ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES DEPARTMENT OF REGIONAL AND LOCAL DEVELOPMENT STUDIES

THE ROLE THE CURRENT NATURAL RESOURCE CONSERVATION PROGRAM THROUGH MASS MOBILIZATION TO PREVENT LAND DEGRADATION PROBLEM IN ETHIOPIA. THE CASE OF EFRATANA GIDIM WOREDA, IN NORTH SHOA ZONE, AMHARA REGION.

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A THESIS TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN REGIONAL AND LOCAL DEVELOPMENT STUDIES.

Addis Ababa University

School of Graduate Studies

This is to certify that the thesis prepared by Demiss G/micheal entitled: "The role of the Current Natural Resource Conservation Program through Mass Mobilization to prevent Land Degradation problem in Ethiopia: The case of Efratana Gidim Woreda in North Shoa Zone Amhara Region" and submitted in partial fulfillment of the requirements for the Degree of Master of Arts in (Regional and Local Development Studies) complies with the regulation of the University and meets the accepted standards with respect to originality and quality.

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ACRONYMS

ANRS	Amhara National Regional State
BoA	Bureau of Agriculture
CEDEP	Consultants for Economic Development and Environmental Protection
CIA	Central Intelligence Agency
CSA	Central Statistical Agency
DA	Development Agent
EFAP	Ethiopian Forestry Action Plan
EGS	Employment Generation Schemes
EHRS	Ethiopian Highland Reclamation Study
FAO	Food and Agriculture Organizations
FDRE	Federal Democratic Republic of Ethiopia
FRA	Forest Resource Assessment
GDP	Gross Domestic product
GEF	Global Environment Facility
GLASOD	The Global Assessment of human induced Soil degradation
IBC	Institute of Biodiversity Conservation
ILRI	International Livestock Research Institute
Kg	Kilo grams
Km	Kilo meter
MEA	Millennium Ecosystem Assessment
MoA	Ministry of Agriculture
MoFED	Ministry of Finance and Economic Development
MoI	Ministry of Information
NDUI	Normalized Difference Vegetation Index

NGOs	Non-Governmental Organizations
NSMA	National Meteorological Service Agency
OoARD	Office of Agriculture and Rural Development
OoWNRC	Office of Woreda Natural Resource Conservation
PA	Peasant Association
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
RLDS	Regional and Local Development Studies
SCRP	Soil Conservation Research Institute
SSA	Sub Saharan Africa
UNCCD	United Nations Conservation to Combat Desertification
UNDP	United Nation Development Program
UNEP	United Nation Economic program
USAID	United States Agency for International development
USD	United States Dollar
USLG	Universal Soil Loss Equation
WB	World Bank
WFP	World Food Program
WRI	World Resource Institute

Translation of Amharic Terms

Ato	In Amharic, a title of an adult person that replaces Mr.
Goit	Sub Locality
Kebele	Locality
Kola	A tropical type of zone
Woina Dega	A warm temperate type of zone
Dega	Cool temperate type of zone

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ABSTRACT

In Ethiopia for the last 8 year starting from the eve of Ethiopian millennium the government of Ethiopia has launched SWC and Environmental rehabilitation works to prevent land and Environmental degradation using massive movement of the people. Land degradation in the form of soil erosion in Amhara region in general and in the study woreda in particular has reached the point where it will became increasingly difficult even to maintain the present level of production of basic food which is already insufficient in many woredas of the region.

Based on this rationale, the primary objectives of this research was to assess the role of the current massive natural resource conservation work towards preventing land degradation in the form of soil erosion by identifying cause and consequence of the problem, type and extent of the change, implication of the change and causes of the positive change in the study area.

The study employed simple random and stratified random sampling methods for data collection and analysis. household survey, focus group discussion, key informant interviews and review of secondary sources were used as major data collection methodologies. Field observation to observe the contribution of the current massive natural resource conservation work and to see the changes on the ground by comparing the data and photos which are documented in the woreda were also takes place. Descriptive statistical method (mean, percentage) and qualitative analysis were used as methodological tools.

The findings of the study revealed that the current massive natural resource conservation program intervention have greatly contributed to the protection of the expanding land degradation problem in the study woreda. Similarly, the communal and farm land conservation, gully rehabilitation, practice of different type of conservation works on selected areas, changing type and source of feed for animals, the rules and regulation which is seat by the local community to protect conserved areas from human and animal, the awareness creation program which is given by DAs, woreda sector offices and model farmers (ginbar kedem ariso aderss) have played a vital role in curbing land degradation and sustaining the livelihood of the poor which could have not possible in the absence of these intervention. In addition to these the extent of the current massive conservation work, the positive change what they seen on their farm land and PAs, the benefit what they gain from conserved areas also motivated the local community in the study area to accept the program and to participate voluntarily for 45 days per year as a public work in the selected areas and all over the year on their private farm land.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Ethiopia is a country which is located in the Horn of Africa between 3^0N-15^0N and 33^0E-48^0E, with a total area of 1,106,000 km^2. The population estimated over 88 million with the annual growth rate of 2.6 per year (CSA, 2008, CIA, 2009). Ethiopia is the second most populous country in Sub-Saharan Africa next to Nigeria. In land area it is the 10th largest country in Africa and 25th in the world. Although the whole of Ethiopia lies within the tropical altitudes, the climate is cool in the high lands and warm in the low lands. The annual range of temperature is relatively small because of proximity to the equator.

Agriculture is the dominant economic sector on which the vast majority of the Ethiopian population directly or indirectly depends for livelihood. It accounts for 47% of Gross domestic product (GDP), 80% of the employment and 60% of the export commodity (World Bank 2011). The agricultural sector is characterized by a subsistent mixed farming, which derives the majority of rural livelihood from land resources. In spite of this, however, land degradation and its associated deterioration of physical, chemical and biological features of the land and its resulting loss in productivity are the major features constraining the agricultural sector (Lakew, 2003).

The economy of Amhara region, like that of the nation, is mainly based on agriculture; it is the principal source of livelihood for about 91% of the population (MoFED, 2002) and account for about 70% of the regional GDP. Although agriculture is one of the sole sources of livelihood for the million in the region, land degradation severely constrains agricultural production and productivity. The topography of the region is very rugged, dissected and mountainous which aggravate the problem of soil erosion. As a result, the region becomes one of the areas where critical food shortages and recurrent drought and famine are severe.

The highlands of the Amhara region suffer from severe land degradation. Annually a considerable area of crop land comes out of crop production due to degradation caused by soil erosion. According to the ANRS (1999), 1.1 billion tones of soil are lost from the region each year by soil erosion. About 42.3% of this soil loss caused by soil erosion comes from 10% of the regional area. Similarly 28%, 33%, and 29% of the regional area that contribute to 38.95%, 17.3%, and 1.5% of the total soil mass moved by soil erosion were categorized under high erosion, moderate erosion, and minimum erosion hazards. An

overall 70% of the region's land suffers from high water erosion. Among others, overgrazing, deforestation and inappropriate agricultural practices account for most of the observable land degradation phenomena.

Due to inherently good soil and relatively abundant rainfall, the high lands (>1500m altitude) have a good agricultural potential. These high lands constitute of 43% of the country's land mass but account for 95% of the cultivated area, and support about 88% and 75% of the human and livestock population respectively (Bekele and Holden, 1999).

Land degradation results primarily from un proper land use and land management (Blum et al; 1998). Similarly, most studies in Ethiopia have also support this idea and put the causes of land degradation as proximate and underlying causes. The proximate causes of land degradation are deforestation, over grazing, burning of dung and crop residues and limitation replenishing soil nutrients through external in puts. On the other hand, the hypothesized underlying causes encompass population pressure, poverty, limited capital, and land tenure insecurity and land fragmentation, limited access to infrastructure, information and market (Lakew, 2003, Fitsum et al; 1999, Pender, 2002).

In Ethiopia, soil erosion is the most visible form of land degradation affecting nearly half of the agricultural land and resulting in soil loss of 1.5 billion tons annually, equivalent to 35 tons per hectares and monetary value of US $ 1 to 2 billion per year (Hurni, 1989). Though annual soil loss estimates differ among studies, the country has been described as one of the most serious soil erosion areas in the world with a national estimated average soil loss of 42 tons per hectares per year (Bekele 1998). It can be even higher on steep slopes with a soil loss rate greater than 300 tons per hectares per year (USAID, 2000).

Large scale deforestation and removal of vegetation cover of the country is one of the direct causes of soil erosion and land degradation in Ethiopia in general and Amhara region in particular. According to estimation made by Ethiopian Forestry Action Plan (EFAP, 1994), approximately 160,000 to 200,000 hectares of forest are lost each year mainly for the expansion of rainfed agriculture and also for fuel wood and through over grazing.

The other direct causes of soil erosion and land degradation is the increasing livestock density and the associated over grazing on both arable and grazing lands that have serious impact on the land vegetation cover (Dejene, 1998); shortage of feed due to over stocking

and expansion of cultivation has also forced households to divert crop residues to feeding livestock and burning as fuel. This probably has reduced both nation's production capacity and agricultural productivity by about 10 to 20% below potential and 2 to 3% respectively (Hurni, 1989).

Forests and the benefits they provide in the form of wood, foods, income and watershed protection play critical role in enabling people to secure a stable and adequate food supply. Land degradation; however, is impairing the capacity of forests and the land to contribute to food security and to provide other benefits such as fuel wood and fodder. Ethiopia is facing rapid deforestation and degradation of land resources. Population increase have resulted in extensive forest clearing for agricultural use, over grazing and exploitation of existing forests for fuel wood, fodder and construction materials which are the cause of land degradation.

To reduce these problems rural afforestation and conservation programs on farms and community land have been practiced in Ethiopia for the past three decades. The ministry of agriculture, in collaboration with national and international organization, has made effort to implement agro-forestry and community tree planting programs. Rural tree planting on farm and community lands was identified as the most important area of international development. In addition, the United Nation Development Program, in consultation with the food and agricultural organization (FAO), has been helping Ethiopia to promote tree planting and soil conservation programs in the high lands since the early 1970_s (Badeg Bishaw, 2009).

The cumulative effects of all these would jeopardize the sustainability of traditional farming system and adversely affect the household food security position of the country in general and the Amhara Region in particular.

This study is; therefore, aimed to make significant contribution to show the role of the current massive natural resource conservation program in preventing land degradation in the form of soil erosion problem in Amhara region North Shoa Zone, Efratana Gidim woreda.

1.2 Statement of the problem

Understandings of the concept of natural resource are diverse. According to Gilpin (1996) "it is any portion of the natural environment such as the atmosphere, water, soil, forest, wild life, minerals and environmental assets generally". It is the back bone of every economy directly or indirectly. In particular, for developing

countries like Ethiopia, where about 85% of the populations are living in rural areas and dependent on agriculture, natural resources are the base for economic development, food security and other basic necessities (Alemneh, 2003).

As the different research findings reveal, the rate and extent of natural resource degradation is appalling. For instance, according to Zenebe (2007) "20% of the Ethiopian highlands are in a seriously eroded condition and a further 24% in moderated erosion condition. The annual soil loss due to erosion is estimated at between 1.3 and 3 million tons, 10% of it is carried away irretrievably by streams".

However, the last two decades have witnessed a paradigm shift in conservation and natural resource management away from costly state centered towards approaches in which local people play a much more active role. These reforms purportedly aim to increase resource user participation in natural resource conservation decision and benefits by restructuring the power relations between central state and communities through the transfer of management authority to local level.

In Ethiopia, community participation in development process is traced back to the 1974 drought episode when farmers were mobilized to soil and water conservation activities with food for work. But this was not successful because of recurrent drought, state violence and stifling political system of the derg regime. The current government has shown the political will to involve the community in development and support their initiative and "devolve" power to the woreda level (Addis, 2005).

The need to involve community members in development interventions has many advantages. Participation of community in local development programs insures the incorporation of the preference and values of different groups of community; improve accountability, transparency and commitment of stakeholders; and provide poor people more influence over their own lives (World Development Report, 2001). Moreover, it helps to empower different groups of a community by promoting their participation in the selection, design, implementation, maintenance and management of development programs. In addition, particularly to rural development programs, participation of primary stake holders improves adaptation of innovation, enable wider coverage and promote understanding of problems, built local capacity, better target beneficiaries, help increasing sustainability, and improve the status of women (Karl, 2000).

In Ethiopia natural resource development and conservation practices have long history mainly supported by external financing with food or work or cash for work approaches. After such long period of intervention, the impacts created on the environmental rehabilitation and improving the livelihood of the communities are not remarkably high as it is to be. Many argue that this has happened as a result of the flawed approach followed in the development process. The communities who are the main actors of the process, despite benefited in terms of cash or food were not taught and convinced of the long term impacts of the implementation on their livelihoods. The development process was not as such an integrated and holistic in nature. It only focused on the achievement of the physical structured with the pretext of conserving fertile soil. In recent years, the emergence of environmental issues has drawn attention worldwide to the necessity of promoting social knowledge, awareness and skills as one means to support sustainable development and poverty reduction. This has led to a growing commitment of different stakeholders to raise general awareness of their communities towards the challenges occurring as a result of natural resource degradation. However, there remain disparities between the ambitions to raise the level of public awareness and creation of ownership in the proper management and use of natural resource (WME Reports, 2010).

Therefore, raise the awareness levels and implementation capacity of communities is of crucially important. Public awareness in natural resource rehabilitation, conservation, development and wise use or management is the process by which communities who are most affected as a result of resource degradation understand the nature and interlinks with their livelihoods and their potential for mitigating and development by their own initiative for sustained period of time. Awareness-raising is the keystone for the achievement of such objectives. People need to know about the interrelationships between their livelihoods and natural resource depletion. Communities have to understand the possibilities of reversing the current alarming condition of natural resource degradation. Whatever the underlying reasons for the resource degradation, it would be important to identify effective way of informing and sensitizing communities about the causes and the solution if he right measures could be taken on time and long lasting. Raising the awareness of the community is a means to increase contact dialogue with people and to improve society's understanding of sustainable resource management (WME Report, 2010).

In response to high resource degradation particularly soil erosion, to mitigate the problem and enhance or maintain the production

potential of agricultural land the government of Ethiopia has taken different measures such as policy intervention, conducted studies, and implemented massive soil and water conservation (SWC) specially the launch of the current massive natural resource conservation program all over Ethiopia and capacity building program. The current massive natural resource conservation program specially SWC were implemented in most regions of Ethiopia largely in drought affected areas. All the above measures were practiced to reduce soil erosion, to restore soil fertility, to rehabilitate degraded lands, to improve micro-climate, to improve agricultural production and productivity and to restore environmental condition. However, land degradation was still serious due to different political and socio-economic reasons.

In the past a number of research were done towards the importance of natural resource conservation practices but most of the research have gaps to show the contribution of mass mobilization in conservation work and the positive changes which is occur due to the presence of the program. In addition to these some of the researches also contradict each other. Some of the research reported that the inefficiency of SWC measures to reduce soil erosion problem (Bewket, 2007, cited in Shimeles, 2012). On the other hand, the research on the same topic indicated that the positive contribution of SWC to the reduction of soil erosion, conservation of soil moisture and restoration of vegetation cover and diversity (Mekuria et al, 2007). So, in order to fill the information gap and to support the country's effort in combating land degradation problem my work which is only focused on land degradation problem in the form of soil erosion assessed the contribution of the current natural resource conservation problem through mass mobilization to prevent land degradation problem have a paramount importance.

1.3 Objectives of the study

The general objective of the study is to explore the contribution of the current natural resource conservation program through mass mobilization to prevent land degradation problem and to see the changes which is occurred due to the presence of the conservation program in the study area.

Specific objectives

1. To identify the causes and consequences of land degradation in the study area.
2. To identify the contribution of the current natural resource conservation program through mass mobilization towards preventing land degradation problem in the study area.

3. To identify the causes of positive change and to see the current situation of recovered lands in the study area.
4. To identify the implication of the change in terms of benefit in the study area.
5. To identify the structural setup of the woreda how they practiced the conservation program in the study area.

1.4 Research question

In order to meet the objectives set, the following study questions were raised.

1. What is the contribution of mass mobilization for natural resource conservation work to prevent land degradation problem in the study area?
2. What has changed by the current natural resource conservation work through mass mobilization in the study area?

1.5 Significance of the study

The findings of the study will help the woreda to recognize its strength and weakness on the community involvement in natural resource conservation program through mass mobilization in the woreda and to seek a better approach. It will also allow other governmental organization, non-governmental organizations (NGOs) and developmental partners to learn as to how to practice natural resource conservation works through active mass mobilization for development. The government can also draw lessons on the effective decentralization and participatory development at woreda, kebele and goit level.

More over the findings will also contribute in providing some information for any interested party on how Efratana Gidim woreda is trying to participate the community in the natural resource conservation program voluntarily on the study areas. It may inspire other potentials researchers interested in the issues of roles of natural resource conservation activities through mass mobilization (community participation).

1.6 Limitation of the study

In undertaking of this study, there were some limitations that appeared to be barriers which assumed to affect the findings of the study. Due to a number of reasons like budget and time the study was conducted only in three kebeles and 90 sample respondent farmers. Moreover, since the question related to the study was serious, the quality of the information gathered from sample farmers through

structured questionnaire were attitudes of the people, depends on the willingness, recalling capacity and knowledge of the respondents which have its own effect on the findings. In addition, the study does not use statistical package for social science (SPSS) to analyze the data collected by household survey. Even though these were some of the limitation of the study the result of the findings can show the severity of land degradation and the role of natural resource conservation program through mass mobilization to prevent land degradation in the study area.

1.7 Challenges faced

Bureaucracy- it was a problem to get secondary data from different offices in Addis Ababa, even after having a letter from Addis Ababa University, RLDS department. In some offices you have to go door to door to an official sign or will have an appointment by the secretary for some other day. However, woreda sector offices, kebele official and DAs are so cooperative.

Time- to get any data from different offices it is normal to go twice or three times on appointment to have permission from official in order to get information, data and to use libraries. This put visible pressure in terms of budgeting the time.

Data- some woreda offices have no written, well organized data or report rather you read from charts put on the walls, or they may go around and look for report papers and collect data and give you after days but they provide you with contradictory information or data for an issue.

Finance- the financial constraints forced the researcher to limit the number of sample kebeles in to 3 PAs from the total of 19 PAs. However, it would have been better if other PAs from all agro ecological zones included in the study.

Accessibility- the physical features and the scattered type of settlement had been a problem of using a means of transport. In the dega and w/dega zone of sample kebeles there is no regular transportation system. Even though the transport system which is irregular may be available for 2 or 3 days per week but the number of the passenger will be out of the capacity of the vehicle. Furthermore, due to the topographic features of the area and condition of the road (which is gravel) to all PAs kebeles except Jewiha and Karakore makes the transportation system highly difficult. However, me and the 2 enumerators used to walk from kebele to kebele and from goit to goit

to collect data and information from those of dega and w/dega zones. This has significant impact on both finance and time.

1.8 Organization of the thesis

This thesis is organized in to five chapters. Chapter one constituted the introduction part, which gives back ground information on land degradation, statement of the problem, objectives of the study, significance of the study, limitation of the study, challenges faced and organization of the paper. Chapter two, deals with reviews of related literature which have relation to land degradation. Chapter three contains short description of the study area and methodology (data source and its method of data collection, sampling techniques and method of analytical techniques). Chapter four presents the result of discussion and findings. Chapter five presents the main conclusion in relation to the objectives of the study and it also forwards key recommendation. Other essential matters like research questionnaire are also annexed.

1.9 Definition of key terms

Deforestation- Deforestation is the reduction of biotic resources and lowering of productivity capacity of forests through human activity.

Indigenous soil conservation- refers to local practices or techniques, which have been adopted by the farmers since long time ago as distinct from the newly introduced or modern techniques imposed from outside (Zenebe, 2000).

Land degradation- it is defined as the loss of utility or potential through the reduction of or damage of physical, socio cultural or economic features, and reduction of ecosystem diversity. There may be a single cause or a complex mix of causes (Head Worth and Steines, 2003). According to UNEP (1992), cited in FAO 1994) Land degradation is the temporary or permanent lowering of productive capacity of the land.

Soil conservation- includes all forms of human action to prevent and treat soil degradation (IIED, 1998).

Soil degradation/soil erosion- soil degradation is caused by natural and human factors. According to Old man et al (1991) soil degradation is a process that describes human induced phenomena, which lower the current and future capacity of the soil to support human life. In general sense, soil degradation could be described as the deterioration of soil quality, or in other words the partial or entire loss of one or more functions of the soil.

Soil and water conservation technologies- they are the sum of practices involved in managing soil and water in agricultural setting and they also include agro-forestry, agronomic and tillage practices (Reij, 1991). It is an attempt to reduce the effect of soil erosion on land degradation process. By means of biological, mechanical and chemical measures it is hoped that the rate soil loss can be kept under control, thereby, reducing the loss of mineral and organic matter, combating selective erosion and stabilizing crop yields.

Participation- according to World Bank (1996) participation defines as a process through which stakeholders' influence and share control over development initiatives, the decision and resources which affect them.

CHAPTER TWO

LITRATURE REVIEW

2.1 DEFINITIONS

2.1.1 Definition of natural resource conservation

Natural resource conservation is a specific concept and action for realizing environmental sustainability and biodiversity conservation. Strong emphasis is placed on how natural resource management affects the present and future generation's quality of life. It requires balancing the needs of people and economy with the ecosystems that directly and indirectly support them.

Natural resource conservation has specific boundaries, such as national, regional, district and community, in which properly planned resource management helps to improve the quality of life of those who reside within such boundaries. Ecosystem and biodiversity loss, deforestation, land degradation, shrinking fresh water supplies, air and water pollution, and global warming represent only a few example of the on-going process of environmental degradation and continuous decline in natural resources. This trend has been observed and documented environmental assessments over the past few decades (Millennium Ecosystem Assessment, 2005).

Concurrently, there has been a growing recognition that the social consequences and economic costs associated with such processes disproportionately affect the world's poorest people. The world's poorest are heavily reliant on natural resources for their livelihoods and, as a result, they are extremely vulnerable to both natural disasters and environmental hazards. The decline of natural system through soil depletion, deforestation, over exploitation, and pollution represents a direct threat to nature based income and is a contributor to increasing poverty (World Resource Institute, 2005).

In addition, much of an ecosystem's goods and services, on which the poor (particularly those in developing countries) rely so heavily, come from public commons such as communal range lands, state or community forests, coastal waters, rivers, and lakes over which no individual can claim exclusive rights, as they fall under a multiplicity or different public or community ownership regimes. Some of the governce issues that prevent sustainable use of natural resources are lack of legal ownership and access, political marginalization and exclusion from decision making processes.

2.1.2 Definition of land degradation

Land degradation is defined differently by different authors. Some regard it as a synonyms of soil degradation (Stocking and Murnaghan, 2002), while others explain the difficulty to define it because of its wider range and scope (Barrow 1997). According to the United Nation Conservation to Combat Desertification (UNCCD), land degradation is defined as a natural process or a human activity that causes the land to be unable to provide intended services for an extended time (FAO, 2004). The history of land degradation is as old as the human civilization, and has resulted in irreversible impacts in some cases. For example, the Atacama Desert once was a jungle (Kelley 1983). At a global scale, agriculture land lost due to degradation is estimated at about 40% out of which agricultural land in developing countries accounts for the larger portion (FAO, 2004). Developing countries, especially in SSA, have been losing large tracts of land due to this problem (Nana-Sinkam 1995; Scherr 2000; Vlek et al. 2008).

2.2 The global impact of land degradation

Land degradation has multiple and complex impacts on the global environment through a range of direct and indirect processes affecting a wide array of ecosystem function and services. An analysis from the scientific literature of the severity and importance of these impacts suggests that the process linkages may be graded according to the degree of sensitivity involved and the certainty of the impacts creating a dangerous condition consequent up on land degradation. The clearest and best researched linkage is between land degradation and climate change. Land degradation interrupts the regulating and provisioning services of ecosystems, in particular nutrient cycling, the global carbon cycle and the hydrological cycle. Sustainable land management critically depends up on the efficient functioning of these cycles. For example, carbon pools in soil and above ground vegetation, particularly forests, are very large but easily disturbed. They are affected by unsustainable land management practices and by the type of land degradation that is prevalent (e.g water erosion, deforestation, soil compaction). Estimates of historical contributions of agriculture to atmosphere CO_2, the amounts and rates of carbon lost as a consequence of deforestation and conversion of land to agriculture and other soil vegetation atmosphere carbon fluxes, all suggest that land degradation has had a very significant impact, through raising atmospheric CO_2 concentration, on climate (GEF, 2006).

With regard to biodiversity, ecosystems provide the habitats for all living organisms. Disruption to ecosystem functions inevitably diminishes the diversity of above and below ground biodiversity, as

well as affecting aquatic life. The potential impact of deforestation on above ground biodiversity is especially large and well documented. Impacts of other forms of land degradation on biodiversity are less clear with effects on below ground biodiversity likely to be the most severe. In the international water focal area, international fresh water basins are critically linked to the status and function of terrestrial ecosystems. Pollution of these basins as a consequence of land degradation is common and the processes are well understood. In marine ecosystem, coastal zones are the most susceptible to pollution-related impacts arising from land degradation. There is evidence of global impacts as large stretches of coast can be affected, extending to reef and large marine ecosystems. There is growing interest in the impact and importance of land-derived dust deposits to ocean systems but this is an area of considerable uncertainty (ibid).

A contamination of water, ecosystems and food-chains by pesticides applied to or accumulating in soil is the best verified impact linking land degradation with persistent organic pollutants. Soil erosion contributes to this contamination but other processes, not considered as land degradation, are also involved; e.g normal drainage of water through the soil, the accumulation of soil derived populations by growing plants destined for food or feed (ibid).

However numerous indirect impacts on the global environment occur through impacts on human society. Any impact on a community that affects wealth, livelihoods, food supply, health, education, resistance to disease or migration will also affect a community's ability to manage the environment sustainability (ibid).

2.3 Overview of land degradation in eastern Africa

The total population of sub- Saharan Africa (SSA) is currently estimated at about 750 million (UNDP, 2005), but this is projected to grow past the one billion mark by 2020 (ibid). The region is the poorest in the world, with an estimated one in every three people living below the poverty line. The demand for food is putting greater pressures on the natural resource base. Assessments of land degradation in the region vary in methodology and outcome (Stoosnijder, 2007; Lal and Stewart, 2013). Based on expert opinion, concluded that in the early 1980s about 16.7of SSA experienced serious human induced land degradation (Yalew, 2014).

The data from the FAO 67% (16.1 million km^2) of the total land area of SSA as degraded (FAO, 2000); with country to country variations. These differences are quite large; Ethiopia is the most seriously affected (25% of territory degraded) while Kenya and Tanzania records

15% and 13%, respectively. Malawi is the least affected (9%). These figure for Tanzania (13%) is quite low compared to a later study (Assey et al; 2007) based on expert opinion that showed about 61%of the territory affected by land degradation. Research results shows that about 25%, 14%, 13% and 9% of the land area is degraded in Ethiopia, Kenya, Tanzania and Malawi respectively (table 1).

Table 1. Land Degradation Severity in Eastern Africa

Country	Land area (%) affected by degradation					Total degraded area (%)
	none	lightly	moderately	severely	Very severely	
Ethiopia	75	0.3	12.7	2.1	10.4	25.4
Kenya	85	1.0	3.9	5.7	4.1	14.6
Malawi	92	0.1	8.4	0.0	0.0	8.5
Tanzania	87	2.5	5.4	5.2	0.4	13.4
SSA	83	0.96	3.4	5.1	7.3	16.8
Global	83	1.4	4.1	6.8	4.4	16.7

Source: - Adopted from FAO, 2000

Most economies in SSA are agriculturally-based and about two-third of Africans depend on agriculture for their livelihoods. In this region, most farmers are small holders with 0.5 to 2 ha earn less than US $1 a day, face 3-5 hunger months, have large families and are malnourished. The fate of the agricultural sector, therefore, directly affects economic growth, poverty alleviation and social welfare in Africa. As the region's populations continues to grow rapidly (3% per annum), out pacing the growth rate in other regions of the world, the carrying capacity of its agricultural land is becoming lower, bringing closer the land frontier. Extensification on to marginal and quality poor lands has reached upper limits and, when farmers do intensify land use to meet increasing food and fiber needs, they do it without proper management practices and with little or no external in puts. Resulting consequences are a lowering of soil organic matter in already poor soils, a depletion of nutrients that have contributed to a stagnation or decline of crop production in many African countries. In some cases, the rate of nutrient depletion is so high that even drastic measures, such as doubling the application of fertilizer or manure or halving erosion losses, would not be enough to offset nutrient deficits.

Unless African governments, supported by the international community, take the lead in confronting the factors that causes nutrient depletion and land degradation, deteriorating agricultural productivity will seriously undermine efforts to bring about food security and to strengthen the foundation of sustainable economic growth in SSA. Agricultural productivity and food security in SSA are being seriously threatened by the steady decline in soil fertility, define as "a net decrease in available nutrients and organic matter in soil" (Scherr, 1999), and caused by the continued nutrient mining of already degraded soils by farmers seeking to increase output. Declining soil fertility jeopardizes the sustainability of farming systems in SSA, especially in arid and semi arid areas that are ecologically fragile. Highly variable and declining rainfall patterns observed since the 1970s compound the ecological fragility of these regions which account for half of the cultivable land in SSA (Marter and Gordon, 1996). Brady, 1990 estimated only 12% of Africans soils to be "moderately fertile, well-drained soils," compared to 33% in Asia. Batjes, 2001 report that degraded soils amount to about 494 million ha in Africa. It is also estimated that 65% of SSA's agricultural land is degraded because of water and soil erosion, chemical and physical degradation (Oldeman et al, 1991; Scherr, 1999). Forms of degradation vary with the causative factor: loss of top soil terrain deformation, mass movement or over blowing (water and wind erosion) loss of nutrient and organic matter, salinization/alkalization, acidification, pollution (chemical deterioration). Of the total degraded area, over grazing, agricultural mismanagement, deforestation and over exploitation of natural resources are said to account respectively for 49, 24, 14 and 13% (Oldeman et al, 1999; Batjes, 2001).

Through overgrazing, deforestation and inappropriate agricultural activities, it poses a serious threat to land productivity. Response to declining productivity has been the abandonment of existing degraded pasture and cropland and the move to new land for grazing and cultivation. Unless there are investments in soil conservation, the process will repeat itself in a vicious circle with overgrazing and cultivation causing land degradation, and then the search for new pasture and crop land (Barbier, 2000).

2.4 Causes and consequences of Land Degradation

Land degradation is the result of complex interaction between physical, chemical, biological, socio economical, and political issue of local, national or global nature (Taffa, 2002). On the other hand Blume conclude that land degradation results primarily from incorrect land use and bad land management (Blum et al; 1998). Similarly,

most studies in Ethiopia have also strengthened this thought and put the cause of land degradation as proximate and underlying causes. The proximate causes of land degradation are deforestation, overgrazing, burning of dung and crop residues and limitation of replenishing soil nutrients through external inputs. On the other hand, the hypothesized underlying causes encompass population pressure, poverty, limited capital, land tenure insecurity and land fragmentation, limited access to infrastructure, information and market (lakew, 2003).

The complex interlink age between poverty, population growth and environmental degradation offer another dimension to land degradation problem (Dasgupta and Maler, 1994). The direct and indirect causes of land degradation are linked by chain of causes and effect called vicious cycle/causal nexus. Limited land resources and increased in rural population are the two external or deriving forces for poverty. Land shortage and poverty, taken together, lead to non-sustainable land management practices which are the direct causes of land degradation.

Theoretically, there are two types of views about population according to FAO (1986): Neo-Malthusians argue that population pressure has resulted in land scarcity, fragmentation of land holdings, reduction of fallow periods, shifting crop patterns, accelerated conflicts and competition over land use and environmental land degradation. On the other hand some argued population growth as a stimulus for agricultural intensification and environmental recovery. According to Boserup (1961, cited in Grepperud, 1994) as land becomes increasingly scare, farmers adopt cultivation practices and input to pressure and improve their land. Increasing labour- land ratios determine the path of technical change, leading to the mix of technology and new inputs associated with improved land management.

According to Pender et al, (2003), population pressure contributed to soil erosion and lower crop productivity in the high lands of Uganda. Gete (2000) also reported that human population is increasing at a frighteningly high rate and the productive capacity of soil resources necessary to sustain that population is steadily decreasing because of land degradation. Efforts to reduce population pressure in the high lands may produce both increases in agricultural productivity and reduce land degradation.

The Ethiopian High land Reclamation study (EHRS, 1985) concluded that population has been an important cause of erosion. Rapid population growth has brought several changes; farm holdings have

become smaller due to constraints in land availability; farm holdings are becoming more fragmented; farmers are cultivating fragile lands (marginal land); fallow periods have become shorter with longer cultivation periods. As a consequence of this intensive farming soil fertility has been declining and increased the high incidences of soil loss due to erosion. More of the original vegetation cover of the land is removed, and new, less fertile land is brought in to agricultural production. New cultivation practices introduced to deal with increasing needs for food may not be well adapted to the local environment and may have harmful long-term consequences on the resource base. Livestock production may intensify as well, increasing the risk of over grazing and making land more susceptible to soil erosion (Grepperud, 1994). Land shortage due to population pressure and poverty create incentive to dismantle conservation structure (Bekele and Holden, 1998).

According to Hurni (1994), soil erosion, wind erosion and physical and chemical deterioration are processes responsible for land degradation and further he indicated that soil erosion by water and wind account for about 84% of all the damage. He has also indicated that 28% of all types of soil degradation at the global level are caused by cultivation, and 35% by overgrazing and 29% are related to deforestation. Thus, land degradation is caused in more than 92% of all cases by a variety of agricultural uses.

Many of sub-Saharan countries are among the poorest in the world and the farming populations constitute both the majority and the poorest segments of these societies. Poverty may lead to inability to invest in land conservation and the survival strategies may be detrimental to the natural resources bases (ILRI, 2000). The combination of low economic growth, rapid population growth and environmental degradation imposes a self-reinforcing vicious circle which worsens poverty and environmental deterioration unless concerted effect is made to promote economic worthening and to deal effectively with the problem of land degradation.

Poverty is very likely to contribute to land degradation for many reasons. When people lack access to alternative source of livelihood, there is a tendency to exert more pressure on a few resources that is available to them. Bekele and Holden (1997 and 19198) showed the intensified pressure on the natural resource as a vicious circle in which household assets in turn affect degradation in the Ethiopian high lands. Better markets access and some credit, technical assistance program have helped to reduced land degradation and poverty (Pender et al, 2001).

2.5 Land degradation and poverty in Ethiopia

Agriculture is the dominant sector of the Ethiopian economy, with 85% of the population living in rural areas. Agriculture provides about 47% of the Gross Domestic Product (GDP), 80% of the employment and 60% of the export commodity (World Bank 2011). Ethiopia's economy is largely dominated by subsistence agriculture, and crop and livestock farming are the principal practices. Mixed farming dominates the high lands, with crop and livestock farming practiced in the same management unit. The production system is mainly rain fed, subsistence based and smallholder oriented.

Crop such as barley, teff, wheat, and beans are grown in the higher altitudes, while sorghum and maize are the principal crops in the mid and low altitudes. In addition, coffee, sweet potatoes, chat, various vegetables, fruits, and groundnuts are extensively cultivated. Cattle, sheep, and goats constitute the livestock in the high lands. Population pressures have decreased the size of land holdings, including both arable and pasture lands, leading to conversion of forested and marginal areas in to agricultural lands (Hoekstra, Torquebiau, and Bishaw 1990 and Bishaw 1993).

Soil degradation in Ethiopia can be seen as a direct result of past agricultural practices in the high lands. The dissected terrain, the extensive areas with slopes above 16% and the high intensity of rainfall lead to accelerated soil erosion once deforestation occurs. In addition, some of the farming practices with in the high lands encourage erosion. These include cultivation of cereal crops such as teff (Ergrofis tef) and wheat (triticum sativum) which require the preparation of a finely tilled seed bed, the single cropping of fields, and down slope final plowing to facilitate drainage. Furthermore, sociopolitical influences, especially insecurity of land and tree tenure, have discouraged farmers from investing in soil conservation practice.

Soil degradation is thus the most immediate environmental problem facing Ethiopia. The loss of soil and the deterioration in fertility, moisture storage capacity, and structure of the remaining soils all reduce the country's agricultural productivity. Soil erosion is greatest in on cultivated land, where the average annual loss is 42 tons/ha, compared with 5 tons/ha from pastures. As a result, nearly half the soil loss comes from land under cultivation, even though these lands cover only 13% of the country. Not surprisingly, the highest average of soil rates of soil loss are from formerly cultivated lands that are currently unproductive because of degradation and little productive vegetative cover (Hurni 1990).

The status and rate of soil erosion in Ethiopia call for immediate action to retard and reverse this degradation process. However, the present population growth rate of 2.6% in comparison with the annual agricultural growth rate of 2.4% (Hammond 2001), will lead to even more intensive use of cultivable and pasture land to produce more food and feed for the growing human and livestock population. Hence, it is clear that intensification of land use must be accompanied by technological innovations that will lead to increased productivity, while simultaneously conserving the soil resource.

Most of Ethiopia's crop-growing high land regions utilize rain-fed agricultural practices that rely primarily on the intermittent and unreliable rainfall patterns. As a result, food production suffers from the adverse effects of climate variation and frequent drought, which have been affecting the nation for a number of decades. The food crisis in Ethiopia traces its origin back to the 1980s. At that time, famine led the majority of the rural population in to absolute poverty. By the 1990's poor economic policies and management(under the command economic system), prolonged civil war and recurring drought left the economy in a deep crisis followed by a severe loss of productive capacity, increased food insecurity, and social crisis (MoFED, 2002).

It is evident that when a natural resource base is not managed for the long-term, and is exploited and polluted for short-term gain, it will cease to provide the fuel for economic development to alleviate poverty (WRI, 2005). This is true in rural Ethiopian farmlands, which are exploited beyond their productive capacity to support subsistence farming. For this reason, the country continues to rely heavily on the world food program (WFP) life line (Brown, 2009). It is recognized that the continued life-sustaining function of ecosystem goods and services depends on the speed at which they can be restored. In this vein, economic growth and development are inconceivable without a conscious understanding and choice to efficiently utilize, conserve, and manage the ecosystems and the services they provide.

Throughout history, drought has forced rural Ethiopians to move from high land areas to the low lands where land is relatively abundant, resulting in large-scale resettlement that were planned and implemented in a state of urgency (MoI, 2001). Following the down fall of the imperial government of Hailesilassie in 1974, the military regime (commonly known as the Derg) proclaimed a radical land reform, nationalizing privately owned and rural lands in 1975 (Jemma, 2004). Nevertheless, the reform did not improve the local economy and livelihood of poor farmers (peasants) as their land holdings were very small with no reliable tenure securities. In

addition, the era was marked by recurring drought and famine that claimed the lives of millions of rural Ethiopians.

One of the major obstacles affecting local economic growth in Ethiopia is land degradation. Given that agriculture is so crucial in supporting the country's economy through food production, the decline in the productivity farm lands threatens the very livelihood of rural Ethiopia where the majority of the poor reside. As the severity of land degradation increases, desertification takes precedence, characterizing the greater proportion of agricultural lands. At present, key component problem in land degradation include loss of vegetation cover and biodiversity, escalating soil erosion, siltation, declining soil fertility, expanding salinization, and soil compaction, as well as aridity through hydrological cycle disruption (MoFED, 2006). Despite the fact that the country is endowed with diverse flora and fauna species, the rapid growth of population has also resulted in over exploitation and severe depletion of the natural resource base that the rural populations rely on for survival. In addition, in adequate economic policies of the Derg regime have deepened poverty, widened in equalities, and forced rural people to exploit biodiversity at rates that are no longer sustainable, bringing about serious implications on the nations agro-ecosystems (IBC, 2005).

2.6 Land degradation and its impact in Amhara region

Land degradation in the Ethiopian high lands (i.e areas above 1500m a.s.l.) has been a concern for many years. Soil erosion, nutrient depletion and deforestation are common, but little has been done to determine its impact on productivity.

Loss of arable land due to soil erosion is widespread phenomenon in the high lands, which account for about 45% of Ethiopia's total land area and about 66% of the total land area of the Amhara Region. On steep hill sides, soil losses of and exceeding 200t per ha per year have been recorded (Kappel, 1996).

Soil erosion by water is the dominant form of erosion. The areas that are severely affected can be found in Waghemra and North Wollo followed by North and South Gonder, Eastern parts of South Wollo and Northern parts of North Shoa Zones. The soil depth in these places is very shallow soils. Gullies are a frequent and permanent phenomenon everywhere in the region. According to CoSAERAR (1997), kobo, Gubalafto and Habru woredas (all of North Wollo) have lost 3700 ha of their 284,950 ha total land area to gullies. In addition to reducing cultivable area, soil erosion and gully formation and

expansion reduce the water holding capacity of the soil and, consequently, result in poor crop yields.

The Ethiopian High Land Reclamation Study (EHRS) has developed a 1:1,000,000 scale soil loss rate map, which shows the types of soil degradation processes, causes, severity and extent. The map is based on the universal soil loss equation (USLE) and soil erodibility and use maps. EHRS assesses the national soil loss rate as 'moderate to high', which is estimated at 30-100t/ha per year (Wright and Yeshinegus Adamseged, 1986). Depending on land use practices, however, the real rate is claimed to be < 2 to > 300t/ha per year (ibid). Based on the EHRS calculation, the region's soil loss rate is estimated at about 58% of the national rate (BoA, 1997; CEDEP, 1999). Thus, given that the spatial coverage of the region is only about one-sixth of the nation, the soil loss rate per unit area is very high in the region, compared with other region. The USLE over estimates net soil losses, since it accounts for erosion off plots above but not sedimentation on plots below. Therefore, the net soil loss may be significantly lower than estimated and, consequently, needs to be interpreted with caution. For example, the soil conservation research project (SCRP) estimate (Dawit Kebede, 1996). The soil loss from crop lands in the high lands of Amhara is much less than that estimated by the EHRS. The table below shows that about 29% of the total area of the region experiences a high erosion hazard (between 51 and 200t/ha per year) and 31% exhibits a moderate erosion hazard (16-50t/ha per year). Although, the highest soil loss rate (>200t/ha per year) occurs in only 10% of the region, it is estimated that this countries almost 50% of the total soil mass that is moved (CEDEP, 1991).

Table 2. Estimated erosion hazard classes in Amhara Region

Erosion classes	Range of soil loss rate (t/ha per year)	Area coverage	
		ha(10^3)	Percentage (%)
Very high	>200	1660	10
High	51-200	4796	29
Moderate	16-50	5284	31
Slight	0-15	5020	30
Total	9-300	16,760	100

Source: - Abegaz Gizachew (1995)

Excess removal of forests is contributed to land degradation. For example, based on population growth (demand) and forest increment (supply), the region recorded a deficit of about 16.6 million cubic meters of wood for fuel and construction in 1996 alone (BoA,1997). About 20 thousand hectares of forests are harvested annually in the Amhara region for fuel wood, logging and construction purposes. Since harvested trees are not replaced adequately by tree planting, soils are exposed to high intensity of rainfall and about 1.9 to 3.5 billion tones of fertile top soil are washed away annually in to rivers and lakes due to deforestation alone (BoA, 1997).

2.7 Soil erosion and its consequences

Soil erosion is both natural (geological) and through human induced processes caused by two agents, water and wind. Geological erosion occurs under natural conditions, where the soil loss is positively balanced by soil formation that indicates net gain (El-Swaify 1997; Kaihura et al.1999). However, soil loss due to accelerated erosion is very much higher than the soil gain through parent material weathering. Water erosion is a common phenomenon in humid environments but is increasingly an issue in semi-arid regions due to the increased incidence of intense storms. Wind erosion predominantly occurs in arid and semi-arid areas (Dregne 1990; Nana-Sinkam (1995). Erosion is a major challenge particularly in SSA countries (Nana-Sinkam 1995).

Ethiopia is one of the SSA countries most severely affected by the problem, and water erosion is prominent. Water erosion mainly occurs in the high lands, which have erratic rainfall generating erosive runoff (Hurni 1993). Various studies provided empirical evidence of the severity of the problem. For example, the Ethiopian high land reclamation study (EHRS) estimated 1.9 billion tons annual top soil loss from the high lands due to water erosion, which is equivalent to 8mm soil depth or 130 tons/ha annual losses. The study also indicated that out of the total high lands, 50% was significantly eroded, 25% was seriously eroded, and 4%had reached a point of no economic use (FAO, 1986). Hurni (1993) also reported as much as 300 tons/ha annual soil loss from crop lands with average rate of 42 tons/ha. Similarly, Herweg and Ludi (1999) estimated a higher than 110 tons/ha annual soil loss from farm lands without terraces.

On the other hand, the annual soil formation of the Ethiopian high lands is estimated to be between 2 and 22 tons/ha and varies with geologic and climatic conditions, topographical setup and agricultural practices (Hurni 1983). Soil erosion varies with soil types (erodibility) and erosive factors like slope of the land (length and steepness),

rainfall characteristics (volume, intensity and duration), soil cover and land management (Prasannakumar et al. 2012). Among the soil type, luvisols and nitosols were found to be most vulnerable to water erosion, while vertisols and phaeozems were less vulnerable (Herweg and Ludi 1999). The same study indicated that rainfall erosivity and very high erosion rates were observed in high rainfall areas. This is in line with the estimation by Prasannakumar et al. (2012) using a universal soil loss model. This indicates that in the Ethiopian high lands, soil formation is much lower than the erosion rate. Due to erosion; farm lands in many parts of the high lands have shallow soil depth and poor fertility (Shiferaw and Holden 1999; Ciampalini et al. 2008). The traditional agricultural practices and in appropriate land use have aggravated the erosion processes (Tamene et al. 2006; Ciampalini et al .2008; Nyssen et al. 2009). The impact of soil erosion is complex leading to reduction in soil depth and moisture storage capacity together with soil –nutrient losses, and ultimately results in reduced agricultural production and productivity (Vancampenhout et al. 2006). Soil erosion is a threat not only to agriculture but also to the economy, as the country's economy depends on agriculture.

2.8 Bio-Physical condition and economy of Ethiopia

Ethiopia has adverse geographical set up, and as a result it has a wide range of bio-physical conditions such as geology, water resources, soils, climate and biodiversity (Tefera et al. 1996; Hurni 1998; Awulachew et al. 2007; Coltorti et al. 2007). For example, the country has geological formations of three categories namely sedimentary, volcanic and metamorphic rocks (Tefera et al. 1996). The topography ranges from depressions below sea level at Danakil to high mountains like Ras Dashen and other land forms such as plateaus, plains and valleys (FAO 1984; Tefera et al. 1996; Coltorti et al2007). As a result, the climate ranges from extreme arid to humid (NMSA 1996; Hurni 1998). Based on agricultural and ecological characteristics, the country can be classified in to five agro-ecological zones, i.e., Bereha (arid), Kolla (warm), Weyna-Dega (mild), Dega (cool) and Wurch (cold) (Hurni 1998). The climate, geological and topographic variability has led to diversified soil types. According to the FAO systems of soil classification, more than 18 major soils types have been reported (FAO 1984). The climatic differences have favored a wide bio-diversity (Asefa et al. 2003; Oba et al 2006; USAID 2008). Thus, Ethiopia is endowed by more than 6000 plant, 280 mammal, 861 bird and 210 reptile species (USAID 2008). It also has wide range of crop types and a large livestock population of different species. However, only 14% of the land is arable (World Bank 2011). Due to the climatic and geomorphologic conditions, the country has ample ground and surface

water potential. As a result, Ethiopia is regarded as the water tower of Africa (Awulachew et al. 2007). The potential surface water and ground water and irrigable land is estimated at about 122 billion m^3 and 2.6 to 6.5 billion m^3 and 3.9 million ha, respectively (Awulachew et al. 2007). Despite the bio-physical resource potential, Ethiopia has been facing a challenge due to land degradation. The land degradation has mainly resulted from improper resource management and traditional agricultural practices (El-Swaify 1997; Lemenih et al. 2005; Nyssen et al. 2009). Deforestation and vegetation clearance were very high to fill the demand for additional cultivable and grazing lands (Puhr and Donoghue 2000; Dubale 2001; Feoli et al. 2002). Replacement of forest and grass lands on marginal with cultivation is followed by severe erosion and soil quality deterioration (Richter et al. 1999; Fu et al. 2008; Kalinina et al. 2009). A large part of the farm lands in the high lands substantially lost its productive potential and a considerable amount (4%) of land reached a point of no-economic return (FAO 1986). Consequently, agricultural production declined at a high rate (Sonneveld and Kyzer 2003). Annual agricultural production growth is estimated to be about 1.4%, which is much below the population growth rate (2.6%). This indicates that an over twofold gap exists between food demand and agricultural production (Sonneveld and Keyzer 2003; Bingxin et al. 2010; Spielman et al. 2011). Thus, agricultural production rate has to grow from the current level to 3.6% (Sonneveled and Keyzer 2003).

2.9 Sustainable land management

The concept of sustainability with reference to agriculture was defined by FAO (1991) as "...the management and conservation of the natural resource base, and reorientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human need for present and future generation. Such sustainable development (in agriculture, forestry, and fisheries sector) conserves land, water, plant and animal genetic resources, and it is environmentally none degrading, technically appropriate, economically viable, and socially acceptable".

In general sustainability refers to meeting the needs of the present generation without compromising the needs of the future generations. Sustainable development is improving people's material well being through the utilization of the resources at a rate that can be sustained indefinitely. Land resources sustainable, if and only if the stock of natural resources remains constant or is improved over time. The land resource base of a country and its quality represent a common

heritage for all generations. The preservation or loss of valuable land resources affects economic growth and human well being.

Swaran and Samra (2001) have indicated that soil degradation does not discriminate. Virtually in all society of the world and degradation is a process, which leads to the loss of a natural resource essential for survival. A sustainable society cannot be built on the lost ground. Creating solid foundation for successful action against degradation is a key need, and it will be a major challenge in the coming decades.

Sustainability is identified by different physio-biotic or socio-economic indicators (FAO 1995). Constancy of the natural vegetation cover, absence of wind or water erosion, constancy of runoff etc, are physio-biotic indicators. Among the socio-economic sustainability indicators absence of rural mitigations to urban centers, the stable or increase rural labour opportunities for all working age, the maintenance of food sufficiency and well balanced diet, the constancy or increase yield etc.

According to Ayalneh (2002), traditional societies have problems regarding efficient resource management. Population pressure has made fallowing, slash-and –burn cultivation and other traditional soil maintaining practices unsustainable, and subsequently converted forests and marginal lands in to permanent agricultural field, which cannot be considered as managing its resource sustainability. He further indicated that, a society may be considered to manage its resources sustainable if the desired out comes have been achieved purposefully, through the operation of ecologically oriented motives.

Sustainable agriculture is indeed concerned with the proper natural resource management and abatement of land degradation, since land (or soil) is a basic factor in this sector. Proper soil management aiming at improving the conditions of the soil by actively integrating soil conservation practices with strategic policies can enhance agricultural productivity, food security and sustainability, and thus have positive impact up on growth perspective (Ayalneh 2002)

In soil erosion, the effects of rainfall and wind erosion are largely irreversible. Although plant nutrient and soil organic matter may be restored, to replace the actual loss of soil material would require taking the soil out of the use for many thousands of year. In other cases, land degradation due to soil fertility decline is reversible, soil with reduced organic matter can be restored by additions of plant residues, and degraded pastures may recover under improved range of management (FAO, 1994)

Land degradation can be controlled, reduced or even reverted if the land is used wisely, if all functions of the land are taken in to account, and if long term interests of all segments of human kinds replace short term vested interested of privileged group globally, naturally and locally. The objective of soil conservation is to ensure that land is only used in such a way that the use can be sustained indefinitely that is, there is not progressive deterioration. This will be achieved when the rate of soil loss is no greater than the natural rate of soil formation.

2.10 Practice and implication of natural resource conservation in Ethiopia

People were already aware of the negative consequences of land degradation on agricultural production and the environment centuries ago. As a result, soil and water conservation practices exist as indigenous knowledge in some areas of Ethiopia (Nyssen et al, 2007). For instance, the Konso people in southern Ethiopia are known for traditionally well developed terraces, where the terrace practices are registered by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a world heritage. Some rudimentary and poorly established terraces and lynchets depicted on older aerial photographs and physical remnants can also be observed in different parts of the northern high lands. For example, Nyssen et al, (2007) reported old lynchets in the Tigray region (northern Ethiopia). This is an indication of indigenous knowledge on natural resource conservation works, and terracing is not only limited to the konso area but it is also found in other parts of the country. However, natural resource conservation practices covered very few areas and most of them except those in konso, have limitation in layout and construction quality (Nyssen et al, 2007).

As the government realized the problem of land degradation, it took policy action. In this regard, a forest and wildlife conservation and development policy was declared in 1980 (Anonymous 1980). Following this policy, the government initiated various studies and capacity building programs and massive SWC interventions (Shiferaw and Holedn, 1999). The capacity building programs involved training of professionals at the national level and farmers on the local level.

In this regard, natural resource conservation was included in the university curriculum and the mandate to train farmers was given to the Ministry of Agriculture. Natural resource conservation interventions in the high lands focused on both on mechanical and biological measures (Tamene et al, 2006). The mechanical measures included construction of bunds, terraces, diversion ditches, check

dams, micro-basins and hillside terraces. The biological measures comprise enclosure of degraded land from human and animal interference, tree seedling production, agroforestry tree seedling planting on farm lands, afforestation and tree planting at homesteads and in exclosures as tree enrichment (Nyssen et al, 2009). In the high lands, drought affected areas such as Harerghe, Wello, Gonder, North shoa, Tigray and North Omo were targeted (Amsalu et al, 2007). In order to support the SWC intervention, six research sites (Hunde lafto, Maybar, Andit tid, Anjene, Gununo and Dizy) were established and research has been taking place there (Herweg and Ludi, 1999). These sites represent different agroclimatic, soil, geomorphologic and farming practices (Shiferaw and Holden, 1999).

Initially, the SWC activities were carried out using food aid in the form of food for work (FFW); however free community labor was mobilized as the people's awareness increased (Tekle, 1999). The basis for the implementation of the natural resources conservation intervention on a large scale was the 1975 land reform and the establishment of peasant associations (PAs). The reform gave farm land usufruct to the farmers that motivated them, and the PAs facilitated implementation of natural resource conservation and played an instrumental role for labor mobilization (Shiferaw and Holden, 1999). The natural resource conservation interventions showed an inconsistent adoption trend over time. Initially, farmers viewed the structures as showing limitations, as they were not getting immediate returns (Amsalu et al, 2007). Among the limitations farmers mentioned were that the mechanical structures on farm lands reduced the area of cultivable land, harbored rodents and the construction was labor intensive (Amsalu et al, 2007). Despite the problem of soil erosion and poor soil fertility, this perception of SWC is to be taken seriously because farmers have small and fragmented farm lands (Shiferaw and Holden 1999). Amsalu and de Graff (2007) reported that larger farms with less livestock, on steep slopes and with poor fertility adopted the practice better than those with contrasting conditions.

The rural land administration and use policy declared in 2005 is an indication of the government commitment to follow up on the previous initiatives. The policy enforces proper land use and gives clear demarcation based on slope of the land (Anonymous 2005). The natural resource conservation interventions have positive impacts such as reducing runoff and soil erosion through reducing the first two erosion processes (detachment and transportation), improving basin hydrology, maintaining and improving farm land soil fertility and thereby improving agricultural production, reducing sediment

load to natural and human made reservoirs and reducing further degradation (Vancampenhout et al 2006).

2.11 Past conservation effort and experience in Ethiopia

In attempting to reduce soil erosion farmers have developed their own conservation practice over the years. At the regional level 27 types of indigenous soil and water conservation practice were identified (Betru, 2002). Conservation of traditional ditches in the high lands of east and west Gojam known as *"fesses"* and *awara "fesses"* level bund around Dessie, contour ploughing of perennials around Bati, counter cultivation in many sloppy areas, agricultural trees in the farm areas, and other indigenous skill are practiced in the region. However, land degradation were still serious problem in the high lands of Ethiopia due to farmers misuse and mismanagement.

The governments of Ethiopia launched a massive soil conservation program in the 1970's to arrest and reverse the process of soil degradation (SCRP, 1994), Bekele and Holden (19980 have indicated that despite the increasing land degradation problem, the issue of conserving agricultural land was largely neglected until the early 1970's. but awareness of the problem was incited by the devastating famine in Wollo in 1973/74, reforestation, terracing, pond construction and road construction program were begun initially in Northern region followed by Eastern region.

The programs were primarily aimed at mitigating drought and famine and, in the mean time, develop infrastructural facilities and stabilize the environment through mobilizing the community. It was supported through food-for-work incentives provided by international, multilateral, and bilateral organizations of which the world food program (WFP), the European Economic Commission, UNDP and FAO were the major one. The role-played by WFP in supporting soil and water conservation program is immense and has increasingly continued to the present time (Danano, 2002).

According to the same author, through soil conservation as an element of agricultural development indicated in the 1970s by MoA, a systematic planned soil and water conservation program begun a decade latter(1981)when the soil and conservation department was established in the same ministry.

In Ethiopia, to solve the problems of land degradation enormous inputs including technical educational and incentives in soil conservations have been made since the 1970s. According to world food program (WFP) report, between 1980 and 1994 an area of

1,045,130 ha was covered with soil bunds and hillside terraces, 17880 km of check dams and cut of drains, 1.259,760 ha were covered by closure and afforestation, and about 170 small earth dames were constructed. This seems very impressive but is not very significant as it covers less than 10% of all cultivated land in need of soil and water conservation (Berhe, 1997).

After almost two decades of implementation, different institution and researchers had conducted many evaluations on the adoption and diffusion of introduced soil conservation technologies. By and large they came to a similar conclusion, that land degradation is a wide spread problem with a wide spread failure of intervention too (Yohannes, 1999). Some of the reasons given for the failure of introduced soil conservation measure can be classified under four major themes: approach, technology, perception and land users security issues.

The approach for the transfer of technology was top down, which marginalized land-users in decision making, while the technology, was predominantly physical structures with a wide range of risks and long-term benefits. Moreover, lack of awareness of land degradation problems among land-users and their lack of interest in soil conservation technology due to poverty were indicated as a major drawback among the subsistence farmers. Lastly the absence of land security was mentioned to be the fundamental factor for the lack of adoption of introduced soil conservation technology (Yohannes, 1992 and Berhe, 1997).

Likewise in Amhara region conservation efforts have been made through food for work, Employment Generation Schemes (EGS) and community participation. As a result, the report of BoA (2001) has indicated that between 1993-2001, about 1,134,709 ha of terraces, 11,303 km cheeked dam, 10868 km cut of drains and 4014 km artificial water ways have been conducted to treat degraded lands in various areas of the region. 158,132 ha of land were also planted with different and multipurpose species of seedlings.

Nowadays, the government is trying to minimize the problem of land degradation based on the voluntary involvement of small holders and implementation of soil conservation project and programs. Moreover, most agricultural development projects consider natural resource development in general and promotion of soil and water conservation activities in particular as the potential area of intervention for sustainable agricultural production and rehabilitating degraded areas of the country.

CHAPTER THREE

METHODOLOGY

This chapter provides an overview of the study area, data source and collection method, sampling techniques, and method of data analysis

3.1 Description of the study area

3.1.1 Location of Efratana Gidim Woreda

Amhara national regional state is located North Western part of Ethiopia between 9^0-13^0N and 36^0-$40^0$36'E, with a total area of 170,152km^2. Of the total area, cultivation and grazing land make up 30% each. Forest, shrub, bush and wood land, water bodies, and waste land make up 17%, 4% and 16% of the total area respectively and the remaining 3% is taken up by settlement (Jabbar, Pender and Ehui, 2001).

Efratana Gidim Woreda is one of the Woredas' in Amhara national ragional state which is found in North Shoa administrative Zone located 270kms north east of Addis Ababa, the capital of the country and 840kms from Bahir Dar town the capital of Amhara national regional state and 140kms north east of Debire Birihan town, the capital of North Shoa administrative zone. The woreda is bordered by Antsokiyana Gemza and Artuma Fursi woreda in the North, Kewet woreda in the South, Jille Timuga in the east, Meniz gera midir in the West and Meniz mama midir in the south west. The woreda has 19 peasant association kebeles where Ataye is a woreda center (capital) having 2 kebeles. The woreda have a total area of 516.86km^2. The capital of the woreda Ataye is linked with Addis Ababa-Dessie main road.

3.1.2 Topography and Climate

According to the data which is obtained from Efratana Gidim woreda office of agriculture and rural development indicates that the total area of the woreda is about 516.85km^2 out of which approximately 25% is characterized by plains, 48% mountains and the remaining 27% is characterized as rugged and gorges. The highest point in the woreda as well as in the semien shoa zone is mount Abuye meda which have 4012m height and found at 10^0 31 'N and 39^0 46'E.

From this one can deduce (understand), how the topography of the woreda affect agricultural activity and has obligated the farmers to cultivate against the normal land use practice. Agro-climatically the woreda include three of the traditional climatic zones. From this Dega, account 20%, Weyna dega 35% and Kolla 45%. Similarly, out of the

total 19 peasant association 4 fall in the Dega zone, 7 PAs in Weyna Dega zone while the remaining 8 PAs fall in the Kolla climatic zone (OoARD, 2007).

In terms of altitude, the woreda ranges from 1150-3500 above sea levels with the highest and lowest temperature of 27^{0}c and 10^{0}c respectively. According to the information which is obtained from the OoARD, rainfall ranges in mean annual amount between 1400 mm to 1600 mm. There is one long summer season from the mid of June up to mid of September, which is the main season for crop production. The other season is one short ('Belig Rain') season that lasts from March to April. In Efratana Gidim woreda the type of soil characterized as red soil, black soil and gray soil. A number of rivers are available in the woreda and some of them are important for irrigation purposes specially in kolla zone.

3.1.3 Population

According to the information which is obtained from the woreda in 2007/8 the total population of the woreda is 142,829 out of this 71,534 are male and 71,315 are female which have almost equal sex ratio. Out of the total population 14,358 or 10 percent is living in Ataye town, the woreda capital and the other 128,471 or 90 percent are living in the rural areas and other urban kebeles of the woreda (Table 4). The population density of the woreda is 213.78 person per km^2 which is greater than the zone average of 115.3 person per km^2 (CSA, 2007). The major ethnic groups in the woreda are Amhara 95.27%. Oromo, Argoba, and other ethnic group constitute 1.11, 2.9 and 0.75 percent respectively. In terms of religion orthodox constitute 88.46, Islam 10.99 and other religion constitute 0.55 percent respectively. The age distribution of the woreda population can be classified as child population (0-14), economically active population (productive age 15-64), and aged population (dependent age group 65 and above) which constitute 41.69, 53.90, and 4.40 respectively (Table.3).

Table 3. Total population of Efratana Gidim Woreda by sex and age (2006/7).

Age group	M	F	Total	Percentage
0-14	29,293	28,715	58,008	41.69
15-64	37,236	37,760	74,996	53.90
≥ 65	3,158	2,970	6,128	4.40
Total	69,687	69,445	139,132	100

Source: OoARD, 2006/7

Table 4. Total population of Efratana Gidim woreda by sex in Urban and Rural in 2007/8

	Male	Female	Total
Rural	57,955	56,494	114,449
Urban	13,579	14,821	28,400
Rural and Urban	71,534	71,315	142,849

Source: OoARD, 2007/8

3.1.4 Land use

The major land uses of the woreda comprise of cultivable land 22,013 ha (30.37%), grazing land 10,457 ha (14.39%), forest and bush land 21,766 ha (29.93%), infrastructure and settlement 4,169 ha (5.74%), unproductive land 14,287 ha (19.66%) (Table 5). Maize, teff, sorghum, beans, wheat, barley, onion, potato, tomato, redroot, and cabbage are the main crops in the woreda.

Land degradation due to sever soil erosion is a predominant feature of the woreda. Except the traditional practices of "oxen grass", demarcated for communal grazing of oxen in some localities, the majority of the farmers in the woreda graze their animals either on degraded communal hillside or on farm lands particularly during the long dry season. Animal are allowed to graze crop residues and left over on farm. A free grazing type of livestock management is practiced in the study area.

Table 5. Efratana Gidim Woreda land use classification

Land use type	Hectares	Percentage (%)
Annual crops	20.887	28.25
Perennial crops	1,126	2.12
Grazing land	10,457	14.39
Forest, bush and shrubs	21,766	29.93
Infrastructure and settlement	4,166	5.74
Uncultivable land	14,287	19.66
Total	72,682	100

Source: OoARD, 2015

3.1.5 Agriculture

Like other parts of Ethiopia, agriculture is the mainstay of the community in the study area. Efratana Gidim woreda is characterized by mixed farming systems, where the rural people depend on both crop and livestock production for their living. Agriculture is at a subsistence level and is practiced in fragmented holding which mostly lack modern technologies. The average land holding at woreda level is 1.25 ha per household, and ranges from 0 ha to 3 ha among the farmers in the woreda. In the crop sub-sector, the main crops grown include maize, teff, sorghum, beans, wheat, barley, onion, tomato, potato, redroot, and cabbage. In the livestock sub-sector, cattle are dominant and large number of sheep and goats are also kept. Oxen, cows, heifers, bulls, calves, chickens, goats and sheep are found in numbers in most households. In Efratana Gidim woreda livelihood therefore depends to a large extent on agricultural production and trading.

3.2 Data source and collection method

In order to assess the role of the current massive natural resource conservation program towards preventing land degradation in the form of soil erosion in Efratana Gidim woreda a combination of several data sources have been used. Primary and secondary data sources are used to collect data and information to be interpreted and analyzed.

3.2.1 Primary data sources

Primary data was collected from household head farmers. They are the main source of primary data. Therefore, by using household questionnaire household heads view was collected from 90 households who are living in the 3 sample PAs kebeles in Efratana Gidim woreda with the help of 2 enumerators.

Focus Group Discussion - The group is composed of farmers and DAs from each kebeles and they are 20 in number. Information is collected from this group through discussion. The information is significant to observe a very clear back ground of the current massive natural resource conservation intervention in preventing land degradation in the form of soil erosion in the area. Since, most of them were lived for a long period of time in the area they know the past and the present situation of the area, and the change resulted due to the current massive natural resource conservation work.

Woreda sector offices – woreda agriculture and rural development, natural resource conservation and protection, woreda communication offices were interviewed on different issues regarding the contribution and the role of the current massive natural resource conservation program towards preventing land degradation in the form of soil erosion in the sample kebeles.

3.2.2 Secondary data source

In order to have secondary data source books, reports, publication and documents of governmental bodies and woreda sector offices are used.

3.3 Sampling procedure

In order to have household sampling; a list of kebeles from Efratana Gidim woreda is taken and stratified in to agro-ecological zones since it has a direct and indirect impact on land degradation, natural resource conservation work and on the socio-economic life of the people. Based on these, simple random sampling and stratified random sampling was employed in the selection of sample kebeles and household heads for interview. From 19 PAs which is found in the woreda 3 PAs were selected. One PAs from each agro-ecological zone (kolla, w/dega and dega) were selected randomly.

Regarding the households to be surveyed; the total number of household heads from each sample kebele were taken and 3 percent of the household heads are selected for the survey. Accordingly, 90 house hold heads are taken from the total of 2642 household heads

from all three sample kebeles. 30 household heads from each sample kebele were selected randomly and household questionnaire was administered for each sample household heads with the help of two enumerators.

3.4 Method of data analysis

To analyze and interpret the data which have relation to land degradation and the role of the current massive natural resource conservation program in bringing change against soil erosion problem descriptive statistics (mean, percentage etc.) and qualitative data analysis were used to compare and contrast different categories of the sample units with respect to the desired characteristics.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter deals with the analysis of the survey data and interpretation of the analytical findings. As it is mentioned in the methodology a structured questionnaire both open and close ended was administered for 90 sample household heads taken from a total of 2642 household heads. From this total number 421 of them are female household heads. These households are taken from three kebeles, one kebele from each agroecological zones (kolla, w/dega and dega). The findings of the data generated through household heads survey, interviews, focus group discussion and secondary data are included and presented here below.

4.1 Household characteristics

4.1.1 Sex, Age and Marital Status of the Respondents

As it is shown in Table 6, 7 and 8 one can see the composition of household heads that have given their response to wards the role of natural resource conservation program to prevent land degradation problem in Efratana Gidim woreda. In the formal household head survey, the composition of the sex of the respondent was 78.9% male and 21.1% female (Table 6). The age compositions of sample respondents were found to be 20%, 53.33%, 18.88% and 7.77% for the age less than or equal to 30, between 31 and 45, between 46 and 64 and age above 64 respectively. The maximum age observed was 70 and the minimum was 26 year (Table 7). In terms of marital status 78.88% of the sample respondents were married, 6.66% of sample respondents were divorced and 14.44% of the respondents were widowed and above 98% of the respondent has lived since birth in the woreda (Table 8).

Table 6. Sex of the respondents

Sex	Frequency	Percent
HHH	N=90	100
Male	71	78.9
Female	19	21.1

Source: - own survey, 2015

Table 7. Age of the respondents

Age	Frequency	Percent
HHH	N=90	100
≤ 30	18	20
31-45	48	53.33
46-64	17	18.88
>64	7	7.77

Source: - own survey, 2015

Table 8. Marital status of the sample household head respondents

Marital status	Frequency	Percent
HHH	N=90	100
Single	___	___
Married	71	78.88
Divorced	6	6.66
Widowed	13	14.44

Source: - own survey, 2015

4.1.2 Educational status

As educational status of household heads increases, it is assumed to increase the transfer of relevant information and as a result increase farmers knowledge about the cause, severity and consequence of land degradation. Education enables farmers to tackle land degradation by using various ways of soil fertility improving practices, traditional and introduced soil conserving technologies. From the total sample household head respondents 34.44% are able to read and write, 47.77% have formal education from 1-4th grade and17.77% were above grade 4th (Table 9).

Table 9. Educational status of sample household heads

Educational status	Frequency	Percent
Read and write	31	34.44
Grade 1-4th	43	47.77
Above grade 4th	16	17.77
Total	90	100

Source: - own survey, 2015

4.1.3 Family size

The total family sizes of sample household were found to be 487 in all kebeles (Laygnaw Ataye, Serdo and Meskel Ber). In the study area, household heads with family size less than or equal to 2 members constituted 2.22%, 3 to 5 members constitute 45.55%, 6 to 10 members constitute 48.88% and above 10 members constitute 3.33 (table 7). The average family sizes of sample kebeles were found to be 5.41. The maximum and minimum sample household head family size was 2 and 11 person. About 48.88% of the sample household head in the sample kebeles have 6 and above number of family members (Table 10).

Table 10. Family size distribution of sample households

Family size	Household number	Percent
≤ 2	2	2.22
3 to 5	41	45.55
6 to 10	44	48.88
>10	3	3.33
Total	90	100

Source: - own survey, 2015

4.1.4 Land holding size

The idea of land distribution is to give land to the ever-increasing land less rural population and to ensure a fair distribution of land among the community. Efratana Gidim woreda, land redistribution was undertaken in 1997/98 by categorizing the rural community into

different age, wealth and political group. Partly land redistribution was based on the family size. The redistribution were not included all the land less young farmers due to low availability of cultivated land. In addition to this all bureaucrats (the official of the former regime/the derg regime) lost most of their lands due to political case.

According to Efrata and Gidim woreda natural resource conservation office, 1ha equivalent to 4 timad. So, the total land holding size of sample household heads in the sample kebeles were found to be 128.25 ha or 513 timad. In the sample kebele the land holding size of the sample household head respondent varies between 0.75 ha or 3 timad to 2.5 ha or 10 timad (Table 11). As a result in the sample kebele there is shortage of agricultural and grazing land. The average land holding sizes of the sample household head respondents in the sample kebeles were 1.425 ha or 5.7 timad.

Table 11. Land holding size for sample household heads

Land size				No of Respondent	Percent
In ha	Percent	In timad	Percent		
0.75x10=7.5	5.84	3x10=30	5.84	10	11.11
1x30=30	23.39	4x30=120	23.39	30	33.33
1.5x25=37.5	29.23	6x25=150	29.23	25	27.77
2x15=30	23.39	8x15=120	23.39	15	16.66
2.25x7=15.75	12.28	9x7=63	12.28	7	7.77
2.5x3=7.5	5.84	10x3=30	5.84	3	3.33
Total=128.25	100	513	100	90	100

Source: - own survey, 2015

The above survey result of sample household heads in the sample kebele indicated that from the total area of farm land which is 128.25 ha or 513 timad, 7.5 ha or 30 timad of the farm land belong to 10 0r 11.11% of farmers who are living in the sample kebele. On the other hand 30 or 33.33%, 25 or 27.77%, 15 or 16.66%, 7 or 7.77% and 3 or 3.33% of the farmers from the total sample household head

respondents who are living in the study area have 30 ha or 120 timad, 37.5 ha or 150 timad, 30 ha or 120 timad, 15.75 ha or 63 timad and 7.5 ha or 30 timad from the total area of farm land respectively. From this we can conclude that from the total area of farm land in the sample kebeles 53.25 ha or 41.51% of the farm land belongs to 25 farmers who are living in the sample kebeles having 2 ha and above farm land for each. The remaining 75 ha or 58.49% of the farm land belong for 65 farmers of sample respondent who have 1.5 ha and below for each. Most of the farmers who have below 1 ha farm land in the study area lost their lands by erosion and political case (the official of the former regime).

4.2 Land degradation status of the study area

4.2.1 Local perceptions of land degradation

The productivity of most farm land decrease year after year, Land degradation particularly soil erosion is, the principal cause of decline in agricultural productivity and total production (crop and livestock) in the study area. Soil erosion reduced the productivity of soil by decreasing soil depth. Farmers suggest that the decline in the productivity of their farm land were due to increase in soil erosion. From different causes of land degradation in the form of soil erosion which is identified by sample farmers in the sample kebele rainfall, deforestation, population pressure, overgrazing and cultivation of steeper slope are the major causes to aggravate the problem. However, in order to understand the presence of land degradation in the form of soil erosion in the study area different question was posed for the sample respondent farmers. The questions were very important to understand (know) the perception of the sample farmers about land degradation in the form of soil erosion in the sample kebeles. Accordingly all of the sample respondent farmers perceived the presence of land degradation in the form of soil erosion in their peasant association. The other very important issue that was asked in the time of survey was the type of soil erosion. From the total sample respondent farmers, 65% of them response the presence of all type of erosion (sheet erosion, rill erosion and gully erosion) on their farm land. Whereas 17%, 11% and 7% of the sample respondent farmers response the presence of sheet erosion, rill erosion and gully erosion on their farm land respectively. In addition to this from the total sample respondent farmers 90% of them response soil erosion as the major cause of land degradation problem in their peasant association and the level of the problem as high (Fig 1 and Table 12).

Source: - own survey, 2015 **Fig 1**

Fig 1. Land degradation severity in the study area

Table 12. Local Perceptions of land degradation at a kebele level

Variables	Frequency	Percent
Did you perceive the presence of soil erosion?		
Yes	90	100
No	—	—
Total	90	100
What is the type of the erosion?		
Sheet erosion	6	6.66
Rill erosion	9	10
Gully erosion	6	6.66
All	69	76.66
Total	90	100
Does soil erosion the main land degradation problem?		
Yes	81	90
No	09	10
Total	90	100
What is the level of the problem?		
High	81	90
Medium	09	10
Low	—	—
Very low	—	—
Total	90	100

Source: - own survey, 2015

The above result implies that most of the farmers who are living in the sample kebeles challenged by different kind of problems regarding agricultural lands. Most of the agricultural lands which is found in the sample kebele affected by land degradation in the form of soil erosion and this had contribution for the decline of agricultural productivity, decline in land holding size, and total loss of farm land, destruction of infrastructure (road), loss of soil fertility, lack of food for livestock and the rapid expansion of other social and economical problems.

4.2.2 Land degradation status of the study area

To understand the status of land degradation before conservation work practice in the sample kebeles the farm land of sample respondent farmers were grouped in to four categories. These are un degraded, slightly degraded, moderately degraded and severely degraded. According to the response of sample household head respondents the status of land degradation differs from place to place.

In the mountainous areas the status is more severe and in the plain areas the severity may be decrease. From the total sample household head respondents 14.44%, 7.77%, 22.22% and 55.55% response as undegraded, slightly degraded, moderately degraded and severely degraded respectively (table 10). Whereas, the land degradation status after, the implementation of conservation work show decline. From the total sample respondent 72.22%, 6.66%, 12.22% and 8.88% response as un degraded, slightly degraded, moderately degraded and severely degraded respectively (Table 13). So, this result can serve as an instrument to guide decision as to which status will be given more emphasis to reduce the problem of land degradation.

Table 13. Land degradation status of sample farmers' private farm land before and after the conservation program.

Land degradation status of farm land before conservation	Frequency	Percent	Land degradation status of farm land after conservation	Frequency	Percent
Un degraded	13	14.44	Un degraded	65	72.22
Slightly degraded	07	7.77	Slightly degraded	06	6.66
Moderately degraded	20	22.22	Moderately degrade	11	12.22
Severely degraded	50	55.55	Severely degraded	08	8.88
Total	90	100	Total	90	100

Source: - own survey, 2015

From the above findings we can conclude that the status of land degradation severity in the study area decrease from time to time after the implementation of conservation work. Beside these the farmers understand the importance of natural resource conservation program in preventing land degradation problem in the study area. In addition to this the change which is observed on the farmers' farm land motivates the whole community to work more on conservation and protection of natural resource to the future.

4.2.3 Slope classification of sample household heads farm land

Slope is one of the farm land attributes that aggravate land degradation problem in the form of soil erosion. Based on the natural resource conservation office of Efratana Gidim woreda classification for construction of conservation method and type, based on farm land slopes which is measured in degree were classified as meda for flat (0-3) and gentle slope (3-8) farm land, zekzaka for moderate steep slope

(8-15), kulkulet for steep slopes (15-30) and gedelama for very steep slopes and mountain (30-50).

According to the survey result 16.66%, 22.22%, 27.77%, 34.44% and 8.88% of the sample respondent farm lands in the sample kebeles were found to be flat, gentle slope, moderate slope, steep slope and very steep slope respectively. Based on these classification steep slope constitute the highest portion of the sampled areas and moderate slope comes next (Table 14). Since the topographic situation of the woreda is mountainous which constitute 48% of the woreda, 27% gorge/rugged it is easy to know the slope of sample kebele farm land would be steep slope.

Table 14. Description of sample farmers' farm land slope

Slope of the farm land	Degree	Areal name	No of respondent	Percent
Flat	0-3	Meda	15	16.66
Gentle slope	3-8	Meda	11	12.22
Moderate steep slop	8-15	Zekzaka	25	27.77
Steep slope	15-30	kulkulet	31	34.44
Very steep slope	30-50	Gedelama	08	8.88
Total	-	-	90	100

Source: - own survey, 2015

Since the slope of the study area is steep slope, it is easy to conclude the presence of soil erosion in the study area.

4.2.4 Causes of land degradation in the form of soil erosion in the study area

According to Taffa (2002) land degradation is the result of complex interaction between physical, chemical, biological, socio-economical and political issue of local, national or global nature. Similarly most studies in Ethiopia have also strengthened this thought and put the causes of land degradation as proximate and underlying causes.

From the different causes which is identified as the causes of land degradation in the form of soil erosion in the study area, the major causes of soil erosion in the farmers farm land are heavy rain fall, topographic situation of the farm land, cultivation of steeper slope, overgrazing, rapid expansion of agriculture and population pressure

both in human and livestock. Before 2006/7 in the study area conservation work does not practiced in organized way (not through mass mobilization) and the way they used to feed their animal and the systems of agricultural activity play a dominant role to aggravate the problem in the study area. But after the implementation of natural resource conservation work through mass mobilization all the causes which is identified above slightly controlled by the farmers.

According to the survey result from the total respondent of the sample household head in the study area 43% identified heavy rainfall and topographic situation of the farm land as the major cause of land degradation in the form of soil erosion. Whereas 26.66% of the sample household head respondent show heavy rain fall, deforestation, overgrazing and topographic situation as the cause of soil erosion in their farm land. On the other hand 30% of sample respondent identified heavy rain fall, deforestation, cultivation of steeper slope, topographic situation of the farm land and rapid expansion of agriculture as the cause before 2006/7. But after 2006/7 for the last 9 years specially after the beginning of the current conventional conservation work the causes of soil erosion in the study area related to natural causes; human made causes more or less decrease from year to year. From the total sample household head respondents 61%, 23%, 16% identified heavy rainfall and shortage of land, topographic situation of the farm land and population pressure as the causes of soil erosion respectively (Table 15).

Table 15. Major causes of land degradation in the form of soil erosion in the sample kebeles before and after 2006/7

Major causes before 2006	Frequency	%	Major causes after 2006	Frequency	%
Heavy rainfall and topographic situation of the farm land	39	43	Heavy rainfall and shortage of land	55	61
Heavy rainfall, deforestation, overgrazing and topographic situation	24	26.66	Topographic situation of the farm land	21	23
Heavy rainfall, cultivation of steeper slope, topographic situation, deforestation and rapid expansion of agriculture	27	30	Population pressure (human population pressure)	14	16
Total	90	100	—	90	100

Source: - own survey, 2015

From the above survey result one can understand that the cause of soil erosion difference after and before 2006/7 in the study area. After 2006/7, according to the response of sample household head respondents above 95% of the cause relate to natural cause. This implies that in the study area the current conservation work through mass mobilization can control or reduce all the problems which are related to human causes. So, if the current conservation work

continues as it is, in the near future they can remove or control all the causes of soil erosion in the study area which is relate to natural causes and can reduce social and economical crisis of the whole society in the long run.

4.2.5 Consequences of land degradation in the form of soil erosion in the study area.

Land degradation in the form of soil erosion has serious consequences in Ethiopia in general and in the study area (Efratana Gidim woreda) in particular. The general consequences of land degradation in the form of soil erosion in Ethiopia are occurrence of persistent food insecurity, economic loss and various environmental hazards such as recurrent drought (Shiferaw and Holden 1999, Tekle 1999). Land degradation in the form of soil erosion in the study area also has negative consequences. The sample household head respondents who are living in the sample kebekes identified the negative consequences of soil erosion on their agricultural productivity and social life. Among these consequences the reduction of land productivity (yield), destruction of agricultural lands, land becomes out of cultivation, land preparation becomes difficult, reduction of farm land size, poverty and migration are the major ones. However, according to the information of sample respondents in the study area all these consequences does not happened at once, it have its own stage. For example above 90% of sample respondent clarify that soil erosion problem first damage agricultural lands and then created different problems on them, such as land preparation become difficult, land becomes out of cultivation, reduction of land productivity, reduction of farm land size, poverty and migration would be the final result.

According to the survey result of sample household head respondents in the sample kebeles 32.22%, 21.11%, 18.88%, 14.44%, 7.77% and 5.55% of the respondent identified that the destruction of agricultural lands, reduction of farm land size, reduction of land productivity, land preparation become difficult, land becomes out of cultivation, poverty and migration as the main consequence of soil erosion in the sample kebeles respectively (Table 16).

Table 16. Major consequences of land degradation in the form of soil erosion in the sample household heads farm land

Consequences of soil erosion	No of respondents	Percent
Destruction of agricultural lands	29	32.22
Reduction of farm land size	19	21.11
Reduction of productivity	17	18.88
Land preparation become difficult	13	14.44
Land becomes out of cultivation	07	7.77
Poverty and migration	05	5.55
Total	90	100

Source: - own survey, 2015

The above result implies that destruction of agricultural land as the main consequences of soil erosion in the study area. Since the whole of the societies who are living in the study area engage themselves in agriculture, destruction of agricultural lands by soil erosion would created a number of social and economical problems on them. In addition to these almost above 95% of the respondents feel the presence of soil erosion problem in their peasant association since birth and 86.66% of the sample respondent lost part their farm land by erosion. Furthermore, from the total agricultural land which is hold by sample household heads (128.25 ha or 513 timad) in the sample kebekes, 26.75 ha or 107 timad (20.85%) of agricultural land taken by erosion (Table 17).

Table 17. Land lose amount of sample household respondents in the sample kebeles

Variables	No of respondents	percent
Did you lose your farm land by erosion?		
Yes	78	86.66
No	12	13.44
Total	90	100
How much of your land taken by erosion? In timad		
1/4x22= 5.5 timad	22	24.44
1/2x9= 4.5 timad	09	10
1x7= 7 timad	07	7.77
1.5x9= 13.5 timad	09	10
2x11= 22 timad	11	12.22
2.5x11= 27.5 timad	11	12.22
3x9= 27 timad	09	10
Total 107tim (26.75 ha)or 20.85%	78	86.65

Source: - own survey, 2015

From the above land which is taken by erosion (26.75 ha or 107 timad), 11.22 ha or 8.75% of land and 30 or 33.33% of sample respondent found in Laygnaw Ataye kebele. In Laygnaw ataye kebele there is one big river which divides the farm land and the kebele in to two parts. At the time of rainy season due to high amount of rainfall and its topographic features all the waters from neighboring Kebeles Mountains collect to the river and the flood accident highly affect the residents.

4.2.6 Measures taken by individual farmers and constraints of natural resource conservation work in the study area

In the study area specially in the sample kebekes the farmers practiced different type of conservation measures to combat soil erosion problem. Some of the measures are traditional terracing (farm

land soil and stone terracing), contour plowing, traditional ditches, hill side terracing, respect the rule and regulation which is seat by community to not sending animals to protected areas. In addition to this some of the farmers in the study area practiced stone bund when there is excess stone and high runoffs are common. Traditional terracing and traditional ditches are widely used by farmers on cultivated land. These ditches and terraces are constructed and strengthen in every plowing season and run diagonally across the slope of cultivated land. In all sample kebeles based on the slope and availability of stone, a combination of stone and soil bund and hill side terracing were constructed. The measures however, are not enough to control land degradation in the form of soil erosion totally since the topographic features of the woreda is mountainous.

On the other hand in the study area there are constraints which hampering the activities of the farmers towards conservation work. These are the systems of grazing (free grazing), attitude of the farmers about conservation work, time, deforestation, expansion of agricultural land (some of the farmers add conserved areas to agricultural land which is found beside or near agricultural land.

According to the survey result from the total sample household head respondents 75% practiced farm land soil and stone terracing, contour plowing, respect the rule and regulation to not sending their animal to conserved area. The rest 25% of sample respondent also practiced hill side terracing, traditional ditches, and other measures to combat soil erosion problems (Table 18). The above result implies that all the farmers in the sample kebele do not seat by crossing their hands rather they tried to found some solution to control and remove the problems totally from their farm land. But the farmers still needs professional assistance in addition to DAs and woreda natural resource conservation office support.

Table 18. Individual conservation measures practiced by sample respondent farmers

Conservation measures	No of respondent	Percent
- Farm land soil and stone terracing - contour plowing -respect rule and regulation	68	75
- Hill side terracing - contour plowing - traditional ditches	22	25
Total	90	100

Source: - own survey, 2015

4.2.7 Household energy consumption in the study area

In Ethiopia trees contributed a higher percentage of the energy consumption, with fuel wood take the most important source, followed by dung, crop residues and charcoal. Within the household traditional fuels contribute 99.6% of the total household energy consumed, with wood (81%), dung (9%), crop residue (8%), charcoal (1.6%) and the remaining contributed by modern fuels (Carla et al., 2001).

Using different products of wood, crop residue and animal west product (cow, oxen) as a fuel in Ethiopia is one of a common system. But, using these as a fuel has its own impact on the expansion of land degradation problem.

From the total sample respondent 80% of them use natural forest, animal dung and crop residue as a fuel wood in the sample kebele. On the other hand 10% of the sample respondents in the sample kebele use private plantation and crop residue as a fuel wood. The rest 10% of the respondents used kerosene and electricity as a fuel in the sample kebele before the beginning of the conservation program. After the beginning of the conservation program 43.33% use natural forest, animal dung and crop residue, 31.11% use private plantation and crop residue and the rest 25.55% the sample respondents used kerosene and electricity as a fuel (Table 19).

Table 19. Sample respondent fuel use before and after conservation work

Fuel use before	Frequency	%	Fuel use after	Frequency	%
-Natural forest - Animal dung - Crop residue	72	80	-Natural forest -Animal dung -Crop residue	39	43.33
-Private plantation -crop residue	9	10	-Private plantation -Crop residue	28	31.11
-Kerosene -Electricity	9	10	-Kerosene -Electricity	23	25.55
Total	90	100	____	90	100

Source:- own survey, 2015

The above result implies that from the total sample household head respondent farmers 15.55% of them changed their system from wood product and animal dung to kerosene and electricity after conservation program. This shows the awareness of the farmers to protect soil erosion problem which affect them highly in different ways.

From different kinds of problems which affect the sample household head respondents in the sample kebeles erosion, very poor soil fertility, very steep slope farm land, and small land holding sizes are the major problems. From the total sample respondent 37%, 07%, 25%, 20%, 11% affected by erosion problem, lack of soil fertility, steep slope, difficulty to plow and shortage of farm land respectively. According to the response of the sample respondent 83% of the problems occur due to high population pressure, poor agricultural activity, topographic features of the area and deforestation. The other 17% occur due to other different reason.

4.3 Natural resource conservation status of sample kebeles

4.3.1 Natural resource conservation through mass mobilization

The two most important resources of any country are the people and the land. In the case of Ethiopia, the tie between man and the land is close, for most of its people drive their livelihood directly from it through their own efforts, and on land adjacent to their homes. Therefore the conservation of natural resource is a matter of immediate, as well as long-term concern. The same is true in the sample kebeles of the study area. In the sample kebeles the tie between land and man are very close, because the majority of the societies who are living in the study area engage themselves in agriculture for long time. In the places like the sample kebeles of this study conservation of natural resource is not only mandatory but it is also obligation since the topographic features of the woreda is mountainous. That is why the farmers of the sample kebeles in particular and the farmers of Efratana Gidim woreda in general practice different type of natural resource conservation method to protect their lands from different kind of problems such as erosion.

According to the information which is obtained from Efratana Gidim woreda natural resource conservation office and key informant interviews the current natural resource conservation program through mass mobilization in Amhara region in general and in Efratana Gidim woreda in particular launched together with other parts of Ethiopia at the eve of Ethiopian millennium before 8 years ago in 2007. As we all know, at the eve of Ethiopian millennium the government of Ethiopia

was launched the current natural resource conservation program through mass mobilization as a new method to prevent land degradation problem all over the country.

Since Efratana Gidim woreda is one of the woreda which is found in the northern high land parts of Ethiopia it is affected severely by land degradation problem for long time. Due to its topographic features the woreda is easily faced for land degradation problem. The altitude of the woreda which is range from 1500m up to 4012m and the mountainous, gorges and rugged features of the woreda which account 75% from the total land facilitated the problem more rapidly. So, to overcome and to remove this expanded problem the woreda launched the current natural resource conservation program through mass mobilization with active involvement of the local community voluntarily like other woredas which is found in the zone.

4.3.2 Contribution of mass mobilization to prevent land degradation problem in the study area

In the study area the contribution of mass mobilization for conservation work to prevent land degradation problem is very high. According to the data which is obtained from woreda natural resource conservation office and practical field observation in 2013/14 and 2014/15 the woreda practiced different type of conservation works through mass mobilization program. From the different type of conservation method which the woreda practiced relocation of watershed, different types of terraces, mountain soil and water conservation structure and gully protection and rehabilitation activities are among the major ones.

From the total conserved area which is done in the woreda through mass mobilization in 2013/14 9023 ha of land covered by terraces, 150468m^3 covered by water storage check dams, 137.73km covered by different canals and 270,087 covered by tranches, micro basin, eyebrow basin in numbers. In general from the total work which is planned to cover in 2013/14 the woreda completed 93.23% of the work successfully through mass mobilization.

Similarly in 2014/15 Efratana Gidim woreda natural resource conservation office were practiced different types of natural resource conservation works through mass mobilization program. From the total work which is practiced through mass mobilization in 2014/15 the woreda covered 3731.55 ha of land by terraces, 126.07km by different canals, 106,812m^3 by different check dams and 52,323 in number by different tranches, eyebrow basin and micro basin. In

2014/15 the woreda completed 74.497% of the work from the total plan (see the detail from Table 22 and 23).

In general the current natural resource conservation program through mass mobilization contributed a lot in recovering degraded lands, reducing flood accident problems, reducing loss of farm lands by erosion, reducing social and economical problems which is occurred due to land degradation problems, reduce infrastructural destruction (road), it increased productivity of land and it created job opportunity for unemployment.

The DAs which are assigned in all kebeles to practice developmental activities, the kebele officials and goit representatives for conservation work take the responsibility to guide and facilitate the conservation work at kebele levels. In addition to this they have also responsibility to select the degraded area for mass mobilization program. All the kebeles which practiced in natural resource conservation work collected the necessary materials like gabion wires from the woreda freely without any payment. In Efratana Gidim woreda the woreda natural resource conservation office also has responsibility to give training for selected farmers how to practice different type of conservation method on the ground and its importance.

4.3.3 Structural setup of the woreda to practice conservation work in the study area

According to the information which is obtained from the woreda agricultural and rural development office, Efratana Gidim worwda natural resource conservation office structured under the woreda agricultural and rural development office. In addition to this the woreda natural resource conservation office has its own sub structures at the kebele level. The kebele natural resource conservation office structured and administered by kebele land administration and DAs office together with a number of committee from the local people.

In additions to this the woreda natural resource conservation office has its own structures at zonal and regional level. A number of institutions at zonal and regional levels are involved in carrying out research and development activities for the controlling of land degradation problems and conservation of natural resources.

According to the survey result, from all sample kebeles from the total sample household respondents almost all of them (100%) response the presence of natural resource conservation work in their peasant association and 83% of the sample household head respondents

practice different type of conservation method on their farm land privately (Table 20).

Table 20. Practice of natural resource conservation by sample household heads in the sample kebeles

Variables	Frequency	%
Is there conservation work in your PA association?		
Yes	90	100
No		
Total	90	100
Did you practice any conservation work privately in your farm land?		
Yes	75	83
No	15	17
Total	90	100

Source: - own survey, 2015

The above result implies that, in the study area from the total sample respondent farmers almost all of them understand the presence of land degradation/soil erosion problem and its consequence. On the other hand the sample respondent farmers well understand the role of natural resource conservation work to prevent land degradation problem in the form of soil erosion from their farm land. That is why they practice conservation work as a PA in general and privately on their farm land.

4.3.4 Challenges of natural resource conservation through mass mobilization in the study area

According to the information which is obtained from Focus Group Discussion and Efratana Gidim woreda natural resource conservation office at the beginning the program were faced a number of problems. Such as attitudinal problems, lack of interest to participate in the program, lack of awareness, shortages of materials like gabion wires, the program does not include the whole society (only include farmers), lack of continuous assessment for previous jobs, lack of rule and regulation for non participant farmers and conserved areas are among the major one. But through continuous awareness creation programs and active involvement of the woreda conservation office, DAs, kebele and goit representatives, and model farmers (ginbar kedem arisoaders) all the challenges which is written in the above reduced through time step by step.

4.3.5 Type of conservation method in the sample kebeles

In the study area specially in the sample kebeles different type of conservation method practiced for the last 8 years through public participation in integrated way. Terracing, stone check dam, stone bund, cut off drain, water way, gabion check dam, hill side terracing, and afforestation are among the major ones.

According to the data which is collected from the sample kebeles 63.33% of the sample respondent practiced terracing, soil and stone bund method of conservation on their farm land. On the other hand 23.33% of the respondent practiced cut off drain, stone check dam, and water way conservation method. The remaining 13.33% of the respondent in the sample kebele practiced hillside terracing, afforestation and gabion check dam on their farm land to prevent the expansion of soil erosion (Table 21). However to practice gabion check dam type of conservation method on their farm land farmers have a problem of finance since the cost of the material is very high. But the importance of gabion check dam to protect soil erosion problem specially in the gully erosion areas is very high.

Table 21. Conservation method practiced by sample household heads in the sample kebeke as a PA

Type of conservation method	No of respondent	%
- Terracing - Stone bund - Soil bund	57	63.33
- Cut off drain - Stone check dam - Water way	21	23.33
- Hill side terracing - Afforestation - Gabion check dam	12	13.33
Total	90	100

Source: - own survey, 2015

In the sample kebeles most of the conservation method practiced by sample household head respondent as a PA and individually are more or less the same. But due to shortage of agricultural land and financial problems most of the sample farmers does not practiced afforestation and gabion check dam conservation method on their farm land. Below there are some photos which show some of works.

Source: - own survey, 2015 **Fig 2**

Fig 2. Mountain farm land terracing, farm land terracing, tranches and farm land stone bund

Fig 3. Gabion check dam, stone bund, eyebrow basin, M.terracing

Source: - OoWNRC and own survey, 2015 **Fig 3**

Source: - own survey, 2015 **Fig 4**

Fig 4. Afforestation, micro-basin and stone bund with terracing

According to The data which is obtained from Efrata and Gidim woreda natural resource conservation office in 2013/14 and 2014/15 different type of works practiced at a woreda level in order to protect land degradation problem in the form of soil erosion (Table 22).

Table 22. 2013/14 Efratana Gidim woreda natural resource conservation work

Type of conservation method	Measurement	Planned	Covered	%
Farm land stone terracing	ha	1,500	1,381.5	92.1
Maintenance of soil and stone terracing	ha	3,329	3,032.2	91.1
Stone face soil terracing	ha	117	117	100
Soil terracing	ha	1,050	1,035	98.54
Mountain terracing	ha	500	571.8	114.4
Maintenance of mountain terracing	ha	364	547.2	150
Check dam	M^3	93,799.5	95,893	102
Maintenance of check dam	M^3	50,000	54,575	109
Small trench	In number	70,000	66,217	94.6
Big trench	In number	50,000	45,648	91.2
Micro basin	In number	100,00	93,305	93.33
Eyebrow basin	In number	65,000	64,917	99.87
Flood diversion canal	Km	75	75.44	100.5
Maintenance of flood diversion canal	Km	30	35.03	116.7
Water way canal	Km	25	27.2	108.8
Table terracing	ha	32	20.7	64.7
Strengthen terraces by plant	ha	30	19	63.3
Relocation and protection of degraded mountain	ha	2,000	1,965	98.25

30-50ha communal forest relocation	ha	1,500	318	21.2
Strengthen gully by plant	ha	20	11	55
Total		10442ha 130km 143,799.5 m^3 285,000 in no	9,023ha 137.7km 150468 m^3 270,087 in no	93.23

Source: - Efratana Gidim woreda natural resource conservation office 2013/14.

According to the above table, in 2013/14 Efrata and Gidim woreda natural resource conservation office planned to work 1,0442 ha different type of terracing, 130 km different canals, 143,799.5 m^3 water storage check dams and 285,000 small and big trench, micro basin and eyebrow basin in numbers. From these total works they cover 9023ha by terrace, 150468m^3 by water storage check dams, 137.73km by different canals and 270,087 by different trench, micro basin and eyebrow basin in number. In general from the total work which is planned to cover in 2013/14 the woreda finish (completed) 93.23% of the work successfully (Table 23)

Table 23. 2014/15 Efratana Gidim woreda natural resource conservation work

Type of conservation	Measurement	Planned	Covered	%
1.Relocation of watershed	In number			
1.1 Major watershed	In number	4	4	100
1.2 Critical watershed	In number	19	19	100
1.3 Communal watershed	In number	96	96	100
2. Survey and revision of watershed	In number	41	39	95.1
3. Adding stable watershed in to development	In number	55	55	100
4. Adding new watershed in to development	In number	41	36	87.8
5. Terracing	In ha			
5.1 Farm land stone terracing	ha	1500	1361.2	96.32

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Source: - Efratana Gidim woreda natural resource conservation office 2013/14.

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1.Relocation of watershed	In number			
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1.2 Critical watershed	In number	19	19	100
1.3 Communal watershed	In number	96	96	100
2. Survey and revision of watershed	In number	41	39	95.1
3. Adding stable watershed in to development	In number	55	55	100
4. Adding new watershed in to development	In number	41	36	87.8
5. Terracing	In ha			
5.1 Farm land stone terracing	ha	1500	1361.2	96.32

5.2 Soil terracing	ha	1125	540.8	46.92
5.3 Maintenance of soil and stone terracing	ha	1125	1056.8	93.94
5.4 Strengthen terraces by plant	ha	37.5	26.3	70.13
5.5 Table terracing	ha	72	53.3	74.02
6. Mountain SWC	ha			
6.1 Mountain terracing	ha	745	368.15	49
6.2Maintenance of mountain terracing	ha	445	308.05	69.2
6.3 Flood diversion canals	km	71	49.52	69.74
6.4 Maintenance of flood diversion canals	km	32	52.2	164.7
6.5 Water way canals	km	24	11.8	49.16
6.6 Maintenance water way canals	km	13.3	12.05	90.60
6.7 Percolation and plantation structure	In number			
6.7.1 Micro trench	In number	50,000	27166	54.3
6.7.2 Big trench	In number	21,398	6,047	28.25
6.7.3 Percolation trench	In number	1,900	933	49.1
6.7.4 Eyebrow basin	In number	30,000	7,927	26.4
6.8 Half moon water storage	In number	50,000	10,001	20
7. Gully protection	M^3			
7.1 Stone check dam	M^3	95,000	75,027	79
7.2 Maintenance of stone check dam	M^3	50,000	31,775	63.57
7.3 Strengthen gully by plant	ha	20	17	85
Total		5070ha 140.3km 145000 m^3 153554 in no	3732ha 126km 106812 m3 52323 in no	74.492

Source: - Efratana Gidim woreda, natural resource conservation and protection office, 2014/15.

In 2014/15, Efrata and Gidim woreda natural resource conservation and protection office planned to work 5,069.5ha terracing, 140.3km different canals, 145,000m^3 different check dams and 153,554 different trenches in number. However, the woreda covered 3731.55ha in terracing, 126.07km in canals, 106,812m^3 in check dams and 52,323 by different trench, eyebrow basin and micro basin in number. From the general plan in 2014/15 the woreda completed 74.497% the work successfully.

At the end of 1999E.C/July 2006/at the eve of the Ethiopian millennium when the conservation and protection of natural resource started as a country level; Efratana Gidim woreda also begun their work by planting different kind of indigenous trees on degraded areas. But at that time the work does not include the whole society and it is not as an integrated way due to awareness problem. But through continuous awareness creation by giving on job training for role model farmers (ginbar kedem arsoader) about the expansion of soil erosion problem and about the role of natural resource conservation in preventing the expanded problem, at this time it is possible to participate the whole local community voluntarily specially farmers (both male and female).

According to the information what I collected from sample respondent farmers, all of them (100%) response that the conservation work in all sample kebeles worked through public/mass mobilization and privately. The work which is worked through public/mass mobilization program most of the time stayed for 45 consecutive days per year and the conservation work done in selected areas (specially affected areas). On the other hand the individual conservation works most of the time done by individual farmers near to their farm land with the help of DAs. In the sample kebeles DAs help and teaches the farmers about the importance of natural resource conservation program, how they practice the conservation work, in selecting degraded areas, the importance of the program on their agricultural activity, and the socio-economic benefit of the program in general. Due to this in the sample kebeles all sample respondent farmers (100%) participate in the conservation work for 45 days per year by mass mobilization in selected areas and all over the year individually on their private farm land voluntarily.

From the total sample household head respondents 63 of them or 70% response as they motivated to participate in the conservation program by the benefit what they gain from the program. i.e the reduction of

flood accident, the reduction of infrastructure destruction (road, agricultural land, crop), it creates job opportunity for un employments (beekeeping, preparing food for livestock, oxen fattening, and got rearing), farmers can get food for their livestock easily. Whereas 16 of the sample respondents or 17.77% response as they motivated by the presence and expansion of the problem by itself. The expansion of soil erosion from time to time on their peasant association in general and particularly on their farm land, motivate the farmers to participate in the program as well as to tackle the problem in organized way. On the other hand, 11 of sample respondent or 12.22% response as they motivated to participate in the program by government policy. i.e government taking the natural resource conservation program as part of the agenda for future development and the awareness creation program by DAs and other government concern body.

Regarding the changes accrued (gained) from the natural resource conservation program what they practice on their farm land and selected areas all the sample respondent farmers response as the program brought change towards soil erosion in their peasant association in general and on their private farm land in particular. In addition to these, from the total sample respondent farmers 63% of them response the recovery of degraded area as high change. While 27% of the sample respondent response the reduction of flood accident and soil erosion as high change which affect them before in their peasant association and on their farm land. The rest 10% of the respondent, response the improvement of soil fertility and agricultural productivity due to the program (Table 24). This group of respondent supported their argument and contended that in the absence these conservation structure as it usually happened in high rain fall areas, the severe erosion could not only remove the soil but also washed the planted crops along with the soil. This automatically resulted in the reduction of production per unit area of the farm land.

Table 24. Positive changes which is seen in the sample kebele due to the presence of natural resource conservation program

Change which is seen by the conservation program	No of respondent	%
Recovery of degraded areas	57	63
- Reduction of flood accident - Reduction of soil erosion	24	27
-Improvement in soil fertility -Improvement in agricultural productivity	09	10
Total	90	100

Source: - own survey, 2015

The photos, which are attached below, shows the changes observed in the sample kebeles before and after conservation program.

Source: - OoWNRC, 2015 **Fig 5**

Fig 5. Previous features of the land in the study area

Source: - own survey, 2015 **Fig 6**

Fig 6. Current features of the land in the study area

The above table and photos implies the presence of positive change towards land degradation due to the work which is done by the community through natural resource conservation program in the sample kebeles. Due to active participation of the local community who are living in the sample kebeles the problems which is associated with soil erosion reduce from time to time. For example after the beginning of natural resource conservation program the sample household head farmers in the sample kebeles can collect food for their animals easily, they can generate job and income for unemployment and can reduce flood accident and soil erosion problem. Furthermore the rapid positive change what thy seen from time to time in their peasant association in general and on their private farm land in particular motivate the local community to work more in natural resource conservation work to the future.

4.3.6 Causes of positive change

As everything have its own causes and consequences the changes which are seen in the sample kebeles due to the presence of natural resource conservation program have also its own causes. According to the response of the majority of sample respondents, the beginning of the program by itself is the main cause of the change. In addition to this the rule and regulation which is seat by the local community to protect the conserved area from human being and animal, the actively participation (involvement) of the local community with interest, the positive change against degraded area, the benefit what they gain from the conserved areas (the social and economic benefit like reduction of flood, reduction of soil erosion, reduction of being washing planted crops, reduction of infrastructure destruction) are some of the causes which is seen in the sample kebeles.

When we see the extent of the change in all sample kebeles it increases from time to time. According to the response of sample household respondents and the information what I collect from sample kebeles DAs every year they planned to cover from 400ha up to 500ha of land by conservation program per year. The number of hectares what I mentioned above include the new selected area which is prepared for conservation work and the maintenance of the previous conserved areas to strengthen, to protect from destruction by different causes, and to assure the sustainability of the work to the future. In addition to these from the total sample respondent household head 61% of the respondent put under control the expansion of the problems on their farm land and the remaining 39% of the respondent slightly controlled the problem from their farm land. The changes which are observed in the sample kebeles due to the

presence of natural resource conservation work have a number of implications in terms of benefit for the local community. Regarding the benefit what the sample respondent gain from the natural resource conservation work, there was no consistent answer among discussants. The majority of them without hesitating said that the natural resource conservation program which is done to prevent soil erosion problem increased crop production/income, it helps the farmers not to migrate to other places due to lack of food for themselves and for their animals, it would be the source of food for animals and it created different job opportunity for the unemployment who are living in the sample kebeles. From the job opportunity which is created for the unemployment by the presence of conserved area in the sample kebeles beekeeping, oxen fattening, got and sheep rearing, preparing food for livestock are the major ones. The woreda small and micro enterprise office select a number of unemployment by preparing different criteria (age, source of income, family back ground, length of residence in the kebele ...etc) and organized them based on their interest in all fields. The unemployment does not only exploited the resource from conserved area but also taken the responsibility to protect and conserve the area. The entire group, which are organized themselves in different jobs in the conserved area done their business in a responsible manner without degrading the area. In all sample kebeles (Laygnaw Ataye, Serdo and Meskel ber) 80 unemployment youngsters organized themselves in the above mentioned created jobs. Many others also show interest to be the members of the group. In addition to these the responsibility of the organized group increased from time to time to protect and conserve the area as a private property and the program unite the people to work together and teaches the importance of working together. According to the information what I collected from all group in all sample kebeles they planned to work more and to participate more unemployment in the future. So, the benefit what they gain from the natural resource conservation work changed the attitudes of the organized groups to work more jobs in the future and also change the attitude of the whole society to make active participant of the program. From the total sample respondent all of them response with a great confidence the capacity of the program to prevent land degradation/soil erosion problem in the future (Table 25).

Table 25. Perception of sample farmers towards natural resource conservation program in preventing land degradation in the form of soil erosion

Variables	No of respondent	%
Can the conservation program prevent soil erosion problem in your PA?		
Yes	90	100
No	—	—
Total	90	100
What is the community attitude on the current extent of land degradation through soil erosion compared to the time before?		
-put under controlled	55	61
-slightly controlled	35	39
-aggravate the problem	—	—
-others	—	—
Total	90	100
Did you believe that investment in the soil conservation practice is profitable in the long run?		
Yes	90	100
No	—	—
Total	90	100

Source: - own survey, Efratana Gidim, 2015

From the above result we can understand that the believe of the framers who are living in the sample kebeles to wards natural resource conservation work in preventing soil erosion problems at this time and to the future and as it is the only solution to recover the degraded land by different problems. But due to high shortage of agricultural land in the sample kebeles most of the sample respondent farmers does not practice crop rotation and fallowing systems.

4.4 Livestock status of sample kebeles

Traditionally, livestock in the study area have been kept for different purpose. They are kept to provide food, fiber, as a means of saving because farmers regard livestock as a safe guard for sudden cash requirement as they requirement as they represent a considerable capital resource. The farmers who are living in the sample kebeles sold animals in time of needs for food, credit repayment, to pay taxes and other. In addition to this livestock are seen viewed as a source of various food products like milk and meat. In the sample kebeles Oxen

are kept for both plowing and fattening purpose. Further more animals in the sample kebeles used as a means of transportation.

From the animals which are reared in the study area cattle, sheep, goat and donkey are among the most important and the common ones. The survey result in the sample kebeles shows that from the total sample respondent farmers all of them (100%) have oxen for plowing purpose. On the other hand from the total sample household head respondent 41% of them have all kind of animals which mentioned above. 33% of the respondent on the other hand does not have donkey, sheep, and goat. The remaining 26% of the respondent does not have cow only (Table 26).

Table 26. Livestock population of sample farmers in the sample kebeles in 2014/15

		Livestock				
Kebeles		Cattle	Sheep	Goat	Donkey	Total
Laygnaw Ataye	No	210	263	189	23	685
	%	30.65	38.39	27.59	3.35	100
Serdo	No	193	181	220	18	612
	%	31.53	29.57	35.94	2.94	100
Meskel Ber	No	213	163	201	21	598
	%	35.68	27.25	33.61	3.51	100

Source: - own survey, 2015

The above table shows that the presence of 1895 livestock population in the sample kebeles which is hold by sample household heads. From these total number cattle constitute 616 or 32.34%, sheep 607 or 32.03%, goat 610 or 32.18 and donkey 62 or 3.27%. This implies the presence of high number of livestock in the sample kebeles without enough pasture land and livestock contribution to soil erosion. Before the beginning of conservation work in the sample kebeles 85% of sample respondents does not have private pasture land for their livestock; only 15 % of the sample respondent have private pasture land for their livestock but it is very small in size and it is only allowed for farm oxen. But after the implementation of conservation work in the sample kebeles 75% of the sample respondent can prepare their own pasture land but it is very small in size and all of the respondent who are prepared private pasture land grazed their farm oxen only. In addition to this due to shortage of lands and awareness in the sample kebeles, the sample respondent household heads does not use the

pasture land in rotation. Furthermore, before and after conservation program in the sample kebeles there is difference in type and source of feed for their animals (Table 27).

Table 27. Type and source of feed for animals in the sample kebeles before and after conservation program

Types of livestock	Type of feed before	Source of feed before	Type of feed after	Source of feed after
Cow	1	1	2,3,6	3,4,5
Calf	6	3, 5	2,3,6	3,4,5
Bull	1	1	2,3,6	3,4,5
Heifer	1	1	2,3,6	3,4,5
Oxen	1, 6	1, 5, 3	1,2,3,6	2,3,4,5
Sheep	1	1	1	1
Goat	1	1	1	1
Donkey	1	1	3,4	3,4,5

Source: - own survey, Efratana Gidim, 2015

A, Feed type code 1. Grazing 2. Hay 3. Straw 4. Maize and Sorghum 6. Cut and carry 7. Any other specify

B, Source of feed code 1. Communal grazing land 2. Fallow 3. Crop Product 4. Purchasing 5. From own farm

Before the implementation of conservation work in the sample kebele most of the sample farmers' use grazing type of feed and the source of feed for their livestock are communal grazing land except for their farm oxen and calf. But after the launch of the current massive natural resource conservation work the majority of the sample farmers changed the type of feed from grazing to hay, straw, cut and carry and other system. Beside this the sample farmers also changed the source of feed from communal grazing land to crop product, purchasing, fallow, from own farm and other sources. Beside these, according to the response of most of sample respondent farmers, the way what they use to feed their animal and the rapid growth of population (human and animal) contributed a lot for the expansion of soil erosion in the area. To overcome this problem the farmers changed the feed type, source of feed and decreased the number of animal what they have

CHAPTER FIVE

SUMMERY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMERY

Natural resource development in Ethiopia affected/hampered by many factors, among which land degradation in the form of soil erosion which is threatening the overall sustainability of agricultural production of the country is the major ones.

This study is, therefore conducted to analyze the role of the current massive natural resource conservation program towards preventing land degradation problem in the form of soil erosion in the study area. Furthermore, it also analyzed causes and consequences of the problem, the positive change which is seen due to the intervention of the conservation program through mass mobilization and implication of the positive change in terms of benefit in the study area also analyzed.

To achieve the objectives of this study, relevant secondary information about the study were collected from various publication, report, and office contacts. But the major sources of data, on which the study mainly depended were, was collected from sample of 90 household heads drawn from 3 rural kebeles of Efratana Gidim woreda by using stratified random sampling. In selecting sample respondents' simple random technique was employed.

With structured questionnaire, on the socio-economic status of selected sample farmers, land degradation status of the study area, natural resource conservation status and livestock status of the study area were administered with enumerators.

Descriptive analysis (mean, percentage) and qualitative data analysis were used to analyzed, compare and contrast the role of the current natural resource conservation work through mass mobilization to prevent land degradation problem in the form of soil erosion.

5.2 CONCLUSION

Settled agriculture in the northern part of Ethiopia in general and in the study area in particular has been practiced for thousands of years. Through the expansion of agricultural land and population growth (human and animal) and farming systems makes the expansion and severity of land degradation more difficult and complicated.

The result of the study shows that the causes which relate to human and physical causes are responsible for the severity of land

degradation in the study area. On the other hand the current natural resource conservation program through mass mobilization contributed a lot in minimizing the expansion of the problem in the study area. For example in 2013/14 and 2014/15 within two years the woreda can covers 12,755 ha land by terracing, 263.75 km land by different canals, 257280 m^3 check dams and 322,410 different tranches, eyebrow basin, and micro basin in number. These shows the great contribution of mass mobilization in the conserving the degraded areas.

In the study area from the total sample respondent almost all of them perceive the presence of land degradation in the form of soil erosion in their peasant association and 77% from the total believe the presence of all kind of erosion (sheet, rill, gully erosion) in their peasant association. Furthermore, before the implementation of conservation work in the sample kebeles 55.55% of sample respondent farmers' response as their farm land severely degraded. Whereas after the implementation of conservation work in the study area 72.22% of sample farmers response as their farm land un degraded.

Furthermore, the human and physical causes which aggravate the expansion of land degradation problem in the sample kebeles before the implementation of the program reduce to physical cause only after the implementation of the program. All the cause which relate to human cause resolved through the intervention of the current massive conservation program.

The measures which is taken by the sample household head farmers and non-sampled farmers can reduce the expansion of the problem from time to time in the study area. For example 83% of sample farmers practice different type of conservation method on selected areas and on their private farm land (see photo: 2, 3 and 4).

The current massive natural resource conservation program has also played a vital role in bringing major change in patterns of household energy consumption. Before the implementation of the program the major sources of household energy consumption were natural forest, animal dung, and crop residue which account 80% together. However, after the implementation of the program this pattern was dramatically reduced to 43.33% and they changed their source of energy for household consumption to private plantation, electricity and kerosene which contributed a lot in reducing the expansion of land degradation through soil erosion in the study area.

The changes what they seen on their peasant association in general and on their private farm land in particular motivates the sample

household farmers to work more towards conservation program. From the total sample respondent 63% of them response the recovery of degraded area, 27% response the reduction of flood accident and the remaining 10 also response without hesitation the improvement of soil fertility and agricultural productivity (crop production) see table 21, photo 5 and 6.

The beginning of the current massive conservation program, the rule and regulation which is seat by the general local community to protect the conserved area and to reduce free grazing systems, the benefit what they gain from the conserved area (social and economic benefit), the active participation of the local community in the program, the positive change against degraded areas, and etc considered as the cause of change in reducing the expansion of land degradation problem in the study area. The positive change which is seen in the area has also its own implication. For example it unites the people to work together and teaches the local community the importance of working together. In addition it teaches the possibility of reduction of social and economic problems such as migration due to lack of food for their animal and for themselves and the potential of conserved area in creating job opportunity for unemployment. The conserved area in the sample kebeles can create job opportunity for 80 unemployment who does not have any job before.

On the other hand the expansion of livestock beyond carrying capacity of land exacerbated the degradation of soil mainly through soil erosion. The study shows that the majority of sample household head farmers before the program used grazing type of feed and communal grazing land as a source of feed for their animal. Due to shortage of land and awareness problem 85% of sample respondent does not have private pasture land before. But after the implementation of the program 75% of the respondents tried to prepare private pasture land but it is very small and they are not allowed to feed all animal except farm oxen. Due to shortage of land in the study area the local people changed the systems of feeding to different type of feed such as hay, straw, cut and carry and to different source of feeding such as purchasing, crop product and from own farm (see table 24)

Generally the living standard and economic status of the people in the study woreda played a crucial role in aggravating the problem/land degradation problem in the form of soil erosion in the sample kebeles. So, improving the social and economic condition of the local people in the study area indirectly played a vital role in reducing the expansion of the problems which relate to land degradation.

5.3 RECOMMENDATIONS

As we all know land degradation in the form of soil erosion, is one of the major problem which negatively affect the socio-economic activity of many countries all over the world. But the expansion of the problem is more serious in developing country where land degradation in the form of soil erosion has a direct relationship with poverty. So, combating and reversing the land degradation process requires comprehensive and cost effective programs. In Ethiopia in general and in the study area in particular the current massive natural resource conservation work will be very important to the future if the concern body give due attention. Based on the research findings, the following specific recommendations were suggested.

- The current natural resource conservation program through mass mobilization to prevent land degradation problem played a crucial role towards conserving degraded areas, creating job and income opportunity for unemployment, reducing social and economical problems, reducing destruction of farm land and infrastructure by flood and improving agricultural productivity in the study area. So, to sustain these improvements in the study area the current conservation work through mass mobilization should be continued in integrated and better way.
- Since 75% of the woreda is mountainous (48%), gorges and rugged (27%) it is sensitive to accelerate land degradation in the form of soil erosion. So, the people who are living in the study area should better to reduce/stop cultivation of steeper slops and deforestation activity and must practiced different conservation work in integrated way to bring sustainable positive change in the study area to the future.
- In Efratana Gidim woreda the current conservation work through mass mobilization only practiced by farmers. To the future it is better to include all society who are living in the woreda since every ones have his/her own direct or indirect contribution to the expansion the problem in the study area. In addition to this participation by itself can add awareness and responsibility for the participant about the issue.
- In addition to conserving the degraded areas, the areas which are conserved by mass mobilization program needs continuous follow up. So, the lessons and the awareness creation program about the positive impact of conservation work and the negative impact of the problem should be better to expanded to other parts of society rather than giving for the farmers only. Furthermore the unemployment who are organizing themselves in the conserved areas in different jobs should be responsible and take care about the conserved resources to transfer good environment for the future generation ratherthan over exploiting and damaging.

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APPENDICES

ADDIS ABABA UNIVERSITY SCHOOL OF GRADUATE STUDIES

CENTER FOR REGIONAL AND LOCAL DEVELOPMENT STUDIES

HOUSEHOLD SURVEY QUESTIONNAIRE

INTRODUCTION

The aim of this questionnaire is to assess the role of natural resource conservation program to prevent land degradation problem in the study area.

Note:-

-Please do not write the name of the respondent

-You can use the box or the space provided against each number for your response

-Make x whenever needed

Woreda_____ PA_____
Village_____

Name of enumerator_____ signature _____
date_____

PART ONE: - Personal and household data

1.1 Sex of the respondent
1. Male 2. Female

1.2 Age of the respondent

1. Age in completed year_____

2. Don't know/No response

1.3 Marital status

1. Single 2. Married 3. Divorced 4.Widowed

1.4 Educational status

1. Read and write

2. Formal education (write the exact education level)
_____

1.5 Length of residence within the woreda

1. Since birth 2. For other write exact number_____

1.6 Family size (in number) 1. Male_____2. Female_____ Total____

1.7 Land holding size

1. 3 Timad 2. 4 Timad 3. 5Timad 4. 6Timad 5. 7 Timad

PART TWO: - Land degradation status data

2.1 Did you perceive the presence of soil erosion in your PA?

1. Yes 2. No

2.2 If your answer is yes for Q 2.1 what is the type of erosion?

1. Sheet erosion 2. Rill erosion 3. Gully erosion

2.3 Does soil erosion the main land degradation problem in your PA?

1. Yes 2. No

2.4 If your answer is yes for Q 2.3 what is the level of the problem?

1. Very low 2. Low 3. Medium 4. High

2.5 What is the degradation status of your farm land before and after the conservation program?

1. Un degraded 2.slightly degraded 3.medium degraded 4.siverly degraded

2.6 What is the slope of your farm land?

1. Flat 2. Gentle 3. Moderately steep 4. Steep slope 5. Very steep slope

2.7 According to you what are the major causes of soil erosion on your farm land before and after the conservation program started?

Heavy rainfall	
Cultivation of steeper slope	
Deforestation	
Overgrazing	
Rapid expansion of agriculture	
Population pressure	
poverty	
If others, please specify	

2.8 How long did you feel the problem of soil erosion in your PA?

1. since child hood 2. Since marriage 3. Not remember

2.9 Did you lose your farm land by erosion?

1. Yes 2. No

2.10 If your answer is yes for Q2.9 how much of your land taken by erosion (in Timad)?

_____

2.11 Does soil erosion have an effect on your agricultural productivity?

1. Yes 2. No

2.12 If your answer is yes for Q 2.11 what did you think, the consequence of soil erosion (give rank)?

Problems	Rank
1.land productivity (yield) decrease	
2.Lose of farm land and shelter	
3.Change in type of crops grown	
4.Land preparation become difficult	
5.Reduced farm land size	
6.Poverty	
7.Land becomes out of cultivation	
8.Migration	
9.others, please specify	

2.13 What did you do individually to combat soil erosion problem?

_____

_____

2.14 If you had been taking such measures, what were the main constraints hampering your activities?

_____

_____

_____

2.15 What did your household use mainly for fuel before and after the conservation program started?

1. Natural forest 2. Cow dung cake 3. Crop residue 4. Private plantation 5.kerosine 6. Electricity 7. If others

2.16 What are the serious problems in your farm land? (Multiple answers are possible)

Rank	The plot is too small	Very poor soil fertility	Affected by Erosion	Very steep slop	Difficult to plow	others
1						
2						
3						
4						
5						
6						
7						

2.17 According to Q 2.16 from what this problem happened?

1. From high population growth (Human and livestock)
2. From Poor agricultural activity
3. From its topographic situation
4. From deforestation
5. Limited capital 6. Lack of technology

2.18 Perceptions in the trend of soil depth before and after the conservation program?

	Farm land number					
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
Remain constant						
Increase						
Decrease						
No perception						

PART THREE: - Natural resource conservation status data

3.1 Is there soil conservation practice in your PA?

1. Yes 2. No

3.2 Did you practice improved soil conservation practice in your farm land?

1. Yes 2. No

3.3 If your answer is yes for Q 3.2 what type of conservation method do you practice to combat soil erosion in your farm land? Based on your farm land slope (flat, gentle, moderately steep, steep slope) (multiple answer possible)

Methods	Rank
1.Afforestation	
2. Terracing	
3.Gabion check dam	
4. Wooden check dam	
5.Reforestation	
6.Stone bund	
7.Soil bund	
8.Cut off drain	
9.Water way	
10.Others	

3.4 How the above conservation methods practice in your PA?

1. Through public/mass mobilization
2. Privately
3. Through public/mass mobilization and privately

3.5 Did development agents (DAs) taught you about soil conservation?

1. Yes 2. No

3.6 Did you conserve your farm land with introduced conservation method?

1. Yes 2. No

3.7 If no why? 1. No erosion problem

2. Shortage of labour

3. Heavy doubt on method of conservation

4. No need of soil conservation

5. Any other, please specify

3.8 Did you participate in any of conservation work?

1. Yes 2. No

3.9 If your answer is yes for Q3.8 how you participate?

1. Voluntarily 2. By force/obligation 3. Payment 4. Others

3.10 The conservation method what you use to combat soil erosion when started?

_____

3.11 Who participate in the above conservation method?

1. Farmers both male and women

2. Volunteers

3. Unemployment

4. Student

5. Civil servant

6. NGOs

3.12 What motivates the people to participate in natural resource conservation work?

_____

_____

_____

3.13 The method what you use brought any change towards erosion in your PA?

1. Yes 2. No

3.14 If your answer is yes for Q 3.13 what has changed? Multiple answers possible

1. Soil erosion decrease

2. Agricultural productivity increase (before and after amount of productivity per timad

3. Soil fertility increase

4. Flood accident decrease

5. Food security secure

3.15 What type of change occur do you to soil conservation program?

1. Slow 2. Rapid

3.16 What are the causes of the change which is happened do you to the method what you use?

_____

_____

3.17 What is the extent of the change?

_____

_____

_____

3.18 What is the implication of the change in terms of benefit?

_____

_____

_____

_____

3.19 According to you can the program prevent soil erosion problem in your PA?

1. Yes 2. No

3.20 What is the community attitude on the current extent of land degradation through soil erosion compared to the time before the program intervention?

1. Put under control 2. Slightly controlled

3. Aggravate the problem 4. Others

3.21 What are the traditional land management practices in your area before the conventional conservation practice started?

1. Fallowing, contour plowing, crop rotation, terracing

2. Fallowing and crop rotation

3. Diversion drain

4. Terracing and contour plowing

5. Terracing

6. Fallowing

7. Contour plowing

8. Others

3.22 Did you believe that investment in the soil conservation practices is profitable in the long run?

1. Yes 2. No

PART FOUR: - Livestock status data

4.1 do you have animal?

1. Yes 2. No

4.2 If your answer is yes for Q 4.1 what kind of animal do you have?

1. Cow 2. Calf 3. Bull 4. Heifer 5. Oxen 6. Sheep

7. Goat 8. Horse 9. Donkey 10. Mule 11. Any others

4.3 Do you have pasture land before the conservation program?

1. Yes 2. No

4.4 Do you have pasture land after the conservation program?

1. Yes 2. No

4.5 Do you have enough pasture land?

1. Yes 2. No

4.6 Did you graze your pasture by rotation?

1. Yes 2. No

4.7 If no why? _____

_____

_____

_____

4.8 What are the type and source of feed for your animal before and after the conservation program?

No	Types of livestock	Major types of feed A		Major source of feed B	
		Before	After	Before	after
1	Cow				
2	Calf				
3	Bull				
4	Heifer				
5	Oxen				
6	Sheep				
7	Goat				
8	Horse				
9	Donkey				
10	Mule				
11	Others				

A, feed type code 1. Grazing 2. Hay 3. Straw 4. Maize and sorghum 6. Cut and carry 7. Any other, specify

B, source code 1.communal grazing land 2. Fallow 3. Crop product 4. Purchasing 5. From own farm 6. Any other

4.9 The way what you use to feed your animal before the conservation program have an effect on the natural resource?

1. Yes 2. No

4.10 If your answer is yes for Q 4.8 what measure did you take to tackle the problem?

_____

_____

_____

4.11 Does both animal and human population growth have an effect for the expansion of soil erosion?

1. Yes 2. No

Check list for Key Informants

1. Is there any institutional structure at woreda and kebele level to facilitate the current natural resource conservation program?

2. What type of structure do you have to manage the mass mobilization in the conservation work?

3. Did you give institutional support for the farmers to practice the conservation work?

4. Who is responsible to guide and facilitate the conservation work at kebele level?

5. How and who select the degraded area for conservation through mass mobilization?

6. From where and how the farmers collect the material such as gabion wires for conservation work?

7. What is the contribution of the woreda natural resource conservation office for the current natural resource conservation program?

8. In your woreda how and when the current natural resource conservation program through mass mobilization started?

9. How and for how many days per year the farmers participate in the conservation work through mass mobilization?

10. What is the contribution of this mass mobilization in terms of conserving the degraded lands in your woreda?

11. What are the challenges that affect the conservation program in your kebele?

12. How you solve these challenges?

THANK YOU

Declaration

I, Demiss G/micheal declare that this paper is a result of my independent research work on the topic entitled "**The role of the current Natural Resource Conservation Program through Mass Mobilization to prevent Land Degradation problem in Ethiopia. The case of Efratana Gidim Woreda, in North Shoa Zone, Amhara Region**" in partial fulfillment of the requirements for the Degree of Masters of Arts in Regional and Local Development Studies at Addis Ababa University. This work has not been submitted for a Degree to any other University. All the references are also duly acknowledge.

DEMISS G/MICHEAL

Signature_____

Date _____

Confirmed by the Advisor

Name AKLILU AMSALU (PhD)

Signature_____

Date _____

Place_____and date of Submission_____