WATERSHED MANAGEMENT: EFFECTS AND PROBLEMS, THE CASE OF MERET PROJECT IN KEBELIE-CHEKORTI SUB-CATCHMENT, KALU WOREDA, AMHARA REGIONAL STATE

A THESIS SUBMITTED TO THE SHCOOL OF GRADUATE STUDIES,
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BY
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Watershed Management: Effects and Problems, the case of Meret Project in Kebelie-Chekorti Sub-Catchment, Kalu Woreda, Amhara Regional State

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ACRONYMS AND LOCAL NAMES

AAU: Addis Ababa University
ADLI: Agricultural Development Lead to Industrialization
ANRS: Amhara National Regional State
BDU: Bahir Dar Univesity
DA's: Development Agent
EARO: Ethiopian Agricultural Research Organization
EEA: Ethiopian Economic Association
EGS: Employment Generation Scheme
EPA: Environmental Protection Authority
ETH: Ethiopia
FAO: Food and Agricultural Organization of the United Nation
FFW: Food for Work
FGD: Focus Group Discussion.
FHI/E: Food for the Hungry International/Ethiopia
GDP: Gross Domestic Product
GNP: Gross National Product
Gott: Village
ha: hectare
IDS: Institute of Development Studies
IFSP: Integrated Food Security Program
LLPPA: Local Level Participatory Approach
MERET: Managing Environmental Resources to Enable Transitions to more Sustainable Livelihoods.
MoARD: Ministry of Agriculture and Rural Development
MoFED: Ministry of Finance and Economic Development
OECD: Organization of Economic Cooperation and Development
OSSREA: Organization of Social Science Research in Easter and Southern Africa
PAs: Peasant Associations
PASDEP:A plan for Accelerated and Sustainable Development to End Poverty
PRA: Participatory Research Appraisal
PWDP: Participatory Watershed Development Program
SARDP: Swedish Agency of Rural Development Project
SNNP: Southern Nations and Nationalities People
SPSS: Statistical Package for Social Sciences
Teff: A major food crop grown in most pars of ANRS including the study site
UNECA: United Nations Economic Commission for Africa
Woreda: District
WFP: World Food Program
WMS: Welfare Monitoring Survey

ABSTRACT

Natural resource degradation is a critical problem in the highlands of Ethiopia including the study area (kebelie-chekorti micro-catchment). In order to address this problem, the Ministry of Agriculture and Rural Development together with non-state actors like World Food Program (food aid projects) have launched environmental rehabilitation programs using food aid resources in different parts of Ethiopia including the study site for the last two decades. However, there is a debate on possible effects of food aid projects in rural development. This research, therefore, has attempted to assess the effect of MERET project on some selected livelihood variables. In addition, watershed management problems were also investigated in the study. In conducting the study, formal survey; focus group discussion/PRA, key informants interview, laboratory analysis and review of secondary literature were employed as major data collection method. The findings indicate that with the aid of MERET project, moderate changes have been registered in the study sub-catchment. It was found out that as a result of the intervention of the project (communal and farm land conservation, and gully rehabilitation activities), the availability of forage and fire wood has gone up moderately. The study also revealed that the project contributed in maximizing the amount of food crop production, self and wage employment opportunity, and increased conservation awareness among the community. However, compared with the objective of the project, the task of replicating model project sites into other near by degraded communal and private farm land is at moderate level. As a result, the problem of land degradation and food insecurity prevails in the study area. The research also indicates that wrong perception, lack of awareness, tenure insecurity, short term needs, resource based conflict, and drought are the major problems weakening the effectiveness, efficiency and sustainability of the on going watershed development in the micro-catchment. Therefore, with the aid of development projects like MERET, applying micro level watershed planning, pursuing interdisciplinary and participatory approach, building up on indigenous knowledge system, addressing of farmers priorities, ensuring of land tenure security and implementation of targeted systems is the appropriate option to achieve the required rural development.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

By the year 2001, more than three billion people lived in rural areas. In many developing countries, the proportion of rural people who are dependent on subsistence agriculture accounts more than half of their total population. This proportion is even much greater in African countries including Ethiopia (M. Todaro, 2003).

To sustain their livelihoods, the rural poor are heavily dependent upon natural resources, particularly on land. Hence, attacking poverty in rural areas is believed to be a matter of improving poor people's ability to derive sustenance and income from more productively and sustainably managed land resources (Pretty, et al., 2000; Debebe, 2000).

Reducing resource degradation, increasing agricultural productivity, and reducing poverty and food insecurity are major challenges in Ethiopia, where nearly 85% of people live in rural areas and depend on subsistence agriculture for their livelihoods. Forest and grazing lands are converted into farm lands in many parts of the country including the study area, Kālu *woreda*, Amhara Regional State. This in turn has led to substantial erosion hazards, diminishing soil fertility, disturbance of the hydrological cycle, land sliding catastrophe, desertification, erratic behaviour of rainfall, and a further reduction in the ability to produce (Yeraswork et al., 1985; Yeraswork, 1988; Desalegn, 1990 and Debebe, 2000).

The degree and nature of the problem varies among different regions and localities of the country. Some regions are more prone to drought than others and are often affected by food crisis. For instance, in the recorded history, drought induced famine was and is more serious in Wello, severely affected household food security. In the former Wello region alone the total vulnerability and chronic poverty was 85.4 and 52.4 % respectively (Mulat, 1995; cited by Debebe, 2000). Regarding the extent of deprivation index of access to resources, and goods and social services, Wello is classified as highly deprived. Moreover, according to Siegfried, et al. (1990), nearly 53 % of rural households in South Wello were under the basket of absolute poverty and food insecurity.

Since 1991, the federal and regional governments have focused on promoting conservation of natural resources and improving agricultural productivity and welfare through a broad program of interventions like, Safety Net, ETH-2488 /Food for Work (FFW) project, which is now called MERET (Managing Environmental Resources to Enable Transitions to more Sustainable Livelihoods) project and resettlement (Lakew, et al., 2005).

The WFP supported Food for Work Project (now 'MERET' project) of the Ministry of Agriculture and Rural Development was initiated in 1974 in response to the existing drought and famine. The program which started in the form of relief gradually shifted to development program (integrated watershed management). Initially, the project was smaller in scope and scattered. However, by 1980, it was consolidated and marked the beginning of ETH-2488 project currently named MERET (Betru, 2006).

Since 1960, there has been an inconclusive debate on the incentive and disincentive effect of food assisted projects over all rural development (natural resources, agriculture and food security) of recipient countries (Maxwell, 1986; Yeraswork, 1988, and Desalegn, 1990).

On the other hand, in the course of exercising development operation, the same development projects may encounter various problems. Different activities in various projects have their own distinctive problems originating either from with in the project or external from the project, or from both (Ibid).

Hence, the researcher has got the gap (debates and possible challenges) as a topic to be investigated by undertaking a case study in Kālu *woreda*. That is, the study attempted to focus on assessing the role of MERET Project in the process of watershed management.

1.2 Statement of the Problem

Among administrative *woredas*/districts in Amhara Regional State, Kālu (the study *woreda*) is the one which is recognized as a victim of regular drought and chronic food insecurity (ANRS, 2000). Although Kālu *Woreda* as a whole is known to be food insecure, the food crisis has been uneven among different *Keble's*, affecting some more seriously than others do. In the study site, food stress happens frequently even in the years of best rainy season; several households have been at risk of food shortage and depend on external assistance (FHI/E, 2003, cited in Girma 2006).

Most parts of the study *woreda* and South Wello are topographically rugged. Though study results warn that continuous and intensive farming on lands above 5% of slope endangering heavy soil loss, most of these rugged hills and mountains have been intensively cultivated for more than a century in unwise manner (WFP, 2006). In other words, deforestation, over grazing and poor watershed management have been common happenings in the area. Consequently, land resources (soil, grass and forestland) are heavily degraded in many parts of the region. Supply of forest and grass products have been declined by 32 percent, whereas agricultural yields by more than 2 % averagely (Ibid).

In order to achieve sustainable watershed management as a part of livelihood security, Food for Work (Project 2488/ETH), which is currently known as MERET project, has been performing for more than a decade in parts of the study *Woreda* including Keblie-Chekorti sub-catchment. Keeping moderate changes that are registered with the aid of the project, indicators of land degradation and its consequences like, food insecurity and other property related syndromes together with bottlenecks for successful watershed management are still there in the project's site, the study sub-catchment.

From reading experience, and preliminary study which I have conducted, there have been much debates (nearly for decades), on possible effects of the FFW on rural livelihood assets: land management, agricultural production, employment and marketing behaviours of the recipients. Some argue that food for work induces agricultural productivity, employment opportunities and income; and increases the availability of forage, wood and domestic water (Desalegne, 2006, and WFP, 2006). Others, on the other hand, consider Food for Work as an impediment to development, underling the fact that it results in discouraging agricultural production by creating labour competition for farm activities, dependency, and depressing prices on local market (Clay, et al., 1985; Debebe, 2000, and Maxwell, et al., 1994).

These all have been a big deal in the minds of development practitioners, donors, recipients and farmers on the role and effectiveness of the same project in the process of alleviating food insecurity through land management intervention. Thus, this study attempted to fill the gap (controversy) which has been discussed above; the study was conducted based on the past practices of the project in the form of case study. In addition, the study attempted to search for problems in performing watershed management successfully.

1.3 Objective of the Study

The general objective of the study is to evaluate the effect of food assisted watershed management on the environment of rural people, and at the same time to identify problems/challenges in the overall watershed development. Specifically, the study has the following objectives:

- to identify soil fertility change (chemical changes) made on soil resources because of the project's intervention;
- to identify species diversity and coverage changes made on tree and grass because of the project's intervention;
- to identify changes made on employment , awareness and crop/fruit production because of the project's intervention;
- to identify existing problems in the over all processes of watershed development.

1.4 Research Questions

- What changes are made on chemical properties of soil resource (Organic Carbon, total Nitrogen, available Phosphorus, Potassium, P^H water, and Cation exchange capacity) after the intervention of the project?
- What changes are made on species diversity and coverage of forest and grassland resources after the intervention of the project?
- What changes are made on availability of wood for fire and construction; and grass for forage and construction after the intervention of the project?
- What changes are made on availability of grass for forage and construction after the intervention of the project?
- What changes are made on employment , awareness and crop/fruit production because of the project's intervention;
- What are existing problems in the over all processes of the watershed management?

1.5 Significance of the Study

Since the study tried to reveal the effect of the program and its major constraints in the program, it is believed that the study will have significant contribution to learn and think more about how to better design and implement the on going program in line with the local condition. The significance of the findings will not be limited to the area under study but also

other cites which have similar socio-economic, institutional and natural resource background with that of the study area.

1.6 Organization of the Paper

The thesis consists of five chapters. The first chapter deals with back ground information related to debates on the role of food aid, land degradation, statement of the problem, and research objective. Chapter two describes methods used for data collection and analysis,. Chapter three displays the theoretical and conceptual foundation of the study. In chapter four, general background of the study area, empirical and comprehensive findings of the study and discussions of findings are presented. The last chapter presents conclusions that are derived from the course of the study. It also forward key recommendations and future focused areas for practitioners, policymakers and researches. Research components like soil test analysis sheet, survey questionnaire, checklists for focus group discussion and key informants interview are annexed next to chapter five.

CHAPTER TWO
RESEARCH METHODS

2.1 Methods and Materials of Data Collection

In order to meet the objective of the study, it was found important to apply both historical analysis (comparison of the situation at the beginning and after the intervention), and spatial analysis (comparison of the situation between the treated and non -treated villages at the same time). The former method was applied to give qualitative and more detailed account of how things have changed because of the intervention in the study site. Such kinds of data have been acquired through consulting secondary sources of data, local elders, administrators and experts, and other segments of the community who know the area at the beginning and after the intervention of the project.

A household survey questionnaire, focus group discussion, key informant interview, direct field observation, and laboratory were the main data collection techniques applied to answer the research questions. In addition to the primary data sources, secondary data sources including reports and seasonal socio economic surveys were also very important for the fulfilment of essential data. Farmers at household level from both sexes, local experts including DAs, and local administrators played a vital role in giving facts and opinions on the research questions.

2.1.1 The Preliminary Data Collection Methods and Sources

Preliminary Survey: in order to have a brief overview of the study area in line with the problem under discussion, and to get a hint on the nature of the problem and methods to be used, a preliminary assessment (field observation and discussion by using pre-planned checklist with purposely selected farmers from beneficiaries, local administrators and experts including DAs) has been made in the study sub-watershed. In addition, a preliminary visit has also been made to relevant personnel in WFP and Agricultural and Rural Development offices at federal and *Woreda* levels. It was an important and preliminary step to be informed about the overall nature of the program, the general situation of land resources and its potential effect on the life of the poor. It has helped me a lot in the process of generating appropriate research questions and to enrich the study with relevant data.

Documentation Review: as part of the methods, to provide a useful bench mark for this study, available literatures (published and unpublished data sources: related research works, base line data, annul reports, project mid-term and final evaluation reports, etc) on land degradation and trends in food production in Ethiopia, evaluation papers on MERET) project have been reviewed.

2.1.2 Main Data Collection Methods

2.1.2.1 Household Survey

The conventional household survey was the fundamental data collection method used to conduct the study. To cover the interest of various segments of the community, questionnaire, for beneficiary households were formulated ,and practiced with the help of enumerators.

Enumerators: in order to run the formal survey, five enumerators (from both sexes) and one assistant supervisor were recruited from the study *kebele*. They were selected based on their academic and practical experience, which enable them to run the enumerating and facilitating part successfully. Priority was given for the one who has better knowledge on data collection, and geographical setting and socio-cultural condition of the study area. They have been given training for six days focusing on the content of the questionnaire, and on how to practice it.

Survey Population and Size: in order to make the sample more representatives, it was tried to collect data both form direct and indirect beneficiaries in the villages where there has been an intervention. In addition, the study considered different segments of the community including males, females, administrators, experts, and people with different economic status. Out of the total household heads (540), 90 were taken as samples with an assumption that could represent the rest of the population.

Sampling Technique: in order to consider the characteristics of different segments of the population (male, female, different wealth and position groups) the researcher has applied purposive proportionate sampling.

2.1.2.2 Key Informants Interview (Individually)

Individuals, who have experience and/or knowledge in the area of MERET project and sustainable watershed management were selected and interviewed. Under this method, the pre-planned checklist was practiced among *Woreda* natural resource protection desk officer, DAs', LLPPA team members, local administrators and community elders. Ten people were

selected through purposive sampling. Field notes taken from the interviews were reviewed after each interview to verify its quality and consistency.

2.1.2.3 Focus Group Discussion

FGD was used as one of PRA techniques for qualitative data collection. It helped to triangulate the findings of the research with formal surveys and key informant interview. The discussion was consisting of key informants from the near by *Woreda* experts, local DAS, LLPPA team members and community elders. In order to keep the balance of power among groups of participants in the discussion, proportionate sampling was applied. In order to ease and make effective the discussion; participants were arranged in to four groups based on gender and job position. Each group was consisting of a maximum of five people. A semi-structured checklist was used for facilitating the discussion. Field notes taken for this discussion were reviewed after each discussion to verify its quality and consistency.

2.1.2.4 Soil Analysis

In order to understand the changes with and with out the project scenarios, soil fertility (chemical) analysis specifically on (Organic Carbon, Nitrogen, Phosphorus, Potassium, P^H Water, and Cation Exchangeable Capacity) has been made. In order to make the samples more representatives, soil samples were taken at the top, middle and bottom slope classes in a stratified purposive manner.

The analysis has been conducted by taking soil samples from four farm land sites at a depth of 0- 20 cm. Each site has an approximate area of one hectare. Two villages (Kebelie and Chekorti) are taken from the treated sub-catchment and the rest from the nearby two village (Chikaberet and Gida) farmland plots where the same intervention is not working. To determine the average soil characteristics of each plot, it is necessary to collect soil from several farm plots and combine into one sample. Thus, we get a total of four field numbers in the analysis. For the purpose of conducting comparison, I preferred to apply the mean value of the two experimental groups.

The soil samples were analyzed at National Soil Research Center, Addis Ababa. Cation Exchange Capacity (CEC) of the soil sample was determined in the laboratory by using ammonium acetate (NH4OAC) method (Tan, 1996, cited by Girma 2006). While the total organic matter were estimated from the organic carbon by using the walkley and black methods and also called titrimertric determination method (Baruah, 1998, cited by Girma

2006). Soil ph was determined by indicator or colorimetric method 1:2.5, soil–water ratio. The total nitrogen was determined through titration method, while the Olsen method was used for the determination of the available phosphorus.

2.1.2.5 Field Observation

To support and maximize the reliability of the data, which were collected by other methods, the researcher accompanied with the DAs and farmers has made systematic field observation. The observation gave emphasis to the physical conservation structures made on communal and private farmland plots, coverage and species of grass and plant-trees, seedling site and the the nature of the topography both in the intervention and non-intervention sites. In order to document the physical observation, pictures were taken with the help of digital photo camera.

2.1.3 Data Analysis and Interpretation

2.1.3.1 Data Analysis

A. Strategies for Analysis: as a strategy, the researcher has got cross-case analysis more suitable to organize the data collected from different methods and sources. The study applied a descriptive approach as a strategy for analyzing the data, which was collected using the methods indicated above. However, in the case of soil lab analysis, it was found much better to apply a quantitative approach of analysis.

B. Patterns of Analysis: in order to describe the data, which were collected at different levels of the research process, the following patterns were used:

Analysis during Data Collection (Pre-Analysis): the pre-analysis was consisting of a set of "formats" for data reduction and display. It was applied flexibly by controlling overly mechanistic (coded) data analysis.

Notes in the field that contain private abbreviations to be partly illegible and sketchy were first to be converted into what is usually called a write up. In order to reduce the degree of missing elements, and to make correction, it was found important to do so shortly after the data collection. As to run the initial processing of row data, filling and storage system and coding categories were used.

Analysis on Completion of Data Collection: At this stage, in addition to SPSS, the interim summary, coding categories Sheet, document sheet, and session summary sheet were also

employed to cover what was not accomplished in the pre-analysis. The drawing of conclusion and their verification is the major remaining analytic task. Descriptive and quantitative (graphical and tabular) methods of data analysis were employed alternatively depending on the nature of the data.

Since it was very important to challenge and ascertain the findings of the study, beyond analyzing (describing) the data, the researcher has tried to offer explanation, drawing conclusions, making inferences, building linkages, and dealing with rival and supporting findings. In addition, findings, which were generated by the study from different sources of information and/or investigation methods, were crosschecked.

2.2. Limitation of the Study

The absence of adequate/in-depth baseline data forced the researcher to depend highly on retrospective (historical) analysis with basing the local community as the main source of data. Except in the case of soil analysis, it was hardly possible to quantify the data as much as it was needed. Lastly but not the least, because of time, budget, information and competence constraint, it was impossible to cover more than one sub-catchments (five *gottes*/villages) in the study.

2.3. Dissemination of Research Result

In order to disseminate the outcome of the study, and make the issue more active among the wider community, typically to WFP (MERET), MOARD, AAU, and Bahir Dar University as well, the researcher would organize workshops and conferences. In addition, the findings of the study will tried to be disseminated through publication.

CHAPTER THREE
LITRATURE REVIEW

3.1 Conceptual Framework

3.1.1 Participatory/Integrated Watershed Development

In this sub-section, literatures focusing on features of degradation, principles, size and elemen -ts of watershed degradation have been presented briefly.

3.1.1.1 Watershed Degradation Features

The study has given an emphasis to natural resource component of the watershed. Among constraints that lead to the decline of natural resource productivity, degradation is a pressing problem. In what follows, I will briefly describe the different forms of land degradation.

Soil Erosion and Land Degradation: soil erosion is one of the most important components of land degradation. Soil erosion and degradation is a reduction in soil depth and fertility. It is caused by erosion (soil removal, loss of nutrients), reduced soil water holding capacity and excessive exploitative use of the land (cultivation of steep slopes, shallow soils, tillage, overgrazing, encroachment of forests/closed areas, and others). Land resources degradation occurs in various forms. In degraded watersheds, forms of degradations can be physical, biological and chemical (Lakew, et al., 2005).

Impoverishment of the Vegetative Cover: impoverishment of the vegetative cover is reduction of the vegetative cover and biomass caused by climatic factors, over utilization of vegetation (such as cutting of trees, overuse of crop residues for forage and fuel wood, overgrazing, and burning), erosion and reduced soil fertility. If watersheds are not managed properly then the natural resources (soil, water, fauna-vegetation and flora) are degraded rapidly and in due course cannot be used for betterment of humans (Ibid).

Depletion of Water Resources: Ethiopia suffers from what is referred as a "recurrent wastage of most of its rainwater". With loss of water through surface runoff soil is also eroded, thus triggering the whole chain of negative consequences leading to chronic food insecurity. In most developing countries, only 20-50% of total surface runoff is controlled and effectively used. Ethiopia is among them as topography, inadequate farming practices, and lack of

conservation hamper water and moisture retention and its efficient use. Runoff is the portion of rainfall that does not infiltrate into the soil where it falls down. Close connection with the conditions of the watersheds can be made; clearly showing that water is scarcer where watersheds are degraded. Therefore, for effective harvesting and utilization of surface and subsurface water sources for both domestic, livestock and production uses, watershed development is the most appropriate modality (Ibid).

The Linkages Among these three Factors are Obvious: land degradation is mostly responsible for reduction of the vegetative cover and ultimately depletion of the water resources which in turn makes the soil, water and vegetation more vulnerable to further aggravation in degradation of the watershed. The chain reaction could ultimately lead to desertification or disappearance of the potential of the land to sustain life and livelihoods (Ibid).

3.1.1.2 An Integrated and Participatory Watershed Management (Principles, Size, and Elements)

The concept of integrated and participatory watershed management is the fundamental framework in the process of running this research. That is, both to evaluate the performance of the given project and to detect problems at different levels against the carriers of the same project. Therefore, it is found important to describe watershed features in a more detailed manner as follows.

Main Principles of Watershed Development

Participatory: watershed communities need to be involved in all stages of planning implementation and management of watershed development activities. It is a continuous process and not a one time exercise. Different participatory techniques will be used based upon existing and innovative experience.

Involvement and Commitment of Various Disciplines: participatory watershed planning requires the involvement and commitment of various disciplines. This is not only logical but also advantageous as different activities are mutually reinforcing. Under ideal conditions, the *woreda* core team is composed of 10 experts: one Soil Conservation expert, one Forestry/Agro-forestry expert, one Agronomist, one Water Harvesting expert, one Home agent, one Livestock expert, one Land use and administration expert, one Food Security expert (economist /socio-economist), one Cooperative /Marketing and Inputs expert, one

Rural Road Construction expert. In conditions where there are no enough *woreda* experts as proposed, the *woreda* agriculture and rural development office with the aid of WFP is expected to fulfill at least the first four experts listed above.

Gender Sensitive: women are the most affected by environmental hardships; for example, they need to walk long hours to fetch increasingly scarce water, firewood and animal dung in addition to attending livestock, to name a few. Their involvement in watershed development planning, implementation and management is the key to ensure that they equally benefit from the various measures.

Building upon Local Experience and Strength: local knowledge is essential to improve existing technologies, to adapt new ones and to manage natural resources and other measures once they are introduced and established. Best practices have to be identified and disseminated.

Realistic, Integrated, Productive and Manageable: watershed development planning should be realistic, based upon local capacity, locally available resources and other forms of government and partners support. Integrated conservation and development of the natural resources base is the guiding principle for watershed development together with the optimum use of social resources. To the extent possible watershed development activities should provide tangible and quick benefits to households. This is possible if measures are designed to accommodate both production and conservation requirements. Some measures, however, need some time before the full benefits can be achieved. In this case, combination of measures with short and long term benefits is essential. This can be achieved if quality criteria and integration aspects of the interventions are met.

The Need for Flexibility at Different Levels: flexibility is a key criterion required in PWDP to fit local conditions. Flexibility is needed during the selection of community watersheds, their size (slightly smaller or larger than the ranges indicated) and clustering and during the steps of the procedures. Similarly, flexibility is essential when considering the choice and design of measures within the agreed criteria of quality and integration.

Cost-sharing and Empowerment/Ownership Building: Cost-sharing by stakeholders contributes to the sustainability of a project for establishing the responsibility of various

stakeholders in the management of the resources. Various forms of local contributions are possible based upon social networks and group formation mechanisms.

Complementary to Food Security and Rural Development Mainstream (Including HIV/AIDs, Health and Education, and Others): to the extent possible, watershed development planning will incorporate additional elements related to basic services and social infrastructures. These activities will all benefit from participatory watershed development framework (Lakew, et al., 2005; YerasworK, 1988; Belay,2002; and Woldamlak ,2000).

Elements and Characteristics of Watershed

Biophysical (Water, Land and Vegetation): the watershed includes climate (rainfall, altitude, and wind), drainage and water, soil, vegetation, specific topographic features (gradient and length of slope, shape and direction and past/current erosion features (rill, gullies, land slides, and the like). Land use includes homesteads, cultivated land, grazing land, forest (natural and artificial), degraded areas used for various purposes. Some areas have more potential than others. However, watershed development applies to potential as well as less potential areas, as both are not only interconnected but also can recover or improve their productivity with specific set of measures and management.

Socio-Economic: the socio-economic elements and characteristics of a watershed involve population, farming systems, social setups, economic activities, vulnerability profile, gender, and the like. Watershed planning is democratic. It embraces the views of various categories of people in the watershed/s. Although all community members are expected to benefit from watershed development, specific attention is required to address problems of resource poor and vulnerable families and promote the empowerment of women (Lakew, et al., 2005; Belay, 2002; and Woldeamlak, 2000).

Size of a Watershed

As Lakew, et al., (2005) and Woldeamlak (2000) stated, a watershed may be only a few hectares as drainage area for filling small ponds or hundreds of square kilometers for rivers. A suitable watershed size is required for effective planning for conservation and maximum production. Efficient management of watershed resources is possible through an appropriate unit so that the resources are managed and handled effectively, collectively and simultaneously. The maximum size of the watershed that should be taken as a planning unit is

suggested to range from 200 to 500 ha. Sizes lower than 200 ha may occur and may be considered in few cased but usually these smaller units are to be included as sub-watersheds within community watersheds. Some exceptions on the upper side may occur, particularly in drier areas where villages are scattered under larger watershed units and natural resource development is possible only if larger units are considered. In this case, however, sub-watershed units can be identified and prioritized for key interventions before others.

3.1.1.3 Soil: Characteristics and Conservation

Solis may be defined as a thin layer of earth's crust which serves as natural medium for the growth of plants. It is the unconsolidated mineral matter that has been subjected to and influenced by genetic and environmental factors: parent material, climate, organism's topography, and type of conservation activities all acting over a period of time.

I. Characteristics of Soil

Soils have physical, Chemical and biological properties that are independent all over the time. The focus of the study, however, is on the chemical one.

A. Chemical Characteristics

Chemical Characteristics refers to inorganic (mineral particles) and organic matter in the soil. The fertility of a given soil can be analyzed through the measurement of principal chemical constituents like organic matter content (organic carbon); macro or mineral nutrient contents like nitrogen, phosphorus and potassium; cation exchange capacity; and P^H, soil salinity and alkalinity (Shingo, et al., 1985; Scoones 2001).

Organic Matter Content (Organic Carbon)

Organic matter makes up only a small fraction of the total materials in soil, yet it is extremely important in all soil processes. Organic material in the soil is essentially derived from residual plant and animal material, synthesized by microbes and decomposed under the influence of temperature, moisture and ambient soil conditions. There are two groups of factors that influence inherent organic matter content: natural factors (climate, soil parent material, land cover and/or vegetation and topography), and human-induced factors (land use, management and degradation) (Scoones ,2001).

Perhaps one of the most important contributions of organic matter to soil is its water-holding capacity. Organic matter acts like a sponge: it can absorb large amounts of water relative to

its weight. Because it is porous, it also readily permits the infiltration of water. Organic matter is also a source of mineral elements, which are made available when it decomposes. In quantitative determination of soil organic mater it is common to measure the organic carbon content, not the total carbon content (Ibid).

Table 3.1: Classification of soil based on their organic matter content

Organic matter	**Rating**
>6.0	Very High
4.3-6.0	High
2.1-4.2	Medium
1.0-2.0	Low
<1.0	Very low

Source: Tan (1996), cited in Girma (2006)

***Cat-ion Exchange Capacity and* P^H**

Cat-ion Exchange Capacity: CEC is the total amount of exchangeable cations that can be held by a given soil mass. The amount is usually expressed in millieqivalents per 100 gram, its SI equivalents is Cmol(+)/kg of soil , R.l Hausen (1997).

It varies inversely with particle size. Because a given volume of small soil particles has much more surface area than an equal volume of large particles, fine soils accumulate and retain many times more cat-ions than do coarse soils. The soil's colloidal particles, clay and humus, are negatively charged and attract cations. When these particles in a soil are saturated with hydrogen ions, the soil has a strong acid reaction.

The exchange capacity of the soil's colloidal particles is of tremendous importance. Nutrients that would otherwise be lost by leaching are held in reserve and when exchanged become available to the plant. The amount is usually expressed in milli-eqivalents per 100 gram, its SI equivalents is Cmol(+)/kg of soil (Tan, 1996, cited in Girma, 2006).

P^H ***(Soil Salinity and Alkalinity):*** soil P^H or soil reaction is an indication of the acidity or alkalinity of soil and is measured in pH units. The pH scale is a measure of hydrogen ion concentration. The scale is logarithmic; one-point change of P^H means a 10-fold change in hydrogen ion count; a two- point change in pH is a 100-fold change in hydrogen ions. The P^H scale goes from 0 to 14 with P^H 7 as the neutral point. As the amount of hydrogen ions in the

soil increases the soil P^H decreases thus becoming more acidic. From P^H 7 to 0 the soil is increasingly more acidic and from P^H 7 to 14 the soil is increasingly more alkaline or basic. Promotes the most ready availability of plant nutrients (R.l Hausen ,1997).

If a soil has too much acid in it, the nutrients in the soil will be dissolved too quickly, and leached away as the water drains. If a soil is too alkaline, or in other words, if there is not enough acid, then nutrients will not dissolve quickly enough. Thus, a P^H range of approximately 6 to 7 soil, which is neither too acidic, nor too alkaline, is the preferred type of soil for plant life to flourish.

Table 3.2: Classification of soil based on their Acidity and Alkalinity

Acidity and Alkalinity	**P^H value**
Very strongly Alkaline	10.0-14.0
strongly Alkaline	9.0-10.0
Moderately Alkaline	8.0-9.0
Slightly Alkaline	7.0-8.0
Slightly Acidic	7.0-6.0
Moderately Acidic	6.0-5.0
strongly Acidic	5.0-4.0
Very strongly Acidic	4.0-0.0

Source: Tan, 1996, cited by Girma (2006)

Mineral (Nutrient) Contents

Nitrogen: the amount of nitrogen available to roots depends on the rate of mineralization and it in turn depends on all those environmental factors that affect the activity of the microorganisms; the amount of carbon, temperature, oxygen and so on. Some species of bacteria absorb atmospheric n itrogen gas a nd convert it i nto a mmonium, w hich p lants can use. This process, called nitrogen fixation, is the principal natural means by which atmospheric nitrogen is added to the soil. The natural decay of organic matter provides a slow but continuous supply of nitrogen, which tends to be taken up by plants rather than lost to the atmosphere or to water. Legumes also can supplement soil nitrogen supplies by fixing nitrogen from the atmosphere. This is accomplished by nitrogen-fixing bacteria living in nodules on the plant roots. On the other hand, the nitrate not captured by plant roots is free to

move with soil water. This can result in significant leaching or movement of the nitrate to deeper soil depths (Scoones, 2001, and Scoones, 2001).

Table 3.3: Classification of soil based on total nitrogen content

Total Nitrogen %	Classes
< 0.03	Low
0.03-0.06	Medium
>0.06	High

Source: Tan, 1996, cited in Girma (2006)

Phosphorus: Phosphorus is one of the major plant nutrients in the soil. It is a constituent of plant cells, essential for cell division and development of the growing tip of the plant. For this reason it is vital for seedlings and young plants.

Phosphorus exists in soils in organic and inorganic forms. Phosphorus in organic materials is released by a mineralization process involving soil organisms. The activity of these microbes is highly influenced by soil moisture and temperature. The process is most rapid in warm, well-drained soils (R.l Hausen ,1997).

The solubility of the various inorganic phosphorus compounds directly affects the availability of phosphorus for plant growth. The solubility is influenced by the soil P^H. Soil phosphorus is most available for plant use at P^H values of 6 to 7. When P^H is less than 6, plant available phosphorus becomes increasingly tied up in aluminum phosphates. As soils become more acidic (P^H below 5), phosphorus is fixed in iron phosphates. When P^H values exceed 7.3, phosphorus is increasingly made unavailable by fixation in calcium phosphates (Shingo, et al., 1985). Based on the content of phosphorus, soils can be classified as low, medium and high classes.

Table 3.4: Classification of soil based on available phosphorus (ppm)

Available phosphorus(ppm)	Soil classes
0-25	Low
26-50	Medium
>50	High

Source: Shingo, et al. (1985)

All manures contain phosphorus, and manure from grain-fed animals is a particularly good source. For this reason, it is advisable to leave manure from grazing animals where the animals have grazed. It quickly binds with iron and aluminum in the soil and becomes unavailable to plants, especially when soil pH is below 5.0. Phosphorus accumulates on the soil surface and is readily available to plants when moisture allows roots to grow to the surface. However, it becomes less available to plants if the surface soil dries out (R.l Hausen ,1997).

Potassium (K) Cmol(+)/Kg : potassium is second only to nitrogen in the quantity required by plants for healthy growth. Soil type and CEC determine the amount of potassium that is available for plant uptake. Soil type and environmental conditions have an effect on the amount of potassium available for plant use. Potassium availability is highest under warm, moist conditions in soils that are well aerated with a neutral or slightly acidic pH (Scoones, 2001).

Movement of potassium (K) in soils depends on soil texture. As clay content increases, potassium movement decreases. For most soils, it is important that applied potassium be incorporated into the soil rather than top dressed because it is relatively immobile. In sandy soils, potassium is quite mobile and can actually leach out of the root zone. Consequently, sandy soils tend to be low in available potassium. Based on relative potassium content, soils can be grouped into very low, low, medium and high classes (Table 3.5).

Table 3.5 Relative level of Soil test potassium

Relative level of potassium Cmol(+)/Kg	**Soil test potassium**
0-10	Very Low
11-20	Low
21-30	Medium
31-41	High

Source: Wild, 1996, cited in Girma, 2006

B. Biological Characteristics of Soils

Raw organic matter in the soil is not directly used by the plants as food. It must be broken down first into humus and then into simpler products before it can be so utilized. This work is done by different kinds of micro-organisms, which inhabit the soils by billions. All the soil

organisms are not beneficial. There are certain bacterial which organic carbon content hinder anaerobic conditions of waterlogged soils cause denitrification, releasing free nitrogen which gets lost into the air. Some others cause plant diseases (R.l Hausen , 1997).

C. Physical Characteristics

It refers to soils properties like the water holding capacity, permeability to water, aeration, plasticity and nutrient-supplying ability, are influenced by the size, proportion, arrangement and mineral composition of the soils particles. The proportion of the four major components of the soils-inorganic or mineral particles, organic materials water and air-vary greatly from place to place and with depth.

II. Soil Conservation and Fertility on Agricultural Land

Soil develops very slowly over a long period of time but can be lost too quickly. Soil is, thus, an important resource that we all must protect. Broadly speaking, the practical methods of soil and water conservation fall into two important classes, agronomic measures and mechanical measures.

Agronomic practices for soil and water conservation help to intercept rain drops and reduce the splash effect help obtain a better intake of water rate by the soil by improving the content of organic matter and soil structure, help to retard and reduce the overland run off through the use of contour cultivation (contour farming), mulches, dense-growing corps, strip-cropping and mixed cropping.

Mechanical measures (also called engineering measures) play a very vital role in controlling erosion on agricultural land. Are adopted to supplement the agronomical practices when the latter alone are not adequately effective. These measures include basin-listing, ridge-type terraces, absorptive-type terraces, graded budding and bench-terracing on steep slopes (R.l Hausen, 1997).

All these methods are believed to be operated in an integrated manner as to keep and or recover the fertility of soil. This study, however, has tried to evaluate only the possible chemical change in soil made by conservation activities, which has been operated with the aid of MERET project.

Soils may be fertile without being productive. Some desert soils have an exceedingly high natural fertility but must be irrigated to render them capable of producing crops. A fertile soil

can be productive only when moisture, temperature, and other environmental factors are in good balance. The aim of soil management must be to make maximum use of the productive capacity of the soil (Shingo, et al., 1985).

3.1.2 A Framework for the Evaluation of Project's Impact

Depending on the nature of an issue to be addressed, it is possible to apply exclusively either qualitative or quantitative methodological approach. Still other may use a mixed approach. Some phenomena have multi- dimensions and have linkages with a range of variables, the understanding of which is recommended to base on a mix of diverse methods (Degefa, 2005). For the purpose of this study, it is found better to apply the latter one.

As it is agreed upon by most scholars (Lakew, et al., 2005), effect (out come) assessment insures the long-term widespread consequences of the interventions. Comparison is made between the situation at the beginning of interventions and the situation after a few years of interventions. It is also made by comparing the intervention area with an area, which did not receive any during the period under observation. Examples of parameters to be measured include changes in income level, changes in poverty levels, and changes in productivity of land, improvement in fuel wood supply, animal productivity, reduced food gap, improved resilience to climatic shocks, and others. As the ultimate beneficiaries of all natural resources are people, it is always wise to see the effect on the livelihood of people. However, the effect on the natural resources bases is also critical for watershed development activities and its effect on sustainable livelihoods.

3.2 Food Aid and FFW (MERET) Project in Ethiopia

3.2.1. Overview of Food Aid and FFW (MERET) Project

Over the last three decades, there has never been a year when Ethiopia did not receive food aid, rather, the per capita production has been declining through time EEA (2005), cited in Daniel (2006). Food aid is the transfer of food commodities from donor to recipient on a grant basis. Some food transfer mechanisms, in addition of FFW, include employment generating schemes (EGS) and free food distribution (FFD) (Sharp, 1997, cited in Daniel, 2006).

The World Food Program supported FFW project was initiated in 1974, mainly as a response to the drought and famine of 1973/74 in the Northern part of the country (mainly Tigray and Wello). The program, which started in the form of relief, gradually shifted to development

program with the objective of addressing the problem of food storages and vulnerability to the project areas. However, until 1980, the initiated development projects were small and scattered all over the places and had little effect. The relatively smaller projects were consolidated into large project called "Rehabilitation of forest, Grazing and Crop lands" in 1980; and this marked the beginning of ETH-2488 project. Finally, it is started to be called "MERET Project".

3.2.2 Organization and the Overall Conservation Activities of MERET Project

3.2.2.1 Naming of the Project: As stated by Betru (2006), inspite of the designation of various technical names over different phases, the project is customarily known as Food for Work project. The changing of the names was intended to fine-tune its names to the role and functions of project. Accordingly, the project was/is called:

- rehabilitation of Forest, Grazing and Crop Lands during the 1st and 2nd phases;
- rehabilitation and Development of Rural Lands and Infrastructure during the 3rd and 4th phases;
- managing of Environmental Resources to Enable Transitions to more sustainable Livelihoods (MERET) during the 5th phase and it is very likely that this name retains beyond and probably for the time because it is very much in line with the vision of the beneficiary government, the development partner, and also the ultimate goal of the project.

3.2.2.2 Organization of the Project

The WFP assisted MERET project is executed through the Ministry of Agriculture's Soil and water Conservation Department (SECD) and the forestry and Wildlife Conservation Development Authority (FAWCDA).It undertakes activities in catchments and down to the peasant associations through their branches at the regional, provincial and district levels. The regional branches play a co- coordinator role while the latter two are engaged in the actual local planning, implementation and monitoring of the activities. However, at *Woreda* level there is no an independent institution which own and run the project. It is rather pulled with the office of agriculture and rural development.

At sub-district level, the extension workers who run the offices are not only responsible for the day-to-day progress of the conservation and related activities, but are also in direct and daily contact with the other local bodies including work - site coordinators and PA. Executive committees, as well as individual participants such as the forest guards, and seeding nursery workers.

3.2.2.3 Objectives of the Project

While the central objective of the project is linking the short-term food assistance with the long-term development opportunities in a sustainable manner and sustainable, the specific objectives are illustrated below:

1. bridge the food gap between production and demand in the project areas by providing temporary food assistance for sustainable development and food security;
2. build the capacity of the implementing government and that of the community to improve the quality of the development plans and their achievement;
3. to rehabilitate and sustain or increase the production capacity of degraded lands through appropriate soil and water conservation, afforestation and land management interventions;
4. reduce the crisis the community facing during dry periods as a result of shortage of water;
5. minimize the shortage of timber, fuel wood and livestock feed in the project area;
6. contribute to the control of environmental imbalance arising from loss of moisture, vegetation, productivity, etc. Betru (2006).

3.2.2.4 Scope of the Project

The project (MERET) has started its operation in six regions: Amhara including the study site, Oromia, SNNP, Tigray, Somalia and Dire Dawa. The project has been assisting *woreda* and communities over 600. Communities in 74 *wereda* (districts) are selected based on chronic food security and environmental indicators (MoARD, et al., 2004).

The number of project sites varied with the volume of the resource and estimated to swing between 600 and 800 sites called LLPPA (Local Level Participatory Approach) sites. The number of the beneficiaries varied over the project phases for the same reason and the total number of participants varies from 125, 000 to 250,000 (out of which 40% are women at the moment). The number of direct beneficiaries is estimated to be 1 to 1.5 million people every year (Ibid).

3.2.2.5 The Major Activities in the Project

As I can understand from the local project plan document, activities which are planned to be undertaken with the aid of the project can be described in some four main categories as follows.

- ***Soil and Water Conservation:*** it includes farmland terraces, hillside terraces, check dams, cutoff drains, gully reclamation, eyebrow, micro-basins and other physical structures;
- ***Reforestation:*** this includes land husbandry techniques such as planting of multipurpose tree/shrub and grass species, seed collection and production, seedling production, pond construction, spring development and stream division for domestic consumption and supplementary irrigation;
- ***Infrastructure***: it consists of mainly feeder road construction and maintenances; and
- ***Homestead Development*** : interventions for intensification of production, increasing and diversification of income that consist of water harvesting and small scale irrigations, cost effective soil fertility management techniques particularly soil organic matter management, horticulture development including fruit trees and vegetable crop production, small scale animal fattening, poultry, aquiculture and high value /cash crop development.

3.2.2.6 Expected Result Chain of MERET Project

Outputs:

- system to engage community participants in planning, implementation, monitoring and evaluation of their own development established and functional ;
- technical and organizational capacity of project management enhanced at all levels;
- performance measurement capacity of project management enhanced at all level;
- rehabilitation of degraded areas and management of natural and of natural resources/ assets for improving land productivity enhanced;
- income generation opportunities diversified and integrated with improved land husbandry;

- partnership for mobilizing complementary resources, integrating efforts with relevant development agencies/projects, and advocating for good practices enhanced.

Outcomes:

- community based natural resources and household/ communal assets managed in a sustainable manner;
- households, particularly female headed ones, in food insecure areas improved their food security.

Impacts:

- food insecure households' capacities to cope with seasonal food insecurity, as well as to increase their future food and livelihood security strengthened (WFP,2005).

The study, however, did not intend to deal with all the variables mentioned above ; therefore, the researcher would like to indicate other investigators to carry out a research in an integrated manner on these issues..

3.2.2.7 Criteria Based Evaluation

Impact:

- what changes did the operation bring about?
- where there any unplanned or unintended changes?

Effectiveness:

- where the operation's objectives achieved?
- did the outputs lead to the unintended outcomes?

Efficiency:

- were stocks of food and non-food items available on time in the right quantities and quality?
- were activities implemented on schedule and within budget?
- were outputs delivered economically?

Sustainability

- are the benefits likely to be maintained for an extended period after assistance ends?

Relevance:

- were the operation's objective consistent with beneficiaries needs and with WFP and governments policies? (WFP, 2005).

3.3 The Agrarian Class Structure (Land Reform) of Ethiopia after the Empowerment of Derg

The class structure of Ethiopia was profoundly altered by the land reform of 1975 and by subsequent legislations and radical programs pursed by the Derg. The out comes of the measures was the complete expropriation of the estates of the landed classes, the nationalization of landed property, the transformation of all rights of holdings of peasant cultivators into use rights an the abolition of private ownership in land. The immediate impact of agrarian change was to remove all classes from the countryside, except the laboring peasant, and to create a homogenous social structure consisting only of a mass poverty of stricken micro holders. This structure is still with us today (Desalegne , 2006).

The past few years have witnessed yet another shift in land reform agenda and regional states (at least the four largest one) have established organizations that as responsible for land administration. This shift seems to be pushed ahead in response to the call for secured tenure, which is thought to improve the incentive available to the formers and lead them towards introducing more efficient management and farming practices. As a result, the Tigray and Amhara regional states started distributing land certificated to the small farmers in 1997/8 (Daniel,2006).

The Federal Government of Ethiopia is in a process of promulgating legislation to follow the same strategy. In this legislation, the ownership of land, with the exclusion of the complete transfer of ownership through selling, is bestowed to the household members (Ibid).

3.4 The Effect of Food for Work Project, and the Existing Debates

Doubts about food aid are arising because there is a growing mismatch between the new circumstance produced by rapid political and economic change and the international arrangements and institutions for food aid that are predicated on an earlier reality. This is important because food aid has historically been a major element of development assistance geared to support longer-term development and the primary response to help countries and people in crisis (Maxwell, 1986).

3.4.1 Incentive Effects of FFW Project

According to Desalegne (1990), to combat poverty in rural Ethiopia and to increase outputs, farmers must use appropriate intervention. An appropriate intervention includes:

- Measures that protect the resources on which farmers rely on (soil, water and trees). It includes controlling erosion, protecting forest, planting trees and building water storage tanks;
- Measures that directly increases production, such as using fertilizers, improved seeds, and new farming methods.

Contacts with the outside worlds (intervention) are necessary for this to happen. These contacts include access to information and skills to apply new technology, appropriate lively credit and project aid to invest in farms, advice about government polices, and market to produce.

A recent cost-benefit analysis has established the considerable success of MERET project in terms of arresting land degradation and improving rural livelihood of target communities. There have been noticeable signs of effect on food production, incomes and people's livelihoods, including that of disadvantaged groups such as marginal farmers and landless, as well as of course, rehabilitation of the environment (WFP, 2005).

Food aid has a positive contribution towards improving the over all well being of the people. It particularly results in nutritional gains directly either through free handouts or in the form of food wage in the food for work programs. It also raises the consumption level of basic food items of also raises the consumption level of basic food items of poor people as a result lowered prices. Low-income households (landless, rural laborers and other disadvantaged groups) would derive relatively more benefits. This is more likely to be achieved if food aid resources are effectively targeted to these social groups (Clay, et al., 1998).

In addition, food aid if properly handled contributes to the creation of employment opportunities. Income created by food- for work programs would in the long term improve productivity (Mellor, cited in Clay, et al., 1995; Mesfin et al., 1997; Yeraswork et al., 1985), also state that FFW project is creating employment opportunities both for people who had and who had not been working away from their farms before the start of the project. Food aid can support labor- intensive public works in three ways: through the provision of commodities for

payment in kind, through public distribution systems which can then be drawn upon for wage payments, or through the generation of local currency to fiancé these works.

Project food aid, for example, will help to build up much needed infrastructure in the recipient countries, as has been done in a number of Asian nations Desalegne (1990). Apart from this, participants would get an opportunity in connection with developing knowledge of conservation techniques (Yeraswork et al., 1985). Furthermore, he founded that some participants have saved time by reducing long distance journey in search of job.

3.4.2 Disincentive Effects of FFW Project

Evidence from some recipient countries indicates that dependency has already been developed to meet short falls in domestic food production Such dependency has in turn affected the process of attaining self-reliance on own farm and non-farm activities. It has also eroded indigenous coping and adaptation mechanisms of the poor, also suggested that if poorly targeted, food aid might depress market prices for food, discourage domestic producers and undermine long-term food security (Clay, et al., 1995; Sharp, 1997, and Maxwell, et al., 1994).

Debebe (2000) and Maxwell, et al., (1994) also stated that food aid may exert changes in food habits and shifts in production pattern of the agricultural system. The increasing share of food aid to the daily intake of food may gradually increase dependency on food imports. There is also an increasing concern that the changing trends in the consumption patterns and marketing behaviors may in the long run lead to a shift to other agricultural production patterns, and may change food habits of the local people. Food aid hinders agricultural development by creating competition for labor between Food-for-Work and on farm activities. Excess supply of food aid, as noted by most often removes farmers' incentives to intensify agriculture.

Having all these possible outcome of FFW (MERET project, the study is limited on assessing the effect of the same project on land resources recovery, employment, awareness, and crop production.

3.5 Problems in the Process of Watershed Management

Obviously, any development projects in general and watershed management projects in particular could face problems both from internal and external working environment. That is, Problems may be related to institutional, socioeconomic and administrative components of a given project (Siegfrid ,1990).

3.5.1. Technical and Managerial Problems

Absence of Baseline Survey: Most development efforts in Ethiopian fail because they do not fit with local socioeconomic realities. That is, most development agents do not conduct empirical base line survey in line with agro-climatic /agro-ecological, socio-economical, and infrastructural situations before the beginning of the intervention (MoARD, 2005).

Lack of Training and Experience Sharing: Ethiopian farmers usually have detailed knowledge of their local situation but most have limited knowledge and skills in improved technologies. They lack basic educational and health facilities. They are short of cash and credit to invest in their forms and to buy inputs. This makes it very difficult for them to pull themselves out of poverty (Siegfried1990).

3.5.2 Socioeconomic Problems

General Poverty and Short-term Needs: Regardless of the income level or stage of development, any economic activity would alter the state of environment in one way or another and has the potential to cause a number of negative effect in the form of unsustainable depletion of resources and deterioration in the quality of resources and the environment. For example, agricultural activities for producing food and generating employment and income in rural areas are the major causes of over grazing, deforestation, soil erosion, soil pollution, river and lake water pollution and the like (EPA, 1997).

In rural poor, the sources of energy for the household are mostly from the forest and residues of plants and animals. This has been resulting in deforestation, and loss of natural fertilizer. This in turn reduces the productivity of the land (MoFED, 2002). As scholars agree it, the desire of the rural people to have many children is to acquire old a ge security. This is a typical attitude of rural poor in Ethiopia. These rural people do not plan to manage the balance of economic level capacity of the environment and population size as to attain sustainable development. The new coming children who look for food, home, water,

livestock and other assets to meet their needs would destroy forests in order to get farmland without taking any preventive and conservation measures. This in-turn leads to the degradation of land (Ibid).

3.5.3 Policy Related Problems

Insecurity of Land Resource Holding: According to Yeraswork (1988) the issue of who owns the trees that have resulted from the project's activities remains unclear to everyone in most FFW project sites of Ethiopia. Most of the community leaders in the FFW project were hesitant regarding the ownership of the different types of plantations established through the same project in their PAs. The rate of adoption of modern soil conservation techniques among peasants is highly influenced by the land tenure system in the society. In addition; insecurity of land resource holding discourages farmers to be engaged in activities in a sustainable manner.

Scoones Ian 2001also argued that a person who is most eager to learn more about conservation of farming and who is interested in making the land highly productive is the individual who is living on his own land. To build confidence on the part of the farmers, therefore, incentives must be aimed at improving profitability and security of land tenure for reasonable time.

Farmland Size Fragmentation: Ethiopia is a country of smallholder agriculture where the diminishing of farm size per household has reached a stage that critically demands search for ways of stopping further. Application of sustainable land management practice such as rotation, agro-forestry, intercropping and soil erosion control are generally influenced negatively by the fragmentation and diminution of farmland. Since such sustain able land management practice needs a consolidated and considerably large farm size. Small farm households face higher overhead cost of application of technology per unit of land area. Further more, mall holders are generally less risk tolerant, for they often have low income and work under a risk-prone environment (Siegfried, 1990 and Werkneh, 2006).

3.5.4 Natural Problems

Dissected nature of the terrain and intense rainfall: In Ethiopia, the intense rainfall and the dissected nature of the terrain, with nearly 70 % of the highlands having slopes in grater than 30 percent. A further problem is a tendency for water logging in the valleys and plains, which encourages cultivation on the more erosion-prone valley sides (Siegfried, 1990).

Subsistence farming can work well at low population levels with very little contact with the outside world; but this system is undermined by two major threats:

- Unreliable rainfall drought and floods-reduces outputs and forces farmers to exploit already overused resources further,
- High Population Pressure results in overgrazing and cultivation of slopes causing soil erosion destroying tree cover, and degrading the land (Ibid)

CHAPTER FOUR

RESULTS AND DISCUSSION OF THE STUDY

This chapter deals with the fundamental questions of the study that are to be answered through using possible methods and data sources. First, background of the study site and household characteristics has been discussed. Next, the effect of the project on soil, forest and grass resources, and its implication have been treated. Finally, problems associated with the development of the watershed both from internal and external working environment will be examined. Triangulating data from different sources, and cross checking them with basic theories and displaying tools like tables, and graphs are important components.

4.1 Background of the Study Site and Household Characteristics

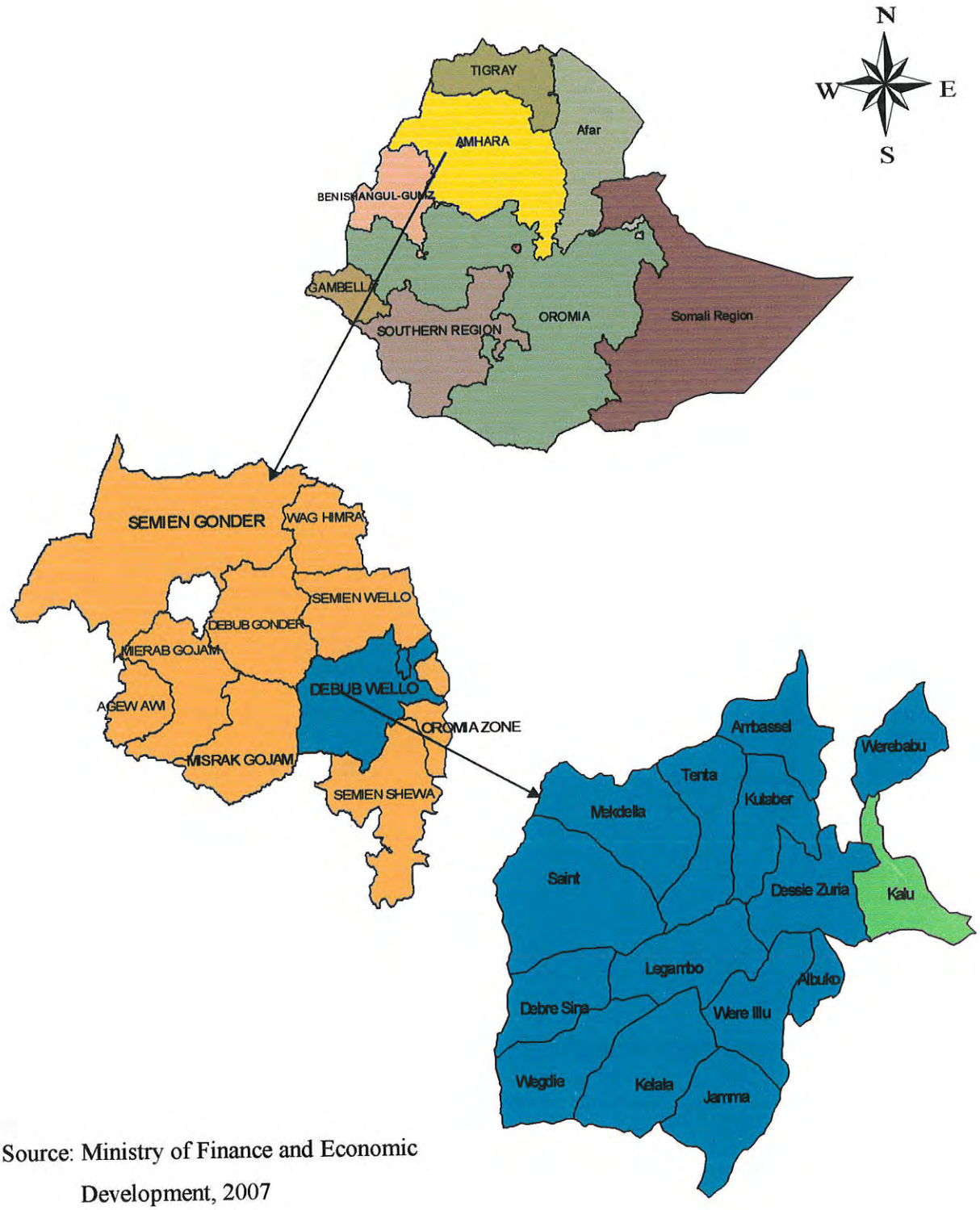
4.1.1 The Physical Environment and Administrative Division

Kebelie-Chekorti sub-catchment is located approximately at 165 Km northeast of the capital of Ethiopia (Addis Ababa) on the way to Dessie. In administrative terms, the study sub watershed is found in Kalu *woreda*/district, Eastern part of South Wello Zone (Figure 4.1). It consists of five *gotts*/villages: Fontanina,Getta, Chekorti, Chefieduba and Kebelie.

The altitude of the *woreda* ranges between 1400 meter and 2800 meter above sea level. According to the Ethiopia Agro climatic *zonation* system, the *woreda* has three-agro climatic *zonations*: *Dega*-29%, *Dry Woina* Dega-38%, and *Kolla*-27%. The *woreda* consists of three main watershed regions. Except in a few things, these watersheds have similar physical and socio-economic environment (Kālu *Woreda* Rural Development Office, 2002).

The total area of the sub-watershed is nearly about 10.7 square kilometer, out of which approximately 44% and 34.5% is characterized by gorges, and mountain, respectively. The remaining is categorized under leveled topography. The major land use patterns of the study sub-watershed comprises: cultivable land-20.8%, grazing land-18.1%, forest land-12.6%, bushland-15.6%, unproductive land-32.9% ,Figure 4.2, (ibid). Chek-orti, Kollad, Yellibalie and Abdil, which are tributary streams to Borkena River, are regular water sources of the study site. Where as, Fontanina, Lakech and Gadula are seasonal streams in the sub-catchment (Field survey, 2007).

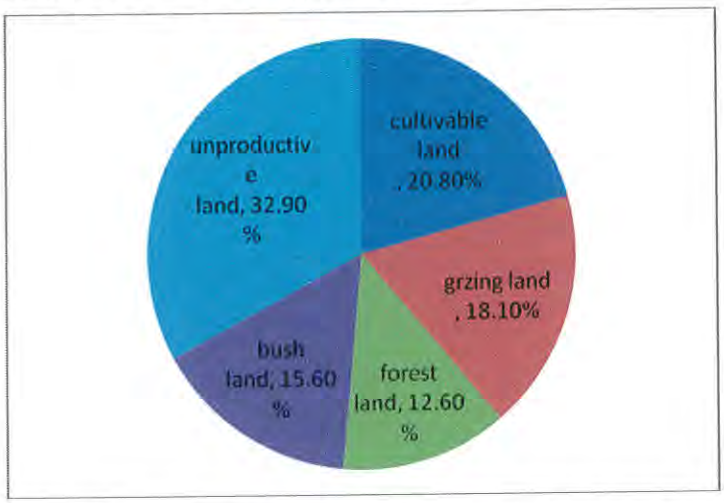
Figure 4.1: Administrative map of Ethiopia, Amhara Regional State and South Wello



Source: Ministry of Finance and Economic Development, 2007

Agro climatically (based on the traditional climatic zones), the micro watershed can be categorized in between *Kolla* and *Weyna Dega*. In terms of altitude, the study site is found at about 1,864 meter above sea level; with the highest and lowest annual average temperature of 26.3^{0}C and 12.3 ^{0}C respectively. The annual average rainfall lies between 650-1,050 mm. There are two crop seasons; the one is summer that lasts from mid June and extends up to mid September, and which is the main season for crop production. The other one is spring that last from January to March. On the basis of their colors, the soils that cover much of the total area of the sub-watershed can be classified into three broad types: Dark brown, reddish and gray to dark (ibid). The near by villages (Chikaberet and Gida), which are taken as to make comparative analysis, have almost the same socio economic and physical environment with that of the study villages.

Figure 4.2: Patterns of land use in the study sub-catchment



Source: Kālu *Woreda* Rural Development Office, 2002

4.1.2 Socio-Economic Background

The total population in the sub-catchment is estimated to be 2,701; out of which 1408 constitute male and the remaining 1292 female. In terms of household, the study site comprises 540 heads. In average, the density of the population is around 27 people per square kilometer. Around 98% of the total population belongs to Muslim and the remaining 2% belongs to Orthodox Christians. The major language spoken is Amharic (Kālu *Woreda* Rural Development office, 2002). Farmers, livelihood in the sub-watershed are predominantly dependent on traditional mixed farming system on a subsistence scale. Land and livestock

are, therefore, the most important assets of the people, with which they lead a sedentary life. The dominant subsistence crops grown in the area are: sorghum, *teff* and wheat (ibid).

Income from off-farm employment (all activates outside of one's own farm and another farmer's farm) and non-farm employment like petty trading, weaving, carpentry and pottery is scanty. According to the same source of data synthesized from the *woreda* office of agriculture, each household's average possession of ox and caw is 0.86 and 0.51 respectively.

4.1.3 Household Characteristics

Using household survey, data in connection to the actual household characteristics of respondents have been generated and summarized in tables and figures. The data have helped to associate the characteristic of household with the prevailing socioeconomic and natural environment of the study site.

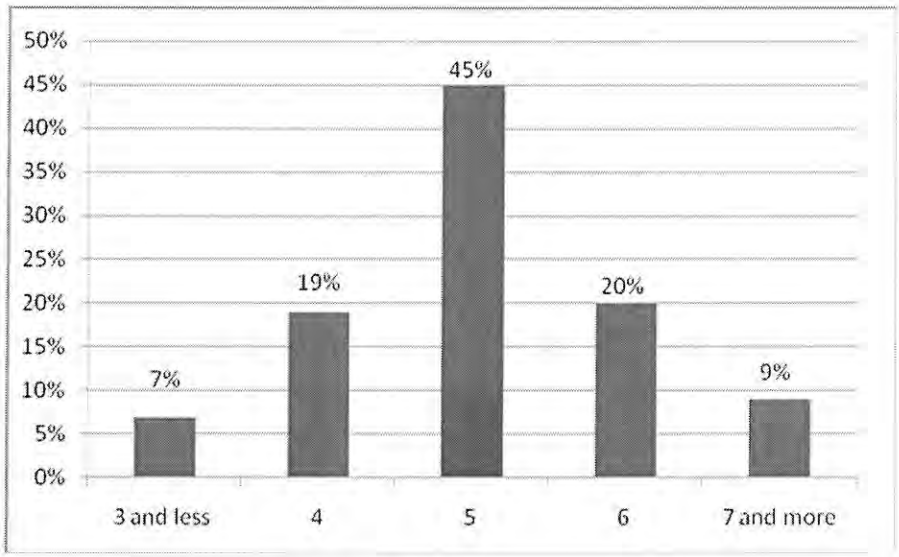
4.1.3.1 Average Sex Composition and Family Size

Table 4.1: Average sex composition of household heads

Sex	Composition	
	(#)	(%)
Male	47	52.0
Female	43	48.0
Total	**90**	**100**

Source: Household Survey, 2007

Figure 4.3 Households' family



Source: Household Survey, 2007

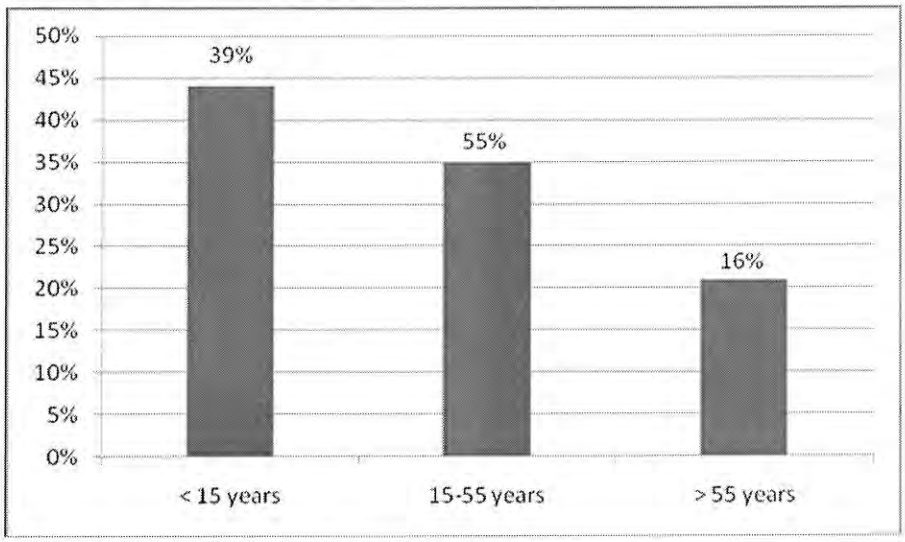
As it is shown in Table 4.1, the male-female composition in a household is 48% and 52% respectively. It clearly shows the existence of balanced population composition in terms of sex. The average household family size is around 5 people (Figure 4.3); it is almost the same figure with that of the average rural household size of Ethiopia, 4.9 (WMS, 2004/5). Compared with the minimal economic achievement, and the ruggedness of the topography and traditional agricultural practice of the site, the population pressure is high.

4.1.3.2 Age Group

In the course of the survey, I found out that the age group of 39% population in the study area lies below 15 years. Whereas working and old age group constitute 55% and 16% respectively.

In rural Ethiopia, the number of dependents for 100 income earning persons (age 15 to 64) increased from 103 in 1995/06 to 108 by 2004/05 (WMS, 2004/5). Therefore, the number of dependents in the study site is less than that the national figure. It implies the availability of more labor supply (working age group) than that of the national average; and there would be minimal competition of labor between MERET project (conservation activities) and farming practices.

Figure 4.4: Age group in the study sub-catchment



Source: Household Survey, 2007

4.1.3.3 Formal Educational Status

As it is found out from the survey, the educational achievement of the sampled households is very low. Unlike the national figure, (in rural areas the rate of literacy has increased to 31%), WMS (2004/5), 79% of the respondents are totally unable to read and write (Table 4.2). This state of affair (happening illiteracy) inhibits the flow of information and adoption of modern and appropriate technology so as to maximize the effectiveness and efficiency of the on going watershed development.

Table 4.2: Households' formal educational status

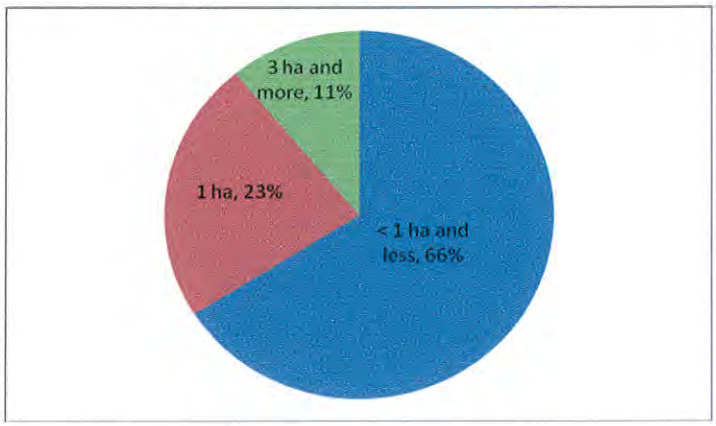
Educational status	**Response**	
	#	**%**
Unable to read and write	71	79.0
Grade 1-4	12	13.0
Grade 5-8	6	6.70
Grade 9-12	1	1.10
Total	**90**	**100**

Source: Household Survey, 2007

4.1.3.4 Households' Total Land Size and Number of Farm Land Plots Land Size

81% of the sampled households posses a total of one and less than one hectare of land (Figure 4.5). It implies the availability of minimal farm land per household head, and the predominance of subsistence farming.

Figure 4.5: Households' total land size in hectare

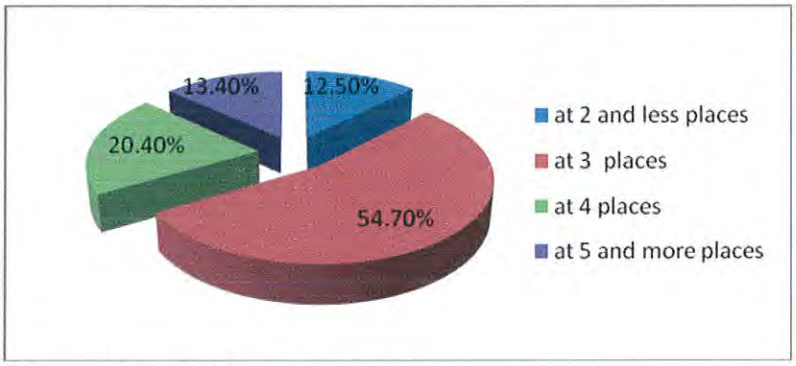


Source: Household Survey, 2007

Number of Farm Land Plots

Based on Figure 4.6, >80 % of respondents farm land is fragmented at 3 and more different places. Thus, when compared with the farmland size farmers' posses, there is high farm land fragmentation. It implies the need of an extra time and labor in the process of constructing physical conservation structures so as to tackle further degradation.

Figure 4.6: House holds' number of farm land plots at different places



Source: Household Survey, 2007

4.2 Effects of MERET Project on Land Resources

4.2.1 Soil Resources (Chemical Properties)

Soil analysis has made on essential components of soils: soil minerals and organic carbon. In addition, soil CEC and P^H are also examined.

4.2.1.1 Soil Nutrient (Vital Mineral) Analysis

One of the parameters used to assess the chemical properties of the soils is the comparison of the available macro nutrients: Potassium, Phosphorus and Nitrogen between the treated and non-treated farm plots.

A. Total Nitrogen (T.N)

The test revealed that the nitrogen content of soil is higher in the villages where the project has been undergoing. The average value of soil Nitrogen in the treated sites is 0.1 %, whereas in the non-treated sites is 0.0575 % (Table 4.3). The mean difference between the two experimental groups is 0.0425 %. According to the classification mentioned above, the soil in the treated and non-treated sites are grouped under medium and high classes respectively. Standing from this fact, it is possible to deduce that the on-going physical and biological conservation activities (carried out with the aid of the project) contributed in improving the content of soil nitrogen.

According to Baruach (1988) cited in Girma (2006), "based on their nitrogen content, soils are classified as low, medium and high classes. Their content of nitrogen in percentage is < 0.03, 0.03 - 0.06, and > 0.06 respectively"

As Shingo, et al. (1985) state, "Since soil Nitrogen is mostly organic in nature, its concentrations in soil increases with increased organic matter contents. The soil P^H also influences plant growth by its effect on activity of beneficial microorganisms. It implies the need of adapting biological method of soil management accompanied with the physical one.

Table 4.3: A comparison of total nitrogen in the soil of treated and non- treated sites

Experimental groups	T.N (%)		Mean
	Sites		
	1	2	
Intervention site	0.09	0.11	0.100
None-Intervention site	0.05	0.065	0.057
Difference	**0.04**	**0.045**	**0.043**

Source: Field Survey, 2007

B. Available Phosphorus (Av.P.)

As it is shown in Table 4.4, soils taken from both experimental sites are grouped under low P content class; however, the mean value of Av.P (ppm) under-treatment-farm-plots is greater than the soil attributes under the non-treated land. On average, the Av. P is 21.26 ppm and 7.58 ppm in the treated and non-treated experimental sites respectively. Hence, rehabilitation of farmland plots with the aid of the project contributed to the improvement of phosphorous content in the soil.

According to Shingo, et al. (1985), "Based on available phosphorus, soils are classified as low, medium and high classes; their content of phosphorus is 0-25, 26-50, >50(in ppm) respectively. All manures contain phosphorus, and manure from grain-fed animals is a particularly good source. Soil phosphorus is most available for plant use at P^H values of 6 to 7".

Table 4.4: A comparison of total potassium in the soil of treated and non-treated sites

Experimental groups	Av.P. (PPm)		Mean
	Sites		
	1	2	
Intervention	17.500	25.020	21.26
Non-Intervention	8.460	6.700	7.58
Difference	**9.04**	**18.32**	**13.68**

Source: Source: Field Survey, 2007

C. Potassium (K) Cmol(+)/Kg

Using the above classification, the soils both in the treated and non-treated site fall under very low potassium content class. However, according to the laboratory result (Table 4.5), the soil content of potassium is higher in the villages where the project has been operating. On average, the amount of potassium in the soil where the project is going on exceeds by 1.855 Cmol(+)/Kg. Thus, the conservation activities which have been carried out with the aid of the project contributed in improving the content of soil Potassium. This recalls what Wild (1996) cited in Girma, 2006) states as:"Based on the potassium content, soils are categorized as very low, low, medium and high classes; their content is 0-10, 11-20, 21-30, and 31-40 respectively".

As Shingo, et al. (1985) puts,

> Soil type and CEC determine the amount of potassium that is available for plant uptake. Soil type and environmental conditions have an effect on the amount of potassium available for plant use. Potassium availability is the highest condition in soils that are neutral or slightly acidic P^H.

Table 4.5: A comparison of total Nitrogen in the soil of treated and non-treated sites

Experimental groups	K Cmol(+)/Kg		Mean
	Sites		
	1	*2*	
Intervention	2.96	2.85	2.91
None-Intervention	1.08	1.02	1.05
Difference	**1.88**	**1.83**	**1.85**

Source: Field Survey, 2007

4.2.1.2. Organic Carbon Analysis

The laboratory result proved the existence of differences in average organic carbon content in the soils taken from the two experimental sites. It is 2.85 in the treated, and 1.11 in the non-treated sites (Table 4.6). Generally, soils with comparatively higher organic matter content are considered more fertile than soils with low organic matter content. Hence, the project aided biological and physical natural resource conservation activities, which in turn contributed in restoring/retaining the fertility of soil.

Table 4.6: A comparison of organic carbon in the soil of treated and non- treated sites

Experimental groups	O.C (%)		Mean
	Sites		
	1	*2*	
Intervention	2.79	2.90	2.85
None-Intervention	1.19	1.03	1.11
Difference	**1.60**	**1.87**	**1.98**

Source: Field Survey, 2007

According to Wild (1996), cited in Girma (2006),

> the content of organic matter in the soil is determined by the available organic carbon in the soil. The organic content of a soil varies from less than 0.1% up to more than 6.0 %. A soil having 4.3-6.0 %, 2.1- 4.2 %, 1.0-2.0 % organic matter is grouped under high, medium, and low classes respectively.

4.2.1.3. Soil P^H and Cation Exchangeable Capacity Analysis

A. Soil P^H

The analysis revealed that the P^H Value of the soil samples ranges between 6.2 and 5.6 (Table 4.7). Thus, it clearly shows us the existence of variation in soil reaction. Theoretically, from pH 7 to 0 the soil is increasingly more acidic and from pH 7 to 14 the soil is increasingly more alkaline or basic. "A pH range of approximately 6.0 to 7.0 (slightly acid reaction) promotes the most readily availability of plant nutrients" (Shingo, et al., 1985).

According to this classification, the soils in the farmland plots, which are under treatment, are grouped under slightly acidic reaction, and contain more important plant nutrients than that of the soil in the non -intervention sites. The conservation activities in the treated site, therefore, contributed in the betterment of retaining and improving the nutrient content of the soil.

Table 4.7: A comparison of P^H in the soil of treated and non-treated sites

Experimental groups	**P^H H_2O 1:2.5**		**Mean**
	Sites		
	1	*2*	
Intervention	6.2	6.2	6.20
None-Intervention	5.7	5.6	5.65
Difference	**0.5**	**0.6**	**0.55**

Source: Field Survey, 2007

B. Cation Exchange Capacity (CEC)

Based on the analysis (Table 4.8), the soil CEC is higher in the villages where the project has been working. An average difference of 5.705 Cmol(+)/Kg is observed in soil CEC between the treated and non- treated farmland sites. This is most probably due to the difference of pH and organic matter of the soils. Thus, the chemical reactivity of the soil in the treated villages is higher than that of the soil in corresponding experimental villages.

"There is a direct relationship between organic matter and CEC. What is more, CEC has a positive relationship with P^H in the soil" (Wild, 1996, cited in Girma).

Table 4.8: A comparison of CEC in the soil of treated and non-treated sites

Experimental groups	**CEC Cmol(+)/Kg**		**Mean**
	Sites		
	1	**2**	
Intervention	33.00	31.35	32.175
None-Intervention	27.62	25.32	26.470
Difference	**5.38**	**6.03**	**5.705**

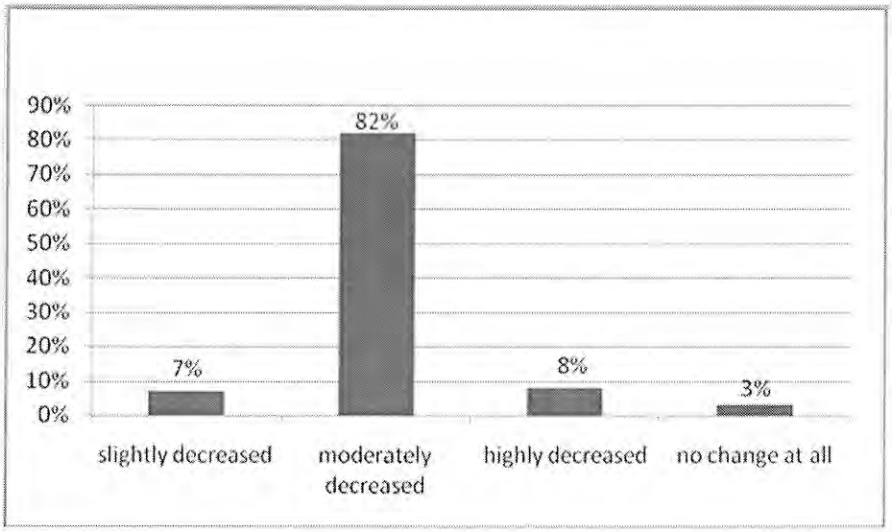
Source: Field Survey, 2007

The results presented above indicate the improvement of farm land soil fertility, and the possibility of increment in food crop production, which is mainly due to land rehabilitation through physical and biological conservation activities through a catchment approach that was carried out with the aid of MERET project. Since the local farmers' livelihood is primarily dependent on farming, the outcome (farm land soil fertility improvement) is highly consistent with the needs of the community at large. The finding of this study is also in agreement with the policies of the government and WFP; that is, in order to meet the goal of ADLI, rehabilitating the degraded agricultural land and maximizing the amount of crop production in a sustainable manner is the major component. All these things have their

own contribution to keep the benefits gained from rehabilitating the degraded land through a watershed approach for an extended period.

So as to cross-check the fertility of soil, the study has attempted to assess the food crop production change possibly due to the intervention of the project. Accordingly, most (60%) of the respondents replied that there is moderate increment in food crop production. In addition, the declining of runoff (moderately) in the study site is also an evidence to prove the betterment of the farm land soil fertility (Figure 4.7).

Figure 4.7: Farmers' perception on changes happened to runoff after the intervention of the project



Source: Household survey, 2007

The study has also generated data (using PRA) on how frequently farmers fallow their farm land before and after the intervention of the project. Accordingly, because of fertility improvement, the frequency of fallowing farm lands has been declined by half after the intervention. At the beginning of the intervention, to cultivate crops, the land used to be fallowed for, on average, on a frequency of two years in a three-year time, especially for *teff* production. However, after the intervention, the farm became fallowed only for a year, on a frequency of once in a three-year time. This shows the improvement of soil capacity to retain moisture for more period of time mainly due to the biological and physical conservation activities carried out along communal and private degraded lands.

From field observation, the research has also recognized the existence of variation in the physical outer shell of the land (soil) in the two experimental groups. In the case of the site where the project is running the most top soil is thicker than the other site. As to showing the

top soil difference during the transect walk, pictures were taken from the two experimental sites and presented below (Figure 4.8 and 4.9).

Figure 4.8: The most top part of the land (soil) in the treated site

Source: Field survey, 2007

Figure 4.9: The most top part of the land (soil) in the non-treated site

Source: Field survey, 2007

As indicated in the national project performance indicators, 60% of the degraded land would be rehabilitated by 2006. Practically, however, the plan is not achieved fully most probably for reasons mentioned in Sub-Topic 4.3 (existing problems in the watershed development carried out in the study site).

In agreement with the research outcome, Belay (2002) states "agricultural productivity in the fragile environment of ANRS can be sustained through integrated watershed management approach". Girma (2006) also found out that because of food aid program intervention in Tach Gayint *woreda* (Amhara Regional State), moderate changes have been registered in natural resources including the fertility of soil. In his work, the organic and inorganic components of soil in the intervention site were in a better condition than that of soil in the non-intervention sites. In addition, as stated by Lakew Desta, et al. (2005),

> Many countries, particularly those having significant areas with complex mountainous and fragile ecosystems have developed national watershed programs or projects. Participatory conservation and watershed-based approaches have been successfully introduced and expanded in various countries in Africa, particularly in Kenya, Burkina Faso and Mali, to name a few. Such programs have been realized within the context of combating desertification and poverty reduction efforts. In addition, Asian countries like China, the Philippines and Indonesia have successfully practiced the concept of small watershed-based development.

4.2.2 Forest Resource (protected and Biological Structure Forest)

4.2.2.1 Species of Trees (Recovered and/ or Introduced)

With regard to answering the question whether new species of trees are introduced, communication was made with segments of the community through formal survey, focus group discussion and key informants' interview. Accordingly, it was possible to understand that species like *Juniperus procera, Manilikara butigi, Grevillea Australia, Accacia saligna, Cajanus cajan* and *Sesbania sesban* were among the major introduced species in the catchment for the purpose of tackling run-off and at the same time to maximize the availability and accessibility of wood for fire and construction. Farmers and DA's responded that even though environmentally friendly and enough number of species were introduced, the task of propagating these species in the sub-catchment at large is not carried out satisfactorily.

Furthermore, the study has attempted to ascertain the effect of the project on recovering and/or degrading tree species. Based on the findings of the study, is revealed that, *Eucalyptus camaldulensis, Carissa edulis, Olea europaea var.africana,* and *Podocarpus falcatus* are among species of trees recovered to some extent in most part of the villages after the intervention of the project. However, according to almost all segments of respondents, plant-recovery activities, which are highly appreciated by the community, have these days been declining, beginning from the last couple of years.

4.2.2.2 Forest Area Coverage

Based on the study, before the intervention of the project, tree coverage was diminishing rapidly due to human and natural factors. Farmers were highly dependent on natural forests in a very traditional and unwise manner. From the government side, there were no organized and program oriented conservation operations. Some moderate change in forest coverage has been registered along both communal and private woodlots with the aid of the project. As most respondents (62%) replied, the forest coverage has shown moderate increment due to physical and biological conservation activities. In contrary, 6% of the respondents responded that the coverage of tree species has shown no change; whereas other 2% replied as the coverage has shown slight decrement (Table 4.9). In addition, with the help of local elders, the research attempted to estimate the change in coverage of forest through making transect walk. Accordingly, it is estimated that the coverage has increased by 3.5 hectares in allover the site after the intervention.

Table 4.9: Local people's perception about changes of forest area coverage after the intervention of the project

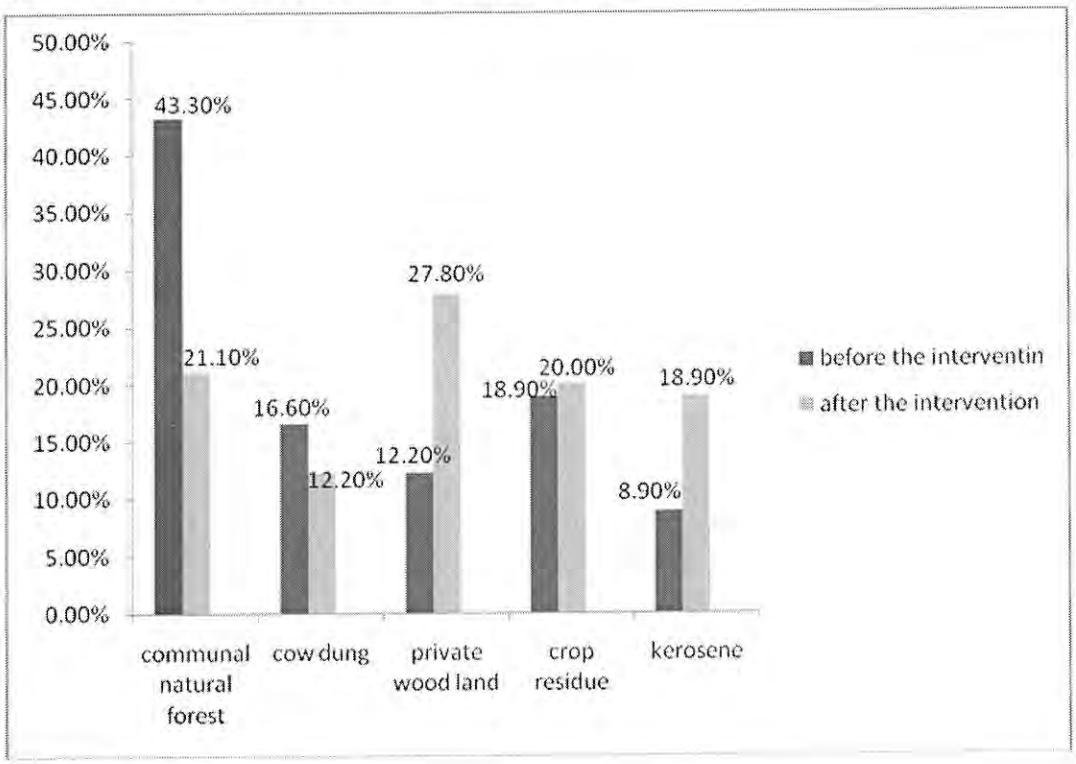
Perceived trend of change		#	%
Increased	Slightly	14	15.5
	Moderately	56	62.0
	Highly	12	13.0
Decrease	Slightly	2	2.00
No change		6	6.50
Total		**90**	**100**

Source: Field Survey, 2007

As a result of increment in protected forest area coverage, the number of wild animals has increased moderately. Furthermore, the biological forest structures played role to some degree in minimizing the rate of run-off and the size of gullies. After the intervention of the project, farmers have better recognized the value of keeping the rules and regulations (in line with natural resource management) which were set by the local government representatives together with the community, of course. According to the sampled household survey, the

change in source of fuel wood after the intervention of the project has contributed for the recovery of forest area coverage. The major fuel wood source of the respondents was communal natural forest both before and after the intervention of the project. However, a change has been registered in the degree of using the same source as fuel wood: 56.5% and 38.9% of the respondents had/have been using communal and natural forest as a major and number one source of fuel wood before and after the intervention of the project respectively. As it is shown in Figure 4.10, a shift towards using kerosene and private woodland as sources of fuel wood has become real to some extent.

Figure 4.10: Major sources of households' fuel wood



Source: Field Survey, 2007

From elder farmers and former community administrators and experts, the study found out that there were little program oriented plant diversification and recovering activities before the intervention of the Project. Unlike the present, farmers were rarely informed about forestry work specifications, protection and maintenance requirements, and harvesting period and expect final use before the tree planting activities started. According to the focus group discussion, a considerable change has been seen in aspects like making session to plan, implement and evaluate the whole watershed development practices. Unlike the former times,

farmers and DA's were able to get an opportunity to conduct discussion on issues related with natural resource conservation and management practices at least twice a year.

4.2.2.3 Availability of Forest Resources

Apart from preventing soil erosion, forests contribute a lot in satisfying the short-term economic needs of the people through providing wood for fire and construction. In the structured survey, household heads were asked if they use forest which has resulted from the project's hillside closure activities. Accordingly, the majority of them replied as they do so. When asked further for what purposes they have used the forest, most of them said that they have used it primarily for firewood, and secondly for construction purpose. However, all the sources are accessible with conditions formulated by the government together with the community.

The study also revealed similar findings from PRA that communal and private (homestead) plantations, which have been carried out with the aid of project, played a role in satisfying the wood demand of the immediate society. Based on the survey, the majority of the respondents (54.5% and 52.2%) replied that the availability of fire wood and wood for construction increased moderately after the intervention of the project (Table10 and 11).

Table 4.10: Farmers' perception about Changes happened to fire wood availability after the intervention of the project

Alternatives		**Response Proportion (household)**	
		#	%
Increased	Slightly	28	31.2
	Moderately	49	54.5
	Highly	5	5.50
Decreased	Slightly	4	4.40
No change		4	4.40
Total		**90**	**100**

Source: Field Survey, 2007

Table 4.11: Farmers' perception on changes happened to construction of wood availability after the intervention of the project

Alternatives		Response Proportion (household)	
		#	%
Increased	Slightly	33	36.8
	Moderately	47	52.2
	Highly	3	3.30
Decreased	Slightly	3	3.30
No change		4	4.40
Total		**90**	**100**

Source: Field Survey, 2007

According to the farmers in the PRA, because of the increment in the availability of woodland, the distance farmers have to travel to get firewood has minimized. At the beginning of the intervention, there were times by which farmers (typically women and children) had to travel more distance (for one and half an hour) out of their village in search of fire wood. After the intervention, since the availability of fire wood in their village has improved, farmers are able to save time by half an hour. Thus, the project has contributed in reducing women's and children's regular workload, which was collecting firewood from distant areas.

The research is also able to recognize the fact that unlike the homestead trees, community forest is not open and accessible to any body with out permission and/or compensation. However, there were exceptional cases by which the communal woodland could be exploited by the local government for the construction and maintenance of schools and other facilities with out any consent and return to the special group who have been devoting their time and labor in the process of developing the woodland. This is against the bylaws (local rules and regulations) in utilizing the community forest which is developed with the aid of the project. Such event has negatively affected the local farmers so as to be engaged in the operation in a sustainable manner.

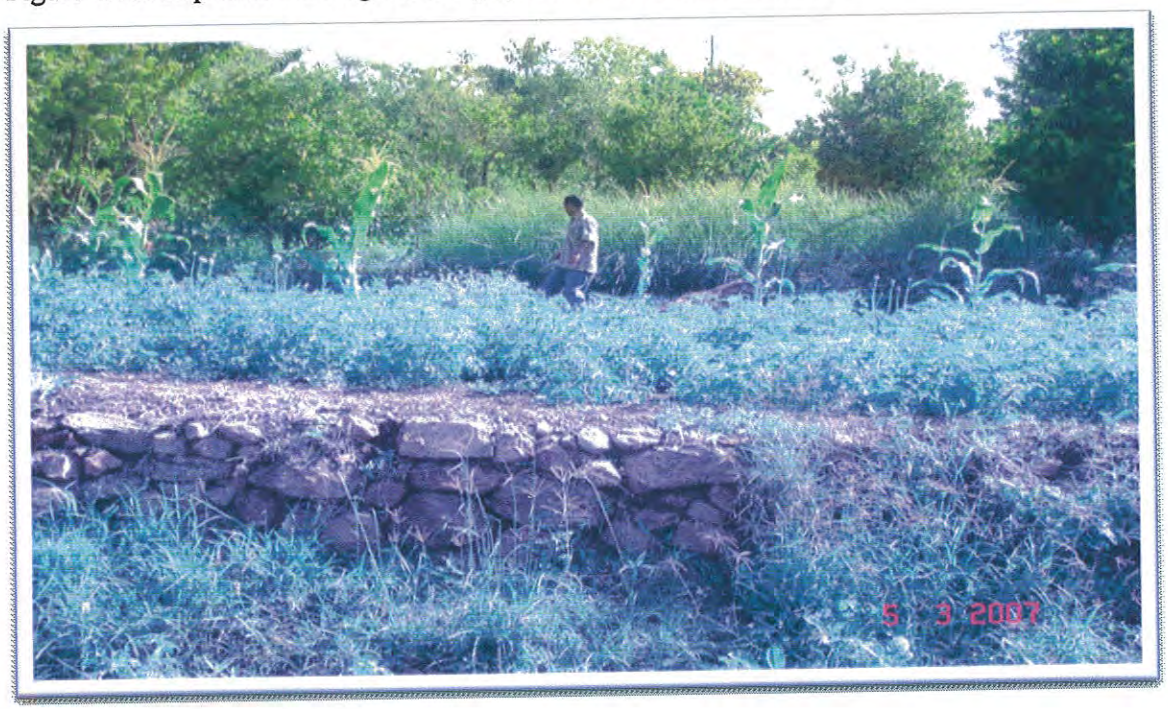
On the other side, because of population increment, the available wood supply for fire and construction do not satisfy the existing demand adequately. As a result, the cost of wood for fuel and construction has still been going up near and at the study area.

4.2.3 Grass Resources

4.2.3.1 Grass Species (Recovered and/or Introduced)

In order to detect the change made on grass resources after the intervention, the study focused on assessing recovered and/or introduced species. In order to generate the data, the same sources and techniques, which were applied to generate data on forest resources, played important role. Most respondents replied that with the aid of the project, harmonious grass species like *Penniselum purpureum* and *Chloris gayana* have been introduced to the sub-catchments for the purpose of soil conservation and maximizing grass availability for fodder and construction. In addition, farmers and DA's added that there is an improvement in recovering grass species: *Pennisetum setaceum* and *Hyparrhenia rufa* which would vanish because of unwise use and poor management.

Figure 4.11: Replicated biological and physical conservation structures



Source: Field survey, 2007

The farmers' demand to adopt the newly coming grass species in their homestead has increased (Figure 4.11). However, the performance of the project in propagating improved varieties of grass in to the community at large has still been moderate.

4.2.3.2 Grass Coverage

Just like the situation in forest resources, grasses were also deteriorating rapidly in the past just before the intervention of the project. Farmers were highly dependent on communal grazing land in a very traditional and unwise manner. In the side of the government, there were no organized and program oriented conservation operations. After the intervention of the project, however, moderate changes have been registered in grass coverage along homesteads and protected forest lands. As most respondents (60%) replied, the grazing land coverage has shown moderate increment because of conservation activities with the aid of the project. In contrary, 4% of the respondents say that the coverage of grazing land has shown no change, whereas 1% of the respondents' response tells that the coverage of grazing land has shown slight decrement (Table 4.12).

Table 4.12: Changes happened to grass area coverage availability after the intervention of the project

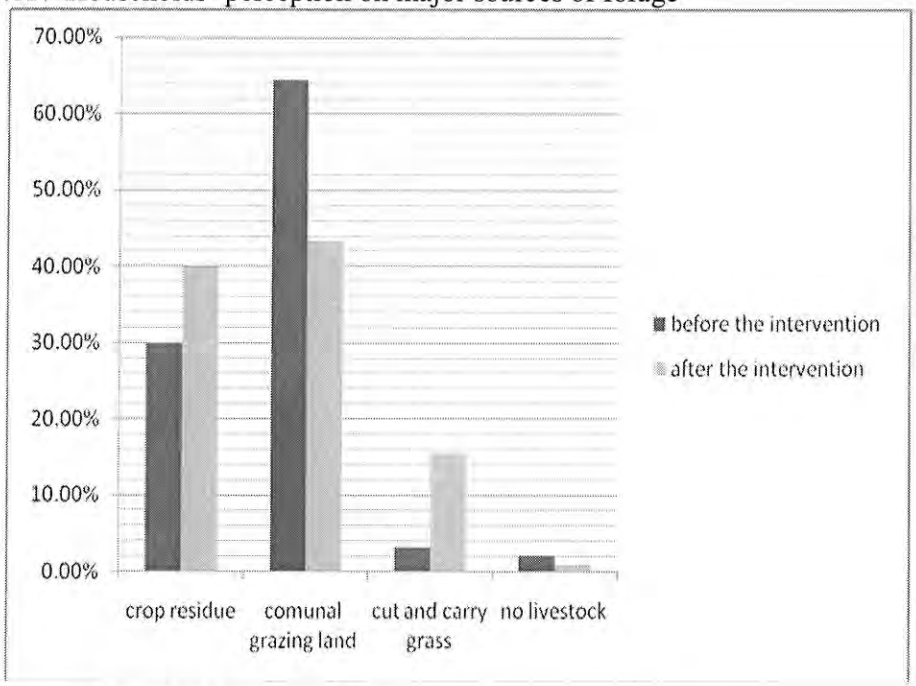
Alternatives		**Response Proportion (Household)**	
		#	%
Increased	Slightly	29	32.2
	Moderately	54	60.0
	Highly	3	3.40
Decreased	Slightly	1	1.10
No change		3	3.30
Total		**90**	**100**

Source: Household survey, 2007

According to the sampled household survey, the change in sources of livestock forage among the community has contributed to recovery of grass area coverage. The major source of households' livestock forage was/is communal grazing land both before and after the intervention of the project. However, there is a change in the degree of using communal grazing land as source of forage: 64.4% and 4.3% of the respondents have been using

communal grazing land as a major source of forage before and after the intervention of the project respectively. Some farmers have shifted from using communal grazing land towards using cut and carry grass (Figure 4.12).

Figure 4.12: Households' perception on major sources of forage



Source: Household survey, 2007

4.2.3.3 Availability of Grass Resources

Based on the PRA, in all villages of the sub-catchments, grass for forage and thatch has been made available inside area closures and protected forest lands of one type or another due to the project's inputs. In the formal survey, household heads were asked if they use grass resource (along hillside closures) which has been developed with the aid of the project activities; and the majority of them responded as they do so. When asked further, for what purposes they have used the grass, most of them said that they have used it primarily for fodder through cut-and-carry, and secondly for thatch. In addition, it has been used by the project nurseries, or allowed to decompose for conservation purposes. The respondents added that unlike the former times, the number of farmers who were using grass through theft has been decreased after the intervention of the project. It is mainly due to the betterment of rules and regulations on utilization of grass resource.

Table 4.13: Farmers' perception on changes happened to grass for forage availability after the intervention of the project

Alternatives		Response Proportion (household)	
		#	%
Increased	Slightly	18	20.0
	Moderately	53	58.9
	Highly	12	13.3
Decreased	Slightly	2	2.20
No change		5	5.60
Total		**90**	**100**

Source: Field Survey, 2007

Based on the survey, the majority of the respondents (58.9%) replied that the availability of livestock feed has increased moderately, and 45.6% responded that the availability of thatch has increased, too, moderately after the intervention of the project (Table 4.13). However, according to the discussion made with the farmers, conservation activities are becoming less active during the last two years.

Table 4.14: Farmers' perception on changes happened to availability of grass for construction after the intervention of the project

Alternatives		Response Proportion	(household)
		#	%
Increased	Slightly	31	34.4
	Moderately	41	45.6
No change		18	20.0
Total		**90**	**100**

Source: Field Survey, 200

Obviously, maximizing area coverage and improved tree and grass species has its own role for both preventing soil erosion, and satisfying the short-term economic needs of the community. That is, farmers have maximized their income through selling firewood, construction wood and grasses for forage and thatch to the near by towns. In addition, these

outcomes are indicators for the betterment of farmers coping strategies so as to secure their livelihoods in seasons of severe drought. All the outcomes discussed above are fruits of the project's activities with better seedling operation and distribution, and improved natural resource management and bylaws as well. However, compared with the objective of the project, the improvement is still at moderate level.

4.2.4 Employment, Awareness Creation, and Local Food Crop Production

Beyond assessing the project's effect on land resources, it was tried to prove its short-term impact on aspects related to employment, awareness creation, and local food crop production.

4.2.4.1 Employment

Based on documentary sources, and PRA made with direct partaker farmers in the conservation activities, local administrators, DA's and woreda level experts, one of the incentive value of the project is providing employment opportunity to farmers for some part of the year. Farmers in the catchment are paid 3.5 kg of wheat a day/8 hours in response to working in the conservation activities. As a result, people with potential labor that would remain idle are given the chance to generate income to their families by participating in the conservation activities. Hence, some farmers prefer to stay in their aboriginal village rather than migrating to other areas. Furthermore, some participants, typically from the treated villages, are able to save time by reducing long distance journey in search of job.

In addition to creating wage employment to the local community, MERET project has played role in maximizing self-employment through rehabilitating the degraded land. As evidence, some farmers, who were displaced because of famine some 20 years ago, in the catchment are coming back and resettle in their original villages. In addition, the study found out from the PRA that there is an approximate decline of out-migration by 10% in the study site. Hence, the project has contributed in creating wage and self-employment to the community in the study site and the near by areas as well.

What Clay and Singer (1995) say seems tailor-made for this:

> Food aid if properly handled contributes to the creation of employment opportunities both for people who had and who had not been working away from their farms before the start of the project. They added that since the opportunity to be employed are very limited in most underdeveloped rural areas, additional job apart from the regular farming in or near their home area highly valued.

4.2.4.2 Awareness Increment

The resent study ensures the improvement of farmers' awareness towards managing natural resources. They have started to adapt better perception that both forest and grass resources could be used for dual purpose: first for protecting the ecology from degradation and second for income generation purpose to satisfy their short-term needs.

Therefore, the project has not only been serving the community through generating employment opportunity to the local farmers but also benefiting them in upgrading their knowledge and skill on how to construct physical conservation structures like soil and stone faced terracing ,check dam; and also on how to exercise advanced contour plaguing.

The research proved from field observation that as a result of awareness increment, farmers have started to replicate area closures and farmsteads; that is, developments like plantation of trees and grasses, construction and maintenance of soil and water physical conservation structures have been adapted among some farmers (Figure 4.11). However, others are not able to do so for reasons related to possessing smaller size of farm land, and its fragmentation.

4.2.4.3 Local Food Crop and Perennial Fruits Production

In contrary to Maxwell's argument, the focus group discussion made with DA's and local administrator revealed that since labor is one and the most abundant resource potential in the study site, the project did not appear to have displaced labor out of regular agricultural production. Rather, most local people (56%) argued that there was a moderate increment in food crop production, whereas only 4% and 1% of the household respondents indicated local food crop and fruit production declined slightly respectively. In addition, due to the intervention of the project, farmers could maximize their income through selling food crops. Some farmers could newly adapt the culture of producing fruits in the micro-catchment.

Based on the discussion with the local marketing informants, the study gained no evidence, which would lead to the conclusion that the project had reduced agricultural output, either by taking people off their fields at critical moments, or by reducing people's wish to produce a surplus because of significantly depressed local market prices.

As local farmers explained in the PRA, *teff* is a food crop that needs more fertile land. At the beginning of the project's intervention, *teff* was produced ones per two or three years in a plot

of farm land; however, this was the case only for farmers who have two and more hectares of land. After the intervention of the project, this group of farmers has started to produce the same crop once in a year or two years. Production change in *teff* crop shows the contribution of MERET project towards improving the fertility of soil through physical and biological conservation activities. This, however, contrasts with what Maxwell, et al.(1994) say: "Food aid hinders agricultural development by creating competition for labor between Food for Work and on farm activities. It also minimizes farmers' incentives to intensify agriculture"

4.3 Existing Problems in the Processes of Watershed Management

According to the study, although moderate changes have been registered because of the intervention of the project, there are still problems in the process of attaining sustainable natural resource management in efficient and sustainable manner. All the problems detected by the study, were related to institutional, socioeconomic, natural, and policy matters. These bottlenecks are observed in different stages of watershed management (planning, implementation, follow up and evaluation).

In terms of their weight, problems were tried to be prioritized by using focus group discussion from different segments of the society-farmers, administrators and local experts. Accordingly, the result has been presented using the table below (Table 4.15).

Table 4.15: Problems in rank based on their weight:

Problems	Rank
Wrong Perception among woreda experts	1st
Absence of organized documentation and supervision	2nd
Poor composition and organization of *woreda* watershed management team (LLPPA)	3rd
Inadequate input supply	4th
Irregularity and delays of payment	5th
Insecurity of farmers in watershed resources and farm land size fragmentation	6th
A conservation initiative in watershed resources and farmland size fragmentation	7th
A conservation initiative is highly limited in aerial extent	8th
General poverty and short term needs	10th
Unexpected migration of pastoralists from Afar	11th

Source: Field Survey, 2007

4.3.1 Technical and Managerial Problems

4.3.1.1 Wrong Perception

Structurally, MERET project is operating under MoARD; however, at *woreda* administration level, the perception of almost all officers is in different way that the project solely belongs to WFP not for MoAD. Thus, the project's activities are considered to be dependent and extra to the office of Agriculture and Rural Development. Consequently, the tasks are considered as burden to the local officials; in other words, the question, 'who owns and takes the responsibility of the project-aided a ctivities a nd responsibilities?' seems to have found no answer. The reason is related to the fact that MoARD has not design a mechanism by which experts at woreda level are evaluated in terms of the project's outcome.

From the PRA, I can understand that lack of belongingness among *woreda* experts in running the overall watershed development activities is the most important constraint in running supervisory and documentation tasks in an accountable manner. This in turn negatively affects the degree of maximizing the operation's objective through identifying possible strengths and weaknesses.

4.3.1.2 Lack of an Interdisciplinary Approach

The focus group discussion made with experts and DA's revealed that the *woreda* watershed planning team does not satisfy even the minimum requirement of interdisciplinary approach. The team consists of only two agronomists. The rest members are totally recruited from the local farmers. Such professional constraint at *woreda* level is a big bottleneck in the process of running an integrated watershed development so as to maximize the out put of the project in a sustainable manner.

> In Participatory watershed management, the involvement and commitment of various disciplines is mandatory. This is not only logical but also advantageous as different activities are mutually reinforcing. Under ideal conditions, the *woreda* core team should consist of 10 experts from various disciplines (Lakew , et al., 2005).

4.3.1.3 Lack of Training and Experience Sharing

Based on the focus group discussion made with farmers, local administrators, and DA's, the study found out that farmers have detailed knowledge of their local situation (the soil, climate, crops and animals), but most have limited knowledge/ skills in improved institution and technologies. Lack of provision of appropriate training, and absence of experience sharing with farmers from model watershed development sites have their own place for the incompetence of the farmers to go ahead hand in hand with the available and improved institutions and technologies. As a result, the farmers, DA's and *woreda* experts were also facing difficulties to do friendly with improved institutions and technologies so as to maximize the intended outcome of watershed development in efficient and sustainable manner.

4.3.1.4 Poor Documentation and Supervision

Theoretically, conducting adequate/in-depth baseline data is a prerequisite task to have a clear background about a given intervention area as well as to evaluate the performance of a given project. However, the study has examined that the document (baseline data) which was made at the study area is incomplete. Consequently, it has made the process of evaluation (effect assessment) more difficult. In addition, the assessment found out that most conservation works are supervised by DAs and peasant a ssociation officials who have little training in supervision and evaluation; it is no wonder that there have been difficulties for local DAs' in making an a ssessment o n out c omes and e ffect o f t he project. T hus the overall quality of annual and seasonal reports is in question. In this circumstance identifying the right weaknesses and strengths on the course of watershed development operation will be

challenging. It finally results in difficulties to take corrective measures as to maximize the long term achievements of the project.

> Betru (2006) also acknowledges that whatever MERET project has registered encouraging results on the farmers' livelihood, the project is not yet able to develop and put in place a system by which the project's progress could be documented in an integrated and consistent manner.

4.3.1.5 Irregularity and Delays of Payment

Based on FGD and documentary sources, farmers who are working in the seedling site and physical conservation structures are paid 3.5 kg of wheat a day (8 hours) averagely. According to the study, there are cases by which people were not paid on time and there are delays which crop up suspicions of eventual non-payment. Apart form delays, the amount of ration paid to the participants is not optimum when compare with the time and energy requirement of the work. Since it has its own touch with their short-tem benefit (Seasonal income) it has been an issue which didn't get satisfactory amendment.

Furthermore, there are cases by which, unexpected and unnecessary disbursement of wheat for b oth d irect p articipants and farmers in the catchments carried out because o f a special order from the higher government bodies. According to the farmers and experts, such thing is mainly done in response to settling farmers' grievance against the existing destitute situation. Hence, unless care is taken in distributing wheat, dependency syndrome will prevail over the area. Finally, it will result in difficulties in keeping longer locally initiated development operations so as to secure their livelihood assets including natural resources.

4.3.1.6 Overlapping of Work Schedule

Based on the focus group discussion, having the positive role of the project in improving the fertility of the land and amount of crop production, overlapping of farm work and conservation work schedule is a hindrance in implementing conservation carriers effectively. As farmers explained, during times of preparation of land/plaguing, another workload related to conservation workload come to be done. In addition to creating work burden on the farmers, such overlapping of work schedule has created a discouraging effect towards maximizing the interest and level of farmers' participation in the operation. Therefore, whatever an improvement has been registered in the degree of farmers' participation, the merit of farmers' involvement at different stage of the catchment development (in planning and decision-making) is still in question after the intervention of the project.

4.3.2 Scio Economic problems

4.3.2.1 Inadequate Input Supply

The assessment proved that inputs and incentives like allowance, clothing and training are at minimal level. As it is described by some farmers, a major amendment (in connection with providing the right incentives and inputs for conservation activities) have to be made to keep longer the life the scheme. Hence, in addition to optimizing the level of proper inputs, designing proper incentive mechanisms are important areas which need a lot of work.

Farmers (who are members of operational committee) and DAs do not get any special incentive for the time they spend that otherwise could be utilized for private purpose. If things continue in such manner, it could results in diminishing of participants' interest in the long run.

There is a consensus among scholars that without significant and integrated support, natural resource conservation (including soil and water) is expensive for poor countries like Ethiopia (Belay, 2002, and Siegfried et al., 1990).

> Generally speaking, the inputs for the development of watershed includes the labor, planting/ working/ construction materials, training and other service costs. The volume of inputs required for implementing the plan is dependent upon a number of factors. The extent of the work (area), specification, degree of slope, soil texture, and condition (wet or dry) and the working pattern, tools of workers, and planting materials are all factors that influence the labor and material inputs (Siegfried P. et al., 1990).

4.3.2.2 General Poverty and Short-term Needs

Based on the household survey and field observation, most farmers in the study catchments are very poor; Individual land holdings and the yield per unit area were very small and low and hence life is hard for them. Although, the general livestock population in the area is enough to cause overgrazing, individual shares are low. Only a few (19%) farmers in the area own a pair of oxen; in addition, there is almost no off-form and non-farm employment opportunity to supplement their low income.

From the focus group discussion, it is learnt that farmers were mostly readily accepting any small but immediate benefit at the expense of any huge future benefit. Poor farmers with inevitable short-term attitudes can hardly appreciate fully natural resource conservation. As evidence, the study also revealed that there were times by which some farmers destruct

physical soil conservation structures intentionally in order to be employed in the reconstruction and be paid to satisfy their short term needs. It clearly indicates the prevalence of poverty born syndrome against rural development operations.

As Degefa (2005) stated,

> poverty can be manifested in inadequacy of certain physical and economic services that are expected to facilitate the process of agricultural project with respect to organizing, institutionalizing, coordinating, producing, distributing, monitoring and evaluating. This in turn leads to the decline of agricultural production and proper land management.

4.3.2.4 Migration of Pastoralist

In the course of the study, it is found out that in times when pastoralist face grazing land constrains, it is a common trend to migrate to the study sub-catchment with the assistance of their regional and local government official. Such things together with other factors mentioned in the study results in discouraging effect for the community to be engaged fully in the watershed development activities. Specifically, the phenomenon has resulted in extensive destruction of trees, grasses, and crops in the micro-catchment which has been under treatment with the aid of the project. In addition, resource based conflict between the sedentary farmers and migrant pastoralist and feeling of insecurity among the sedentary groups are among negative effects prevailing in the catchment community. Consequently, a situation that forces sedentary farmers to compete with migrant pastoralists for unwise use of the rehabilitated watershed resources like protected trees and grasses has created.

4.3.3 Policy Related problems

4.3.3.1 Ownership Insecurity on Land Resource: The focus group discussion made with the community members including local experts, farmers and local administrators on the issue related to ownership of different types of plantations and other resources established thorough the aid of the project. Accordingly, there were participants doubtful on the issue. However, the majority (69%) responded that every development operation in the catchment belongs to the government not for the PAs. In other words, people in the area still feel that natural conservation activities and its fruit (especially, protected tree plantation) does not belong to them, and hence, they do not give appropriate care for the conservation measures that keeps sustainability of the resource and the ecology.

Farmers were also asked to justify their feelings on the issue under discussion. Accordingly , they replied that ,breaking the bylaws, in times when trees (planted by groups of farmers with the aid of the project) is needed for the construction of community services like school, and administrative offices, it was taken by the local government with out any approval and/or compensation. It obviously indicates the existence of discouraging working environment so as to be engaged in the initiated conservation schemes in a sustainable manner.

The data obtained from the household survey also revealed that the sustainability of maintaining physical conservation structures is in question. Some farmers do not maintain the destructed structures without aid. They often wait for payment for most conservation structure; and maintenance activities to be done on protected, communal and private forest and farm lands. It clearly shows the absence of belongingness on the available resources in the watershed.

Von Braun, and Teklu (1992), and Workenh (2006) also stated that

> farmers' decision on improved production, land management , input use and farm enterprise patterns depend on: land tenure system; factor cost and product cost (profitability and gross farm income); households' total resource endowments of land, labor, oxen, other livestock assets; household access to roads market, credit and other institutional services that affect farmers ability to purchase or hire inputs and to sell their farm products; and other community level factors such as culture and agro-ecology.

4.3.3.2 Farmland Fragmentation: The study revealed that peasants in the study site are exercising farming in a fragmented and small sized farm plots. Most (69 %) of the farmers possess 0.75 hectare of farm land at three scattered places (Graph 4.5 and 4.6). According to the farmers, in the focus discussion, practicing physical soil conservation structures in scattered small plots of farm land is not beneficial in terms of the proportion of land, which is covered with the structures. In addition, it is costly in terms of labor and time, which is required to run conservation structures on fragmented farmland plots. In contrary, farmers were at times placed in a fragmented land where this becomes advantageous like in the situation when disasters prevail over the locality, There is, a possibility that some plots may be saved from the disastrous situations.

Together with inappropriateness of the topography and rapid population growth, the existences of small sized and fragmented land have been one of the major constraints in maximizing the performance of the ongoing watershed development.

In a situation where farm land is fragmented, bringing about a successful soil and water conservation for an extended period of time is hardly possible. That , the process of constructing physical conservation structures requires more budget and time; it also makes difficult the task of running commercial agriculture so as to meet the objective of the government in line with food security.

> In consensus with this outcome, Workneh (2006) argued that application of sustainable land management practice such as rotation, agro-forestry, intercropping and soil erosion control are generally influenced negatively by the fragmentation and diminution of farmland size. Small farm size holders face higher overhead cost of application of technology per unit of land area. On the other hand, they are generally less risk tolerant, for they often have low income and work under a risk-prone environment.

4.3.4 Natural problems

Ruggedness of the Terrain and Erratic Rainfall: From field observation and documentary sources, the study has found out the fact that the study site is characterized by rugged topography (Figure 4.13). The total area of the site is nearly about10.7 square kilometer; out of which (approximately) 44% and 34.5% is characterized by gorges and mountainous land forms respectively. According to the data obtained from the local (Kālu) meteorology station, rain fall in the study area is irregular in pattern; that is, the annual average rain fall lies between 650mm-1,050mm. Together with unreliability/unevenness of rainfall, the ruggedness of the topography has maximized the hardship of farming and conservation practices in the site. The study revealed from the PRA and field survey that if farming continues intensively, performing physical conservation structures require more budget. As a result, the efficiency of the operation to rehabilitate the degraded land so as to secure food self sufficiency is in question.

Figure 4.13: The topography of the catchment at large (side view)

Source: Field Survey

All the problems mentioned above clearly shows the fact that even though moderate changes have been registered in rehabilitating the highly deteriorated natural resources, the problem of degradation is still an issue to be addressed to be addressed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The ongoing watershed development with the aid of MERET project has contributed moderately to the livelihood of the study micro-catchment. The project has played meaningful role in the process of improving the natural resource, economic, and social assets of the community.

Based on the soil analysis conducted, the research revealed that there is a difference in soil fertility. The average organic carbon and basic mineral content (nitrogen, phosphorus, and potassium) is more in the soils taken from the villages where the project has been going on. The variation is as far as creating a change in the fertility of soil to produce food crops and fruits. As a result, farmers in the intervention site have started to use farm lands which were unproductive before the project was launched; and they have to some extent maximized their total amount of food crop products and their income.

The study also found out that (with the aid of the project), compared with the objectives of the project, moderate changes have been registered in the coverage and species of trees and grasses along protected and private land plots. The coverage of trees and grasses has shown moderate increment due to biological and physical conservation activities. On average, the coverage of forest has increased by 3.5 hectares in the over all study site. *Juniperus procera, Manilikara butigi, Grevillea Australia, Accacia saligna, Cajanus cajan* and *Sesbania sesban* were among the major introduced species of trees in the micro catchment; and *Eucalyptus camaldulensis, Carissa edulis, Olea europaea var.africana,* and *Podocarpus falcatus* are among species of trees which have been moderately recovered in most part of the villages after the intervention of the project. Moreover, harmonious (to the local environment) grass species like *Penniselum purpureum* and *Chloris gayana* have been introduced in the sub-catchment, and there is an improvement in recovering grass species like *Pennisetum setaceum* and *Hyparrhenia rufa.*

As a result, the rate of run-off and the size of gullies in some villages have declined to some degree. Because of increment in the availability of woodland, the distance farmers have to

travel to get firewood has been minimized and they are able to save time by half an hour (on average). Farmers have a lso strengthened drought coping mechanisms through selling fire wood and construction wood.

Even though harmonious and adequate number of species is introduced, the task of propagating species of trees and grass in the catchment at large is still minimal. Farmers expressed their concern that this appreciated plant-recovery activities is becoming less active in the last two years. It is also found out that because of population increment, the available wood supply for fire and construction is not satisfying the existing demand adequately. As a result, the cost of wood for fuel and construction has still been going up near and at the study area.

According to the study, most local people (56%) argued that there is moderate increment in food c rop p roduction. F armers have a lso s tarted to produce fruits on h omesteads after t he intervention of the project. People with potential labor that could have remained idle have also got the chance to generate income to their families through participating in the conservation activities. In addition, they have started to adapt better perception that both forest and grass resources are useful for dual purposes: for protecting the ecology from degradation and for income generation so as to satisfy their short-term needs.

Compared with the objective of the project, however, the effectiveness of the operation is still at moderate level. This is because of the prevalence of weaknesses and challenges against the operation in the sub-catchment. These problems are related to socioeconomic, institutional, and policy issues. These problems are generated from both internal and external working environment. In accordance with their weight; lack of belongingness lack of awareness, land- tenure insecurity, short term needs, resource based conflict, and drought are the key existing problems. As a result, land degradation and food security are still big issues (in the site) to be addressed by concerned stakeholders.

5.2 Recommendations

As far as the effects of MERET project in the livelihood of the rural people at the micro-catchment and its practical problems is concerned, the following points are recommended.

- MERET project has played meaningful role in improving the fertility of soil, coverage and species diversity of tree and grass, and the level of food crop and fruit production in the community. Therefore, the ongoing watershed development has to continue in a more enhanced manner through advocating and exploiting the merit of building up on indigenous knowledge , addressing of farmers' priorities and opening the door of participation for concerned stakeholders;
- Because of unplanned population increment, the cost of wood for fuel and construction has still been going up near and at the study area. Thus, emphasis has to be given to replication of more community forestry development so as to maximize the supply of the resource;
- Instead of practicing seasonal food crop production on highly rugged lands, alternative economic activities like fruit production and afforestation are much better so as to be efficient, and to keep healthy the ecology of the catchment at large in a sustainable manner;
- In order to raise ownership security, level of participation, empowerment, sense of belongingness and its consequent profit (in the community), the government has to reconsider rural land-tenure policies and strategies. In the short-run, the land certification system is better to be enhanced; however, empirical study is required so as to apply this system as a long lasting solution in the process of sustainable rural development.
- The performance of the project in documentation and supervision at the study woreda is at minimal level. It is mainly due to the absence of a means by which experts and DA's are evaluated based on their performance in line with meeting the objectives of MERET project. Therefore, the regional government is strongly recommended to design a mechanism so as to make the project part and parcel of their responsibility. In addition, since MERET is food aided project, the same body is highly recommended to integrate the project with other food security development programs.

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APPENDIXES

APPENDIX 1

DEFINITION OF BASIC TERMINOLOGIES

Direct Beneficiaries are assumed beneficiaries who are with in the project.

Indirect Beneficiaries are assumed beneficiaries who are out of the project site. .

Emergency Food Aid is a relief food aid distributed to the targeted beneficiaries in response to sudden food needs occurring from man made or natural crises.

Program Food Aid is non-beneficiary targeted food aid given to government as loan or grant.

Project Food Aid is the food aid given to development related activities; like, FFW, which is now called MERETT project.

Participatory Watershed Development is a rational and socially acceptable utilization of all the natural resources for optimum production to fulfill the present need with minimal degradation of natural resources such as land, water and forest.

A Household is one household family unit, headed by one person, which eats from the same pot and shares the same resources; for example, a household with one house, one wife/ one husband and one family.

A Watershed is a topographically delineated area that is drained by a stream system, i.e. the total land area that drains to some point on a stream or river. The watershed is a hydrologic unit that has been described and used as a physical-biological unit and a socio- economic political unit for planning and management of natural resources.

A Catchment (can be used interchangeably with Watershed) refers to a surface area which drains to a particular point and it can be used for an area as small as a roof or as large as a river basin.

APPENDIX 2

STUDY SITE SELECTION CRITERIA

In order to select a site, intrinsically or extrinsically, there are always criteria in the mind of the researchers. The same was true in the case of this research. Even if the process of selection was not rigorous, here are the criteria, which were used to select the sub-catchment to be studied.

- Being an area where there is base line data;
- Being free from other projects' intervention which have the Same kind of activates with that of MERET project;
- Being an area which has a potential to represent the rest Village that are under the same treatment;
- Being an area where the project has operated at least for seven years, and where the project is still active;
- Being an area where there is full intervention of the project;
- Being an area which is manageable in terms of geographical size;
- Being an area which is not highly inaccessible.

NB: in the selection process, all points had equal weight.

APPENDIX 3

LOCAL AND SCIENTIFIC NAME OF GRASS AND TREE SPECIES

Local and Scientific Name of Grass Species

Local Name	Scientific Name
Elephant Grass	*Penniselum purpureum,*
Rhodes Grass	*Chloris gayana,*
Nechsar	*Pennisetum setaceum*
Sirsira	*Hyparrhenia rufa*

Local and Scientific Name of Tree Species

Local Name	Scientific Name
Gravillia	*Grevillea Australia*
Yeferenji Tid	*Juniperus procera*
Butigi	*Manilikara butigi,*
Saligna	*Accacia Saligna*
Pigen Pea	*Cajanus cajan*
Sesbania	*Sesbania Sesban*
Zigba	*Podocarpus falcatus*
Key Bahirzaf	*Eucalyptus camaldulensis*
Girar	*Accacia bussie ,*
Weira	*Olea europaea var.africana,*
Agam	*Carissa edulis*

APPENDIX 4

EMPLOYED FARMERS AND HUMAN RESOURCES

Target group/ number of employed farmers in the over all conservation activities

No.	*Gott*/Village	Employed farmers		Total
		Male	Female	
		N	N	N
1	Chefieduba	68	7	75
2	Fontennina	81	19	100
3	Chekorti,	32	11	43
4	Kebelie.	7	6	13
5	Geta	10	8	18
Grand Total		**198**	**51**	**249**

Total human resources of the project in the study sub-catchment

Different source group	Sex		Total
	Male	Female	
DA's	1	1	2
Common supervisor	1	-	1
Planning and Development Team: (From farmers, local administrators and experts)	5	5	10
Direct Participants (farmers)	198	51	249
Grand Total	**205**	**57**	**262**

APPENDIX 5

SOCIOECONOMIC BASELINE DATA OF KEBELIE-CHEKORTI SUB-CATCHMENT COLLECTED AT THE BEGINNING OF THE PROJECT'S INTERVENTION (in 2000/1).

Population and land holding	**Major identified problems in the sub-catchment**	**Major subsistence crops**	**Major Sources of forage and firewood construction**
Population: Male: 1408 Female: 1292 Total: 2,701; Average family size= 4; Average total land holding size (ha) per family head=0.77.	Soil erosion, Shortage of animal forage, Problem of materials, Shortage of food, Problem of foot path, Problem of pest , Shortage of irrigation and Shortage of floor mill	Sorghum, Teff and Wheat	**Grasses** *Pennisetum setaceum and* *Hyparrhenia rufa.* **Trees** *Podocarpus falcat*us, *Eucalyptus camaldulensis,* *Accacia bussie,* *Olea europaea var.africana,* *and* *Carissa edulis*

Traditional fertility imp rovement p ractices	**Major problems in crop production**	**Crop marketing**	**Coping strategies at time of food shortage**	**Common livestock management pr actices**
Manure Trees along crop land Mulching Fallowing.	Erratic rainfall Erosion/degradation, Shortage of cropland , Pests, Poor prices , Shortage of inputs, Tenure insecurity, Training insufficiency.	The main crops for s ale: teff ; Perennial cash crops for sell: nothing.	Selling: livestock, fire wood and crop stocks.	Free grazing , Cut and carry and Stalling feeding.

Agricultural calendar of the study sub-catchment			
Plaguing	***Sowing***	***Weeding***	***Harvesting***
February-March	March-May	May-September	September-January
February-June	June-August	July-September	November- January
February-June	June-August	July-September	November- January

APPENDIX 6

SOIL ANALYSIS RESULT SHEET

Total Nitrogen (T.N), Available Phosphorus (Av.P.) and Potassium (K)

Experimental groups	T.N (%)		Av.P. (PPm)		K Cmol(+)/Kg	
	Sites		sites		sites	
	1	2	*1*	*2*	1	2
Intervention site	0.09	17.500	2.96	2.85	2.96	2.85
None-Intervention site	0.05	8.460	1.08	1.02	1.08	1.02

Organic Carbon (O.C), P^H water and Cation Exchange Capacity(CEC)

Experimental groups	O.C (%)		$P^H H_2O$ 1:2.5		CEC Cmol(+)/Kg	
	Cites		Cites		Cites	
	1	*2*	1	2	*1*	*2*
Intervention	2.79	6.2	33.00	31.35	33.00	31.35
None-Intervention	1.19	5.7	27.62	25.32	27.62	25.32

APPENDIX 7

SURVEY QUESTIONNIARE

Survey Questionnaire to be filled by Household Beneficiaries of MERET Project at Chekorti-Kebelie Sub-Catchment

Dear sir/madam,
Mintesinot Azene, a postgraduate student at Addis Ababa University, is conducting a study on watershed management: its impacts and problems, the case of MERET project. Thus, the researcher is kindly requesting you to provide him with the right information. Your response will be confidential and be used only for the purpose of this study.
Thank you, truly!

I. Personal and household data related questions

1. Name of (Optional):_____
2. Sex: 1. Male 2. Female
3. Age:_____
4. Family size (in number) : Male: _____; Female: _____ ; Total :_____
5. Marital Status: 1. Married 2. Not married 3. Divorced
   4. Other_____
6. Educational status : 1. Non-literate 2.Able to Read and write
   3. Other_____
7. Duration of residence in the kebele: 1.since birth 2.others _____
8. Number of members, who are in the age between15-60, in your family: 1.Male 2.Female

II. Questions related to land degradation in the sub-catchment

9. Was there any serious land degradation before the intervention of the project?
   1. Yes 2. No (if no, go to question 18)
   9.1 If yes, which part of the land was degrading? _____
   Probing
   1. Soil.
   2. Forest
   3. Grass
   4. Rivers and streams and
   5. All
   6.other
   9.2 Put the above degraded parts of land in order based on the severity of the problem:
   1st _____; 2nd _____; 3rd _____
   9.3 What were the reasons do you think for the problem you mentioned above?_____
   _____
   Probing
   1. Improper management of natural resources
   2. Improper farming practices
   3. Land insecurity
   4. Drought
   5.Erratic pattern of rainfall
   6. Rugged topography
   7. Human population pressure
   9.4 put the reasons you mentioned above in order based on their weight:
   1st _____; 2nd _____
   3rd _____
10. Is there any serious land degradation in your village after the intervention of the project?
    1. Yes 2.No
    10.1 If yes, which part of the land is degrading? _____
    _____

Probing

1. Soil 2. Grass 3. Forest

4. Rivers and streams and 5. All 6.other

10.2 Put the above degraded parts of land in order based on the severity of the problem:

1st _____; 2nd _____; 3rd _____

10.3 What are the reasons do you think for the problem you mentioned above?

_____ _____

_____

Probing

1. Improper management of natural resources
2. Improper farming practices
3. Land insecurity
4. Drough
5. Erratic pattern of rainfall
6. Rugged topography
7. Human population pressure

10.4 Put the reasons you mentioned above in order based on their weight:

1st _____; 2nd _____

3rd _____

11. If you have any, what did you mainly use as a source of livestock feed before the intervention of the project?

_____

_____

Probing

1. Crop residue
2. Communal grazing land
3. Private grazing land

12. If you have any, what do you mainly use as a source of livestock feed after the intervention of the project?

_____

_____

Probing

1. Crop residue
2. Communal grazing land
3. Private grazing land

13. What did you mainly use as a source of firewood before the intervention of the project? _____

_____

_____

Probing

1. Communal forest
2. Private plantation
3. Cow dung
4. Crop residue
5. Kerosene

14. What do you mainly use as a source of firewood after the intervention of the project? _____

_____

_____

Probing

1. Communal forest
2. Private plantation
3. Cow dung
4. Crop residue
5. Kerosene

III. Questions related to participating in the project

15. Did you participate in any part of conservation operation which has been carried out with the aid of the project?

1. Yes 2. No

15.1 If yes, for how many months /years did you take part in the carriers? _____

15.2 If yes, why did you decide to do so? _____

15.3 Are you still taking part in the project?

1. Yes 2. No

15.4 In the future, do you like to extend your participation as long as the project alive in your village?

1. Yes 2. No 3.Other_____

15.5 What is/are the reason/s for your decision to question number _____

16. Do you receive food (wheat/ oil) from the project? 1. Yes 2. No

16.1 If yes, what was the modality for receiving food (multiple answer is allowed)? _____

Probing

1. Labor exchange 2.Free distribution

16.2 If yes, have you satisfied with what you are paid?

1. Yes highly 2.yes moderately 3.yes slightly 4.No, I don't

IV. Questions related to forest resource

17. Have you observed any species of trees that are introduced, recovered and/or endangered after the intervention of the project?

1. Yes 2. No 3.Other_____

17.1 If yes, mention species of trees that are introduced_____

- What is/are the reason/s for the above change?_____

17.2 If yes, mention species of trees that are recovered_____

- What is/are the reason/s for the above change_____?

17.3 If yes, mention species of trees that are endangered_____

What is/are the reason/s for the above change? _____

18. Had /have you been beneficiary of trees before and after the intervention of the project?

1. Yes, before the intervention of the project
2. Yes, after the intervention of the project
3. No, before the intervention of the project
4. No, after the intervention of the project
5. Other _____

19. If yes, for what purpose you were using trees before and after the introduction of the project?

19.1 Before the intervention of the project? _____

19.2 After the intervention of the project? _____

20. Have you observed any difference in forest area coverage after the intervention of the project?

1. Yes 2. No 3. No difference 4. Other

20.1 If yes, how do you describe the differences?

1. Decrease (slightly, moderately, highly) after the intervention

2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other_____

21. What weaknesses and strengths have you noticed in the process of diversifying tree species and maximizing its coverage?

A. Weaknesses _____

_____

B. Strengths: _____

_____

22. How do you describe the availability of wood for construction after the intervention of the project?
1. Decrease (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other_____

23. How do you describe the availability of fire wood after the intervention of the project?
1. Decrease (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other_____

24. What activities/techniques are being used by the project in conserving trees in the catchment? _____

_____

Probing

1. Seedling 3.Awareness creation
2. Reforestation 4. Gully reclamation

25. Is there is any, what is/are the challenge/s in the process of maximizing trees diversity and its coverage?

V. Questions related to grass resource

26. Have you observed any species grass that are introduced, recovered and/or endangered after the intervention of the project?

1. Yes 2. No 3.Other_____

26.1 If yes, mention species of grass that are introduced_____

_____

What is/are the reason/s for the above change? _____

_____

26.2 If yes, mention species of grass that are recovered_____

_____

What is/are the reason/s for the above change_____

_____?

26.3 If yes, mention species of grass that are endangered_____

_____

What is/are the reason/s for the above change? _____

_____

27. Had /have you been beneficiary of grass resources before and after the intervention of the project?
1. Yes, before the intervention of the project
2. Yes, after the intervention of the project
3. No, before the intervention of the project
4. No, after the intervention of the project
5. Other _____

28. If yes, for what purpose you were using grass resources before and after the introduction of the project?

28.1 Before the intervention of the project? _____

_____

28.2 After the intervention of the project? _____

29. Have you observed any difference in grass area coverage after the intervention of the project?
1. Yes 2. No 3. No difference 4. Other

29.1 If yes, how do you describe the differences?
1. Decrease (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other

30. How many bundle of grass do produce in a year before and after the intervention of the project?
- Before intervention of the project:
- After the intervention of the project:

31. What weaknesses and strengths have you noticed in the process of diversifying grass species and maximizing its coverage in the catchment?

A. Weaknesses

B. Strengths:

32. How do you describe the availability of grass for construction after the intervention of the project?
1. Decrease (slightly, moderately, and highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other

33. How do you describe the availability of forage after the intervention of the project?
1. Decrease (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. Other

34. What activities/techniques are being used by the project in conserving grass resources in the catchment?

Probing

1. Seedling
2. Reforestation
3. Awareness creation
4. Gully reclamation

35. Is there is any, what is/are the challenge/s in the process of maximizing grass diversity and its coverage?

VI. Questions related to Soil resource

36. What is your main economic activity?

1. Farming
2. Weaving
3. Animal rearing
4. Small scale trade
5. Other

37. If farming, what kind of crop you were/are producing before and after the intervention of the project?
- Before the intervention of the project?
- After the intervention of the project?

38. How is crop production now as compared to production before the intervention of the project?
1. Decrease (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other

38.1 If there is any change, what do you think the reason for this change? _____

_____

39. How many quintal of millet do get in a hectare/Timad of land? _____

40. What is your supplementary economic activity? _____

_____

41. How do you describe soil erosion after the intervention of the project?

1. Decreased (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other_____

42. What activities/techniques are being used by the project in conserving soil resources in the catchment? _____

_____

Probing

1. Terracing
2. Reforestation
3. Awareness creation
4. Gully reclamation

43. Is there is any, what is/are the challenge/s in the process of conserving soil resources in the catchment?_____

_____ _____

_____

VII. Property related Questions

44. Which kind of cattle do have? (Multiple answers is possible)

1. Cow
2. Ox
3. Sheep
4. Goat
5. Mule
6. Horse
7. Combination of the above, specify_____
8. Other_____
9. I don't have any

45. The number of cattle you have after the intervention of the project?

1. Decrease (slightly, moderately, highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other_____

45.1 If there is any change, what do you think the reason for it? _____

_____

46. How many hectares of land do you had /have before and after the intervention of the project?

- Before the intervention of the project? _____
- After the intervention of the project? _____

47. How do you describe your average annual income after the intervention of the project?

1. Decrease (slightly, moderately, and highly) after the intervention
2. Increased (slightly, moderately, highly) after the intervention
3. No any change
4. Other_____

48. Other than MERET, is there any other project which is doing on natural resource conservation?

1. Yes 2. No

48.1 If yes, specify their name: _____

_____

49. If there is any thing to be added you can do so.

_____

_____

_____

DECLARATION

The thesis is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

Name ***Signature***

Mintesinot Azene

This thesis has been presented for examination with my approval as university advisor:

Name ***Signature***

Belay Simane