A STUDY ON THE ROLE OF INTEGRATED WATERSHED DEVELOPMENT APPROACH ON LIVELIHOOD IMPROVEMENT OF THE RURAL COMMUNITY: THE CASE OF GEREBSHELELA WATERSHED WITH PARTICULAR REFERENCE TO MERET PROGRAMM

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DECLARATION

I hereby declare the Dissertation entitled A STUDY ON THE ROLE OF INTEGRATED WATERSHED DEVELOPMENT APPROACH ON LIVELIHOOD IMPROVEMENT OF THE RURAL COMMUNITY: THE CASE OF GEREBSHELELA WATERSHED WITH PARTICULAR REFERENCE TO MERET PROGRAM submitted by me for the partial fulfillment of the M.A. in Rural Development to Indira Gandhi National Open University, (IGNOU) New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

Place: Addis Ababa, Ethiopia

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CERTIFICATION

This is to certify that Mrs. Genet Ambaye Yihdego, student of MA (RD) from Indira Gandhi National Open University, New Delhi was working under my supervision and guidance for her Project Work for the Course MRDP-001. Her Project Work entitled STUDY ON THE ROLE OF INTEGRATED WATERSHED DEVELOPMENT APPROACH ON LIVELIHOOD IMPROVEMENT OF THE RURAL COMMUNITY: THE CASE OF GEREBSHELELA WATERSHED WITH PARTICULAR REFERENCE TO MERET PROGRAM which she is submitting in her genuine and original work.

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TABLE OF CONTENTS

DECLARATION i
CERTIFICATION ii
ACKNOWLEDGMENT iii
TABLE OF CONTENTS iv
LIST OF TABLES vi
List of Figures vii
ACRONYMS vii
ABSTRACT viii
CHAPTER ONE 1
1. INTRODUCTION 1
2. STATEMENT OF THE PROBLEM 5
3. RESEARCH QUESTIONS 6
4. OBJECTIVE OF THE STUDY 7
GENERAL OBJECTIVE 7
SPECIFIC OBJECTIVEs 7
CHAPTER TWO 8
2. LITERATURE REVIEW 8
2.1. THE DEFINITION OF WATERSHED 8
2.2. THE GROWTH OF WATERSHED DEVELOPMENT 9
2.3. CONCEPTS AND DEFINITIONS RELATED TO WATERSHED DEVELOPMENT 11
2.4. AN INTEGRATED AND PARTICIPATORY WATERSHED MANAGEMENT 14
2.5. PRINCIPLES, ELEMENTS AND SIZE OF WATERSHED 14
2.6. ELEMENTS & CHARACTERISTICS OF WATERSHED 17
2.7. WATERSHED DEVELOPMENT AND ITS ROLE ON RURAL LIVELIHOOD ECONOMY 19
2.8. EXPECTED BENEFIT OF IWDMA 20
2.8.1. ENVIRONMENTAL BENEFITS 20
2.8.2. ECONOMICAL BENEFIT 21
2.8.3. SOCIAL BENEFITS 22
2.8.4. OVERVIEW OF FOOD AID AND FFW (MERET) PROJECT 23
2.9. PROBLEMS RELATED TO THE PROCESS OF WATERSHED MANAGEMENT 25
2.9.1. NATURAL PROBLEMS 25
2.9.2. TECHNICAL AND MANAGERIAL PROBLEMS 26
2.9.3. SOCIO-ECONOMIC PROBLEMS 27
2.9.4. POLICY RELATED PROBLEMS 28
CHAPTER THREE 30
3. RESEARCH METHODS 30
3.1. DESCRIPTION OF THE STUDY AREA 30

3.2. SCOPE OF THE STUDY 31
3.3. SAMPLING DESIGN 33
3.4. SAMPLING 34
3.5. DATA COLLECTION 35
3.6. DATA ANALYSIS 38
CHAPTER FOUR 38
4. RESULTS AND DISCUSSIONS 39
4.1. SOCIO-ECONOMIC CHARACTERISTIC 39
4.2. ACCESS TO BASIC SERVICES 47
4.3. PERCEPTION OF POVERTY 54
CHAPTER FIVE 66
5.1. CONCLUSION 66
5.2. RECOMMENDATIONS 70
REFERENCES 73
ANNEXES 77
ANNEX: 1 LIVESTOCK INCOME AFTER PROJECT INTERVENTION 77
Annex 2: Households off – farm income after project intervention 78
Annex. 3 Household Questioner 79
Annex.4. Household Questioner for None Participant Households 85
Annex. 5. Guide Questions for Focus Group Discussions at the level of District (Woreda) 89

LIST OF TABLES

Table 4.1: Number of persons living in the household …… . 40

Table 4.2: Number of children living in the household ……41

Table 4.3: Number of children going to school by sex …… 41

Table 4.4: Average age of husband and wives, Educational status and

Types of activity involved ...……. 42

Table 4.5: Participation in Non – farm activities and type ...…….44

Table 4.6: Land ownership and Size of Land ownership by the household…… 44

Table 4.7: The mean Land owned, rented and cultivated by the household ……45

Table 4.8: Source of traction power ...……..46

Table 4.9: Access to credit, saving and remittance ...…….. . 48

Table 4.10: Households received Training …….. ...…….48

Table 4.11: Number of Households participated in association & co-operatives …… 49

Table 4.12: Respondents view on Benefits in joining association ……. .50

Table 4.13: Respondents View on accessibility to school & Health services …….50

Table 4.14: Average distance traveled to the nearest market and main road ……..51

Table 4.15: Availability and type of extension service & the utilization of modern

inputs …….53

Table 4.16: Input providers & modality of provision in the study area …… 53

Table 4.17: Perception of Poverty …….55

Table 4.18: Average income from livestock sale before and after the project intervention..57

Table 4.19: Participation in non – farm and type of activities …….. …… 58

Table 4.20: Household income from land rent ……...59

Table 4.21: Household average income from saving and credit ……60

Table 4.22: Household income trend in the last five years …….. …... 61

Table 4.23: Type of service obtained from government, NGOs and Community …… 62

Table 4.24: Households participating and willing to participate in development works…….63

Table 4.25: Household received technical support and types of support ……65

Table 4.26: Household participation in irrigation schemes and size of land ……..83

List of Figures

Figure1. Map of the study area in Tigray Region

ACRONYMS

BOARD	Bureau of Agriculture and Rural Development
CP	Country Programme
FAO	Food and Agricultural Organization
HH	House Hold
IWDMA	Integrated Watershed Development and Management Approach
LLPPA	Local Level Participatory Planning Approach
MERET	Managing Environmental Resources to Enable Transitions to More Sustainable Livelihood
NGOs	Non-Governmental Organizations
STD	Sexually Transmitted Disease
SWC	Soil and Water Conservation
SSRS	Stratified Simple Random Sampling
WFP	World Food Programme
WOARD	Woreda Office of Agriculture and Rural Development

ABSTRACT

The livelihood of the farming community of Tigray is more challenged with high-population pressure, highly variable and unreliable rainfall. The steep topography has accelerated the process of land degradation in the largely unprotected watersheds of the region. The top fertile soil and part of the subsoil were washed away for so many years and as a result the water holding capacity of the soil has declined from time to time. Rapid deterioration of land quality has reduced the already insufficient food production of the region. The rainfall pattern is erratic, unreliable and with short duration, which in most cases was not sufficient to grow the crop to the required level. Due to these reasons, farmers living in the region in general and the watershed community of the study area in particular were suffering from food & fodder shortage for more than half of the year. In order to address the problem, Integrated Watershed Development and Management Approach (IWDMA) was introduced as a development approach and has been implemented in GerbShelela watershed, located in Hintalo Wajrat woreda, South Eastern Zone of Tigray. Earlier traditional Soil and Water Conservation (SWC) measures were used with integration of other development activities in the watershed.

This study was designed to assess (1) the contribution of Integrated Watershed Development and Management Approach in improving the livelihood of the rural community in the watershed, (2) the role of watershed management practices in rehabilitating and protecting the environment, and (3) the changes in income and livelihoods of the community as a result of the intervention. In addition, the evaluation includes the contribution of the community in improvement of their income due to watershed development interventions other than the direct food support obtained for the scheme implementation. Primary and secondary data were collected through interviews, focus group discussion, and field observation and literature review and office reports. With a sample size of 5.8% of the total households, 50% from intervention area and 50% from non-intervention households (treatment group and

control group) were selected through stratified simple random sampling method. To analyze the collected data SPSS 12 version was applied.

The result had shown that the ongoing watershed development programme with the aid of MERET project has contributed highly to improve the economic condition of the community in the study area through diversified livelihood activities. It has also played meaningful role in improving the vegetative coverage through tree planting and grassland development due to bio-physical conservation activities. Gullies were also stabilized. IWDMA has also enhanced the capacity of the community through access to information and networking among them. Natural environment of the degraded highlands of Tigray in general and the *GerbShelela* watershed in particular has began to be rehabilitated and as a result the livelihood of the community improved.

CHAPTER ONE

1. INTRODUCTION

Sustainable development and increased food production in agricultural based developing countries requires availability of sufficient water and fertile land. Water especially affects greatly the prosperity of people and their development potential and health. The availability of this vital resource is not guaranteed for large sections of the world's population. Over 40% of the extra food required to meet the growing food demands by 2025 will have to come from intensified rainfed farming in sub-Saharan Africa region. In contrast, almost a quarter of Sub-Saharan Africa (SSA) population lives in water-stressed area. (World Bank, 2005; UNDP, 2006). Ethiopia is relatively well endowed with water resources, having an estimated annual surface runoff close to 122 billion m3. However these water resources are unevenly distributed both spatially and temporally. Only 10-20% of the country's surface water resources access to the population (MOARD, 2008). To provide adequate water to users, in the right quantities, at the right places and at the right time, by applying environmentally sound techniques and procedures is the challenge in this decade. Hence effective water management becomes very crucial.

The extent of fertile land available for agriculture is decreasing due to land degradation which, in turn, is caused by deforestation and inappropriate use and management of the natural resources (soil and water). It leads to both non sustainable agricultural production and increased risks of catastrophic flooding, sedimentation, landslides, (Pla, 2000). "Land degradation in developing countries, mainly in Sub-Saharan Africa (SSA), is largely an outcome of the existing agricultural production system, which is a "resource-poor"

agriculture characterized by uncertain rainfall, low inherent land productivity, lack of capital, inadequate support services and poverty" (Mekuria 2005, cited in: WECD, 1987).

Ethiopia is one of the Sub-Saharan African countries most seriously affected by land degradation. It has been reported that land degradation in Ethiopia accounts for 8% of the global total. Ethiopia, like other developing countries, has been suffering from poverty and environmental problems for a long time. The fact that the country consists of many mountains has created gullies and hillsides that are considered as the main reasons for removal of the top soil through soil erosion (Tesfay H, et. al 2011). Tigray region is the best example in this regard. The region is located in the extreme northern part of Ethiopia extending between 12 ^{0}15'to 14^{0} 50' n and 36^{0} 27' to 39^{0} 59' E. with a total area of 53,438.6 sq.km (Regional BOFED).Regional economy is mainly dependent on agriculture which is characterized by subsistence mixed farming system growing prominently cereals and vegetables crop and to some extent oil seeds and different livestock. The agriculture sector is mainly dependent on erratic rainfall, which, in turn is considered to be one of the main causes for widespread food insecurity in the region. Droughts occur every 3-5 years in Tigray resulting in famine. According to the 2007 census the total population of the region is estimated to be 4.3 million covering three Ethnic groups (Tigrigna, Kunamas, and Saho) with 80% rural population. Traditionally, the agro ecology of the region is classified into (dry high land ecology ranging from 2300-3200 meters above sea level (masl) with an average annual rainfall of less than 900 mm, dry weyna dega (dry mid land) is ranging from 1500-2300 masl with annual rain fall of less than 900mm, dry kola (dry lowland) is ranging from 500-1500 masl with annual rainfall reaching 900 mm per annum.

The livelihood of the farming community is heavily dependent on subsistence agriculture with slight or unchanged farming practices for long. Livestock rearing, petty trade, daily

wage labour and stone quarry are also contributors to the livelihoods of the rural population. It is more challenged by speedy natural resources degradation; particularly, the top fertile soil and part of the sub-soil were washed away for so many years due to many factors so as the water holding capacity of the soil is declined from time to time. Tigray region in general and GerbShelela in particular was highly affected by land degradation for so many years, which adversely affects the production and productivity of the land so as challenging the sustainable livelihood of the rural community.

According to Sutcliffe (1995), cited in Desta Gebremichael (2005**),** to tackle land degradation problems in Ethiopia, major efforts were made from 1975 onwards to implement improved soil and water conservation (SWC) measures and tree planting. According to **Elsevier B.V., (2005**) due to the conservation of soil, there is an increase of infiltration, which increases the availability of water.

The United Nations World Food Programme (WFP) as a development partner initiated a rural land rehabilitation programme called 'project 2488' mainly focused on soil & water conservation, reforestation activities, in support of the government's effort on reducing soil degradation problems and increasing land productivity in the 1980s.

Towards the end of the 1990s the concept of sustainable livelihood emerged, with a focus placed on better understanding household dynamics and the coping strategies used within the rural community (WFP, 2002c; 2005a). This background paved the way, in 2002, for the WFP food-for-work based environmental rehabilitation program under the name of Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods (MERET). The project, MERET has strengthened the "people centered" focus on participatory natural resource management (with strong emphasis on household income generation activities) rather than merely dealing with natural resources degradation problems.

A five-year 2007-2011 Country Program (CP) was prepared for MERET at the end of 2006 (WFP, 2006c). The overall goal of this program was the reduction of poverty and food insecurity in Ethiopia (WFP, 2006c). This CP builds on two principal components of which rehabilitation of deteriorated watershed areas in food insecure districts using community participatory approaches is the major one. To effectively implement this program the U.N. World Food Program (WFP) in Ethiopia together with the Ministry of Agriculture and Rural Development has developed a community-based participatory watershed development guideline (Lakew et al., 2005).

Similarly since 1998 through MERET project tremendous amount of SWC structures was built in the upper catchments of *GerbShelela*, different exotic and indigenous tree species planted and the area also closed to allow regeneration and recovery (Office of Agriculture & Rural development report, 2007). Now-a-days, the down command area is well protected from silting up. So that farmers are exercising irrigation practices,

World Food Program (WFP), in particular Managing Environmental Resources to Enable Transitions to sustainable livelihoods (MERET), has for the last twenty nine years played a crucial role in the endeavors of protecting indeed developing our natural resources.

Sustainability of the project is ensured mainly by involving the local communities in identification, implementation, and monitoring and evaluation of the project, as well as, creating a sense of ownership through direct contribution. The simplicity of the techniques to be used, the short and long-term economic benefits generated by the project will encourage communities to sustain project activities and benefits even after the withdrawal of the WFP support.

This research is aiming at assessing the role of the IWDMA on the livelihood improvement of the rural communities of the study area, by evaluating the capital assets the community gained.

2. STATEMENT OF THE PROBLEM

The topographical nature of Hintalo Wajrat Woreda in general and *GerbShelela* watershed in particular is highly exposed to land degradation as a subsequent effect of human intervention and the natural hazards. *GerbShelela*, the study area has been experiencing severe soil erosion for a long period of time (two-three decades) resulting in gully formation, silted up of cultivated and grazing land. Consequently, the production and productivity of the land decreases dramatically to the extent of disabling the farming community to feed the entire families. As a result of this phenomenal, prior to intervention of IWDMA in the area, the community were in a very high risk to sustain their livelihood.

Had it been not addressed in 1998 the degradation problem would have been beyond the economic and environmental degradation issue only, it would have created a social upheaval. Since 1998, a five-year integrated watershed management program was launched to overcome the risk of land degradation so as to enable the rural poor community to be stable and become productive.

Nonetheless, the challenge is still to evaluate the impact of the intervention of the program and its contribution to the rural community on the overall improvement of the livelihood in the watershed. Therefore, applying scientific assessment and measuring of the actual benefits

gained so far by the community to date has created opportunity to recommend the approach to others with similar problems. Accordingly, it is also time to inform the donor, government and policy makers, as well as, the community whether to improve and/or to continue with the approach to manage environmental degradation for sustainable livelihood.

3. RESEARCH QUESTIONS

Believing the integrated watershed development approach has a significant role and contribution in enhancing the economy, improving sustainable livelihood and empowering of the rural poor community in resource management and utilization, the following research questions are posed:

1. What is the contribution of Integrated Watershed Development and Management Approach in improving the livelihood of the rural community in the watershed?

2. What is role the of watershed management practices in rehabilitating and protecting the environment?

3. Does community members income have improved due to watershed development interventions?

4. OBJECTIVE OF THE STUDY

GENERAL OBJECTIVE

The overall objective of the study is to assess the effectiveness of the integrated watershed development management approach in the improvement of the livelihood of the rural poor community of the study area and its sustainability in generating income.

SPECIFIC OBJECTIVEs

- To assess the contribution of IWDMA on introducing different improved technologies that can assist in the enhancement of production and productivity of land,
- To examine the benefit gained so far by assessing pre and post IWDMA household income and expenditure of the rural community.
- To assess how the key five productive capital assets (human, natural, financial, physical and social capitals), which exist in the community as well as, at household level contribution for sustainable livelihood,
- To assess the empowerment of the rural community on decision making process on the overall resource management and sustainability of the intervention to smoothing utilization of the available inputs

CHAPTER TWO

2. LITERATURE REVIEW

2.1. THE DEFINITION OF WATERSHED

Watershed refers to the geographic boundaries of a particular water body, its ecosystem and the land that drains to it (http://www.wallkilleriver.org) [1]. It is the land area that drains to a single body of water such as a stream, lake, wetland, or estuary. Hills or ridgelines often bound watersheds; interior valleys collect precipitation in streams, rivers, and wetlands. These physical boundaries define the movement of water and delineate the watershed.

A watershed-based management approach therefore takes into account everything that occurs within a watershed, including both naturally occurring activities and human activities. In this regard, soil, vegetation, animals and humans are all an integral part of a watershed.

It is also a method for maintaining, protecting and restoring the natural resources with in a watershed while also enhancing the quality of life in the community through the availability of different inputs and the improved natural resources itself (http://www.chesapeakebay.net/info/watershedplanning) [2].

Therefore, the contribution of integrated watershed development and management approach is also expected to improve sustainable livelihood of the rural community of the study area by restoring the natural resources within a given watershed.

According to Hurni (1985, 1990) and Nyssen et al., (2004) cited in Vancampenhout et al., (2005), in the Ethiopian highlands, soil degradation and desertification are major issues since

agriculture and deforestation have been practiced here over 2500 years. The unmanageable cut of trees and shrubs were leading to serious soil degradation contributing to poor productivity of land and finally lead to poverty. The basic cause of this high degradation in most case is that negative intervention of human being to the natural resources. Before major human intervention started, the Tigray highlands were covered by forest and with deep soil as it can still be observed in some remnant (churches) forests (Nyssen N. et al, 2007).

2.2. THE GROWTH OF WATERSHED DEVELOPMENT

Several government and non-government agencies have launched watershed development projects with the objective of soil conservation, improving the land productivity and promoting appropriate technologies for efficient and sustainable use of natural resource, (Johnson et al., 2001 cited in Yoganad B. & Gebremedhin T., 2006). Gerebshelela IWDM were launched in due consideration of addressing the high level of soil degradation so as to improve the land productivity with introduction of new farming technologies for the improvement of the livelihood of the rural communities living in the watershed in a sustainable manner.

Soil erosion in the Ethiopian Highlands degrades the soil resources on which agricultural production and food for the people are based (Hurni, 1986 cited in Desta Gebremichael, 2005). As Hunting (1974); Virgo & Munro (1978); Machado et al. (1998) cited in Nyssen J. (2003), in northern Ethiopia a change in hydrological response of the land has been attributed to overall lowering of soil infiltration capacity caused by removal of the natural vegetation. Therefore, to address this problem, the conventional soil and water conservation (SWC) were

practiced in the highland of Ethiopia in general and Tigray in particular for several years. This approach had a top-down approach in which the participation of the community was limited only to the involvement during the implementation process. The government has launched a Local Level Participatory Planning Approach (LLPPA) on SWC in collaborating with different NGOs, Bilateral organizations working in the country particularly in Tigray.

However, all these intervention did not able to overcome the existing problem of natural resource degradation and to change to economical values. According to Kjell Esser et al (2001), the Konsos of southern Ethiopia are well known for their traditional soil and water conservation practices. The Konso farming is based on an elaborate system of terraces, a variety of other soil and water management practices and the integration of livestock and forestry with the rest of their agricultural practices (Ibid). Experiences of the people of Erob in soil and water conservation practices had contributed for the expansion of cultivated land in the deep gullies throughout Tigray of Ethiopia.

Several governments and non-governmental agencies have launched watershed development projects to tackle some of these generic problems with the objective of soil conservation, improving land productivity, and promoting appropriate technologies for efficient and sustainable use of natural resources Yoganad B. & Gebremedhin T. (2006). Moreover, as Nyssen (1998) cited in Vancampenhout et al., (2005) indicated that to curb these problems, the people, NGOs and governmental institutions make huge effort for soil and water conservation problems. Since the introduction of IWDMA in 1998 in Gerbshelela there is significant shift on the level of the participation of the community with a tangible improvement on the livelihood of the community through the introduction of the improved

technology in a sustainable way. Now-a-days the government and NGO's are highly involved in the practice and implementation of IWDMA for its effectiveness and sustainability throughout the country.

2.3. CONCEPTS AND DEFINITIONS RELATED TO WATERSHED DEVELOPMENT

Watershed development refers to the conservation, regeneration and the judicious use of human and nature (like land, water, plants, animal) resources within a particular watershed. Watershed development attempts to bring about the best possible balance in the environment between natural resources on one side and man and grazing animals on the other. It requires people's participation because conservation is possible only through the whole hearted involvement of the entire community (Common Guidelines for Watershed Development Projects, Gov. India, 2008).

Components of Watershed Development

Watershed development involves:-

- Human resource development (community development),
- Soil and land management (conservation and use),
- Water management (conservation and use),
- Afforestation,
- Pasture (fodder) development,
- Agricultural development,

- Livestock management, and
- Rural energy management.

Watershed development involves continuous interaction and exchange between various sectors e.g. the livestock that can depend on the availability of fodder, which in turn is related to soil and water management. The availability of firewood and other fuel is related to the extent of forest cover, the livestock in the area and the productivity of the land. The development of all the above sectors is crucially dependent on the development of the human population inhabiting that watershed.

When the environment gets degraded, the quality of life of the human community within that region also deteriorates. Watershed development thus aims at the rejuvenation of the environment in an integrated and comprehensive manner.

Activities of man-made like deforestation, wrong farming practices, overgrazing and faulty land use lead to the destruction of plant and tree cover exposing the earth to the natural forces like heavy rains, direct sunshine and high velocity winds. These in turn lead to environmental problems such as soil erosion, floods or water scarcity. Agricultural yield is lowered and this results in decline in the income levels of the community resulting in poverty and eventually leading to migration of lablur from rural to urban in search of livelihood.

Watershed development, therefore, involves not only regeneration of the environment, but also the management of needs of the human community in such a way that their demands

match the resources, viz. land, water and vegetation available within that particular watershed. This equilibrium between need and availability of resources will lead to a better and increased resistance to drought and increased agricultural production augmenting food supply, fodder, fuel and timber. The standard of living improves leading to reduction in poverty-induced migration.

There is a pervading influence of the environment on the human community living within that region, as they depend on it for food, water etc. When the economic condition of a community deteriorates, it leads to over-exploitation resulting in degradation of natural resources. When agricultural return is low people expand their cattle herds for financial security. This leads to over-grazing and in turn to soil deterioration and erosion.

It is necessary for people to understand the relationship between their poverty and the degraded environment in which they live in. They must also provide with an equally good economic alternative. Only then they will willingly let go their claims on the environment in favor of possible benefits that will willingly let go their claims on the environment in favor of possible benefits that will accumulate in the long run from environmental regeneration through appropriate management. Environmental regeneration is therefore possible only when the local community feels the need for it and they are fully in control of all aspects of resource mobilization, management and conservation.

2.4. AN INTEGRATED AND PARTICIPATORY WATERSHED MANAGEMENT

The concept of integrated and participatory watershed management is detected to solving watershed problems on a sustainable basis. Said, G.Sehlke, et al (2006) illustrated that managing watershed development on a sustainable basis usually entails a balance between the needs of humans and nature, both for the present and in the future. From a watershed or water resource development basis, these problems can be classified into five general categories: lack of water quality, deterioration in water quality, ecological impacts, weak public participation and weak economic value. The first three categories can be combined to make up physical sustainability while the last two categories can be defined as social and economic sustainability. Therefore, integrated and participatory watershed management should be designed to achieve physical sustainability utilizing to the greatest extent possible, public participation in an economically viable manner.

2.5. PRINCIPLES, ELEMENTS AND SIZE OF WATERSHED

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 in one time exercise. Different participatory techniques will be used based upon existing and innovative experience, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia, 2005)

***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 each from soil conservation, forestry/agro-forestry, agronomist, water harvesting, home agent, livestock, land use and administration, food security (economist/socio-economist), cooperative/marketing and input, rural road construction sectors. 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, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia ,2005).

***Gender Sensitive**:* Women are the most affected by environmental hardships; for example, they are forced to walk long hours to fetch 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, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia, 2005).

***Building upon Local Experience and Strength**:* Local knowledge is essential to improve existing technologies, to adopt new ones and to manage natural resources and other measures once they are introduced and established. Best practices have to be identified and disseminated, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia, 2005).

Realistic, Integrated, Productive & 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, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia 2005).

The Need for Flexibility at Different Levels: Flexibility is a key criteria required in participatory watershed development planning to fit local conditions. Flexibility is needed during the selection of community watershed, their size (slight smaller or longer 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, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia, 2005).

Cost-sharing and Empowerment/Ownership Building: Cost sharing by stakeholder 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, (Lakew, Volli, Asrat, Yitayew, Community Based Participatory Watershed Development Guideline, Addis Ababa, Ethiopia 2005).

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

2.6. ELEMENTS & CHARACTERISTICS OF WATERSHED

Bio-physical (Water, Land & Vegetation): the watershed includes climate (rainfall, altitude & wind), drainage and water, soil, vegetation, specific topographic features gradient and length of slope and direction and past/current erosion features (river, gullies, landslides, & the like). Moreover, homesteads, cultivated land, grasslands and forest (natural & artificial) degraded area used for various purposes are elements of watershed (Belay, 2002; Lakew et al, 2005). Therefore, some areas have more potential than others, but 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 system social setups, economic activities, vulnerability profile, gender and the like. Watershed planning is democratic. It embraces the views of varies categories of

people in the watershed. 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 (Belay, 2002; Lakew, et.al, 2005; & Woldeamlak, 2000).

Size of Watershed: It is very difficult to set a generalized limit for the area of a watershed, because it is a question of basin order, terrain conditions etc. In a rugged terrain a number of basins can be delineated based on divides while in a flat terrain even a first order basin can cover much larger area. Watershed or basin is a physical unit. However, the term community based watershed can be applied or associated as a general term. Basin can be characterized by community having under defined limit or mixed one.

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. It is also a hydrologic unit that has been described and used as biophysical unit and socio-economic and political unit for planning and management of natural resources (Lakew, et al, 2005). The same source also revealed that, catchments can also be used interchangeable with watershed and 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.

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 kilometer 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 hectares (Lakew, et.al, 2005). The same source shows, sizes lower than 200 hectares may occur and may be considered in few cased but usually these smaller unites 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 intervention before others.

2.7. WATERSHED DEVELOPMENT AND ITS ROLE ON RURAL LIVELIHOOD ECONOMY

As IWDMA has evolved from externally imposed biophysical interventions towards more participatory approaches encompassing a broader range of activities, the potential impact on household asset has increased (Srigiri S.R., Chennamanei R. & Hagedorn K., 2003). Since the commencement of the new approach to watershed development in the highland of Tigray in general and GerbShelela in particular significant improvement were achieved both in the livelihood of the community as well in the natural environment regeneration. According to Igbokwe N. Kennedy and Adede John, (2001) the striking impact of the intervention of WDMA is that the local population has started observing at agriculture with renewed interest for development. This is a good indication that the level of awareness of the community towards improving and wise utilization of the rehabilitated environment is in place. The fodder shortage earlier experienced for months now start reduced. According to WOARD (2006), the availability of fodder increases from six to ten months and the livestock production and productivity improved from what was observed in 2001.

As observed in the case of GerbShelela watershed the vegetation cover of the hillside is noticeably improved and the availability of ground and surface water also improved. By utilizing these advantages farmers of the watershed, attempt to diversify their cultivation practice from subsistence crop farming to various income oriented livelihood activities. As watershed development have evolved from externally imposed biophysical interventions towards more participatory approaches encompassing a broad range of activities so the potential impact of watershed on household assets has increased (Turton C., 2000).

2.8. EXPECTED BENEFIT OF IWDMA

Livelihoods and productivity development shall be given priority along with conservation measures. Resource development and usage will be planned to promote farming and allied activities to raise local livelihoods while ensuring resource conservation and regeneration. IWDA encompasses different sectors in order to obtain various benefits.

2.8.1. ENVIRONMENTAL BENEFITS

Applying IWDMA in degrade environment improves the vegetation cover of the hillside and sloppy areas by reducing high-runoff and planting of different tree types. Controlling expansion of already established gullies and silted up of the cultivated and grazing lands by applying different technology of SWC activities. In the highland of Tigray Region 522,600 ha of land have been treated by different soil and water conservation measures (Nyssen J., 2006) quoted 2002 annual report of the bureau of agriculture and natural resources

development. Some of the benefits, which can be achieved through this type of interventions, are;

- Decline in sedimentation downstream,
- Improved fodder production and more livestock managed under stall-fed conditions,
- Improving recharge of ground water, quality of water for irrigation, drinking and other recreational uses, Year-round availability of drinking water,
- Protect wildlife habitat and improve natural resources,
- Controls flooding by restoring riparian and wetland areas (http://www.chesapeakebay.net/info/watershedplanning.cfm) [3].

All these improvement have positive contribution towards enhancement of the natural capital asset through the development of the natural resource stocks to a given households. Clearly, natural capital is very important to those who drive all or part of their livelihoods from resource based activities (DFID, (Sustainable Livelihoods Guidance Sheets (SLGS), searched on May 08, 2009).

2.8.2. ECONOMICAL BENEFIT

Economic benefit of IWDM can be seen from the point of community as well as, individual benefits. At community level we can see access of the community to natural resources that exist in the watershed because of the intervention. At household level individual farmers can have direct involvement during the implementation of the physical and biological activities, for daily wage in the form of cash/food for work. On top of this individual household can

have an access in manipulating the existing resources such as irrigation, fodder, and other resources for better economy and improving their living standards. According to Yoganad B. & Gebremedhin T., (2006) most of the watershed projects were developed for the purposes of raising farm income, enhancing agricultural productivity, soil and water conservation, generating rural employment, reducing risk by diversifying crops in rain fed areas.

2.8.3. SOCIAL BENEFITS

Through the involvement of watershed community in different steps and the formation of watershed committees, user groups and new or strengthened institutions of activities they can have an opportunity to strengthen social bondage in collaborating among them. According to DFID (2008) to create social benefit for such intervention social capital can have an opportunity to create mutual trust and reciprocity lower the costs of working together, which means that it has a direct impact upon other type of capitals. In addition to this, through the direct involvement during the intervention of watershed development, communities can have the following opportunities:

- Directly involve the community members in developing a vision for the future of the watershed,
- Provides educational opportunities to citizens to understand the interaction of natural resources management with existing and future development,
- Provide opportunities to increase cooperation with neighboring communities (http://www.chesapeakebay.net/info/watershedplanning.cfm) [4].

2.8.4. OVERVIEW OF FOOD AID AND FFW (MERET) PROJECT

According to Betru (2004), 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 shortages and vulnerability to the project area. 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 in to a large project called "Rehabilitation of forest, grazing and croplands" in 1980; and this marked the beginning of ETH 2488 project. Finally, it is started to be called "MERET Project".

The WFP assisted MERET project is executed through the Ministry of Agriculture's soil and water conservation department and the forestry and wildlife conservation development authority. 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 wereda 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 were not only responsible for the day-today 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 seedling nursery workers.

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

1. Bridge the food gap between production and demand in the project is 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 achievements,

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, production etc. (Betru, 2006).

As I can understand from the local project plan document the major activities which were 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 farmlands terraces, hill side terraces, check dams, cutoff drains, gully reclamations, eyebrow, micro-basins and other physical structures.

- Reforestation; this include land husbandry techniques such as planting of multi-purpose 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

- Homestead development: intervention 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 fruits trees and vegetable crop production, small scale animal fattening , poultry, agriculture and high value/cash crop development.

2.9. PROBLEMS RELATED TO THE PROCESS OF WATERSHED MANAGEMENT

Obviously, any development project in general and watershed management project in particular could face problems both from internal and external working environment. That is, problems may be related to institutional, socio-economic and administrative component of a given project (Siegfried, 1990).

2.9.1. NATURAL PROBLEMS

Dissected nature of the terrain and intense rainfall: Ethiopian highlands are characterized intense rainfall and dissected nature of the terrain with nearly 70% having slopes greater than 30%. Further problem is of water logging in the valleys and plains, which encourages

cultivation on the more erosion-prone valley sides and geological structures such as faults and fractures leads to the formation of gullies (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:

i. Unreliable rainfall, drought and floods-reduce outputs and forces to exploit already overused resources further,

ii. High population pressure results in overgrazing and cultivation of slopes inducing and accelerating soil erosion, destroying tree cover, and degrading the land (Siegfried, 1990).

2.9.2. TECHNICAL AND MANAGERIAL PROBLEMS

Absence of Baseline Survey: Most development efforts in Ethiopia fail because they do not fit with local socio-economic realities. That is, most development agents do not contact empirical base line survey in line with agro-climate/agro-ecological, geologic, socio-economic and infrastructural situations before the beginning of the intervention (Lakew, et al, 2005).

Lack of Training and Experience Sharing: Ethiopian farmers usually have detailed knowledge of their local institution but 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 farms and to buy inputs. This makes it very difficult for them to pull themselves out of poverty (Siegfried, 1990).

2.9.3. SOCIO-ECONOMIC PROBLEMS

General Poverty and Short-term needs: Regardless of the income level or state 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 overgrazing, deforestation, soil erosion, soil pollution, river and lake water pollution and the like (EPA, 1997).

In rural poor, the sources of energy for the households 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 the desire of the rural people to have many children is to acquire old age security. This is a typical attitude of rural poor in Ethiopia. These rural people do not plan to manage the balance between 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, which in turn, leads to the degradation of land (MoFED, 2002).

2.9.4. 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 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 different types of plantations established through the same project in their kebeles". 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.

Scones (2001) also 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, incentive must be aimed at improving profitability and security of land tenure for reasonable time.

Farmlands Size of Fragmentation: Ethiopia is a country of small holder farmers where the diminishing of farm size per household has reached the stage that critically demands search for ways to check it. Application of sustainable land management practice such as rotation, agro-forestry, inter cropping and soil erosion control are generally influenced negatively by the fragmentation and diminution of farmland. Such sustainable land management practice needs a consolidated and considerable large farm size. Small farm holders face higher overhead cost of application of technology per unit of land area. Furthermore, small holders are generally less risk tolerant, for they often have low income and work under a risk-prone environment (Siegfried, 1990).

Therefore, applying scientific assessment and measuring of the actual benefits gained so far by the community to date will create opportunity to recommend some major approaches on the type of intervention to be included. Accordingly, it is also time to inform the donor, government and policy makers as well the community whether to improve and/or to continue with the approach to manage environmental degradation for sustainable livelihood.

CHAPTER THREE

3. RESEARCH METHODS

3.1. DESCRIPTION OF THE STUDY AREA

Tigray Region is located at the Northern tip of Ethiopia, between 12^0-15^0 north latitude and $36^0$30'- $40^0$30' east longitude, which has an area of 53,638 km^2 (BOFED, 2003). The study area, *GerbShelela* has total area of 1350.5 ha. (WBOARD, 2005), which is located in Northern highland of Ethiopia, south eastern zone of Tigray, Hintalo Wajrat wereda, is situated at about 37 kms South of Mekelle, Tigray's regional capital (Figure 1). The area is selected for this study based on the type of intervention done so far to rehabilitate the degraded environment and in order to assess both pre and post watershed interventions and measure changes at community and individual households. The main rainy season extended from June to August and March to April, this is a bimodal rainfall pattern with an average amount of 500-600 mm ((Hintalo Wajrat WARD, 2008 report).

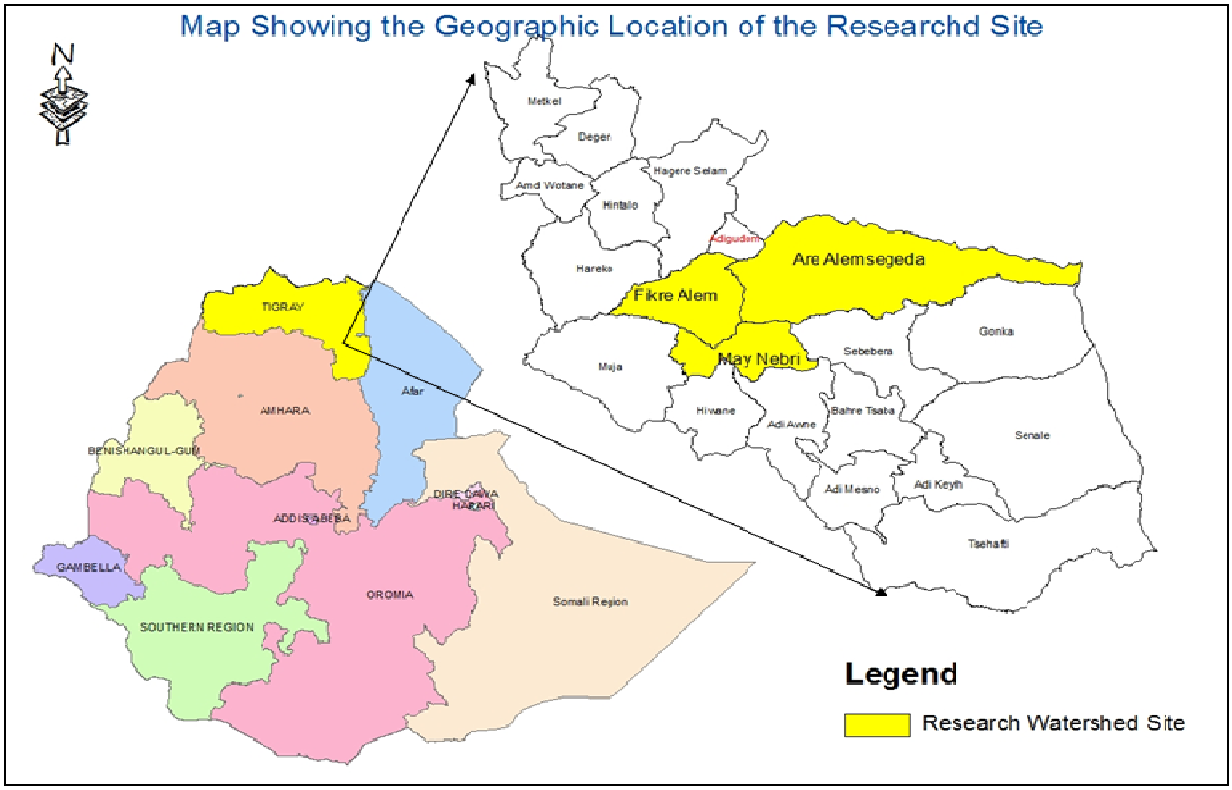

Figure 1. Map of the study area in Tigray Region

The land of the study area is delineated into cultivated land, which accounts to 500 ha, grazing land 500 ha, forest land 245 ha, and others 105.5 ha; in total it is 1350.5 ha. As a continuation of the watershed development program, different indigenous and exotic tree species were planted in the hillside sloppy area, gullies and grazing lands, respectively. Some of the major woody species are *Juniperus Procera, Olea europea, Melia Azandaricha, Acacia* etc., fodder trees such *as Luccunia eccustifolia and Susbaya sasban* and grass species, such as vetiver grass, elephant grass, and some local ones were planted.

3.2. SCOPE OF THE STUDY

The study shall be conducted in Gerebshelela watershed, Hintalo Wajrat Wored, Tigray Regional State, Northern Ethiopia. Two sites were selected; one treated with different

watershed activities and the other non-treated site for comparison purpose. The project under study was where watershed activities have been initiated five years ago.

Gerebshelela Watershed

Hintalo Wajrat district is located in South East Zone of Tigray Region at about 37 km South of Mekelle, Tigray's regional capital. Its altitude ranges from 1400 to 2300 m.a.s.l. The area of the district is 36,107hectars. According to the 2007 census the total population of the woreda is estimate to be 152,219.

The study area, *GerbShelela* is one of the watersheds in Hintalo Wajrat, in which different soil & water conservation and afforestation activities have been undertaken. This critical watershed, which is a cluster of Fekri Alem, Araasgeda and Mainebri micro-watersheds or sites has 1350.5ha of intervention area and 1724 households, with a total beneficiary of 819. The altitude of this critical watershed ranges from 1900m to 2173 meters above sea level.

The area is selected for this study based on the type of intervention done so far to rehabilitate the degraded environment and in order to assess both pre and post watershed interventions and measure changes at community and individual households.

The main rainy season extended from June to August and March to April, this is a bio-modal with an average amount of 500-600 mm ((Hintalo Wajrat Woreda Agriculture and Rural Development, 2008 report).

Natural resources rehabilitation intervention in Gerebshelela site started in 1990's. However, watershed development approach has been started in 1996. The soil type with in the area is

black cotton sandy soil which is fragile and subject to erosion with the variation of poor water holding capacity. Natural vegetation cover is dominated by scattered acacia species with no forest area. The livelihood of the community predominantly depends on crop production, with few cattle rearing, petty trading and causal labour. The major crops grown include wheat, barely, teff, maize, sorghum and pulses. The average land holding size of a household is less than one hectare.

The site is situated in the semi-arid area and the climatic condition is characterized by high temperature, very windy, and intense sunlight which has an adverse effect on water harvesting and rate of biomass enhancement. Very often, the rate of land degradation (such as severe soil erosion, deforestation) has exposed the farming community to face critical food shortage. As a consequence, in 1996 when the principle of Local Level Participatory Planning Approach (LLPPA) started in Gerebshelela site, MERET started providing support to natural resources rehabilitation and development intervention.

The major activities undertaken in the site since its inception include farmland erosion control measures (soil bund and fanya juu bunds); cut off drains & waterways; water harvesting structures such as hillside terraces, micro-basins, dip trenches, micro-ponds, ponds; area closure & seedling plantation; agro forestry systems; gully stabilization and check dam.

3.3. SAMPLING DESIGN

Within the watershed three cluster kebeles, two interview sites in each kebele, one from participants in the project, and another from non-participants community, and in total six interview villages were selected. Moreover, the sample had considered different segments of the community, including male, female, experts, and development agents.

Table3.3.1. Sampling Design

Sample areas	Kebele (sub district)	Sites/Villages	Total No. of HH s	Sample size
	Fikri Alem	Adirak (participant)	322	17
		Beleatsegdom (non-participant)	283	16
	Ara Asegeda	AdiHana (participant)	340	16
		Hawatso (non-participant)	213	17
	Mai Nebri	Mainebri (participant)	243	17
		Adibeakel (non-participant)	323	17
Total	3	6	1724	100

Source: Woreda (District) Agricultural Office

3.4. SAMPLING

To treat both genders equally and to minimize possible bias, at village level stratified Sampling approach was applied. At household level, systematic sampling was used to reduce bias and sampling error. Then after securing the representative individuals by systematic sampling technique questionnaires were administered to household heads.

Sample size (survey population): In order to make the sample more representative data were collected proportionally of treated and untreated kebeles. Since the watershed was laid in three cluster kebeles, interviewed HHs was selected from all the three kebeles. Two interview sites from each kebele, one from participants in the project, and another from non-participant community. Six interview villages in total (/ Adihana, Mainebri and Adirak) and (Beakel, Hawatso and Beleatsegdom) were selected. Moreover, the sample considered different segments of the community, including males, females, experts, and development agents. Out

of the three participant and three non-participant villages with a total households of 1,724, 5.8% i.e. 100 households were selected as a representative sample size for the study by using systematic sampling from the list of households, based on their participation status.

3.5. DATA COLLECTION

In order to meet the objectives of the study, the data were acquired through questionnaires and discussion with experts and Development Agents (DAs) of the community who know the area since the beginning of the intervention of the program. Farmers at household level from both sexes, local experts including DAs have played a vital role in giving valuable information and expressing their opinions on the data questions.

In addition to the primary data, secondary data sources including reports and seasonal socio-economic surveys were used since they are very important for the fulfillment of essential data.

The records of the district office were used to evaluate the changes in land cover and the existing socio-economic condition.

Household survey

The conventional household survey was the fundamental data collection method used to conduct the existing socio-economic condition, resource utilization and watershed development practices in the study site. To cover the interest of various segments of the community, questionnaire, were formulated and administered to the sampling households with the help of enumerators in order to run the formal survey. Enumerators and one assistant supervisor were recruited from the study Woreda and kebeles. They were selected based upon their academic and practical experiences. Priority was given to the one who has better

knowledge on data collection, geographical setting and socio-cultural condition of the study area. They were given training for one day focusing on the content of the questionnaire and how to administer it.

Key Informants Interview

Individuals, who have experiences and knowledge in the area of MERET program and sustainable watershed development and land resource management were identified and interviewed. Under this method, the pre-planned checklist was used. From among the district, natural resource protection desk officers, DAs and Food security officers were interview.

Focus Group Discussion

Focus Group Discussion (FGD) was used as one of Participatory Rural Appraisal (PRA) technique for data collection. The group consisting of key informants from the District experts, local DAs and community Planning Development Team members was participated. In order to keep the balance among groups of participants in the discussion, appropriate sampling was applied. A semi- structured check lists were used to facilitate the discussion.

Field observation

To support and maximize the credibility of the data which were collected by other methods, the researcher used her previous knowledge of the area. The observation gave emphasis to the physical conservation structures made on communal and private farmland plots, coverage and species of grasses and plant trees and the existing gullies both in the intervention. In order to document the physical observation, pictures were taken with the help of digital photo camera.

Study Site Selection Criteria

The researcher designs her own criteria of site selection in accordance with purpose of the research. The criteria which were used to select the study sites were:

- An area which has a potential to represent the rest sites that are under the same treatment in the catchments;
- An area where the program has operated at least a decade and where the program is still active;
- An area where there is full intervention of the program;
- An area which is manageable in terms of geographical size and which is not highly inaccessible;

Limitations of the Study

1. The study covers only one district among 17 districts in World Food Program assisted projects;

2. The unavailability of (limited) literature on watershed development in the area;

3. It was very difficult to obtain the relevant information from the district office as there is no good filing system. Some selected households were not available during the actual data collection period;

3.6. DATA ANALYSIS

The collected data was statistically analyzed using SPSS 15.0 Software to show the change in the livelihood of the rural community by comparing pre and post watershed development interventions. People-centered analysis is most likely to begin with simultaneous investigation of people's asset, their objectives (the livelihood outcomes which they are seeking) and the livelihood strategies which they adopt to achieve these objectives. Based upon the collected data, factors that affects people's livelihoods and typical relation between these was analyzed.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

4.1. SOCIO-ECONOMIC CHARACTERISTIC

Among the 100 households selected to participate in the study, half of them were enlisted from the Integrated Watershed Development Project site and the other half were non-project participants who are residing in the area.

Household size (the numbers of persons that are living in each household) varies, ranging from 1 to 11. In total, only one person was dwelling in the house in 9 percent of sample households and only one household had 11 persons residing in the house. The majority of the households (45%), had 5 to 7 persons living in each house. The findings also had shown that the largest family size (10 – 11) were recorded from non-project participant population. It was also revealed that the average family size of the target area (both participants and non-participants) was 5.09, when it is disaggregated; it becomes 5.06 for project participants and 5.16 for non - participants. This result is close with the results of CSA, where the average family size for Ethiopia was 4.7 and for Tigray region it was 4.4 (Table 4.1).

Table 4.1: Number of persons living in the household

Number of persons/household	Number of Participants	No. of Non participants	Total
1	1	8	9
2	6	-	6
3	9	6	15
4	6	5	11
5	4	6	10
6	11	8	19
7	6	10	16
8	4	2	6
9	3	3	6
10	0	1	1
11	0	1	1
Total	50	50	100
Average family size	5.02	5.16	5.09

Source: Own Survey

The number of male and female children in the households varies and the maximum number of male children was 5 among the project participants and 7 in the non-project participants. The mean number of male children for both the project participants and non-project participants was 2 per family.

On the other hand, the maximum number of female children for the project participants and non-project participants is 5 and 4, respectively. The mean and median number of female children was 1 for project participants and 2 for non- project participants. The mean number of children for both the project participants and non-participants were three (Table 4.2).

Table 4.2: Number of children living in the household

Number of Children in the HH	Participant	Non-Participant	Total
0 (no child)	2	7	9
1	14	5	19
2	7	5	12
3	8	8	16
4	11	11	22
5	5	9	14
6	1	2	3
7	2	2	4
9	-	1	1

Source: Own Survey

The number of children attending school was also assessed varied from 0 to 4 per household. The majority of respondents, exactly half from non-project participants and 42% from project participant households didn't send any child to school. However, 34% of project participant households and 22% from non-project participants had sent only one child to school. The male-female ratio for attending school was similar for both participants and non-participants. This result is consistent with the results of the regional annual abstract report 2010 (Table 4.3).

Table 4.3: Number and sex of children attending school

Number of Children going to school	Participant	Non participant	Total
0	21	25	46
1	17	11	28
2	8	8	16
3	4	5	9
4	-	1	1
Ratio of children going to school by sex	Mean	Mean	
Male	1	1	
Female	1	1	

Source: Own Survey

Education:- The literacy status of the households (the husbands and wives) has been assessed. The result had indicated that 19 male and 37 female (56%) from project participants, and 24 male and 35 female (59%) from non-project participants were illiterate. As compared with the results from CSA, (2009), which reveals that the illiteracy rate in the country is 42.7%, a higher illiteracy rate was recorded in this study The remaining households had a low level of education. In general it can be observed that there were slightly better educated people among the project participants and the male spouse were better educated than the female spouse among both participants and non-project participants (Table 4.4).

Livelihood characteristics:- Based on group discussion and personal observation, the main source of livelihood activity of all farmers was agriculture and agriculture related activities, mainly crop and livestock production. Crop production includes cereals, pulses and vegetables both under rain-fed and irrigation. Income from livestock includes sale of honey, dairy products, fattened animals, and poultry. According to the survey result, 21 households depend on crop production and the remaining 79 households depend on both crop production and livestock rearing (Table 4.4).

Table 4.4: Average age of husband and wives, Educational status and Types of activity involved

Description	Sex	Average age	Educational status				Type of activity involved	
			Illiterate	Read and write	Primary school	Post-secondary	Crop	Crop & livestock
Project Participant	Husband	47	19	10	12	0	10	40
	Wives	38	37	6	7	0		
Non project Participant	Husband	52	24	12	6	1	11	39
	Wives	41	35	2	8	0		

Source: Own Survey

Non-Farm Activity:- When it comes to non- farm activities, fifty percent of the project participants and twenty percent of the non- project participants had reported that they had participated in other income generating activities. According to the result, there was a wider employment opportunity for the project participants than non-project participants and the income obtained from such activity was the main source of income for the project participants.

The type of non-farm activities they were involved varies. Twenty percent of the project participants and 6 percent of the non-project participants reported that they are involved in rock splitting for construction purposes. In addition, 18 percent of the project participants and 4 percent of the non-project participants stated that they were employed in wage labor and engaged in masonry work. Besides, 30 percent of the project participants and 18 percent of the non- project participants reported that they were earning income from other sources. The other sources from which they earn income were loading and unloading, petty trade and rock salt and crushed salt trade (Table 4.5).

Respondents were also asked if the non-farm activities were the main source of income. The result had shown that twenty percent of the people participating in the project and eight percent of the non- project participants reported that rock crushing, loading/unloading and masonry work were additional source of income for them. In addition, six percent of the project participants and the same proportion of the non-project participants confirmed that petty trade and rock salt trade were also their additional income.

Table 4.5: Participation in Non – farm activities and type (percent)

Type of Non -farm activities	Participants		Non participant	
	Yes	No	Yes	No
	50	50	20	80
Rocks crushing	20		6	
Salt mining and trade	2		4	
Wage labour and masonry	18		4	
Petty trade	4		10	
Other types	56		76	

Source: Own Survey

Land ownership:- In Hintalo Wajrat Woreda, more than 85% of the population were dependent on agriculture for survival and land was their main resource. With regards to land ownership, almost all respondents did own land (98%)) for farming and there was no difference in the land ownership between the two types of respondents. The size of land owned by the households varies, ranging up to 2.5 hectares per household based on their family size (Table 4.6).

Table 4.6: Size of Land ownership by household

Size of land in hectare	Land ownership			
	Participant		Non participant	
	Yes	No	Yes	No
	49	1	49	1
0.25	10		3	
0.50	13		13	
0.75	3		8	
1.00	15		8	
1.25	2		7	
1.50	2		5	
1.75	2		2	
2.00	2		1	
2.25	-		1	
2.50	-		1	
Mean	0.80		0.97	

Source: Own Survey

Land size:- The average size of land for the project participants seem to be slightly less than that of the non-project participants. The mean size of land owned by the project participants and non-project participants is 0.80 and 0.97 hectares respectively. The average size of land rented in was 0.05 hectare. The average size of land rented in is 0.04 hectare for the project participants and 0.07 hectare for the non- project participants. The average size of land cultivated was 1.31 hectares (own, rented and shared land) for the project participants and 1.73 hectares for the non- project participants. In general, the mean size of the cultivated land was 1.52 hectare per household. The mean size of land sharecropped was also estimated and results show that it was 0.49 hectares for the project participants and 0.66 hectare for the non-project participants. The overall mean of the size of the land sharecropped is 0.57 hectare per household (table 6). This is consistence with the result achieved during group discussion. The watershed planning committee and woreda experts was confirmed that households are selected to participate in the watershed activities based on set criteria. Among the list household landholding size is the main one. Thus, project participants HHs have less land holding size than the non-project participants (Table 4.7).

Table 4.7: The mean Land owned, rented and cultivated by the household

Description		Mean (ha)
land area owned	Participants	0.80
	Non - Participants	0.96
Average land area rented	Participants	0.04
	Non - Participants	0.07
land size share-cropped	Participants	0.49
	Non - Participants	0.66
land size cultivated	Participants	1.31
	Non - Participants	1.73

Source: Own Survey

Traction power:- Assessment made on the type of traction power used in farming activities. In general, 55 percent of residents (both project participants and non-project participants) had used their own oxen. When this is disaggregated, 72 percent of the participants and 38

percent of non-participants own oxen for traction power, indicating that more participants in the project benefited in having their own oxen. The non-participants tend to rely more on sharing and renting in for traction power (Table 4.8). Participants in group discussion affirmed that the majority of the households in the project area possess more oxen than the non- project participants.

Table 4.8: Source of traction power (percent)

Source of traction power	No of Participants	No of Non-participants	Total
Own	72	38	55
Sharing	24	34	29
Rent in	4	26	15
Others	-	2	1
Total	100	100	100

Source: Own Survey

Livestock holding:- The number of oxen owned by the households varies from 0 to 6. Thus, 24% of the project participants and 31% t of the non- participants did not have any ox while 34% of project participants and 32% of the non- t participants had only one ox. In general, on average, regardless of participation in the project, the majority of households had an ox. On the average, each household had one cow, regardless of their participation in the project. None of the interviewed households own either goats or camel. Both project participants and non- participants, on the average, owned only one donkey. . The households were also inquired with regard to ownership of poultry. The mean and median number of poultry owned were two for both project participant and non- participants Similar view was reflected in group discussion whereby households tend to possess livestock as a durable asset to protect them in time of disaster (or crop failure).

4.2. ACCESS TO BASIC SERVICES

Credit Access:- Availability of credit facilitates technology adoption and increase investment in social services. It is more essential to introduce farm technologies including fertilizer and the like. According to the findings of academicians (Feder et al. 1985 cited by Ametemariam G. 2009) credit programmes enable farmers to purchase inputs or acquire physical capital needed for technology adoption. Consistent with this result most of the interviewed households have confirmed that credit access facilitated to obtain farm inputs like fertilizer, improved seeds, oxen and farm implements. The survey confirmed that majority of the households, 92 percent of the interviewed project participant households and 94 percent of the non-project participant households, had access to credit to purchase farm inputs and educational materials for their children. Only 8 percent and 6 percent of the participants and non-participants, respectively had responded as no access to credit schemes (Table 4.9).

Saving:- Saving could be an indicator of success or getting additional assets and changes in livelihood. The study indicated that most of the interviewed respondents did not seem to have savings. Only 24% of project participants and 26 % of non- participants, had savings and the remaining t respondents did not have any savings. In addition, regardless of their status of participation, only 6 percent of the interviewed households had received remittance from relatives and friends to support their income.

Table 4.9: Access to credit, saving and remittance

	Have access to credit			Saving			Remittance		
	Participants	Non-participants	Total	Participants	Non-participants	Total	Participants	Non-participants	Total
Yes	46	47	93	12	13	25	3	3	6
No	4	3	7	38	37	75	47	47	94
Total			100			100			100

Source: Own Survey

Training:- It is obvious that knowledge and information is gained from trainings and education. Knowledge can influence productivity. As indicated in the below, training access to non-project participants was nil. When it comes to the project participants, the majority or 90% had received trainings on Integrated Watershed Development Technologies, on improved farming etc. All non- project participants responded not to have received any training related to improved farming and IWSD technologies (Table 4.10). Results obtained from key informants and group discussion had revealed reflected similar view on training. The training had helped them to enhance productivity at farm level and to protect the soil and water from excessive runoff.

Table 4.10: Households received training (percent)

Training received on farming activities and IWSD technology	Participants	Non-participants	Total
Yes	90	0	90
No	10	100	55

Source: Own Survey

Participation in community associations: Regarding participation in community associations, most of the interviewed households had responded that they were members of one or more associations in their community. Eighty percent of project participants and 84

percent of non- participants were members of one or more associations in their locality. In addition, 89 percent were members of local co-operatives.

Very few respondents belong to rural youth associations, signifying that only few qualify to be in this category within the families (Table 4.11).

Table 4.11: Number of Households participated in associations & co-operatives (percent)

Associations in the community	Percentage of participants membership		Percentage of non-participants membership	
	Yes	No	Yes	No
Membership	82	18	88	12
• Cooperatives	86	14	92	8
• Farmer association	28	72	78	22
• Women association	4	96	0	100
• Youth association	6	94	8	92
• Others	16		8	24

Source: Own Survey

Benefits of joining association:- Respondents had given different reasons for joining associations. Some, 28%, had stated to get their share of commodities at a fair price. Others, (9%), expressed to earn membership dividend, while 5% responded to get fertilizer and improved seeds. However, the majority stated to be benefited from various other services.

To be more specific, respondents had expressed that being a member of an association will help in getting priority in distribution of fertilizer and improved seed (Table 4.12). According to DFID (2008), In order to create social benefit from associations, social capital can have an opportunity to create mutual trust and reciprocity and lowers the costs by working together, which means that it has a direct impact upon other type of capitals. In addition, through direct involvement of watershed development, communities can have opportunities on developing a vision for the future. The educational opportunity to enhance

natural resources management in the existing and future development can increase cooperation with neighboring communities.

Table 4.12: Respondent view on Benefits in joining associations (percent)

Reasons for membership in Associations	Benefits	
	Participants	Non-participants
To get basic commodities at nearby and fair price	26	30
Fertilizer	8	4
Improved seed	0	4
Fertilizer & improved seed	8	0
Membership dividend	16	2
Other services	42	60

Source: Own Survey

Access to school and Health:- , Regardless of being participants in the project or not, the majority of the respondents had accesses to school for all of their children. Besides, the majority, 66%, had access to health services in the near-by locality (Table 4.13).

Table 4.13: Respondents view on accessibility to school & Health services

Accessibility	No. Participants		No. Non participants	
	Yes	No	Yes	No
Access to school	45	5	44	6
Access to Health	32	18	34	16

Source: Own Survey

Distance to nearest main road:- Road access creates an opportunity to transport products to market and purchase services and inputs easily to increase productivity. The distance traveled to the nearest main road from one's residence varies from five minutes to two hours walk. The closest travels only five minutes to reach to the main road, while the farthest taken two hours. Out of the total interviewed individuals, 64% or the majority of the respondents, travel one to two hours to reach the nearby main road (Table 4.14).

Distance to Market:- Major market places are mainly found in towns, such as capital town of the woreda/district. The majority of the rural community have to travel to these towns to sell and buy commodities. The average distance traveled to the nearest market in the study area is 1:35 hours. The maximum distance traveled to market 2:20 hours and minimum only 20 minutes (Table 4.14).

The distance traveled to the nearest town also been studied. The result had shown that on the average it takes 1.37 hours and the maximum distance traveled to the nearest town was 2.00 hours and the minimum 30 minutes (Table 4.14).

Table 4.14: Average time to travel to the nearest market & main road and towns in hours

Group	Number	Average time to travel to nearest town (Hours:min)	Average time to travel to main road (Hours:min)	Average time to travel to nearest market (Hours:min)
Participants	50	1:45	0:45	0:50
Non participants	50	1:30	0:50	2:20

Source: Own Survey

Availability of Extension Service:- Adams (1983) as cited by Ametemariam (2009) defined extension as assistance to farmers to help them identify and analyze their production problems and become aware of the opportunities for improvement. Extension provides agricultural and vocational training on the use of fertilizer, insecticides, improved seeds, land use practices, post-harvest technology, and home economics (Tiruneh, et al., 2001). Any extension system should target particular categories of clients to meet their needs effectively

(Saito and Weidman, 1990). Similarly, the survey indicated that the majority of the interviewed respondents confirmed that extension services were provided in their locality.

The availability of agricultural extension service for both project participants and non-participants was assessed and the result had shown that both had access to extension services equally in their locality (Table 4.15). It seems that the provision of agricultural extension services do not depend on participation in the project.

As to the types of services given, 92 percent received training in the use of modern technologies and on the use of modern inputs (Table 4.15).

In the focus group discussion it was stated that in each kebele there were three agricultural and health extension workers residing in the locality to support the farming community. These extension workers were supposed to serve farmers in consulting, supervision of field activities and providing information with regards to farm management, inputs, credit and training.; Health extension workers teaches the rural community on nutrition, hygiene and sanitation, mother and child health through direct contact or organizing different meetings.

Input supply:- There was no difference in access to agricultural inputs, between project participants and non-project participants in the study area. Among the types of improved inputs, the main ones distributed to farmers were, credit service for purchasing farm implements, improved seeds and fertilizers. The majority, 96 percent benefited by the availability of improved seeds and fertilizer (Table 4.15).

Table 4.15: Availability and type of extension services and the utilization of modern inputs (percent)

Description	No. Participants		No. Non participants	
	Yes	No	Yes	No
Availability of extension service	96	4	96	4
1. Type of services provided				
- Training	6		2	
- Training and modern inputs provided	86		90	
- Others	4		4	
2. Type of modern inputs				
- Farm implements	4		10	
- Seed and fertilizer	84		80	
- Others	0		0	

Source: Own Survey

Most inputs were provided by co-operatives, Relief Society of Tigray (REST), joint service by Co-operatives and REST and other NGOs. Among the total interviewed respondents, 53 percent seem to favor the joint operation of REST and Co-operatives with provision of extension services (Table 4.16).

The modality of provision of agricultural inputs varies. The majority 98% of respondents had obtained inputs on long term credit basis (Table 4.16).

Table 4.16: Input providers and modalities of provision in the study area (percent)

Input providers in the study area					**Modalities of input service provision**			
Recipients	REST and cooperatives	Cooperatives	REST	Not applicable	Family support	On long term credit	Purchase	Not applicable
Participants	42	40	12	6	2	80	12	6
Non-participants	64	26	6	4	0	96	0	4

Source: Own Survey

4.3. PERCEPTION OF POVERTY

Perception of Poverty:- Perception of poverty at community level varies depending upon one's personal perception and perspective. According to Dixon and Macarov (1998, p. 3) cited by Mekonnen A. (2007), define poverty as, a persistent problem which has presented political and moral challenges to all societies at all times. At its simplest, poverty refers to a basic lack of means of survival; the poor are those who, even in normal circumstances are unable to feed and clothe themselves properly and risk death as a consequence.

They further argue that being poor is a "complex and wide-ranging state which is affected by many factors including income, health, access to goods, location, gender, race and family circumstances, and it is difficult to measure poverty in such a way as to express this complex multi-dimensional quality" (1998, p.16). In this context, "income and/or expenditure are used to measure poverty, but in all countries it is important to consider many other indicators of the quality of life such as life expectancy, infant mortality and school enrolment rates" (ibid, 16). Similar to this definition, Chambers (1983, p.112) explains that "poverty contributes to physical weakness through lack of food, small bodies, malnutrition leading to low immune to powerlessness because lack of wealth goes with low status, the poor have no voice".

According to respondents view, on aggregate, 41% perceive poverty as lack of food, 20% defines it as lack of livestock, 16% viewed poverty as laziness, shortage of cash and lack of property and 23% expressed it differently (Table 4.17). However, it is believed that the concept of poverty includes all the above specified shortages.

Similarly, perception of poverty at household level also varied on individual basis. The majority, 85% of respondents defined poverty as lack of food, while only 2%t conceives poverty as shortage of cash, one percent lack of seed for sowing and 12% understand it differently. However, according to key informants, poverty in their locality was clearly defined. Households with less than ET Birr 5,600 per head per annum income are categorized as poor. Variables induced to calculate household income is land quality and size, family size, income from other sources, number of productive labour forces in a household, livestock ownership and availability of irrigable land.

Table 4.17: Perception of poverty (percent)

Understand poverty			Total
	Participants	Non- participants	
Lack of food	58	24	41
Lack of livestock	10	30	20
Laziness, shortage of cash and lack of property	22	10	16
Others	10	36	23
Total	100	100	100

Source: Own Survey

Household Income:- Improving the livelihood of the watershed inhabitants is one of the activities that the watershed project addresses through their implementation program. Therefore, household income is among some of the important variables that are likely to influence watershed management. Crops, livestock and their products and off-farm activities are the main sources of household income in the study area. In Tigray Region a net area of about 352,924 ha (6.8%of the region) is defined as area of IWSM (Integrated Watershed Management) and covered adequately with the different SWC measures (2009, BOA annual

report). According to the environmental impact assessment made by scholars in Mekelle University, Tigary has retained its environmental status back to the environmental situation which was 30 years ago. In tangible terms, specific locations the environmental condition was mostly improved which is reflected in terms of improved grazing land, water source, and forest products for the community(Sustainable Land Management, 2009)**)**. The same source had indicated that crop production at regional level, according to 2006/2007 harvest, had shown growth by 13%. In rain fed agriculture, the productivity of small holders land ranges from 8.5 to 15.8 quintal per hectare. In line with this, during group discussion at Gerebshelela, watershed community members had indicated that land productivity has increased and livelihood of community in the watershed area had improved. This result was achieved because of the integrated and interdisciplinary approach of the rural development strategy. Watershed development intervention was also believed to be a great contributor to the increase of household income in addition to the extension services, including application of modern inputs (fertilizer, improved seed, trainings…).

Income from Sale of Livestock: Farmers raise and sell animals as source of additional income**.** The number of people who had earned income from sale of livestock had increased from 56 to 66% after the project intervention. Before the intervention, the number of respondents who had earned income above Eth. Birr 1000.00 was only 5 of them. But after the intervention, 18 respondents had reported to have earned more than Birr 1000.00 (Table 4.18).

Table 4.18: Average income from livestock sale before and after the project intervention in Eth Birr

Livestock income	Project participants (percent)				
	Before		After		
	Yes	No	Yes	No	# of HHs
Change in HH Income status	56	44	66	34	50
HH income Range (number)			HH income range		
150-500	15		260-1000		15
501-1000	8		1001-2000		4
>1000	5		2001-5000		12
			>5000		2
Total	28 (i.e. 56 percent)				33 (i.e. 66 percent)
Non-Project participants					
	Before		After		
Change in HH Income status	Yes	No	Yes	No	
	0	100	0	100	

Source: Own Survey

Engagement in Non-Farm Activity:- According to Readon et al (2001, p.396) cited by Mekonnen A. define non-farm as activity outside agriculture (own-farming plus wage employment in agriculture)". The further argue that "rural non-farm employment is understood by employment of rural household members in the non-farm sector, and rural non-farm income is the income thereby generated. Employment includes self-employment and wage employment" (2001, p.396). Studies carried in Africa concerning the role of non-farm activities shows that the sector has a positive contribution towards poverty reduction. Readon (1997) quoted in Devereux et al (2003, p.193) reviewed "33 households surveys from 18 African Countries and found that, on average, 45% of rural household income was derived from non-farm rural activities, even in subsistence farming communities.

According to Yoganad B. & Gebremedhin T., (2006) most of the watershed projects were developed for the purposes of raising farm income, enhancing agricultural productivity, soil and water conservation, generating rural employment, reducing risk by diversifying crops in rain fed areas.

Similarly among the total respondents in the study area, 35 percent had engaged in non-farm activities (45 percent of project participants and 26 percent of non-project participants) and they had indicated that their income has shown an increasing trend from time to time. Their involvement also has somehow diversified which may help them to withstand during drought spell.

The average income per household from off-farm activities before the intervention of project participants was Birr 179.00 and for non-project participants it was 180. While the maximum income generated from off-farm activities was Birr 3000.00 and 5000.00 for project participants and non- participants, respectively (Table 4.19).

Table 4.19: Participation in non – farm and type of activities (percent)

Category	Participant		Non participant		Average HH income			
	Yes	No	Yes	No	Participants		Non-participants	
Participated in off farm activities	50	50	20	80	Before	After	Before	After
Types								
Breaking rooks	20		6		179.40	1025.40	180.00	1578.60
Salt mining and trade	2		4					
Wage labour and masonry	18		4					
Petty/trade	4		10					
Others	56		76					

Source: Own survey

Income from Land Rent:- As indicated in the below the number of households earning income from land rent is insignificant.; Only three households from non-participates in the integrated watershed development project had rented out their land. The amount of money earned from land rent varies between birr fifty to three thousands. None of those who are involved in the project had generated income from renting their farm land. Similarly, the majority: 94% of non-project participants had not rented their land (Table 4.20).

Table 4.20: Household income from land rent

HH income from land rent (Birr)	Project Participants		Non- participants		Total	
	# of HHs	percent	# of HHs	percent	# of HHs	percent
0.00	50	100	47	94	97	97
50 – 500	-	-	1	2	1	1
>5000	-	-	2	4	2	2
Total	50	100	50	100	100	100

Source: Own survey

Income earned from saving and Credit association and Cooperative membership

The mean income share from saving and credit association was birr 234.5 (149 for project participants and 320 for non-participants). The maximum income share was two thousand five hundred for project participants and five thousand birr for non-project participants (Table 4.21)

The average income share from co-operatives membership was birr 25.41 (33.44 for project participants and 17.38 for non-participants). The maximum income for project participants were three hundred and two hundred fifty none participants (Table 4.21).

Table 4.21: Households average income from saving and credit

HH average income from saving and credit	# of HHs	Maximum	Mean
Project participants	50	2500.00	149.00
Non – participants	50	5000.00	320.00
Average		3,750.00	234.50
HH income from cooperative membership		Maximum	Mean
Project participant	50	300.00	33.44
Non – participant	50	250.00	17.36
Average		275.00	25.41

Source: Own survey

HH Income trend: According to Tesfaye H. (2011), a watershed management approach intervention increases in employment opportunities and forage production from gullies. Introduction of new technology and using local labor for the execution of work to improve livelihood in the watershed; Women participation and benefit through food for work activities.

In addition, Dr. Prem Singh (1995-1998) revealed that change in ground water level, surface water, irrigation facility, water regeneration capacity, land use pattern, cropping pattern, livestock production, employment generation, income generation and debit reduction.

Similarly, the survey result reveals that when we compute the trend of income generation during the last five years, on the average, 42%, (68% of project participants and 16% non-participants) responded to have a positive trend. The remaining 58%, (32% participants and 82 non-participants) had expressed either no change or a negative trend (Table 4.22).

Table 4.22: Household income trend during the last five years

Increase in income trend	Participants	Non- participants
Yes	34	8
No	16	41
No change	-	1

Source: Own Survey

Local Government Support

The types of support granted from local government ranges from supply of relief assistance to provision of credit. In both groups, 59 percent asserted that they had received relief assistance, 17 percent were granted credit supply, 6 percent input supply, 7 percent were involved in food for work and safety net project activities, and 11 percent received other types of supplies. The majority, 74 percent of non-project and 44 percent of project participants have received relief assistance (Table 4.23). The above result was in agreement with the results from group discussion in that project participants have relatively better income and their involvement in government relief assistance was low. The Majority of relief assistance was targeted towards non-project participants as it was believed to have lower income.

Similarly, the types of support received from non-governmental organizations were basically food for work and holds the highest percentage, which was close to 59 percent. The second highest NGO involvement was credit service in 31% of cases, 7% were involved in school construction and 3% on safety net and other wage labour (Table 23). Results of group discussion also revealed that non-government organizations (NGOs) were involved in development works, especially in food for work for the rehabilitation of the environment. This was in line with the government strategy whereby regions like Tigray the land had been

degraded for many years, and environmental rehabilitation is on top of the agenda. NGOs were engaged in supporting the community in food for work program to rehabilitate the environment.

The local community also generates assistance, especially in the selection of the needy one seeking support and in the provision of information (Table 4.23). This result is further enriched by the active participation of the community in development work, including the provision of information to different scholars, government staff, non-government staff, and others.

Table 4.23: Type of services obtained from government, NGOs and Local Community

Type of services	Participants	Non participants	Group Total
1. Government			
• Relief assistance	22	37	59
• FFW/safety net	7	0	7
• Credit service	7	10	17
• Input supply	4	2	6
• Other	10	1	11
Total			100
2. Non-government organization			
• Food for work/safety net	7	-	7
• Food for work	28	31	59
• Safety net and Wage labour	1	2	3
• School construction	4	3	7
• Credit	10	14	24
Total			100
3. Community			
• Nominal relief assistance	21	18	39
• Produce new information	14	15	29
• No support	13	3	16
• Other	2	14	16
Total			100

Source: Own Survey

Involvement of Community Development Work:- In general, participants and non-participants of the project had equally and willingly participated in community development works (Table 4.24).

According to the Focus Group Discussion (FGD) the elected planning team was responsible to mobilize community to participate in development works initiated in their locality. Besides, the kebele leader was responsible for project management in closely following activities, coordination of the overall implementation, providing managerial support to the planning team, resolve issues related to the project implementation and management, take appropriate action against wrong doers.

Table 4.24: Households participating and willing to participate in development works

participating in developments work	Participants	Non-participants	Total	willing to participate in development works		
				Participants	Non participants	Total
Yes	49	49	98	50	46	96
No	1	1	2	-	4	4

Source: Own Survey

The local community has confirmed a high level of participation in the discussion on policy issues and strategies of government as well as non-governmental organizations.

Decision to Launch IWSDP:- Decision to launch IWSDP was made by full community participation through the kebele representatives. They were responsible for selection of sites for programme implementation; mobilization and organization of the participating population in general and specific workforce in particular; the selection of farmers for training; selection of food-for-work and other beneficiaries, proper maintenance, safekeeping and distribution of

tools and other material inputs (REST, 1997). In line with this the survey result also indicated that the majority of the interviewed households, (98%) of the total respondents had indicated that launching integrated watershed development was carried out by self-initiation with agreement of both project participants and non-participants. This was due to the realization of benefits of the intervention. Besides, they know the assets created belong to the community and benefit of the project is highly acknowledged by the community.

The focus group discussion revealed that IWSDA has initiated by the community through the planning team, this team comprises of 5 women and five men and were selected by the community to coordinate and develop plan in their community. The development agent of the area was also a member of the planning team. This team is responsible to identify watershed intervention area, delineate the area, mobilize community to participate in the process and implementation of watershed activities, identify workforce (beneficiary) and Coordinate food distribution.

Technical support:- Both IWSD participants and non-participants had confirmed of obtaining technical support. Ninety seven percent of total respondent have replied that they have received technical support.

The technical supports rendered to local community were variable, ranging from integrated watershed development technologies to improved farming techniques. The majority had expressed that the technical support obtained was focusing on integrated watershed intervention technologies, which include stone-bund construction, trench construction, check-dam and gully treatment or gully rehabilitation. Five percent had support on methodology of farm input application.

A FGD confirmed that a range of technical support had been provided by both governmental and non-governmental organizations. Mainly technical support had been provided by woreda agriculture and rural development office experts (Table 4.25).

Table 4.25: Status of Households in receiving technical support and types of support rendered

HH received technical support	Participants	Non participants	Total
Yes	50	47	97
No	-	3	3
Type of technical support received by the HH			
• Stone bund construction, trench, check dam and gully rehabilitation	42	48	90
• Input application	3	2	5
• Other	5		5
Source of technical support			
• Woreda agriculture office expert	8	30	38
• Development Agents	42	16	58
• NGO experts	-	4	4

Source: Own Survey

Irrigation:- Out of the 100 households interviewed, only 20 had irrigated land, (4% of project participants and 36% of non-participants). Most of the project participants, (96% and 64% of the non-project participants) had no irrigation scheme. The size of irrigated land varies from 0.25 to 2 hectares (Table 4.26)

Table 4.26: Household participation in irrigation scheme and size of land

HHs participated in irrigation scheme	Participants	Non-participants	Total
Yes	2	18	20
No	48	32	80
Size of irrigated land			
0.00	48	-	48
0.25	2	-	2
1.00	-	7	7
2.00	-	11	11

Source: Own Survey

CHAPTER FIVE

5.1. CONCLUSION

In a traditional rural Ethiopia, as well as, in the study sub-watershed area there has not been remarkable watershed development activity implemented to treat land degradation and deforestation problems on organized basis. The existing traditional practices were implemented by individual farmers to expand agricultural land when there is a need. Given this background, the Integrated Watershed Development approach has created a favorable environment in which joint actions of local communities, Development Agents and technical staff to identify community problems, formulating development plans and selecting the best available practices for implementation. Thus, the people themselves assume ownership and accountability for activities, which they have identified and developed with the support by watershed intervention project.

The study confirmed that the integrated watershed approach has offered a suitable tool to encourage the community to jointly identify marginalized areas and design the best suitable techniques to minimize environmental degradation and deforestation. Communities were also convinced to work in the identified development areas willingly.

The achievements made in reducing natural resources degradation problems, increasing income generation opportunities and contributing to the betterment of livelihoods of people have increased the project's approach to be embedded within various government organizations and NGOs working in the study sub-watersheds and elsewhere in the country.

The spillover effect of the integrated watershed project into neighboring watersheds has increased. This shows that a watershed being managed based on organized plan and by community participation would have a huge economic, financial and environmental benefit. This also shows that a properly planned and organized environmental rehabilitation and development programme could lead to improved community asset and be an ideal activity for contributing to poverty reduction at community level.

The Integrated Watershed project has contributed visibly to land rehabilitation and enhancement of ecosystem as well as to improved food security and livelihood outcomes of beneficiary communities and households.

The food security and livelihood outcomes of the project were achieved through improved crop and livestock productivity, income from income-generating activities, income from sale of products from community assets (grass, wood), and improved availability of wood and water for domestic uses.

The overall result of improved local environmental conditions and production systems, livelihood diversification and creation of enhanced asset base to households, enhanced capacity of communities, community-based institutions and local government organizations, and improved social networks and access to different sorts of information is that communities now possess enhanced resilience and adaptive capacity to withstand negative impacts of rainfall variability and climate change.

The ongoing watershed development with the aid of MERET project has contributed highly to the economic condition of the study area. The project has played meaningful role in improving the status of natural resources, economic and social assets of the community.

The study also found that in accordance with the objectives of the project, significant changes have been registered in the coverage of tree plantations and grasslands due to bio-physical conservation activities.

As a result of the project, soil erosion and the size of gullies in some villages have been reduced. The expansion of wood lands has reduced the time consumed by the farmers to collect fodder by about four hours on average. Moreover, the incomes of farmers have increased from the sales of grass from the area closure.

According to the study the project participants' general knowledge has increased, they have started reducing their family sizes. The average family size of project participants had been less than that of the non-project participants.

The study had also confirmed that though the primary livelihoods of respondents were depending on agriculture, significant number of respondents who participated in the project were also diversified their sources of income and engaged in non-farm activities. This indicates that farmers have increased their resilience to respond to food insecurity due to drought and environmental changes.

The project participants have more access to asset creation, such as oxen, the most critical asset for farming society. This might be due to the existence and participation in the project.

Over ninety percent of project participants have created access to training on basic technologies. This in turn increased their ability to pay cash on hand to purchase various inputs.

Prior to the start of the project the mean average income of a household from off-farm activities were Birr179.00 and while after the introduction of the intervention the mean average income from off farm activities has increased and reached to Birr 1,301.00. In general, the income of project participants has shown an increasing trend. This is due to the direct and indirect benefits gained from the Integrated Watershed Project.

In addition, people with labor potential that could have remained idle, have got the chance to generate income to their families through participating in the conservation activities. In addition, they have started to adapt better perception of both forest and grass resources for protecting the ecology from degradation and for income generation to satisfy their needs.

In line with the objectives of the project, the effectiveness of the operation was still at high level. This may be due to the active community participation level in the watershed. Although there was high level of participation in development by the communities, land degradation and food security are still big issues at the sites which need to be addressed by concerned stakeholders.

In general, we can conclude that, based on the interview to the beneficiaries, the planning team, the DAs and district natural resources experts, the people have attained better attitude of the benefits of Integrated Watershed Development and were willing to extend the approach to neighboring sub-watersheds.

As far as the benefits are concerned, there was a significant increase in production and a positive change in environmental protection. In addition to these benefits, organizing in groups and forming cooperatives, creating of assets such as grass and fuel wood and generating additional income had improved the livelihood of participants.

5.2. RECOMMENDATIONS

Based on the achievements of Integrated Watershed intervention on the physical and human environments of the rural people in Gerebshelela, the following recommendation will be forwarded for future intervention.

The Integrated watershed development project has to be extended to neighbouring villages to cover wider areas through joint efforts of the Ministry of Agriculture (MoA) and other communities, NGOs by seeking more donor support to achieve similar successes. Strengthening the new initiative towards partnering with other development agencies may also help along this line.

MERET project has played a meaningful role in improving the physical and availability of soil fertility. In order to maintain the positive output, the project should further design and apply community based integrated watershed management approach, with a particular emphasis on protecting the land from gully formation, and on rehabilitating the already existing ones.

Income generating activities (IGA) were having significant impact on household livelihoods, but inadequate knowhow and low extension service support from Agriculture Bureau have prevented many households from scaling up their activities and prohibited others from engaging in similar venture. Improving awareness of community members through intensive training and demonstration will help to scale up and increase the impact of these components of the project.

In order to bring about sustainable economic development, community members have to get continuous training on diversified economic activities and acquire knowledge on basic technologies,

A major weakness observed, while conducting this study was, absence of well documented site-level information showing the nature and extent of problems prior to the introduction of the intervention programs, which could have served as baseline to measure better the overall achievement. Maintaining appropriate database is also important in enabling continuity and given a high turnover rate among DAs and woreda experts. Hence, improved documentation and database management system need to be established. Basic skill training on document management needs to be provided for all agriculture and rural development office staff at all level.

A detailed and site-specific research is necessary to clearly establish project outcomes and disseminate results to different stakeholders.

As it is observed from the study, recurrent drought caused by erratic types of rainfall becomes major challenges for effective developments of the watershed and for ongoing soil and water conservation practices.

Improper site selection had created difficulties to measure the outcome of the project. In some cases, community members who participated in the watershed project were dwelling in the upper catchments of the project and the command area belongs to other community members. Thus, for more effective continuance of the assessment, appropriate site selection to reflect the socio-economic conditions of the area should be given due consideration.

The project has also played a meaningful role in improving coverage and species diversity of trees and grasses, and even in the increase of types and species of wild animals/birds. Therefore, the ongoing watershed development program has to continue through proper advocacy and resource mobilization.

The woreda had been affected by recurrent drought which brought about food insecurity. In order to alleviate the problem the project has to continue for some time come until the watershed is exhaustively treated and food security for the community is assured.

The provision of innovative technologies, necessary inputs, materials, capacity building efforts, regular monitoring/evaluation, field supervision and technical back up with the objectives of intensification of productivity, income generation, and improvement of livelihoods and alleviation of poverty should continue.

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ANNEXES

ANNEX: 1 LIVESTOCK INCOME AFTER PROJECT INTERVENTION

Livestock income after project intervention	Participants		Non-participants		Group Total		Total	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %
0	17	34%	-	-	17	34%	17	34%
250	1	2%	-	-	1	2%	1	2%
350	1	2%	-	-	1	2%	1	2%
360	1	2%	-	-	1	2%	1	2%
366	1	2%	-	-	1	2%	1	2%
450	2	4%	-	-	2	4%	2	4%
460	1	2%	-	-	1	2%	1	2%
486	1	2%	-	-	1	2%	1	2%
492	1	2%	-	-	1	2%	1	2%
550	1	2%	-	-	1	2%	1	2%
650	1	2%	-	-	1	2%	1	2%
696	1	2%	-	-	1	2%	1	2%
700	1	2%	-	-	1	2%	1	2%
766	1	2%	-	-	1	2%	1	2%
800	1	2%	-	-	1	2%	1	2%
1550	1	2%	-	-	1	2%	1	2%
1600	1	2%	-	-	1	2%	1	2%
1900	1	2%	-	-	1	2%	1	2%
2000	1	2%	-	-	1	2%	1	2%
2364	2	4%	-	-	2	4%	2	4%
2441	1	2%	-	-	1	2%	1	2%
2456	1	2%	-	-	1	2%	1	2%
2500	1	2%	-	-	1	2%	1	2%
2571	1	2%	-	-	1	2%	1	2%
2864	1	2%	-	-	1	2%	1	2%
3000	4	8%	-	-	4	8%	4	8%
3500	1	2%	-	-	1	2%	1	2%
8400	1	2%	-	-	1	2%	1	2%
8844	1	2%	-	-	1	2%	1	2%
Group Total	50	100%	-	-	50	100%	50	100%
Total	50	100%	50	100%	100	100%	100	100%

Annex 2: Households off – farm income after project intervention

Off – farm income after intervention in birr	Participants		Non-participants		Group Total		Total	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %
0.00	28	56%	38	76%	66	66%	66	66%
50.00	1	2%	-	-	1	1%	1	1%
200.00	3	6%	-	-	3	3%	3	3%
400.00	3	6%	-	-	3	3%	3	3%
450.00	1	2%	-	-	1	1%	1	1%
500.00	-	-	1	2%	1	1%	1	1%
650.00	1	2%	-	-	1	1%	1	1%
800.00	1	2%	-	-	1	1%	1	1%
900.00	1	4%	-	-	1	1%	1	1%
980.00	-	-	1	2%	1	1%	1	1%
1000.00	3	6%	-	-	1	1%	1	1%
1200.00	1	2%	-	-	1	1%	1	1%
1900.00	-	-	1	2%	1	1%	1	1%
2000.00	-	-	1	2%	1	1%	1	1%
2500.00	1	2%	2	4%	3	3%	3	3%
4000.00	1	2%	2	4%	3	3%	3	3%
4500.00	1	2%	-	-	1	1%	1	1%
5000.00	1	2%	-	-	1	1%	1	1%
6000.00	2	4%	1	2%	3	3%	3	3%
9000.00	-	-	1	2%	1	1%	1	1%
10000.00	-	-	1	2%	1	1%	1	1%
14400.00	1	2%	-	-	1	1%	1	1%
35550.00	-	-	1	2%	1	1%	1	1%
Group Total	50	100%	50	100%	100	100%	100	100%
Total	50	100%	50	100%	100	100%	100	100%

Annex. 3 Household Questioner

1. How many persons live in the household? _____

2. How many children are living in the household? _____

3. Number of children by sex: Male _____ Female_____

4. Age of the husband and wife: Husband_____ Wife____

5. Number of Children by age: Below 5 year____ 6-14 _____, 15-18 _____ Above 18_____

6. Number of children are going to school:? Male____ Female_____

7. Literacy level:

Husband: a)Illiterate b) Read and Write c) Primary school d) Secondary e) post-secondary

Wife: a)Illiterate b) Read and Write c) Primary school d) Secondary e) post-secondary

8. Household Livelihood Activities:

Primary_____

Secondary_____

9. Type of agricultural activity engaged:

Crop - __ Livestock__ Both Crop and Livestock__ Other___

10. Are you participating in any non-farm activity? 1. Yes__ 2. No___

11. If Yes, indicate

What:_____ why _____ where_____

12. Do you earn money from other sources? Yes____ No _____

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13. If yes, indicated sources of earning

a. _____

b. _____

c. _____

14. Household Assets: a. Land 0woership: a. Owned b. Rented in c. Share in d. Others

i. Size of land owned _____ (Tsimad)

ii. Size of Rented in _____(Tsimad) iii. Size of share in_____(Tsimad)

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b. Total size land cultivated _____(Tsimad)

c. Traction power: a. Own b. Sharing c. Rent in d. Other_____

d. Number of Livestock owned:

Oxen _____Cow_____Small ruminants_____ Poultry_____Bee-keeping_____

Donkey_____ Horse_____ Camel

15. Has your household participated in IWSD asset creation activities? Yes__No___

16. If yes, Which assets have you created? _____

17. Do you have access to the created assets? _____

18. Do you have access to credit schemes? Yes _____ No _____

19. Do you have savings? Yes___ No ____

20. Do you have transfers from remittances from relatives or friends? Yes __ No___

21. Describe trainings received on farming activities and IWSD technology or other type of skills trainings? Yes ___ No ___

22. Have you implemented the skill you learnt in your farmland? 1. Yes__ 2. No __

23. What effect/benefit did you gained/observed? _____

24. Are you member of any association in your community? Yes __ No ___

25. If yes, which type? _____

26. Why you join?_____

27. What benefits do you get? _____

28. Do have access to school to all your children? Yes____ No _____

29. Do have access to health services in near by locality? Yes___ No ___

30. Distance traveled to the nearest by

Main road-----hrs

Market--------hrs

Town----------hrs

31. Do you get extension services? Yes___ No ___

32. If yes, what kinds of services? Training _____ Modern input _____

33. If you get modern inputs – what type?

a. Farm implements ____ b. Seeds _____ c. Fertilizer _____

34. Who provides you with inputs? _____

35. On what basis do you receive inputs?:

a. On long term credit,

b. From your own money or

c. Other mechanism used please describe it_____

36. Number of meals per day eaten by adult household member during the previous five years before starting of the intervention. _____times

37. Number of meals per day eaten by adult household member during the previous five years after the intervention. _____ times

38. Number of meals per day eaten by adult household member during the drought years? _____

39. Number of month food shortage experienced by the household before starting the household IWSDA intervention? _____

40. Number of month food shortage you have after IWSDA intervention? ____

41. Number of months or alternative sources of income used to fill your food gap.

a. Five years before the introduction of the intervention. _____

b. Five years after the introduction of the intervention (IWSDA)?

42. How do you understand poverty in your community? _____

43. How do you understand poverty in your Household? _____

44. What is the level of crop production or land productivity after starting of the intervention (for the last five years). 1. Increase___ 2. Decreased __3.No change_

45. What is the income received from livestock sales? -

Before the starting of the intervention----------Birr

After the starting of the intervention ----------Birr

46. What is the source of animal feed before the starting of the IWSDA? _____

47. What is the source of animal feed after the starting of the IWSDA?

48. Do you engage in off-farm activities, Yes_____ No _____

49. If yes, What is the level of income coming from off-farm activities:

Before the starting of the intervention ----------Birr

After the starting of the intervention ----------Birr

50. Income from other Sources?

From rent of land----------Birr

Shares from saving and credit Birr

Fees from cooperative membership----------Birr

Other----------Birr

51. Has your total income increased during the last five years, if so what are

the factors for the increase?_____

52. Has your food security situation improved during the last five years comparing with the years without the IWSDA intervention? Yes ____ No ___ No change ___

53. Has your vulnerability to food security improved with the introduction of IWSDA intervention? Yes __ No ___

54. If yes, so indicate the main reasons: _____

55. What type of supports are you getting from the local government? _____

56. What type of supports are you getting from NGOs? _____

57. What type of supports are you getting from village communities? _____

58. Are you participating on community development works? Yes__ No___

59. If Yes, is it on your own will? Yes ___ No ___

60. Have you ever participated in discussions on policies and strategies and programs coming from local leaders as well as NGOs? Yes ___ No ___

61. What type IWSDA intervention do you have implemented?_____

62. Why did you choose this type of intervention?_____

63. How was the decision carried to have such intervention?

a. Self-initiated _____

b. Government or NGO extension workers _____

c. Other _____

64. If it is not self-initiated, are you convinced on the advice or extension of the government or NGO? Yes ___ No _____

65. Did you get technical support? Yes ___ No ___

66. What kind of technical support did you get _____

67. Who provided it? _____

68. When was the programme started?_____ _____(month & year)

69. Do you have irrigation scheme implemented in village? Yes ___ No___

70. If yes, What is the size of land irrigated?_____

71. How many times per annum are you harvesting? _____

72. What is the level of crop productivity per hectare on the irrigated land? _____

73. What is the total annual harvest (by crop type) during the previous three years?

	Crop Type						
Years							
Year 1							
Year 2							
Year 3							

74. Do you have skills to maintain your irrigation scheme? Yes __ No __

75. If no, what mechanism are you planning to use for the maintenance of the scheme?

76. Any other suggestion you want to say?

Annex.4. Household Questioner for None Participant Households

1. How many persons live in the household? _____

2. How many children are living in the household? _____

3. Number of children by sex: Male _____ Female_____

4. Age of the husband and wife: Husband_____ Wife____

6. Number of Children by age: Below 5 year____ 6-14 _____, 15-18 _____ Above 18_____

6. Number of children are going to school:? Male____ Female_____

7. Literacy level:

   Husband: a)Illiterate b) Read and Write c) Primary school d) Secondary e) post secondary

   Wife: a)Illiterate b) Read and Write c) Primary school d) Secondary e) post secondary

8. Household Livelihood Activities:

   Primary_____

   Secondary_____

9. Type of agricultural activity engaged:

   Crop - __ Livestock__ Both Crop and Livestock__ Other___

10. Are you participating in any non-farm activity? 1. Yes__ 2. No___

11. If Yes, indicate

What:_____ why _____ where_____

12. Do you earn money from other sources? Yes____ No _____

13. If yes, indicated sources of earning

   a. _____

   b. _____

   c. _____

14. Household Assets:

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a. Land 0woership: a. Owned b. Rented in c. Share in d. Others

   i. Size of land owned _____ (Tsimad)

   ii. Size of Rented in _____(Tsimad) iii. Size of share in_____(Tsimad)

b. Total size land cultivated _____(Tsimad)

c. Traction power: a. Own b. Sharing c. Rent in d. Other_____

d. Number of Livestock owned:

Oxen _____Cow_____Small ruminants_____ Poultry_____Bee-keeping_____

Donkey_____ Horse_____ Camel

15. Do you have access to credit schemes? Yes _____ No _____

16. Do you have savings? Yes___ No ____

17. Do you have transfers from remittances from relatives or friends? Yes __ No___

18. Are you member of any association in your community? Yes __ No ___

19. If yes, which type? _____

20. Why you join?_____

21. What benefits do you get? _____

22. Do have access to school to all your children? Yes____ No _____

23. Do have access to health services in near by locality? Yes___ No ___

24. Distance traveled to the nearest by

Main road-----hrs

Market--------hrs

Town----------hrs

25. Do you get extension services? Yes___ No ___

26. If yes, what kinds of services? Training _____ Modern input _____

27. If you get modern inputs – what type?

a. Farm implements _____

b. Seeds _____

c. Fertilizer _____

28. Who provides you with inputs? _____

29. On what basis do you receive inputs?:

a. On long term credit,

b. From your own money or

c.Other mechanism used please describe it_____

30. How do you understand poverty in your community? _____

31. How do you understand poverty in your Household? _____

32. What is the income received from livestock sales? -

Before the starting of the intervention----------Birr

After the starting of the intervention ----------Birr

33. Do you engage in off-farm activities, Yes_____ No _____

34. If yes, What is the level of income coming from off-farm activities:

Before the starting of the intervention ----------Birr

After the starting of the intervention ----------Birr

35. Income from other Sources?

From rent of land----------Birr

Shares from saving and credit Birr

Fees from cooperative membership----------Birr

Other----------Birr

36. Has your total income increased during the last five years, if so what are the factors for the increase?_____

37. What type of supports are you getting from the local government? _____

38.What type of supports are you getting from NGOs? _____

39. What type of supports are you getting from village communities? _____

40. Are you participating on community development works? Yes__ No___

41. If Yes, is it on your own will? Yes ___ No ___

42. Have you ever participated in discussions on policies and strategies and programs coming from local leaders as well as NGOs? Yes ___ No ___

43. How was the decision carried to have such intervention?

a. Self-initiated _____

b. Government or NGO extension workers _____

c. Other _____

44. If it is not self-initiated, are you convinced on the advice or extension of the government or NGO? Yes ___ No _____

45. Did you get technical support? Yes ___ No ___

46.What kind of technical support did you get _____

47. Who provided it? _____

48. When was the programme started?_____ _____(month & year)

49. Do you have irrigation scheme implemented in village? Yes ___ No___

50. If yes, What is the size of land irrigated?_____

51. How many times per annum are you harvesting? _____

52. What is the level of crop productivity per hectare on the irrigated land? _____

53. What is the total annual harvest (by crop type) during the previous three years**?**

	Crop Type						
Years							
Year 1							
Year 2							
Year 3							

54. Do you have skills to maintain your irrigation scheme? Yes __ No __

55. If no, what mechanism are you planning to use for the maintenance of the scheme?

56. Any other suggestion you want to say?

Annex. 5. Guide Questions for Focus Group Discussions at the level of District (Woreda)

1. What are the development challenges (opportunities and constraints) of rural households in this Woreda?
2. What is the Level of poverty in this Woreda? How do you define poverty in this locality?
3. What experiences of the national or regional context are you considering in defining and understanding Poverty?
4. What are the Main causes of poverty in your locality?
5. What is the frequency and extent of drought occurring in this Woreda/watershed?
6. What strategies or solutions are in place to prevent the consequence of Drought in the Woreda/Watershed?
7. Is irrigation considered as a means to reduce the level of poverty in this locality? If so, what types of irrigation structures are feasible and sustainable to reduce or end poverty?
8. What are the views of the local experts and local authorities in relation to household irrigation schemes? If you are supporting, please indicate the reasons why you are supporting? If you are against these schemes, indicate the reasons why you are against?
9. Are they technically manageable at the level of household farmers? What will be the role of local experts in design or construction of the schemes?
10. What was the role of farmers in the introduction of these schemes?
11. What are the opinion of the experts in the cost-effectiveness and their sustainability of this household irrigation schemes in comparing with small and micro Irrigation schemes in this locality? How do you evaluate the ability of these schemes to reduce or end poverty from this locality?
12. What is the level of productivity achieved per hectare in the irrigated land?
13. What type of extension services are rendered by the local Institutions to the household farmers? (Credit access, input supply, training, education, health...).
11. If household irrigation schemes are assumed feasible, what will be the role of local institutions in promoting and expanding in your locality?
12. How is the level of involvement of regional institutions in your Locality?