turnover, wastes institutional capacity and discontinuity of activities and initiatives. In this regard, MoARD and World Bank also suggested that these all undermines the proper implementation and up-scaling of successful sustainable environmental management practices in the country.

Lack of professional and technical standards: the technical interventions were not supported by dialogue/negotiation process. Construction of physical soil and water structures was considered as the only main solution to halt land degradation. Even the selection criteria and design parameters of SWC structures were not considered as per of required. Unfortunately, attention is mostly given to the number/quota of interventions but not their quality, standard, sustainability, and integration with other soil and land management practices [6]. Besides, there is an indication in which non professionals have been assigned to initiate activities in natural resources management.

Other socio-economic and bio-physical challenges: There are many socio-economic and bio-physical constraints that hinder decisions to invest and sustain appropriate practices for overcoming land degradation in Ethiopia. Among the others poverty, population growth, land use change, land shortage, deforestation, climate change (drought and floods), and the others have often negatively affects the sustainability of watershed management practices in the country.

2.2.3. Lessons Learned from Watershed Management

The present government has been taking lessons from the past shortcomings. Hence, it has initiated community based integrated watershed management approaches based on bottom-up and smaller units. As opposed to the past watershed development works, community is actively participating in problem identification, planning, technology and treatments choice, designing, community byelaws setting, implementation, monitoring, evaluations and maintaining of the interventions [34] and [58]. Then watershed started yielding positive results and it becomes the practical models for understanding environmental issues and rehabilitating severely degraded land in Ethiopia [70]. Watershed management is becoming the effective and quickly responding to control runoff, to reduce soil erosion and associated downstream siltation in the country. Currently, watershed management practices are not only to protect and rehabilitate severely degraded land but also they contribute to increased agricultural output, diversification of food and income sources,

reduced migration and improved biodiversity [68]. Due to these achievements, the local communities understand the importance of watershed management and they become willing to invest and participate on watershed development toward the future.

2.2.4. Opportunities in Watershed Management

Currently, Ethiopia has also the opportunities helping to improve watershed management interventions and to scaling up successful practices. These opportunities can be the followings.

- Existence of good policies and strategies (environmental and land tenure policy)
- Good start and experiences in community based watershed management
- Better institutional setup and research systems
- Integration of concerned organizations
- Availability of indigenous knowledge and scientific technologies
- Existence of donor support and development partners

Therefore, in addition to implementing these ambitious climate resilient green economy strategies through watershed management practices, it must be capitalizing these opportunities in the country [70] and [6].

2.2.5. Controversies on Watershed Management

Globally, many important controversial issues have been raised on the effectiveness of watershed management programs. For example, according to [65] the following controversial issues were taken under questions that should be also examined in Ethiopian context. Those questions are:

1. Who should receive the most benefits from a watershed program?
2. Is that more incentives were given to people who participate in a watershed program?
3. Which type of work highly emphasized; structural or vegetative/rehabilitation or prevention?
4. At what level watershed planning was carried out; at farm or watershed level?
5. How far should integrated watershed go?

From these questions what we can understand that watershed management program is a sustainable if and only if both upstream and downstream linkages and benefits should be considered as well as the optimum balance among protection, production, and development should be maintained. In addition, unfitness of natural watershed boundary and administrational boundary is also another issue especially in Ethiopia context. Thus, in combination with the outcomes of the previous related studies, it also provides additional investigations in the future.

2.3. Comparisons of the Past and Present Watershed Management

In order to summarize, the following table was employed to show the compare and contrasts between the past and present watershed management approaches, strategies, institutions, activities and results. See Table 1: Comparison of the past and the present watershed management approaches and achievements. Even though the current approaches are better than the previous, various criticisms were raised on the present government. Such as grabbing of lands due to large scale investments, settlement programme and other development activities; SWC activities mainly implemented on mountainous and communal lands (ex-situ) rather than on individual farm (in-situ), less integration of SWC measures (structural interventions have limited to biological supports), working quality like structural design and maintenance as well as the survival rate of the seedlings is under question and then the equitable and faire sharing benefit between and among upstream-downstream community must be paid attention.

Table 1. *Comparison of the past and the present watershed management Approaches.*

T. No	Approaches in the past (Before 1991)	Approaches at the Present (Since 1991)
1	Reactive adaptation (actions taken after the initial impacts like land degradation, drought and famine)	Anticipatory adaptation and mitigation strategies (actions have been taken before impacts may become apparent) eg. CRGE
2	There was unsecured land tenure policy	It has been enhanced land tenure security through certification program
3	Lack of an adequate institutional arrangements and it entrusted to the donors	Better institutional setup, integration of concerned organizations and research systems eg. Basins Authority, MoFEPCC
4	Top-down planning, inflexible and less prototypes	Both top-down and bottom-up planning approaches, flexible at local level, prototype and scaling up strategies
5	Larger planning unit with disrespect of watershed logic and agro-ecological potential	Smaller unit, micro-watershed, agro-ecological characteristics and land use types have been used into consideration
6	Focused on on-site effects, short term projects with food/cash for work incentives	It has been considered both on-site and off-site effects and long-term programmes (PSNP, SLM, AGP etc.) and it also implemented through free labour massive social mobilization
7	It was focused on sector driven and single medium	It focusing on multi-sectoral, multi-disciplinary and integrated
8	Technical interventions were the primary focus and it was not supported by dialogue/negotiation process	The economic viability, social acceptability and ecological soundness has been paid attention as the same as technical feasibility
9	Less attention was paid to the needs communities	It paid attention to the spatial and temporal interactions due to soil erosion, siltation and flooding
10	Less admiration was given to the local or indigenous experiences/knowledge	Attention has been given to the local or indigenous experiences/knowledge as the same to scientific knowledge
11	Lack of effective community participation and limited sense of responsibility over asset created	It has been initiated participatory planning and involvement of community-based organisations and then it shows the positive results

Source: the author (2016)

3. Conclusion and Recommendations

There are multiple interacting factors which have been caused land degradation in Ethiopia. Land use change, extensive deforestation, overgrazing, inappropriate land use, infrastructural expansions, burning of dung and crop residues are among the proximate causes; whereas ever rapid population growth, poverty, land tenure insecurity and climate change are among the main indirect causes. The natural phenomena of the country also highly exposed to land degradation because it has rugged mountains, deep gorges and incised river valleys, rolling plains, a wide range of temperature and rainfall events. On the other hand, highly concentrated mode of life on the highland areas and rain-fed agricultural dependency has made the country highly susceptible to land degradation and subsequent problems. Thus, watershed management was aimed to address the root causes of the problem. But, the previous watershed management approach was unsatisfactory or remains failed mainly due to lack of community participation, ignoring indigenous knowledge, land tenure insecurity, disincentives and unmanageable planning units. The present government has been taking lessons from the past shortcomings and it has been initiated participatory community based watershed management. In fact, the massive watershed management practices used by social mobilization in Ethiopia showed positive results in rehabilitating severely degraded land and they helped to increase agricultural productivity, diversity and income sources. Here, it doesn't mean that current watershed management practices are perfect, but practically there are various problems that will be solved in the future. To ensure watershed management sustainability in Ethiopia, both biophysical and socio-economic characteristics and the upstream-downstream linkage of the watershed should be considered. Any interventions aimed to implement in a watershed should be in an integrated, flexible, multi-sectoral and multi-disciplinary approach; both scientific and indigenous knowledge should be equally paid attention; strengthening awareness creation, capacity building, real community participation and equitable benefit sharing are also requiring attention. In general, the effectiveness of watershed management practices must be evaluated in terms of environmental soundness, economic viability and social acceptability. Besides, they should be supported by research and educational institutions.

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