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Assessments of the Effects of Land Degradation on Freshwater and Local Communities Participation in Essera District, Dawro Zone, South Western Ethiopia

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Abstract
Human activities such as pollution, habitat destruction, overexploitation and foreign plant and animal invasions are resulting in the ever-increasing loss of the freshwater resource biodiversity wealth. A natural and human induced change to freshwater resource patterns is critical for efficiently conserving and managing these highly impacted ecosystems. Water is indispensable for all forms of life. Conversion of natural forests into cultivated fields can affect water and soil. Perception of soil erosion as a hazard to agricultural production and sustainable agriculture is the most important determinant of participatory integrated watershed management practices. Land in the study area is scarce mainly due to population pressure. Spring is the source of water for drinking and other purposes. Hand dug wells, rivers, surface water, and pipe water are the sources of water in the study area. Removing silts and other dirties deposited in to water by using different materials and hand. Others plant tree and grass to keep their freshwater resource from siltation, still others use cut off drainage and diversion ditch to keep their water resource from damage caused by land degradation. Integrated activities are required to minimize land degradation and fresh water.
Keywords: land degradation, fresh water, soil and water conservation, Essera

1. INTRODUCTION

1.1. Back ground

A water resource is vital to human life and economic well-being, and societies. Extract vast quantities of water from rivers, lakes, wetlands, and underground aquifers to supply the requirements of cities, farms, and industries. Freshwater resources ecosystems are important for global biodiversity and provide essential ecosystem services. Human activities such as pollution, habitat destruction, overexploitation and foreign plant and animal invasions are resulting in the ever-increasing loss of the freshwater resource biodiversity wealth. A natural and human induced change to freshwater resource biodiversity patterns is critical for efficiently conserving and managing these highly impacted ecosystems. Water is indispensable for all forms of life. It is needed in almost all human activities. Access to safe freshwater is now regarded as a universal human right (United Nations Committee on Economic, Social and Cultural Rights, 2003), and the Millennium Development Goals include the extended access to safe drinking water and sanitation (UNDP, 2006). Sustainable management of freshwater resources has gained importance at regional (e.g., European Union, 2000) and global scales (United Nations, 2002, 2006; World Water Council, 2006), and 'Integrated Water Resources Management' has become the corresponding scientific paradigm.

Freshwater is a vital, but limited, resource that is essential to life. Without sufficient, clean freshwater, human health, cultural health, the economy and agricultural output would all decline. Freshwater features such as rivers and lakes enhance the landscape, as well as providing an important resource for recreational activities such as swimming, freshwater fishing, and kayaking (Nigel Arnell, 2011).

During the next few decades, land degradation is expected to have major impacts on ecological (water, soil resources, social, economic, and political aspects of human society (Dale, 1997). Therefore, causes and consequences of human-induced deforestation and land use activities have largely been examined independently (Turner et al.,1993). Land use activity contributes to water pollution and soil erosion, and changes in land cover patterns are one way in which the effects of deforestation is expressed. Land use is the human modification of natural environment or wilderness to build fields, pastures, and settlements. The major effect of land use on land cover has been deforestation of temperate regions (IPCC, 2007). More recent significant effects of land use include urban spread out, soil erosion, soil degradation, solemnization, and desertification. Land use and land management practices have a major impact on natural resources including water, soil, nutrients, plants, and animals. According to a report by the United Nation Food and Agriculture Organization (FAO, 1995), land degradation has been exacerbated where there has been no effective land use planning, or of its orderly execution, or the existence of financial or legal incentives that have led to the wrong land use decisions, or one-sided central planning leading to overutilization of the land resources for immediate production at all costs. As a consequence, the result has often been misery for large segments of the local population and destruction of valuable ecosystems. Such narrow approaches should be replaced by a technique for the planning and management of land resources that is integrated and holistic and where land users are central. Land use effects on water and soil

erosion include both implications of land use change and its subsequent impact on water and soil, and the alteration of water resources and soil change impacts through land management. The direct ecological effects of land use and deforestation are dominated by the land use change effects, at least over a period of a few decades (Dale, 1997).

According to Getachew and Demele (2000), the most pressing environmental problems in the least developed countries are prevalent in rural areas, where the bulk of the populations live and whose livelihood depends on agriculture and related activities. Natural resource base (land, water and forest) is essential to the survival and livelihood of the majority of the people in Ethiopia. Environmental resource concerns are crucial for Ethiopia. The reason is that, there is a strong and direct link between the most basic needs of human beings such as food and shelter and natural resources in least developed countries like Ethiopia (Mitchel, 1991). However, this crucial resource is in the state of serious degradation: the problem manifest itself in the form of soil and water degradation and loss of biodiversity (Aklilu, 2006). Addressing the root causes of the reinforcing cycle of declining crop and livestock productivity, water resource degradation, high population growth and vulnerability among vast numbers of resource poor farmers is a crucial challenge facing Ethiopia today (Alemneh, 2003). Therefore, understanding the current status and causes of land degradation is very important (Girma, 2001).

Determining the effects of deforestation on land use involves resolving direct biophysical effects as well as management responses to water and soil recourse. The population density on given land use system links deforestation with soil erosion and facilitates their effects on water through land use of human activity. There are two aspects to considering impacts of land use: effects of land use on water and soil erosion. According to Turner*et al*., 1993, deforestation is a major concern in Ethiopia as studies suggest loss of forest contributes to soil erosion, loss of nutrients in the soil, loss of animal habitats and reduction in biodiversity and affecting of water quality. The vegetation resources and ecology of Ethiopia, including forests, woodlands and bush lands, conservation of soil, have been studied by several scholars who have employed different methods and have studied different localities to come up with conclusions.

1.2. Problem statement

In Ethiopia, environmental degradation and deforestation have been taking place for hundreds of years. Forest coverage, in the entire country, declined from 35% to an estimated 2.4% in 1992 (Sayer et al., 1992). The low level of living standard and illiteracy of the majority of the people coupled with lack of alternatives are the fundamental factors responsible for the decline in forest areas of Ethiopia. This is due to the increasing demand for crop and grazing land, and wood for fuel and construction (Taye Bekele *et al*., 2002). Moreover, new settlements in forest are increasing and have resulted in the conversion of forestland into agricultural and other land use systems (Kitessa Hundera and Bishaw Deboch, 2008). Conversion of natural forests into cultivated fields can affect water and soil. The cumulated results of these and related actions cause land degradation, which is a great risk for today's world to sustain natural environment. According to Dale, 1999.The ever-increasing deforestation, soil erosion and the associated problems of decline in soil and loss of water have resulted in making livelihood improvement a very challenging task to countries like Ethiopia that are highly dependent on agricultural and natural resource products. High population growth, land degradation and soil erosion, drought and associated famine, are reinforced resource depletion, poverty, and political instability.

1.3. Significance of the study

In spite of a generally good understanding effects of land degradation on freshwater biodiversity. However, there is no consistent, reliable inventory, well-studied and documented concerning effects of land degradation on freshwater biodiversity. This shows there is a scanty of detail study in the area. To fill the knowledge gap, this proposed senior research study examines the effects of land degradation on freshwater biodiversity.

1.3. Objective

1.3.1. General objective

To assess the effect of land degradation on freshwater and local communities participation in case Essera district.

1.3.2. Specific objectives

- To assess the effect of land degradation on freshwater in case Essera district.
- To assessing the exits of modern and indigenous methods of water resources management practices in case of Essera district.
- To assess the status of local communities participation towards water resources management practices in case of Essera district.

1.4. Research questions

1. What are the existing modern and indigenous methods of water resources management practices and measures in this area?

2. How do you evaluate (see) the challenges farmer face in practicing water management practices strategies on their farmlands?
3. How farmers perceive the cause and consequences of the challenge farmer face when they practice water resources management method?

2. LITERATURE REVIEW

2.1. Land degradation

Land degradation indicates temporary or permanent long-term decline in ecosystem function and productive capacity. It may refer to the destruction or deterioration in health of terrestrial ecosystems, thus affecting the associated biodiversity, natural ecological processes and ecosystem resilience. It also considers the reduction or loss of biological/economic productivity and complexity of croplands, pasture, woodland, water resources, forest, etc. Across the world, over 20% of cultivated areas, 30% of forests and 10% of grasslands are suffering from degradation, affecting about 1.5 billion people. This degradation may be the result of numerous factors or a combination thereof, including anthropogenic (human-related) activities such as unsustainable land management practices and climatic variations (BuzayehuTefere and Tariku Alemu, 2004). Note that degradation processes e.g. erosion do occur naturally, and are generally balanced by the rate of soil formation. However accelerated degradation is typically associated with human modification of the Environment. Degradation encompasses deforestation (tropical and temperate forests) and desertification of dry lands (arid, semi-arid and sub-humid regions). Underlying causative factors of land degradation, and environmental mismanagement in general, are poverty and undervaluing of natural resources. In both cases people focus on immediate economic gain irrespective of damage to the same resources they are dependent on. The latter in particular promotes inefficient use and wastage of resources.

2.2. Root Causes of Land Degradation

The impact of natural conditions especially periodic drought, inaccessibility of rural areas due to topographic constraints.

2.3. Causes of Water Resources Degradation

2.3.1. Population expansion

Population expansion combined with the adoption of inappropriate technology uncontrolled growth has times made up land livelihood unstable and insure the majority of upland in habitats migrates to town or the low land. This has eventfully led to adoption of many highly de graded water resources (FAO, 2007). According to research (FAO2000) water resources degradation often been attributed the high human population density increasing population particularly in the steep mountains out water resources are rapidly depleted the existing natural resources base, because the soil and vegetation system can no supported present level of land use. In sense, caring capacity of land is being exceeded as population continues to raise the pressure of forest land is in appropriate cultivation practices. Most rural inhabitants are depends on for their livelihood up on water resources and found on this lands miss use of water resources has related soil losses. Loss in productivity land deterioration, general environmental degradation and further improvement of the rural inhabitants themselves (FAO, 2007).On many water resources the procreative vegetation cover of the soil has been removed result on substantial soil erosion soil loss reduces soil water storage capacity which leads to more runoff water over the soil surfaces and even grater erosion rate. The result of these action have been increased flash flooding and shifting of stream channels causing water and soil to in agricultural lands irrigation structures reservoirs and plains. Stream flow during dry period becomes unreliable and insufficient for the prevention of disease maintenance of irrigation works and urban and industrial needs. When infiltrations rates of water into the soil are groundwater level often decline resulting in the failure of springs and wells.

2.3.2. Land use change

Land use change is an important factor which contributes to water resources degradation more over water resources is for growing stress from increasing human population in which the population changes the forest land to satisfy their need that leads to deforestation. Farmer using unsuitable agricultural practices contributed to massive soil loss through soil erosion sedimentation of drains and rivers and destructive flooding downstream (ESAPP 2006).It is one of approach which used to flood protection is to restrict land use on the flood plains so that flooding will cause no damage agricultural land recreational uses might be permitted as they would not obstruct the flow of flood water. The constriction of dwelling and other buildings could be damage by flood and would impede the flow of flood water may be prohibited (WRC, 1976).Improved agronomy practice like: crop cover .strip cropping, mulching, compositing etc increases the susceptibility of soil erosion (Tefere, and Alemu, 2004).

2.3.3. Sedimentation

Water from streams and rivers is used for drinking, irrigation, waste dilution, power generation, transportation,

and recreation and provides habitat for fish and other aquatic organisms (Allan, 1995). This water also contains sediment (e.g., eroded soil particles), which can be either suspended in the water or deposited on the bottom. Sedimentation is the process by which sediment is transported and deposited in water. In-stream sediments come from two sources: runoff from surrounding areas and erosion from both the sides and bed of the channel. The complex interaction of streams and the surrounding landscape can be characterized to a large extent by describing sediment movements. Erosion and sediment deposition affect many stream characteristics including channel depth, channel shape, substrate, flow patterns, dissolved oxygen concentrations, adjacent vegetation, and aquatic communities (Leopold et al., 1964; ASCE, 1992; OMNR, 1994; Rosgen, 2006). Sedimentation is a natural process that occurs in most aquatic ecosystems, and sediment-borne organic materials provide the primary food source for a number of filtering macro invertebrates (Waters, 1997). However, human activities such as urbanization, agriculture, and alteration of riparian habitat and flow regimes have increased the concentrations and rates at which sediment enters streams and rivers (Wood and Armitage, 1997; USEPA, 2000; Zweig and Rabeni, 2001; Angelo et al., 2002); and losses of habitat, biota, and ecosystem services due to sediment have caused severe socioeconomic impacts (Duda, 1985). As a result, sedimentation is listed as one of the most common impact of water resources (USEPA, 2000, 2004).

2.3.4. Shifting cultivation

Shifting cultivation is an important cause of deforestation this is practiced by cutting the forest and set the fire after drying the branches and tree trucks .Population increases and enforced shortening of follows period has to becoming human sustainable shifting cultivation is found in the hill area of the watershed that leads to the loss of value watershed due to erosion (Taigthiendsingh, 1983).It is still main stay of traditional farming systems over vast areas of the tropical and sub tropics. Estimation of the area under shifting cultivation is varying (FAO, 1982).Although the system is dominant mainly in sparsely populated and lesser developed areas. Where technological in puts for advanced agriculture such as fertilizers and farm machinery are not available, it is found in most part of tropics, especially in the humid and sub humid tropics of Africa (Grand stoff, 1980).

2.3.5. Erosion

Erosions normal geographic process that vary over time in response to land use changing, climate and site condition .erosion rate are usually minimal on undisturbed forest water resources however both surface and mass erosion can occur under deforested disturbance either naturally or human practices (Holisties, 1995).in fact weed and shrubs devoid of under grown which often with loss when grazing is unfrosted net necessary prevent soil.

2.4. Consequence of Water Resources Degradation

In nature, there is perfect balance and harmony between land vegetation and water. If we disturb this balance the consequence are serious for human and castle life over the last about hundreds of years ,and more so since the increasing places of developmental work is and steeps rise in population has led to large scale deforestation. These in turn increases intensity of drainage of rain water and excessive erosion of the land surface the drainage area of the rivers and streams known as water resources have been particularly where affected by this process this have result in excessive loss of top soil increase intensity of flood alarming lowering of ground water table and reduce in lean seasons low in river and stream this in turn has reduced availability of both and ground water causing the present water scarcity in many part of the country unfortunately in nature the degradation process continues unabated (Kiersch, 2000) and

(FAO, 2007) report shows water resources degradation has resulted in the loss of million farm land declining biodiversity and it has also causing billion of tone of sediment annually lodging up downstream reservoirs reduces the hydraulic of capacity of important river system and caused serious flood risk in the lower reaches water resources degradation has also several economic consequences as it leads to field from the crop lands, grass land, forest land, and consequently reduce income gain from the water resources and it increased also profound social consequence. It has reduced food security and increased healthy problem due to malnutrition pouted water and poor air quality. Lack of biomass for energy is another consequence around the study areas the supply of fuel wood decreased from the time to time due to exploitation of diverse plant species in the areas as result the community failed the problem of fuel wood shortages in genera's the major consequences of water resources degradation the results of this factors.

2.5. Trend of Water Resources

It is believed that Ethiopia has a total volume of 109 billion cubic meters of surface water and about $2.6M^3$of ground water. The western half of the country receives sustainable amounts of precipitation and has many perennial rivers and streams while the precipitation is marginal in the eastern half of the country according to (Renault d. *et al*, 2OO1) Because of the progressive land degradation that is taking place at present, the amount of water leaving the catchments carrying away soil with it must have increased ever than before. Hence, the amount of available water in situ has been reduced particularly in the eastern half of the country.

3. METHODS AND MATERIALS

3.1. Description of the Study Area

3.1. Study area description

This study was carried out in Essera Woreda of Dawuro zone, which is located between 6.7-7.02^0 latitude and 36-37.1^0 longitudes. Essera Woreda with its capital at Bale town is situated 575 km south of the capital Addis Ababa. The district has a total area of 1043 km^2 and is divided in to 29 kebeles. The altitude of the district ranges from 501-2500 meters above the deal level. The area receives an average a new rainfall of about 1600.5mm and has an average annual temperature ranging from 17.6 to 27.5^{0}c mixed farming system is main economic action practiced in Essera Woreda Agricultural and Rural Development office (EWARDO, 2013). The cattle population of Woreda is 54,800.

3.2. Sampling Size and Sampling Procedures

Essera district was selected using purposive sampling technique because of the extensive problems of effect of land degradation on freshwater biodiversity and local community's participation. The study was conducted using a combination of qualitative and participatory methods of data collection, including formal and informal interviews, semi-structured interviews; Key informant interviews (KI) as well as focus group discussion (FGD) with elderly people, model farmers, DA$_s$ and other concerned government bodies. This study conducted by using rural households as ultimate sampling unit as indicated sampling method. In such a way that households in selected kebeles were selected randomly.

3.3. Method of Data Collection

The study was employed both primary and secondary data source. Primary data was collected from personal interview transect walking, and direct observation of the study area. The study data was collected through key informant interview and questionnaire.

3.3.1. Secondary Sources

These were including information from natural resource office, other stakeholder office and review of different written document reports.

3.3.2. Key informant interview

The key informants defined as individuals who are knowledgeable about impacts of land degradation on water and soil resources of Essera district, in current situation and who are knowledgeable about its status of change and who know the major impacts that affects the resource and that have live continuously in the area for a long period of time and more years, and are willing to be interviewed.

3.3.3. Questionnaire

Questionnaires developed to generate sufficient information from household by interviewing around individual people for this study by the questionnaire. People who have more knowledge about the Kebeles the subjects and the data were collected with key information or assistance. After completion of data collection in some village of selected kebeles from different agro ecological zones, the information was checked together with key information's.

3.3 Method of Data Analysis

Microsoft excel 2010 was used for analyzing data and generating tabulated reports and charts. Tabular and categorization method was used as a method of data analysis for qualitative information.

4. RESULT AND DISCUSSION

4.1. Descriptive Analysis

This chapter presents the survey data and interpretation of the analytical findings. Of the 80 sample respondents all reported that they have participated in the conservation of some soil and water conservation activities in watershed management practices and they have hint about what land degradation is other than female household heads. However, the degree of adoption differs widely between households. As we discussed with the farmers erosion is one of the problems to decrease their production so this is as a problem to solve those problems discuss with our group members how to solve such a problem and also with development agents.

4.2. Demographic Characteristics

From the sample of 80HH, the result indicates that 79% of the heads of household are male. These household heads include a wide range of people, village elders, decision makers (local administration), younger people, older people, poor farmers and rich farmers. Out of the total sample households in the study area, 21% of the household heads are women, who are single, widowed or divorced. No female household heads had almost adopted SWC practices. During discussions with women headed households the main reasons why women headed households are not involved in the participation of SWC practices are that female heads have limited

access to the information and that other socio-economic issues related to traditional social barriers limit women's resources.

4.3. Education Status of Household

Table 1 Educational status of household heads

Educational status	Frequency	Percent
Illiterate	22	28.0%
Write and read	13	17.0%
Primary school	40	50.0%
Secondary school	5	7.0%
Total	80	100.0%

Sources: Field survey (2017)

From the survey results, better-educated households have more realistic perceptions about soil erosion problems and more knowledge related to SWC and hence can more easily be involved in conservation activities. From discussion with key informants, with respect to educational status of households educated farmers have positive attitude in soil and water conservation activity.

4.4. Age Status of Households

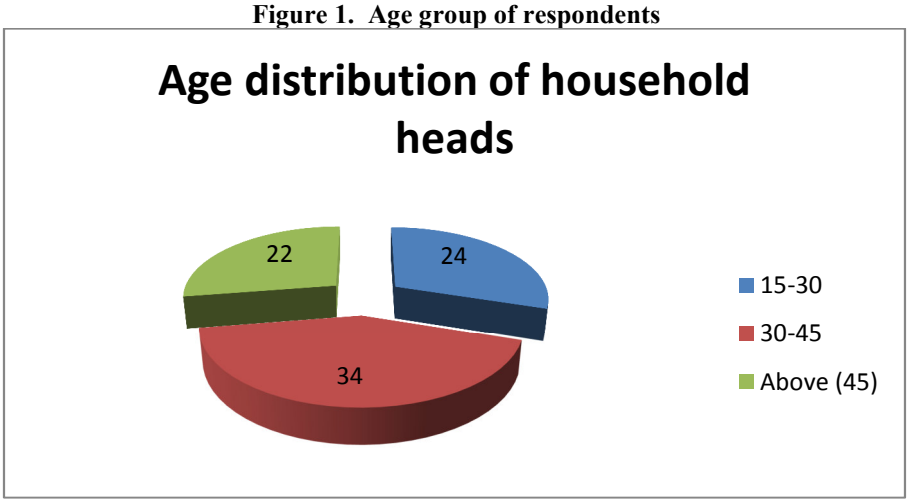
Table 2 Age distribution of household heads

Ages	Frequency	Percent
15-30	24	30.0%
30-45	34	43.0%
Above (45)	22	27.0%
Total	80	100.0%

Sources: Field survey (2017)

Three age groups of family members were identified as it can be seen from table and figure.

Figure 1. Age group of respondents



4.5. Perception and Attitude of Farmers

Perception of soil erosion as a hazard to agricultural production and sustainable agriculture is the most important determinant of participatory integrated watershed management practices. When interview with, those farmers who perceive soil erosion as a problem on their lands and have negative impacts on productivity and when farmers do not understand soil erosion as a problem, they do not expect benefits from controlling erosion and as a result their productivity decrease they decide against adopting any conservation technologies.

Thirty sixteen percent of the sample farmers believed that overgrazing was the most important cause of soil erosion followed by 24% of the farmers who considered that deforestation caused the most erosion. Interestingly, only 12% found that cultivation of steeply sloping land was the most important cause.

Table 3 the perceived major causes of soil erosion and their ranks

	Ranks and percentage of responses (n=80)							
Causes of soil degradation	1s	2nd	3rd	4th	5th	6th	7th	8th
Deforestation	15		17	30	4	6	0	0
Over grazing	5	20	28	22	6		2	0
Over cultivation	29	14	9	7	19	2	0	0
Poor agricultural Practices	50	10	5	14	0	0	0	1
Cultivation of steep slopes	48	12	0	0	9	1	3	7
Excess rain fall	21	30	20	8	1	0	0	0
Poor gov't policies	0	0	0	0	0	0	1	0
Others	0	0	0	0	0	0	0	6

Table above presents farmers' awareness and perception of the erosion problem in the study kebeles (Manara kebele from low land altitude below 1200 m above sea level, Hageli 02 kebele from midland altitude between 1200 - 1800m above sea level, Gudumu kebele from highland altitude above 1800m above sea level). All of the surveyed farmers (100%) indicated that soil erosion was a problem in their farm. Almost two thirds of the farmers observed that erosion had increased over the past 5 years. The opinion of the farmers on the impact of soil erosion on farm production was almost evenly divided between severe and moderate Comparing the number of respondents who rated the impact of soil erosion on farm production as 'smaller' to the number of respondents who rated the intensity of erosion as 'severe', it can be stated that the link between soil erosion and decline in land productivity may possibly be ambiguous to the farmers. Additional evidence to this assumption is the explanation given by the farmers during informal discussions about decline in fertility levels of their lands. They generally agreed that there had been a decreasing trend in fertility levels of their plots of land, but that was attributed to immature of the land due to overuse, and erosion was rarely mentioned. In general terms, it can be concluded that the farmers were well aware of the problem of soil erosion.

Table 4 Farmers' perceptions of soil erosion hazards

Perception on erosion	Proportion of total Respondents (%)
Whether soil erosion was perceived as a problem in own farm	
– Yes	100%
- No	-
Severity of the problem, if yes to the above question	
– Severe	2%
- Medium	31%
- low	67%
Observed change in soil erosion severity over the past 5 years	
- Has become more severe	-
- Has become less severe	100%
- No change	-
Extent of impact of soil erosion on farm production	
– Severe	18%
- Moderate	61%
- Has no effect	21%
Believing that soil erosion can be controlled	
- Yes	53%
- No	47%

From the sampled households70% of respondent farmers believed that erosion can be controlled hence, their lack of interest to adopt the introduced SWC measures cannot be explained by a lack of awareness about the problem and the potential for solving it. The most of the farmers had indicated soil erosion as an important agricultural problem, yet the majority again was willingly participating in the construction of different bunds. In the study area the majority of farmers were well aware of the problem of soil erosion.

4.6. Farmland Characteristics

4.6.1. Land Size and Distribution

Land in the study area is scarce mainly due to population pressure. The farm size varies between 0.25 and 3.75 ha (Table 7). The majority of farmers' land size was from 1 to 2 ha (Table7). Average land holding for the sample households is 1.8 ha in upstream area and 1.9 ha in the downstream area. Because of the small farm size, fallow lands are not common and there is also a shortage of grazing land. Limiting fallow land loses an

opportunity to increase soil fertility and reduce soil loss from erosion.

Table 5 Distribution of sample household heads by land holding

Farm size (ha)	Number of farmers	%
Up to 1	22	27
1 to 2	34	43
2 to 3	16	20
3 to 4	8	10
>4	-	-

Sourses: Field survey (2017)

4.6.2. Slope, Fertility, Soil Color and Degree of Erosion

Interviewers together with respondents classified each farm plot into flat (<6%), gentle slope (6-15%) and steep/mountainous (>15%), which require different types of soil conservation measures to reduce soil erosion. The physical characteristics of farm plots are indicated in Table 8. Of the total plots, only 12.8% are flat. This implies that according to soil and water conservation experts about 87% of the farm plots require conservation of one kind or another, in addition to volunteer flat land conservation practices. Respondents have also classified their own plot fertility into three categories: low, medium and high. A total of 42 farm plots divide into 17%, 68% and 15 % low, medium and high fertility respectively (Table 8). The farmers identified general soil colors: 87 % black, and 12 % sandy. Farmers usually consider black color soils as fertile in the study area. This may affect farmers' decisions on conservation because they want to take better care of fields that give better yield.

Table 6 : Distribution of farm plots by slope category, level of fertility, soil color and degree of erosion

	Description	Number of plots	
		Frequency	%
Slope category	Flat (< 6%)	11	26.2
	Gentle (6 - 15%)	29	69
	Steep/mountainous (>15%)	2	8
Fertility	Low	13	31
	Medium	19	45.24
	High	10	24
Soil color	Red	35	83
	Black	3	7.14
	Brown	0	0
Degree of erosion	Low	31	74
	Medium	9	21.4
	High	2	4.7

Source Field survey, 2017

4.6.3 The sources of fresh water

The nature of sources of water supply is the water sources which provide water for the community and for the individuals at required place and time. The following table shows the major sources of water supply in study area.

Table 7 Sources of freshwater supply in study area

Item	respondents	
Sources freshwater in study kebeles	Number	percentage
Spring	29	36.8
Hand Dug wells	9	10.5
River	9	10.5
Surface water	4	5.3
Pipe water	29	36.8
Total	80	100%

Source Field survey, 2017

The above table shows that the natures of sources of fresh water for drinking and other purposes. Based on the responses from the respondents 29 respondents said that spring is the source of water for drinking and other purposes 9 said that hand dug wells are sources of water, 9 said that rivers are the source of water, 4 said that surface water is used as sources of water, 29 said that pipe water is the source of water. From this it is possible to conclude that the major source of water is not pipe water, but the naturally available water. Most of people of study kebeles use freshwater from the above water sources.

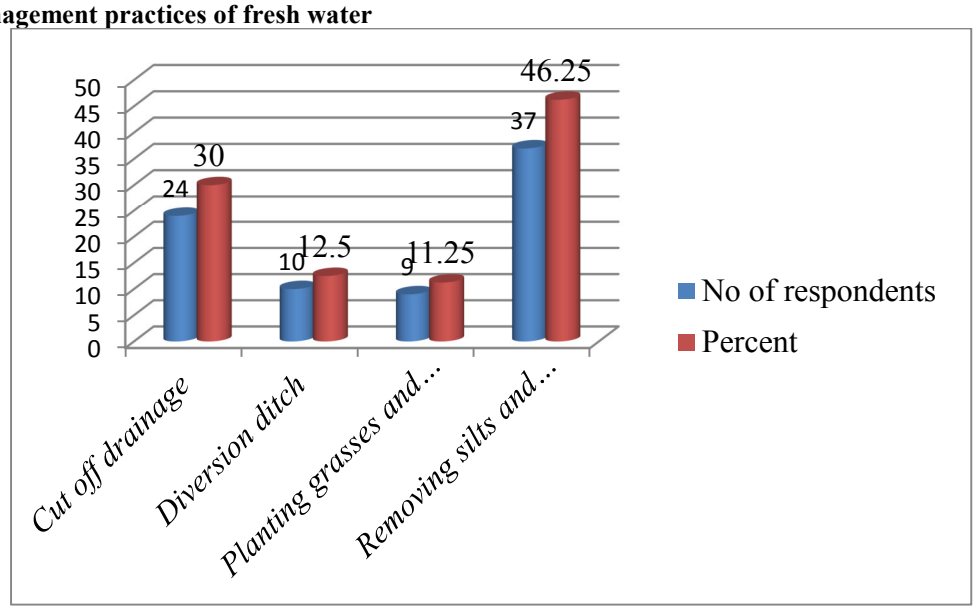
Table 8 Trend of freshwater resource

Trend of freshwater resource	Number of respondents	Percent
Decreased	43	54.12
Increased	17	21.18
Remain the same	20	24.7
Total	80	100

Source: Field survey, 2017

As it can be seen from above table the trend of fresh water resource in study area is being decreased from time to as most respondents said. As their response land degradation have adverse impact on freshwater by silting fresh water as result shortage of water for drinking, bathing, irrigation, Recreation and others. As discussion with Woreda and Kebele experts of natural resource management the fraction of farmland that is irrigated has grown rapidly. Expansion of irrigation using water pumped from non-renewing or incompletely renewing underground stores temporarily increases the amount of water available for agriculture, but eventually the subsurface reservoirs will be depleted, reducing the water available and increasing the amount of energy that must be expended in raising it to the surface. And as the idea rose during these key informants, land degradation is jeopardizing small living things in water that have great ecological value

4.6.4 Management practices of fresh water



As above figures show most farmers use Removing silts and other dirties deposited in to water by using different materials and hand. Others plant tree and grass to keep their freshwater resource from siltation, still others use cut off drainage and diversion ditch to keep their water resource from damage caused by land degradation.

4.7. Soil and water conservation practices in the area

Various major soil and water conservation practices (traditional and improved) have been identified by the local development agent in the study area within the previous two years. Farmers in the area were exclusively practicing traditional methods. Thus, the use of "improved" soil and water conservation measures is a recent development.

4.7.1. Traditional and newly introduced SWC practices

Until recently, soil and water conservation practices without technical knowledge have been ignored or underestimated by development agents; however, surveying both traditional and improved soil and water conservation practices provides an understanding of farmers' way of thinking about the interventions (Hudson, 1992). To prevent land degradation, especially soil erosion, farmers use a number of improved soil and water conservation technologies. These technologies include application of manure, traditional and newly introduced cut-off drains, plantation of both traditional and newly introduced trees, stone bunds, leaving crop residues in the field and fallowing on the farm.

4.8.1.1. Cut-off drains

The survey results show that almost two thirds of the 42 sampled cultivated land(ha) had few traditional practices and more improved cut-off drains (or both). The farmers construct these drains to prevent loss of seeds, fertilizers, manure and soil due to water flowing onto the plot from uphill. The excess water is disposed away from the field**.** However, according to farmer opinions, most of the drain structures enhance soil erosion

through time. As we seen with key informants cutoff drain practiced or implement on their erosion affected lands because implementing the fertility of their land increased time to time.

4.8.1.2 Leaving crop residues

Another traditional practice common in the area is leaving crop residues on the field after harvest. Area farmers are generally not attempting to use crop residues to improve the fertility of soil. The survey results showed that most of the users are implementing this measure in order to protect the soil from erosion. During the transect walks with the farmers, there were only small amounts of crop residues visible in farm plots. Key informants indicated that the farmers had serious fuel wood and animal feed shortages and therefore gradually used the crop residue for off-plot purposes

Most of the farm households in the area, especially women members, collect crop residues from the field for animal feed and fuel wood. Similarly, research conducted by Tilahun (1996) found that farmers in kebele removed all crop residues from their fields and used them in their livestock pen or home garden. Some of the residues from cereals (wheat, barley and teff) and legumes (haricot beans and pea beans) are stored in the home compound and sold as fodder or used to feed livestock during the dry season.

4.8.1.3. Contour farming

Contour farming is a practice of cultivating the land along contours of equal elevation in order to reduce the runoff on lands with a slope over 6%. It is used alone or in combination with other conservation practices such as cut-off drains and plantation of different trees. Of the sampled plots, 45% had contour farming and although the farmer was aware of the soil and water conservation function of contour farming. In addition to this, it was implemented during land preparation before planting season because their ploughs the land for preparing an appropriate seedbed for production.

4.8.1.4. Fallowing

Fallowing is one of the best methods to reduce soil fertility loss (Hudson, 1992). In the study area, fallowing is restricted to highly degraded lands which cannot be restored within a short period of time. In most cases only stones are found on these lands. Only 8% of the surveyed plots were fallowed. During discussions with the farmers it was learned that through time, the traditional fallowing periods are practiced less and less as a result of the increasing population pressure and decreasing agricultural productivity.

4.8.1.5. Application of manure

Application of manure was used on more plots than any other conservation practice, 67% of the total. Farmers applied manure near the homestead, rather than to land at a distance. Based on focus group discussions with key informants, farmers have increased the amount of manure applied because of the high price of inorganic fertilizers (such as DAP and UREA) which the farmers cannot afford.

4.8.1.6. Plantations

Trees and other non-crop plants are planted on 66% of the surveyed plots sometimes together with other conservation practices. During the transect walks, trees and other plants such as sisal were observed to be planted along the contour in order to reduce runoff and conserve the soil and water around the root of the plants. In general these plants are drought tolerant, not edible and therefore not destroyed by animals in the area. Another advantage is that farmers use these to mark the border between adjacent fields.

4.8.1.7. Soil bund practices

About 61% of the surveyed plots included soil and stone bunds. During focus group discussions with key informants, it was learned that farmers are well aware of erosion problem in the area. Moreover, they agree that bund terraces are effective in protecting the soil. The newly introduced SWC measures, stone and soil bunds, were widely acknowledged as being effective measures in arresting soil erosion and as having the potential to improve land productivity. Nevertheless, due to the top-down approach (haven't participation of Development Agents with local farmers), adoption of these new soil and water conservation practices by the farmers appears less likely (Mitikuay H, Karl H., Brigitta S., 2006). During discussions with key informants in each of the study areas, the farmers mentioned that ineffective designs by the development agents are responsible for causing gullies.

Farmers use mostly soil/stone bunds that are impermeable intended to maintain all rainfall but when overtopped at one location will cause gullies unless they have specially designed spillways and protected soils below. These structures are better suited for semi-arid and arid parts of the country than in the high rainfall areas. This is in line with a study conducted by Belay (1992) in southern Ethiopia which concluded that farmers are willing to conserve their soil and water but demand more appropriate technologies, and that poorly designed practices can be the major cause of erosion in areas treated with SWC. Key informants indicated that the farmers were not aware of this SWC practice. Other farmers using this type of structure explained that the advantage of fanyaju terraces is that it changes gradually into a bench terrace, does not need too much maintenance, and decreases the speed of runoff more than a soil bund. This is consistent with findings of earlier studies in southern Ethiopia. Tegene (1992) reported that the farmers considered the introduced soil and fanyajuu bunds as inappropriate technologies because they occupy cultivable area, and they harbor rats and other rodents.

4.8. Perceived Benefits from Conservation

Farmers were asked to rate the conservation measures on the basis of soil deposited. More than half of the respondents considered the increase in soil deposition to be major benefit, while 22% indicated that conservation structures improve soil fertility. Clearly one expects the increase in soil deposit and added fertility to ultimately contribute to enhance yield. But yield enhancement as a result of conservation was seen as a major benefit by only 12% of the respondents. Farmers were also asked to compare the introduced conservation measures with the traditional ones. 85% of the respondents indicated that introduced conservation practices perform better in retaining soil from being eroded than the traditional ones. Whereas only 12% of the respondents considered that local practices are better we indicated farmers rationally judge an innovation based on their perception with regard to its attributes.

4.9. Situation of Soil and Water Conservation Practices of the Study Area

The investigators observed the prevalent soil and water conservation measures in the study area. There are different conservation structures constructed on the individual farmers land holding and outside the farm lands. Commonly observed conservation structures are traditional methods. Modern conservation structures are mainly constructed on the fragile lands outside of cultivated and grazing lands. According to the reports of farmers the construction of modern soil conservation measure locally known as *'tefases'* (modern soil conservation structure) took place by the government through campaign. Furthermore, according to the report of woreda's or district's Agriculture and Rural Development, the farmers are resistant of adopting SWC structures since they assumed that the structure consume their lands. Mainly the farmers of steep slope area are highly resisting the experts' design of 'tefases' constructions. Because as the steepness of the slope increase the gap between the structures are expected to close to one another which result the occupying of their land by the structures.

4.10. Assessment of Indicators and Severity of Soil Erosion on the Farm Land

Even if all farmers perceive problem of soil erosion on their land, their attitude towards its severity shows great variation on the surveyed watershed. This may be due to the variation of factors and their intensity affecting soil erosion. As indicated on the details regarding Farmers' Household profiles, land holdings and occupations, the socio- economic condition of the farmers in all surveyed area is more or less similar but there are certain physical feature variations. Therefore, the investigator decided to analyses the perception of the farmers on the severity of soil erosion on their farm land according to their respective kebele. According to them, gradient influences the decision of farmers that the farmers at the steep slope always practice conservation due to the severity of soil erosion.

5. CONLUSION AND RECOMMENDATION

5.1 Conclusions

The problem of land degradation could not be solved without addressing the socio-economic problems of the area. Demand based technologies; people's participation, effective conservation, education and sense of ownership are the key elements essential for the sustainable management of natural resources. Simple and low cost technologies are more acceptable for farmers rather than expensive and labor intensive conservation techniques. Farmers need technologies which they can easily understand and implement on their farms with minimum cost.

Participatory water resources management processes in the Save Catchment must be based on shared knowledge. Stakeholders should work towards building grassroots organizational and financial capacity.

Participatory, integrated watershed management presents many challenges to research and development actors. To move forward here, it is important to take a systematic look at the tasks and skill base required to operationalize PIWM, and the degree to which existing institutions can be mobilized to fill the gap. Funding for action research and social learning approaches to test new types of institutional arrangements and linkages (partnerships) can be starting point from which broader experiences are drawn and strategies formulated. Another key challenge lies in forging stronger linkages between research and development, so that development (community or organizational facilitation) is linked to and given at least equal status as research, and action research given equal weighting as more conventional empirical research. For this, university training, institutional mandates and incentive systems, and opportunities for social learning at local and institutional levels must be given close consideration if the integrated mandate embodied in PIWM (Participatory Integrated Watershed Management) is to be enabled.

Expansion of irrigation using water pumped from non-renewing or incompletely renewing underground stores temporarily increases the amount of water available for agriculture, but eventually the subsurface reservoirs will be depleted, reducing the water available and increasing the amount of energy that must be expended in raising it to the surface. And as the idea rose during these key informants, land degradation is jeopardizing small living things in water that have great ecological value.

5.2. RECOMMEMDATION

- The approaches to expansion of SWC structures should not be top-down and coercively. It should be participatory and depend on the indigenous knowledge of the farmers.
- Sustainable and participatory soil and water conservation structures must be developed to reduce degradation and achieve the productivity of the eroded land
- It is important to enhance farmers' awareness on the indicators of soil erosion in addition to physical conditions of their land. Even if farmers have good perception of prevalence of soil erosion in their farm land, they attached its existence mainly with what they can observe physically such as rills and gully formations.
- Farmers have good awareness on trends of soil erosion over time which they underline the causes with shortage of land due to rapidly growing population size. However, they have no intention for livelihood diversification and other methods of coup upping with the problems of land fragmentations. Therefore, it is advisable if the concerned body intervene to encourage farmers' awareness of reversing the problems and adopt any other ways of livelihood.
- Any policy and program aimed at land resource management in general and soil and water conservation in particular has to give due attention and priority in training and mobilizing farmers that help in raising their perception and awareness level so as to manage and use the land resource in sustainable way.
- Government or NGO's should provide alternative source of fuel (Electricity, Natural gas etc.), so that natural vegetation and crop residue would be saved and used for soil and water conservation.

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