ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

ADOPTION OF IMPROVED NATURAL RESOURCE MANAGEMENT TECHNOLOGIES IN NORTH WESTERN ETHIOPIA: A CASE STUDY IN DANGILA WOREDA OF AMHARA REGION

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Adoption of Improved Natural Resource Management Technologies in North Western Ethiopia: A Case Study in Dangila Woreda of Amhara Region .

By

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ACRONYMS

AG	Agree
ANRS	Amhara National Regional State
COUNT	Number of Observations(Frequencies)
CSA	Central Statistics Authority
CSO	Central Statistic Office
CSE	Conservation Strategy of Ethiopia
DAG	Disagree
EPA	Environmental Protection Authority
ECA	Ethiopian Cartographic Agency
EFAP	Ethiopian Forestry Action Program
EHLRS	Ethiopian High Land Reclamation Study
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
F(f)	Frequency
FDRE	Federal Democratic Republic of Ethiopian
FFW	Food For Work
FTC	Farmers' Training Center
GDP	Gross Domestic Product
HHHs	Household Heads
Ha	Hectare
IMF	International Monetary Fund
IUCN	International Union for Conservation of Nature
KMs	Kilometers
MNRD & EP	Ministry of Natural Resource Development and Environmental protection
MOA	Ministry of Agriculture
MA	Master of Arts
masl	meters above sea level
NRM	Natural Resource Management

NR	Natural Resources
NO	Number
#	Number
N	Neutral
NCS	National Conservation Strategy
NBE	National Bank of Ethiopia
OSSREA	Organization for Social Science Research in Eastern Africa
PAs	Peasant Associations
P	Significance level
SDAG	Strongly Disagree
SAG	Strongly Agree
SPSS	Statistical Package for Social Science
SWC	Soil and Water Conservation
t	t-test
TLU	Tropical Livestock Unit
UN	United Nations
WB	World Bank
WFP	World Food Program
WoAaRD	Woreda office of Agriculture and Rural Development
X^2	Chi-Square

ABSTRACT

The major objective of this research is to examine the state of adoption of improved NRM technologies particularly, the adoption condition of two improved NRM technologies which are economically and ecologically important in the study area (bund and woodlot tree planting) and to identify some of the basic socio-economic and institutional factors affecting it. The source of data was based mainly on the survey of 160 randomly selected sample HHHs of the five PAs of the woreda under investigation. However, data of 148 sample households was analyzed since the data of 12 sample households was deficient with the necessary information . The study has employed both descriptive and qualitative data analysis techniques.

As it is evidenced from the survey result the majority of the farmers of the study area implemented(adopted) NRM technologies. However , the mode of implementation was both forceful as well as on voluntary basis . Hence ,even the though the adoption incidence seems encouraging, the adoption intensity and its final out come is minimum and it is not as expected in the study area .Thus ,the research result have shown us that the adoption condition of farmers to the improved NRM technologies ,specifically the bund and woodlot tree planting technologies is influenced by a range of socio-economic and institutional factors.

Therefore, the factors like land holding size, livestock size, agricultural extension service delivery/frequency of extension contacts by conservation agents, land tenure security, participation of farmers at planning stage of NRM activities and attitude of the beneficiaries towards the bund technology were found to be significantly associated with the adoption decision of bund technology. On the other hand, age of the household heads, land holding size, agricultural extension service delivery, land tenure security, physical access of market , participation of beneficiaries at planning stage of NRM works and the attitude of farmers towards the woodlot tree planting technology have been found significantly associated to the adoption decision of the farmers to wood lot tree planting .

In conclusion, blanket approach to natural resource management intervention efforts could make the measures inappropriate to local conditions and could be even unacceptable by the land user. Hence local specific, household focused and technology based approaches have to be followed in order to able to tackle the socio-economic and institutional factors that are involved in adoption decision of NRM technologies by the farmers of the study area.

CHAPTER ONE

1 .INTRODUCTION

1.1 Backgrounds

The interaction of population, environment and Agriculture is one of the hot issues of these days. The population of human beings and livestock is increasing from time to time at an accelerated rate. But natural resources are limited

Thus, the debate for or against population growth in relation to the natural resources availability and its supporting capacity is still on going. It is however, believed that the presence of too many people in an area with out any change in the production system that enables efficient resource use, will end up in the degradation of natural environment which will finally lead to the decline in production and makes, living difficult. Environmental problems are the results of human intervention which mainly includes population pressure, improper farming practices, over stocking, improper tenure system and inappropriate policies governing the environment and agriculture (Bounder, 1987; Compbell, 1991; Abbi, 1995; D'sousa and Gebremehin, 1998: Woldeamlak, 2003).

Environmental degradation refers to loses in quality of basic resources, such as soil, water, vegetation (forest) in a certain environment (Constable, 1984: Kirkiby, 1995). According to Constable 1984, and Kirkby 1995, our world is highly threatened by environmental degradation than ever before. But, environmental changes resulting from human intervention in physical environment differs from place to place according to intensity, scale and quality of human interventions in the environment. Thus, both developed and developing countries are suffering from this problem. But developed countries environmental problems mainly emanated from industrialization and urbanization, while, developing countries problems largely emerged from in appropriate agricultural ecosystem management. This environmental (natural resource) degradation, among other things, is the cause of low agricultural productivity and stagnant economy of some poor developing countries like Ethiopia. This problem is reflected in the plight of the majority of the rural population who depend primarily on the exploitation of natural resources for their livelihood (Kirkby, 1995:)

Ethiopia is one of the poorest countries in the world depend on agriculture with a very low (Gross national product (GNP) and GDP per capita of around USD, 96.3 (National Bank of Ethiopia, 2004). Agriculture is the mainstay of Ethiopia economy, with about 85 percent of population living in rural areas. It provides over 85 percent of employment, generates about 52 percent GDP and accounts for over 90 percent of the foreign exchange earnings of the country (CSA, 1996 as cited in Muluneh 2001). The small holder /peasant/ sector accounts the greatest hectarage of the total cultivated area and produces the over whelming share of the country's food and cash crop. But the recorded yields of food crops per hectare are generally low. On the other hand, the population grows rapidly.

The causes for the stagnation of agricultural production in particular and the country's economic development in general are too many and complex in their nature. But they can be broadly grouped into environmental (natural resource) degradation and policy related issues, (World bank, 1987). Even though Ethiopia is a country of greater geographical diversity and well endowed with natural resources in the earlier periods, currently it is often cited as one of the most seriously affected countries in environmental/natural resource/ degradation in the World, (FAO, 1986: Hurni, 1988: Bojo and Casells, 1995). This severe resource degradation can be manifested in the form of deforestation , soil nutrient loss and degradation, depletion of water resources, loss of biodiversity . . etc. In the begging of 1990's about 40 percent of the country's area was covered by forest. The productivity of soil was good, the rangeland was promising to support the live stock population, and the rate of resource degradation was not sever. But, currently, the rate of resource degradation is highly accelerated and severe. For example, the rate of deforestation at the country level is estimated to be 200,000 hectare per year and the total forest coverage remained les than 3 percent only. The annual soil loss is also very severe. The average soil loss all over the country is about 2 billion tons per year (FAO, 1986 as cited Woldeamlak, 2003)

The natural resource degradation has been most serious in the high land parts of the country. The highlands are center of economic activity of the nation. The area coverage of it comprises nearly 43 to 45 percent of the country's total area (some source indicate that it is 43% and others indicate it is 45 percent. This high land area supports 88 percent of the country's total population that are overwhelmingly rural (FAO, 1986 as cited in wood, 1990, Woldeamlak, 2003: and Alemneh etal, 2004). High lands are characterized by enormous ecological,

environmental, agricultural, and cultural diversity. However, a combination of rapid population growth, improper land use policies and practice, technological stagnation and poverty have brought about environmental degradation, retarded agricultural growth and ultimately contributed to the decline in per capita in come. Moreover, famine and recurrent drought has long become part of the country's image all over the world due to resources degradation problems (Muluneh, 2001: Alemneh et al 2004). Agricultural production is highly weather dependent and fluctuates from time to time. For instance, at national level, in the peasant sector production has taken by 22.5 percent from 69.4 million quintals in 1979/80 to 53.8 million quintals in 1987/88 and the estimates of C.S.A for the year 1994/95 was about 67.4 million quintals (CSO/CSA, 1987/1988, C.S.A,1996). Also, the country faced serious ecological imbalances for the last three decades that has resulted in a declining of agricultural production, water depletion, disturbed hydrological conditions, and food insecurity (Abbi, 1995, Muluneh, 2001). Therefore, the highlands of Ethiopia could not be able to support and sustain the livelihoods of the rural community if such a trend of farming practices, overgrazing, deforestation, soil erosion, lack of water control, continue unabated (Muluneh, 2001, Alemneh et al, 2004).

Thus, to alleviate this all problems, the government as well as the international community showed their concern to this major issue after the manifestation of the problem in the country in the form of drought and famine in 1970's. The government with the community and other actors did an effort to rehabilitate/conserve/ natural resources in different parts of the country. The largest work was that carried out between 1976 and 1988, in which farmers/peasants/ were mobilized to participate either via food for work payments or just by force. Over this period, about 800,000KM s of soil and stone bunds and 600,000KMs of terraces were constructed: about 500 million tree seedlings were planted, about 100,000 hectares of land with slopes of over 60 percent were closed for natural regeneration, and check dams were constructed along gullies over tens of thousands of km (Danel, 1988: Hurnii 1988, as cited in wood, 1990, and Woldeamlak 2001). By these rehabilitation and conservation works, the total area that was covered is estimated to be only 7 percent of the high lands that needed treatment. At this rate, all the area in need of treatment could take some 70 years for rehabilitation (Berhe and Chadhokar, 1993: as cited in Woldeamlak, 2001). On top of that, some evaluation studies concluded that these limited conservation and rehabilitation works them selves were not effective

and sustainable. The achievements were only quantitative with minimal (little) desirable out comes. (Kebede, 1989; Stahl, 1990; Yeraswork, 1995; as cited in Woldeamlak, 2001). This shows that, the management efforts undertaken in the high land parts of the country nearly for the last three decades hasn't been satisfactory (wood, 1990,Muluneh, 2001). This is partly because of poorly structured conservation practices and technologies as well as lack of adoption of these conservation technologies and effective participation of people who are in away directly and indirectly responsible for such degradation and resource mining. But, the severity of the problem demands very committed and aggressively active participation and partnership of the state, farmers, the community as a whole and other development actors (wood, 1990, Muluneh, 2001)

Therefore, the basic questions to be raised are: Did the natural resource management intervention efforts in the high lands help in curing the environmental ills? If not why not?. What factors associated with or promote/ hinder the state of adoption decision of improved natural resource management technologies. It is this crucial task which has promoted the investigator to under take this study.

1.2. Statement of the Research problem

Sustainable development is a global concern today. Above all environmentally sustainable development is a crucial issue. Countries are striving to follow environment friendly policies in their development endeavors. Such policies are heavily advocated in countries whose livelihood is entirely dependent on agriculture. The productivity and sustainability of agriculture basically depend up on well-managed environment and its resources. This issue deserves much more attention in traditional agrarian societies such as Ethiopia where rapid population growth and stagnant economy exists.

Poor countries like Ethiopia have a more immediate and very direct dependence on their natural resources (soils, water, natural vegetation and forest - - - etc) . Thus, the existence of good and productive natural resources is essential pre-condition for the sustainability of livelihoods of most peoples of sub Saharan African countries in general and in Ethiopia in particular (Alemneh, etal, 1997). That is natural resource remains the basis of Ethiopia's survival and prosperity. Particularly, the rural people of the country depend on land and its resources for growing their crops and grazing their livestock.

However, in many parts of the country, especially, in the highlands where the population size is beyond the carrying capacity there is high level of natural resources degradation (Solomon, 1994: Alemneh, etal, 2004). The area for this study is found in the north western highlands of the country; which is characterized by degraded agricultural land, little vegetation (forest) cover and with scarce and deteriorated grazing land. On the other hand, there is a high density of human and livestock population, which brought about a scramble for farm and grazing lands. The absence of enough fodder and sufficient range land is frequently forcing peasant to feed their cattle population on crop residue and/or let the cattle on the existing grazing land and land cover, which is with little fodder. The acute shortage of forest products is also causing a severe problem in fuel wood and construction materials, which again persuades the population to rely on animal dung and crop residues for fuel source .

Thus, to tackle, the resource degradation problems, over the past three decades, many governmental and non-governmental organizations have been involved in massive natural resource management activities in the country. Different natural resource management technologies were practiced (Yeraswork, 2000). The emphasis has been on construction of mechanical soil and water conservation (SWC) measures in cultivated fields and the forestation of hill sides, which are common property resources. The largest conservation activities in the country are those implemented during the 1970s, and 1980s; for which the farmers were mobilized at the national level for campaign works. The international donor community made significant contributions to those conservation efforts by supplying food grains and edible oil that were used as food for work payments for the participating farmers. The national effort, combined with the huge assistance from the international aid agencies resulted in achievements that were described as impressive' (wood, 1990, Scoones etal, 1996; as cited in Woldeamlak 2003). However as some evaluation studies concluded these rehabilitation and conservation works were not effective and sustainable. The achievements were only quantitative with minimal /little/ desirable out come (Azene, 1997; as cited in Woldeamlak, 2003; Yeraswork, 2000). The result achieved in reducing the resource degradation problem and improving agricultural productivity have been unsatisfactory (Muluneh, 2001; Alemneh, etal, 2004). For instance, in the study area, the majority of improved resource conservation structures constructed in the past years are destroyed by the people themselves or left with no maintenance since the implementation approach was forceful. This condition further aggravated land degradation. The

whole effort was therefore, eminently a failure, because there was no real adoption of these technologies. Hence, the problem of degradation of natural resources, such as, soils and forests/vegetations has continued to grow to a greater extent and affect more communities than ever before (Alemu, 2003).

Thus, the limited success of different efforts necessitates the investigation of socio – economic and institutional factors that are associated/ related with the acceptance and adoption of improved NRM activities. Several factors have been identified as a reason for failure of adoption of improved natural resource conservation measures /management technologies/ in different literatures . Among the factors identified, the most important ones have been the lack of consideration of the socio-economic and institutional aspects of the people targeted towards conservation activities. Designing realistic and acceptable conservation techniques and identifying promising approaches for intervention requires a rigorous understanding of the process, extent, and rate of resource degradation and the socio-economic and institutional circumstance at the local level (Gregersen, etal, 1996; Brooks et al, 1997, as cited in Woldeamlak, 2003). But, there is no study carried out in this study area to identify the socio-economic and institutional factors and how these factors are associated / related to farmers' adoption decision up on improved NRM technologies. There is a need to investigate some of the socio-economic factors, like : age of the household heads, educational status of the household heads , labour size of the house hold ,physical market access, livestock resource size, land holding size . . . etc and institutional factors like: land tenure security, extension service(frequency of contact to farmers) ,farmers participation in planning of NRM activities - - - etc could affected the state of adoption of the improved natural resource management technologies. Hence, the questions like: Do really the farmers understand (perceive) the extent of natural resource degradation and its causes and consequences?, Do the farmers adopt improved NRM technologies and use them sustain ably?, What are the major socio-economic and institutional factors that hinder or promote or associated with the adoption condition of these technologies?. These and other pertinent questions were raised and got answers in this topic under investigation.

Hence, the above questions were the core of this thesis. The investigator is tried to investigate pertinent socio-economic and institutional factors related to or facilitating/hindering

the adoption of improved natural resource management technologies / conservation measures/ of the study area/woreda/.

1.3 Objectives of the Study

i. General objective

The over all objective of this study is to look into the state of adoption of improved natural resource management technologies by the farmers of the study area and to identify the key socio- economic and institutional factors that affect the adoption condition /decision .

ii. Specific objectives

1. To asses and understand the trend of natural resource use and farmers understanding of the degradation.
2. To examine the state of adoption of improved natural resource management technologies (bund formation and woodlot tree planting) .
3. To investigate the basic socio-economic and institutional factors that affect the adoption decision of farmers on improved NRM technologies.

1.4 Research Questions

The following research questions are formulated to be answered through field investigation/ survey/

1. What is the trend of natural resource use and degradation in the study area ?
2. What is the level of adoption of some of the NRM technologies specifically the adoption level of bund formation and woodlot tree planting technologies in the study area?.
3. What are the basic socio –economic and institutional factors that are associated to the adoption decision of farmers to improved NRM technologies ?.

1.5 Significance of the Study

The study assessed the pattern (trend) of natural resource use and management intervention efforts in the highland agro-ecosystem of the study area. Especially, it focused on farmers' adoption to improved conservation technologies . To this end the study tried to identify the basic socio-economic and institutional factors that hindered or promoted the adoption of improved natural resource management technologies in the study area .

However, no comprehensive study so far has been undertaken regarding these issues in the study area. Thus, this study could contribute fruit full findings by identifying some of the socio-economic and institutional factors affecting successful adoption of improved natural resource management technologies by the rural farmers. The findings of the study could also help for designing sound and sustainable natural resources management strategies to different stake- holders operating at different level in the highland agro-ecosystem, of the region in general and the study area in particular.

Thus, the findings of this investigation could help the following institutions and organizations:

1. It may provide general information about the natural resource base of the woreda under study. By so doing, it can serve as a base for project proposals, for resource conservation intervention efforts , relief and rehabilitation works and other development endeavors that can be undertaken in the study area.
2. The findings of the study would give concerned authorities, some possible suggestions for combating natural resources degradation, and improving agricultural production.
3. The Amhara national Regional state agricultural and rural development bureau and environmental protection authority and others could benefit from this study and can use the findings to implement its policies in the Woreda under study and other rural areas of similar demographic and environmental settings.
4. The findings, may possibly initiate and encourage others for further investigation and it can help as a springboard to under take an in depth study on similar problems and issues

1.6 Scope and limitations of the study

Though, there are a number of factors related to the natural resource use, degradation, and management intervention efforts in an area, it is impossible to analyze all of them in this piece of work, hence, this study will be confined to the analysis of the issues that revolve around the formulated objectives. Thus, the scope and limitations of the study include:

1. The study is confined to certain key socio-economic and institutional factors affecting the adoption of improved natural resource management technologies in the study area .
2. The study is limited to a specific woreda for the reasons that are mentioned in selection criteria's of the study area (Methodology part) and to do in depth investigation on the state of adoption of improved NRM technologies .

3. Due to time constraints, it is needed to be forced to select only 5 kebele peasant associations(PAs) from , 25 high land kebele PAs and 160 sample house holds heads, which would have some limitations in making inference to the general population.
4. Since it is not possible to investigate all the types of natural resources available in the study area with in this piece of work, the research focused to soils, forest/vegetation, pasture or rangeland, and water resources only.
5. The study also focused on selected, economically and ecologically important and widely applied improved NRM technologies .These are bund construction and tree planting in a woodlot.

1.7 Organization of the Thesis

This text is organized in six chapters. The first chapter provides general introduction an overview of the research problem and objective of the study. Chapter two presents the related literatures and conceptual framework of the study. The third chapter highlights the research design and methodology that was used to collect the data and analyze it. Chapter four describes the study area focusing on physical and socio-economic settings of the study area under investigation. The fifth chapter presents the results and discussion part. The last chapter (chapter six) briefly presents the summary of major findings, conclusion and recommendations of the study.

CHAPTER TWO

2. REVIEW OF THE RELATED LITERATURE AND CONCEPTUL FRAMEWORK

2.1. Review of the Related Literature

2.1.1 Natural Resource Management and Technology Adoption

2.1.1.1 Trends in Natural Resource use

Natural resources are elements of supply inherent to an area that can be used to satisfy human's needs (Bergsma, 1996 cited in Azene, 2001) The elements of natural resources include soil, forest/vegetation/,water ,sources, pasture/range lands), wild life climate.... etc.

The natural resources are categorized as renewable and non- renewable resources. Renewable resources are those, which can be renewed or regenerate through proper management and conservation while non-renewable resources are those, which can not be renewed. For instance, minerals and oil are non renewable resources while, soil and plant resources are renewable resources (Daniel, 2001)

Direct production of food and economic strength are strongly influenced by the influences of these natural resources. The productivity and sustainability of agriculture basically depend up on well managed environment and its resources. This issue deserves much more attention in traditional agrarian societies where rapid population growth and stagnant economy exists. Agriculture production is by its nature an extractive process; it is, however, only in relatively recent times that the realization has crystallized that appropriate measures have to be taken, if agricultural resources are not to be irrevocably destroyed by negligent use of land and water by man .Agricultural activities increases the potential for natural resource deterioration and even destruction. In most countries of the world, especially in the tropics and sub tropics, enormous areas of land have been damaged by clearing of forests ,soil erosion, mismanagement or over grazing of range lands and water resources depletion (Arnon,1987, Johnson and Lewis,1995). That is, resource degradation will cause reduction of availability of goods and services (quantity and quality wise) from the physical environment (Ermias,2003).

All economic activities based on ultimately from nature and environment doesn't exist as a separate sphere from human actions. People are forced to over use environmental resources to survive, and this impoverishing of the environment again threatens their survival (N.M Molee

and T. Ntsabane, 2001). As Mohammed,1994 indicated that the reliance of poor people on natural resources for survival leads to depletion of resources and further environmental stresses. For example, deforestation is causing desertification in Africa and Latin America. Further more, in poor communities the increasing demands for fire wood as a result of population increase, particularly in the high lands, leads to deforestation or to the use of dry cow dung and crop-residue for fuel as in Africa which deprives the soil nutrients .

The Ethiopian high lands, the central and northern massifs are the most highly unstable and are no longer able to support local human and live stock population at present status (Amare as cited in Assefa,1995). According to the Ethiopian highland reclamation study(FAO,1986a) ,if present trends (1985) in soil erosion are allowed to continue, in the high lands as a whole, in addition to the present 20,000 KM^2 area which is unable to be cultivated, a further 26,000 KM^2 area is likely to be added by the year 2010 and 10 million rural high land dwellers or more are going to become incapable to feed themselves from the remaining soil resources. Thus, practices of poor land management coupled with absence of proper conservation measures lead to land or resource degradation unless the proper resource management technologies are applied.

2.1.1.2. Adoption of Improved Technologies (Innovations)

Innovation adoption, is a point of consideration by many politicians, policy makers, economic planners commercial agents, extension agents, health workers, priests etc. All of them want their ideas and producs to be accepted : to be spread to all members of the public to which they are addressed , and to be adopted in the shortest time possible .However ,a long time may elapse before a new idea or product is widely diffused and adopted. Some times the innovation may never be adopted it may fail or perhaps be rejected. It is therefore quite logical for any one to raise the question; " Why development triggering innovations, while advantageous to users, fail to be adopted and diffused". An attempt to answer this question is central to an adoption study.

Adoption: Definition

Among the scholars who have attempted to show, the meaning of adoption is Rogers(1983)., who defined it as follows

Adoption is a decision to make full use of an innovation
As the best course of action available (Rogers,1983).

The other scholar (Aregay,1980) defined adoption in relation to agricultural innovation is:

Adoption is a variable representing behavioral changes
That farmers under go in accepting new ideas and
innovations in agriculture.

According to Misko, cited in Mulugeta ,1992, Adoption is defined as it is an acceptance and use of innovations and make it to sustain

Hence, the definitions of Roger's , Aregay's and Misco's are complementary than contradictory and therefore are adopted for the purpose of this paper. Hence adoption is there fore a process of behavioral change in an individual as a result of his/her exposure to an innovation and accept to use it. Webster's dictionary defines the word adoption to mean

" It is to take up or accept especially a practice or tenet often evolved by another".

Stages in the process of adoption:

Five stages in the adoption process by the individual innovator have been recognized (Rogers(1962), cited in Aronon,1987). The individual first becomes aware of the innovation, but is not yet motivated to seek further information .If he feels that the innovation may be relevant to his needs he becomes interested and actively seeks additional information on the subject .He then attempts to evaluate the possible costs and benefits to himself of the innovation .If his evaluation is favorable , he may decide to give the innovation a trial , by applying it on a small scale to determine its utility under his conditions. Even farmers surrounded by neighbors who have previously adopted the practice and proven its value will generally insist up on personal experimentation before adopting the innovation completely .

Thus, the decision to adopt usually takes time. For many practices, people appear to go through a series of stages in time. Lionberger,(1960), Rogers(1962) as adopted by Itana,1985,and Arnon,1987 identified the various five stages through which the processes of adoption occurs. These are:

- Awareness: a farmer learns about an innovation.
- Interest: a farmer develops an interest in the innovation and seeks more detailed information
- Mental decision (evaluation): the farmer evaluates an innovation and makes up his mind to try it.
- Trial: the farmer tries out an innovation

- Adoption: the farmer decides that the innovation is good enough for full scale and continued use. But the time to pass from one stage to another differs from individual to individual .

In the literatures on technology adoption, a distinction is made between diffusion and adoption. Diffusion is considered to begin at a point in time when an innovation is ready for use, and the main focus of diffusion is to explain how the innovation or technology is made available to the potential users. On the other hand, adoption studies consider the behavior of individuals in relation to the use of the technology, particularly the reasons for adoption at a point in time; relative to adoption, diffusion may be viewed as a dynamic process over time (Stoneman,1983; Feder etal,1985;Thirtle and Ruttan, 1987 cited in Jabbar, A. etal ,1998).

Empirical studies on agricultural technology adoption generally divide a population in to adopters and non adopters(potential adopters) and analyze the reasons for adoption or non adoption at a point in time, principally in terms of socio - economic characteristics of the adopters and non adopters (Thirtle and Ruttan,1987; Feder and Umali,1993 as cited in Jabbar A, 1998).

Thus in this study the sample households are divided in to adopters and non-adopters based on whether they implemented the improved physical natural resource management technologies or not. Then, the reasons for adoption and non adoption were analyzed at a point in time, in terms of socio - economic and institutional factors affecting the adoption situation.

2.1.13 . Socio-economic and Institutional Factors of NRM Technology Adoption:

Natural resources management includes both short-term measures directed at the production of current crops and all the long-term measure for maintaining/enhancing of the productivity of the land and the creation of the asset that mature in the long run (Blaikie and Brookfield 1987), (Andres,1993 cited in Abdella 1996), states that conservation measures should be directed to achieve improved production through suitable measures so as to gain more sustainable use of natural resources. Hence in order to attain the above benefits from any natural resource management activities ,it is mandatory to identify the socio-economic and institutional variables affecting natural resources management interventions. However, as indicated Warford (1989),

critical socio-economic variables affecting natural resources management are not clearly identified and addressed in most natural resources management projects.

The concern for managing natural resources dates back to 1970s, since the emergence of alternative development approaches. However governmental organizations, NGOs and other groups have attempted to treat the environmental problems with simple, neat solutions. This approach is focused commonly on biological and / or technical solutions which neglect the social dimensions (Vivan,1993,cited in Brohman 1996). As Warford (1989:7) states:

> *... if projects and policy measures are to be viable they should be based on a sound understanding of not only the physical linkages among events, but also of the equally complex economic, social and institutional linkages parallel to them*

Though further research is needed in this direction, various authors working in the field of land management have identified some socio-economic and institutional factors that have to be considered in the adoption of conservation-oriented activities. Some of these are; age and educational status of the household heads, availability of labour in the house hold, land holding size, land tenure security, market access, livestock resource , agricultural extension service(training and technical advice) to target communities, participation of beneficiaries at the planning stage and attitude local people towards the improved natural resource management technologies are some among the many.

i) Age of the house hold heads

Adoption decision of technologies could be influenced by age of the technology users because of its influence on planning horizon (Long,2003). NRM technologies, such as conservation measures are long term investments. Hence, the effect of age of the farmer on conservation technology adoption decision may be either negative or positive (Baidu-Forson,1999,Lapar and Pandey,1999). Older age often associated with long years of farming experience could positively influence conservation decisions. In contrast younger farmers with longer planning horizons are likely to invest more in conservation. On the other hand, older farmers usually have shorter planning horizon and they may be less interested on long term negative effects of resource depletion(Bromley,1980). Empirical studies by different researchers at different places have found mixed results. For instance, Korsching etal(1983),compared the mean age of adopters and non adopters of soil conserving technologies and identified that, the

mean age of adopters was 49.9 years old and that of non adopters was 55.1 years old . Long (2003) and Traore etal(1998) on the other hand have found that older farmers are not less likely to use conservation practices on their agricultural land

ii) Labour availability/ size of labour/ in the household

It is believed that labour is an important factor for the rural sector, to undertake traditional means of production system and agricultural production process. The traditional explanation for higher fertility regimes in subsistence economies was the notion of labour requirement. Subsistence/Peasant/ agriculture is by nature a labour intensive system since only traditional and elementary equipment is available for use. Hence, labour is an important input for agricultural activities and natural resource conservation works.

The farmers are working in the field starting at the time of land preparation till the end of the harvest (Markos,1997). In Ethiopia experiences showed that in addition to above activities, there are works done by community participation which include, conservation works, road works, digging holes for tree planting, manual works in construction of public schools and health units.... etc. More importantly, peasants were made to work on conservation activities for longer hours and many days with obligation and it influences the agricultural activities of the house hold. Thus, adequate labour supply both for conservation works and agricultural activities is vital in the house hold of rural community . Labour shortage is critical during the time of planting, weeding, and harvesting. During crop harvesting time an overlap is seen with soil conservation works. Moreover, NRM activities are highly labour demanding in their nature. Hence, labour availability, particularly active household labour size affected farmers' decision regarding adoption of introduced and improved NRM technologies. For instance, stocking and Abel(1989) cited in Woldeamlak(2003[b]) estimate,40 working days will be required to install simple biological measures per hectare construction of bench terraces on one hectare of steeply sloping land will require 1800 working days.

Furthermore, a considerable size of household labour is required to tree planting and management of it. Beginning from seedling raising to planting and management up to harvest of tree products are routine activities in wood lot planting in addition to SWC tasks and other agricultural undertakings. Hence, household labour is vital in the rural settings to adopt agricultural technologies particularly introduced and improved ones.

iii) Land Availability/ holding size/ of the household

Many researchers agree that too small land holdings and unequal land holdings can affect the adoption of conservation measures(Hudson 1992,Yeraswork 1995, Alemneh etal, 1997). Even when the plot sizes is very small the farmers are unwilling to apply conservation measures, especially the physical land conserving structures as they occupy the significant portion of their land(Dudal 1981 cited in Amare 1988,Alemneh 1990,Belay 1992b). Pearce (1986) cited in Warford 1989) does not accept the above findings and notes that small farmers with limited plot sizes are better than farmers with large plot sizes in adopting conservation measures. However improved NRM technologies must not put land out of production and even if it does it will be only acceptable if there are balancing benefits, particularly in food production.

The scarcity of land due to population pressure is the widespread phenomenon in Ethiopia, besides the natural desire of people to remain on their accustomed and familiar family land. In terms of spatial distribution, some 88% of the population live in the highlands which constitute only 43% the country's land area. According to CSA (1995) cited in Woldeamlak 2003,Some 80% of the Ethiopian farmers in the high lands (>1500m) cultivate less than 1 hectare of farm land. When there is scarcity of land people are forced to cultivate only the little plot they have. As stated in EHLRS (1986) in areas where there is shortage of land the farmers are unwilling to allow the traditional direction of the fallowing period for their land. Yeraswork (2000) states that due to the severe reduction in the size of the average land holding in the country the tradition of giving land fallow for a year or two has become a thing of the past. Therefore, conservation measures introduced by different organizations should consider the holding size of the beneficiaries for successful adoption.

iv) The size of livestock (availability of live stock)

The scarcity of livestock has negative implications for land management in many respects (EHLRS 1986, Alemneh 1990,Yeraswork 1995,2000). First, because of lack of livestock resources, there is limited possibility of the use of organic manure in plots as well as spreading on the farm fields. Second, lack of animals is also related to the need for cash for survival. Cattle are the major source of income for most rural households, hence they are left with limited choice to invest on their land .Presence of draught power for land preparation to secured food availability in the household and generate income from surplus production are also vital; that

enables the farmer to invest on his land in a long term . However, it should not be forgotten that over stocking can also discourage adoption of conservation measures like area closure. Thus those who are undertaking conservation measures should also consider the farm households' livestock size and their characteristics. The success of conservation on private farm lands can be better ensured if the related pasture land problem is properly addressed

v) Agricultural extension service delivery/Training and technical assistance/:-

Agricultural extension: Definition:

The term agricultural extension means different things to different people (Purcell and An derson,1997). Vanden Ban and Hawkins (1996) arrive at a concept of extension that seems to synthesize diverse perspectives in to five goals-transferring knowledge from researchers to farmers; advising farmers in their decision making; educating farmers to be able to make similar decision in future, enabling farmers to clarify their own goals and possibilities and to realize them; and stimulating desirable agricultural developments.

Arnon(1987) stated that extension education is generally the main if not the only agent for farmer education in developing countries, and is specialized kind of the broader concept of adult education. FAO, as cited in Arnon (1987), also defines agricultural extension as an informal out of school educational service for training and influencing farmers to adopt improved practices in crop and live stock production, management, conservation and marketing. Hence the concern is not only with teaching and certain adoption of a particular improved practice but also with changing the attitude of the farmers.

Kumar and Hansra(2000) also tried to explain extension as a process where by the extension worker tries to encourage or motivate the clients in order to solve their acute problems; due to that the clients would acquire a better understanding of their problems and also consider the alternative solutions available.

➢ Roles of Agricultural extension:

The major role of agricultural extension in many countries in the past was seen to be transfer of new technologies from researchers to the farmers. Now it is seen more as a process of helping farmers to make their own decisions by increasing the range of options from which they can

choose and by helping them to develop insight in to the consequences of each option. (Vanden Ban and Hawkins,1996). So, an agricultural extension service is required to describe new technology to farmers and teach them as how to adapt and adopt improved production practices. With out extension's guidance, farmers often are unable to exploit the opportunities available to them wisely(Bernor, etal,984). Contrary to the developed counties, in developing countries, the problem is not only how to communicate information but also how to initiate the farmer to accept and adopt technological changes (Arnon,1987).

Thus, the extension workers will operate the extension program, through the mass methods or through personal contacts. Especially, personal contact between the extension agent and the farmer is the dominant technique to introduce the technical changes(technologies). This is employed by visiting individual farmers, to deal with their specific problems, offering advice on whole farm basis or a specific issues.

On the other hand, there are contradicting views regarding the role of environmental training in facilitating farmers' adoption of land management activities. For instance, Hudson(1992:138) states:

> ... *In the last two decades it was commonly assumed that the most important thing in achieving soil conservation was to educate and train the farmers to tell them about erosion and erosion control and it's importance to them and their grand children and the country. Though that is well appreciated as a whole, but the peasant farmer is well aware of the cause, the process and the results of erosion, but they are not prepared to do much about it because there are more problems to attend to.*

Laban(1995) also support the above idea by noting that only sensitizations and information dissemination may not lead to successful conservation technology adoption, although it is one of the necessary condition. As opposed to the idea of Hudson(1992) above, Plup and Routely (1982, cited in Dalkoh 1993) describes that " ... the widespread environmental degradation in Africa has been largely attributed to the absence of environmental awareness or consciousness among the poor in Africa". Local level conservation efforts have no long term significance unless both the growth of human population and their unsustainable patterns of resources use eventually cease (Cincotta, 1994). Thus, the environmental concerned organizations should address the population component in their environmental projects. In general, environmental problems can be better managed if the people affected can organize and educate themselves about attacking, if not solving the problems, as a whole, in a planned/phased way if feasible .

Attacking all problems in one way may not be feasible, but doing it in an integrated, mutually-reinforcing mechanism may do.

Regarding the contents and methods of training programs for NRM, Hudson(1992) argues that for widespread adoption there must be the multiplier effect of trained farmers teaching other farmers. For this matter the technology of teaching and demonstrating should be made easier. The introduction of innovations in form of new ideas, new techniques of production, HYV(high-yielding variety seeds) new species of plants, new tools new breeds of animals, or grain storage or other post-harvest technologies or whatever, the peasants who are by the very nature conservationist and traditionalist, and hence naturally resistant in adoption of innovations, must be given well articulated and structured orientation, and if necessary training and demonstration course prior to actual intervention measure suggested or given to them. Hence before targeting to conservation a high level awareness creation among peasants is crucial for success.

In Ethiopia in general, lack of extension service(training and advice) and awareness is also found to be another constraint for the limited adoption of NRM technologies. Regarding this point, Mulugeta(1992) noticed that conservation movements in Ethiopia still faced with a number of much problems despite the endeavors made and the achievements recorded. Many of the projects reflect the lack of effective soil conservation education and training to be imparted among the peasants who are mobilized to implement the conservation programs. In general that supplementing environmental education and training to the knowledge of farmers and the other concerned groups targeted for conservation activities is, though not the only condition for success, but one of the necessary conditions for successful adoption of improved physical NRM activities.

Hence, accurate and timely information and technical assistance has a positive impact on farmers' conservation adoption decision. Farmers with better information can asses the impact of soil erosion on long-term productivity of their farm land and adopt practices that help to resolve the problem of soil degradation (Traore, etal 1998).

vi) Educational status of the household heads

Farmer' decision to adopt technologies can be influenced by educational status, since it enhances farmers' ability to obtain, understand and utilize the theory can practice of innovations as well as it improves the over all managerial expertise of farmers (Itana,1985). As a human

capital variable, education is found to positively affect the efficiency of adoption of conservation practices (Rahm and Huffman,1984,as cited in Lapar and Pady 1999). It has often been concluded that beneficial innovations tend to be adopted more quickly by farmers with higher levels of education (Goodwin and Schroeder,1994) Also,Geoffer (2004) and long (2003) in their model predicted that, there is positive and significant association between education and adoption of conservation measures. However, the study conducted by Shiferaw and Holden(1998) in central high lands of Ethiopia at Andit Tid shown that, education does not significantly shape erosion perceptions of farmers. Off course, the level of education of Adit tid was to low; that is 1.3 years on average.

vii) The Land Tenure Security (System)

Land tenure system, as defined by Dejene and Teferri(1995), is the various forms and rights of access to land such as free-hold, lease-hold, share-cropping, on a village or customary use rights. Thus, the type of land tenure system determines the efforts towards the conservation of environmental resources, which concomitantly affects the socio- economic development of a country in many ways. According to the same authors(1995),the land tenure system determines the distribution of incomes among users of the land, the type of land use, power, social attitudes and social satisfaction and national traditions and character. Different countries have experienced different forms of ensuring land access rights to their population at different times.

In Ethiopia, land has been under state ownership since 1975 where the peasants appropriate the land from the state. They have usufruct right but lack the ultimate right of ownership(the ability to sell, mortgage or transfer) for a particular piece of land.

Bounder(1987) has identified many problems that might arise from tenure insecurity. Activities such as indiscriminate felling of trees for fuel wood, intensive grazing in forestland, conversion of forest lands to agriculture, poor efforts for forest regeneration etc. became evident. This, will, in turn, result in a complex environmental problems manifested by land degradation and extinction of genetic diversity.

Despite the fact that the 1975 land reform has been appreciated for its merits, there have been acute problems related with it. Landholders were only provided with usufruct rights, resulting in bad land use practices. Large-scale deforestation and land degradation have been observed

after the 1975 land reform. The combined effects of these problems have been manifested in declining natural productivity of the land.

The land tenure system also determines the type of crops grown on a specific plot of land. In situations where the peasant makes a short-term contract with the landowner, the farmer usually prefers to harvest annual crops that would enable him/her to maximize agricultural out put in the short run. However, when the individual owner cultivates own land himself, the types of crops grown would be perennials, conservation based types of crops or plants that have been increasing rates of return on investment in the long run. Studies in different parts of the country have tried to reveal empirically that land tenure insecurity influences farmers' decisions on land management practices. As an example, Kebede(1989) cited in Woldeamlak(2001) mentions that the absence of clear property owner ship right was one of the reasons for the failure of past attempts of environmental rehabilitation and conservation works, specifically on that of communally held hill sides. Terefe (2001) who conducted a research on land tenure and environmental degradation in the oromia highlands, confirm that the peasants did not feel comfort with state owner ship of the land. They suggest that government should be the out actor and the owner ship right should be given to them.

viii) Market Access

In subsistence agriculture itself all agriculture production may not be used for self consumption. A certain proportion of the production may be available for sale.

Developing countries are generally characterized by the inefficiency of their marketing services with many small-volume, high unit-cost transactions and high food losses(Arnon,1987).

Market links between the farm and non farm sectors. The development of an efficient and equitable marketing system as well as to create the accessibility of it is critical component for improving food security. This condition benefits both producer and consumer by reducing marketing margins ,there by raising and stabilizing farm incomes and reducing the cost of food to consumers. Well-functioning agricultural markets also promote farmers' incentives to use productivity enhancing in puts, and reduce poor households dependence on food aid for survival. Agricultural marketing plays important role not only in stimulating production and consumption, but also in accelerating the pace of technology adoption, that resulted in a substantial increase in farm production(Abera,1999).

Improved marketing and value added processing can increase the potential of new cropping systems (for example agro-forestry) that are less environmentally degrading or more land-saving and the potential of new crops(Such as non timber forest products). That can increase the returns from resources. However, care must be taken to ensure that marketing margins are realistic but not punitive to producers overcoming infrastructure and marketing bottle necks may also require innovative policies for directing credit and other inputs to poor farmers in remote areas whose livelihoods are most threatened by recourse degradation (Arnon,1987,Barbier,1997). Improving the road system/Road building/ encourages the farmers to adopt new technology and able to produce for market sale. Roads often reduce marketing costs, thus improving income-earning opportunities from agriculture and promoting land conserving investments(Barbier,1997).

However, most roads in developing countries are simply dry weather tracks. During the rainy season, they may become completely unusable for varying periods of time; the surfaces are generally rough; rutted and doffed and that can not provide transportation service during rainy/wet/ seasons. Transportation of farm produce by human and animals is common to the market in most African countries due to lack of feeder roads. But it is not possible for certain products like tree products (example pole, log and timber) that impede the farmers to plant trees(Arnon,1987).

In Ethiopia many roads have been poorly developed, and feeder-roads are under developed which in turn result in high transport costs that deny small farmers access to major markets. It has been reported that Ethiopia has the least developed road net work in Africa (Legese etal,1992) and approximately 80% of the rural areas are situated at over one day's walk from an all weather roads (USAID,1995) which increases transportation costs and declines transport services to more remote agricultural markets. Many of the existing roads and feeder roads have been inadequately maintained and have deteriorated and truckers are refusing to go in to rural areas because of the high cost involved. Farmers, therefore, encounter increasing difficulty in finding transport services. (Abera,1999). Thus, physical accessibility of market is a problem to the rural people to transport their agricultural products to markets and this hindered the farmers to adopt new technologies and increase agricultural productivity in a sustainable fashion by conserving the natural resource base like , soils; forest/Vegetation/, water... etc. Hence accessibility to the market network, which is closely related to the status of transportation

infrastructure. Farmers who are not connected by all weathered roads will refrain from adopting technologies. A guaranteed access to marketing out let is probably an essential condition (Feder 1981).

ix) Participation of the Beneficiaries

The participation of local people is found to be among the most important factors for the success of newly launched conservation measures(improved natural resource management technologies). Hazelwood (1987) argues that successful implementation of natural resources management activities requires the active and willing involvement of farmers and local communities. Hams (1994) also notes that local use and management of natural resources should underline the application of the participatory development approach. That means decision making power and responsibilities should be entrusted to the local population as far as possible and feasible, as the people should have an important share in the benefits of their efforts. Oliver (1992) underlines three comparative advantages of local people involvement in natural resource management: first, higher degree of sustainability will be ensured when the community members identify them selves with conservation and management strategies through direct involvement as opposed to top-down approaches. Second, the local people will observe and appreciate the desirable link between environment and development. Thirdly, the dependency on external resources will be minimized and local people will take their own initiatives in the management of and conservation of natural resources. Moreover, the peoples' learning and experience curve would go upwards in management of not only natural resources but also other local development affairs. Deerutins(1992) based on empirical study on land management projects in Sri Lanka concluded that the successful planning and implementation of conservation measures largely depend on the participation of target population in all fields right from the beginning. According to Van den Bremer(1995:97):

> *Environmental problems in Africa have become so widespread and severe that any solution to them excluding consultation with and involvement of the rural population is unrealistic. Hence rural communities should be allowed and encouraged to become responsible for the sustainable management of natural resources in their own localities.*

The participation of affected members of the community in the planning and design of NRM technologies also enables to incorporate indigenous NRM knowledge to the intervention package

to make the effort more sustainable and effective. As Bailey (1986) argues, it is also a fact that maintaining local practices and values through isolation from modern development processes may be neither possible nor necessary. The incorporation of community values relating to natural resources management, among others, might provide a basis for sound project design and a sustainable development process

Thus, as far as possible, peoples' traditional knowledge , experience and expertise should be suitably adapted as far as they help in newer technologies to be made locally more applicable to solve problems. People should be kept as far aware of these adjustments as possible, so that they continue to feel that neither their knowledge nor techniques nor suggestions are being ignored nor any thing is being superimposed on without involving them.

Million (1996) indicated that various land management projects intervening to improve soil and water conservation in Ethiopia adopted top-down approach. That is farmers were/are minimally involved in the soil conservation activities. Similarly ,indigenous knowledge and experience were also ignored within the entire stages of identifying, and planning, implementation process of conservation works. Regarding this the findings of Bekallu (1994) from Agaw areas of Gojjam show that the major reason for the failure of soil conservation in that locality was the overall neglect of integrating the traditional conservations practices with 'modern scientific' approaches. In addition, a study done by Alemneh(1990) among the peasants of wollo revealed that most peasants perceived ' area closure' method for rehabilitation of grazing land as another outside intrusion to their lives and were resentful of such programs particularly, because, local people were not consulted at all during planning and implementation of this measures.

x)Attitude of Local Peoples Towards Improved NRM Technologies

After knowledge acquisition, the second stage in the process of adoption is the formation of attitude. Many diffusion scholars, including the followers of the knowledge, Attitude and practice(KAP) model believe that when an individual has learned some aspects of the attributes of an innovation he forms certain inner feeling towards it. Accordingly he sets his mind in the direction of adoption or rejection. This feeling of attachment, in difference or rejection is referred to as an attitude. It is concerned with either favorable or unfavorable, situation towards the innovation and it is there for affective and psychological (Rogers 1983). Rogers(1983),

defined attitude as " it is a relatively enduring organization of an individual beliefs about an object that predisposes his or her actions". The farmer mentally applies the new idea or innovation to the present or anticipates future situation, before deciding whether or not to try it.

Farmers' conservation behavior and willingness to apply alternative resources conservation techniques are largely determined by their overall attitude and perception (Belay, 1992). In the words of William (1973) attitudes of individuals and groups towards environmental issues have been always matters of high concern.

On the other hand,(Shxon 1989,cited in Bahiru 1993) states that there are contradicting views regarding farmers' decision making process. The conservationist school argues that small, poor farmers are irrational and ignorant, but on the other hand it is believed that they usually know much about their environment and make rational decisions, within their thinking capacity. According to (Shanner et al 1981,as cited in Bahiru 1993). Perceptions, knowledge and attitudes are the main factors determining the individuals' decisions making behavior. For instance, as indicated by wood (1990), during the colonial era in Zambia only a few of the indigenous African farmers viewed conservation measure as any thing attractive for sound farming system. Rather African farmers perceived conservations measures as another outside colonial intrusion into their life. The reason was partly due to the discrimination in the provision of incentives and financing between African and settler farmers.

While making attempts to induce and introduce innovations and changes in indigenous peoples' behavior patterns, working schedules and techniques of production or consumption styles etc, proper in-depth analysis of their social, cultural, behavioral and psycho-attitudinal patterns must be studied so as to make the induced efforts successful in adjusting to these patterns and make them more easily acceptable and palatable. This is more essential if the interventionist agencies are external. Peasants resistance to innovations breaks easily when the intervention measures are not only theoretically beneficial to them but also these measures should be seen and realized objectively by them to be actually beneficial to their economy, society, culture or future in a sustainable way. Their mode of life has sustained over long period of historical times in some safety first model decision-making in their productive and reproductive behavior. They feel quite 'safe' with the well experienced and gloomed techniques, seeds, implements etc, so that production does not have to fall below the felt disaster level; any thing new creates suspicions in their mind and they would not accept the ' new' till it is

essentially proven to be beneficial to them. Hence the peoples behavioral, cultural ,social norms and value systems must be well known before innovations are introduced, and proper adjustments and adaptations must be suitably made. For instance, there is age-old pattern in role behavior of family labour-men, women and children of different age groups ,what each does and can do and does not/can not do. So, also time and reasons and types of work have their own patterns . For instance, NRM strategy should consider the different roles of men and women in production of the allocation of different tasks in different period in the web of communal production system (Randriamapiania and Anton,1992) . So before the intervention rising questions like.(How is the neighborhood tie of that particular community? How is the social division of labour? How is the gender division of labour?) could facilitate the implementation process of the new innovations introduced in the system . It is often difficult to find homogenous groups, whose members share the same interest, identical typology of role behavior in task assignments of behavior patterns, and all these in the same catchments area . So, in many areas of natural resources management, the fact that success is contingent on the willingness of ordinary citizens to accept the validity of official or any other induced policy framing is a less recognized subject. To this extent, success is not achieved to the expected level. Hence the knowledge of the attitude of local peoples towards innovations in general, and improved natural resources management technologic in particular is critical for the success of rehabilitation activities being undertaken . This is because this package of measures would need their full and committed support and active participation in performing the tasks and keeping them alive and sustainable in the efforts of their life supporting system.

2.1.2. Ethiopian experience in natural resource management

2.1.2.1 Major causes and consequences of natural Resources Degradation in Ethiopia.

Land and its resources degradation is one of the serious environmental problems facing Ethiopia to day (Alemeneh 1990, Wood 1990,Belay 1992[b]) Though most studies have centered on physical factors as a cause of land degradation, the process is not well understood (Blaikie,992). However many diverse and complex factors are involved as the causes of environmental degradation in Ethiopia. For instance, deforestation is essentially a human process. Most of it is due to agricultural expansion ,human settlements including

metropolitan-urban spread, fuel wood and construction lumber and timber supply ,furniture and industrial raw material supply etc. Un warranted causes such as natural forest and /or range fire, human induced fire, and other destructive agents also lead to deforestation process (Teferi ,1999). Deforestation is there fore at present a major issue in Ethiopia, since it is one of the main causes of prevailing land degradation (Via-facilitating soil erosion). For instance, the country 's entire fuel consumption from forest resources accounted 89% for the year 1990 (Pearce and Kerry, 1990). As world recource,1990 –91 cited in Teferi (1999) forest resource of Ethiopia in 1980s in thousand hectares looks like the following:

- Extent of wood land and forests ..... 27,150 hectares
- Average annual deforestation rate ..... 88,000 hectares
- Average annual reforestation rate..... 13,000 hectares
- Net average annual loss ..... 75,000 hectares

On the other hand, the deterioration of both manmade and natural water flows and storage areas represent another degradation among land resources. This increases the extent and frequency of drought in dry seasons and flooding in wet seasons. In this case again disruption occurs in domestic water supply, atmospheric systems, which results in disease which when coupled with malnutrition, famine, and flooding; shorten life expectancy of both animals and humans (Teferi,1999).

The other greatest source of land, which accounts for all the biotic life systems, including human life and civilizations support base is the soil resource . It is also one of the thinnest and most valuable human resources and one of the most impacted upon resource by human and their agents. Though geological or natural soil erosion is a nature induced process, it is the human induced soil erosion, soil loss and soil fertility deterioration etc, which creates problem.

According to FAO (1986) cited in Woldeamlak (2003) about 2 billion tones of soils are eroded every year in Ethiopia. Hurni (1987) earlier researched on this problem and indicated that most victim areas to soil loss/erosion in Ethiopia are arable lands, where the annual average loss is 42 tons/ha. This is six times the amount of soil formation and causes an annual loss/reduction in soil depth of 4 mm. Soil erosion occurs primarily due to human activities, particularly deforestation, over cultivation, and overgrazing, inducing together the main causes of land resource degradation (Alemneh,1990). Other socio economic factors are also stated as its causes and accelerating land degradation. These are: intensive cultivation, lack of appropriate

conservation and agronomic practices to maintain vegetative cover, decline in the traditional use of manure, declining of per-capital land holding size, shortening of the fallowing period, shrinking of the grazing area etc. (Daniel 1988,1990, Belay 1996).

The consequences of land degradation as discussed by Daniel (1990) are several such as the deterioration of fertility, moisture storage capacity and changes in the structure of the remaining soils, which together lead to decline of country's agricultural productivity. Belay(1996) also states that land degradation in general and the agricultural land degradation in particular severely reduce the productivity of land in Ethiopia, where agriculture is the basis of the economy. It has been indicated that between 1985 and 2010 the rate of land degradation would cost Ethiopia 15.3 billion Birr (EHLRS,1986). As (Hurni 1988 cited in Million 1996) also states crop production in Ethiopia might decline by more than 2% per year due to land degradation in areas where environmental degradation is serious, if fruitful protective measures are not taken.

2.1.2.2 Efforts of implementation of improved NRM technologies in Ethiopia.

The Ethiopian government recognized the seriousness of land deterioration problem particularly following the 1973-74 famine and responded by initiating huge projects in the different parts of the country mainly through the foreign aid programs(Million,1996). However, the achievements so far recorded are far below the expectations. Thus, wood (1990) stated that in addition to the current rehabilitation measures, Ethiopia needs a tow-to-four fold increase in dimension of measures for adequate management of natural resources in order to increase the agricultural and livestock productivity and developing the protective land use forms and practices.

How ever, both the strategies and approaches that formulated FFW and first come first served type approaches, followed by the government were repeatedly cited as a hindrance in addition to local socio-economic and physical factors to the adoption of project- initiated conservation activities. Besides, the government's approach to conservation was focused on physical measures such as constructing bunds and terraces, tree planting and area closure. For instance, between 1976 and 1988 FFW programs funded the construction of 600,000 Kms of hill side terraces for afforestation of steep slope and 800,000 kms of soil and stone bunds for terrace formation on 350,000 ha of crop land. Some, 500 million-tree seedlings were planted covering

some 180,000 ha (Daniel ,1988,Hurni,1988 cited in Wood,1990) . Also, about 300,000 ha of land was put under area closure in some parts of the country, wollo(Chaohkar,1992). However, due to lack of participation of local people who are close to such area; area closure as conservation did not get popular acceptance and faced public hostility. Yet, by these rehabilitation and conservation works, the total area that was covered is estimated to be only 7 percent of the high lands that needed treatment. At this rate, all the area in need of treatment could take some 70 years for rehabilitation (Berhe and Chadhokar,1993;as cited in Woldeamlak,2001). On top of that, some evaluation studies indicated that, these limited conservation and rehabilitation works them selves were not effective and sustainable. The achievements were only quantitative with little desirable out comes (Kebede,1989,Stahl,1990,Yearswork,1995;as cited in Woldeamlak,2001).

2.1.2.3 Natural Resource Management and Policy Environment in Ethiopia

Environmental and agricultural policies play a significant role in the development of a nation economy particularly in agrarian countries like Ethiopia . The Ethiopian government and donor agencies have formulated one policy after another to combat natural resources degradation. This is done in the absence of village level data that could identify the socio-economic forces that could mitigate or exacerbate the process of natural resources degradation .

In the last three decades the concerns for environmental issues have seriously grown in Ethiopia. This is signified from the increase in number of government departments and authorities concerned with environmental issues. Besides this in 1988,decision was made that the country should undertake a national conservation strategy (NCS), latter it was renamed as conservation strategy of Ethiopia (CSE). The strategy was meant to create linkage of sectoral policies development to the sustainable use of the country's natural resources and to co-ordinate all natural resources- related programs by ensuring co-operation and exchange of information. The CSE has made remarkable achievements in preparing necessary documents for the out come of national environmental policy in Ethiopia. CSE has been also strengthening the capacity of regional governments in order to develop their own conservation strategy. In addition, the country's new constitution of 1995 also has included environmental issues both as fundamental right and policy directives. Also, Ethiopian forestry action program (EFAP) was formulated in 1994 to enhance the management and expansion of forestry in the country, though it is not

implemented as expected. Further more, in response to environmental problem, the Ethiopian government approved environmental policy of the country in 1997,even though its implementation process lags by far . Also, provision of land use right certification card is one of the recent policy measure taken by the policy makers .Thus different polices regarding natural resource management activities have been launched in different times in the country. However the practicability of these polices is not as required/expected .

2.2. Conceptual Framework

As it is documented in different literatures, different disciplines and stakeholders involving in NRM present different sets of solutions to the various natural resource 'ills'. From relatively recent literatures, three major approaches(policy paradigms) can be cited. These approaches are classic, populist and Neo-liberal approaches(Biot et al 1995,cited in Alemneh etal, 1997).

The first approach is classic approach which assumes that land degradation problems can be solved through readymade technical solutions. The emphasis of this approach has been based on technical ' fixes' and expert opinion and little merit has been attached to local land users' practices and participation(Clay andSchaffer,1984). That is it seems to ignore the socio economic dimension of resource degradation and conservation discourse. The second approach, often referred to as populist approach which links poverty and environmental degradation. The approach is centered around the participation of local peoples by using their knowledge and practices like land use practices as a guide for policy formulation and action towards conservation (Chambers,1983,Blakie and Brookfield,1987, Mascarenhas, etal, 1991, Richards,1985, Hudson 1991). The third approach is neo-liberal approach. Its principles are drawn from both the classic and populist approaches. The idea that technology to control land degradation is available can be Suitably adapted and adopted wherever and when ever required is taken from the classic approach. On the other hand, the populist view contributes the notion of empowerment of the people for their adoption of the technologies at the household level. Hence, the argument on major causes of natural resources degradation incorporated in this neo-liberal view is centered around the institutional failures and the lack of adequate incentives for the adoption of appropriate conservation technologies among the land resource users (Brohman,1996, Binswanger 1989, Repetto and Gillis,1988; World Bank, 1992). Thus, this study

is based on this neo-liberal approach, as conceptual frame work. Because it considers both technical and local conditions for natural resource conservation efforts.

Until recently many natural resource management and land reclamation projects were influenced by the classic approach, which has often resulted in conflict between technology and local farming as well as socio- economic conditions. As many authors believe this aspect moves to a continuous serious impediments to successful land degradation control projects (Blaikie and Brookfield,1987). The idea is that local conditions like socio-economic and institutional aspects have to be seriously considered in the intervention measures to address natural resource degradation problem. Therefore, the extending argument of this study is based on this neo-liberal approach which could help in diagnosing some emerging and observable socio-economic and institutional constraints to the adoption decision of improved natural resource management technologies by the local people. Because natural resource degradation is influenced by local socio-economic and institutional factors operating in a society. 'Farmers' natural resource management practices are actually influenced by many Macro, Meso, and Micro level factors, including availability of resources (natural, human, technological, capital). Constraints (biophysical, socio-economic), and policy environment (including land rights, land tenure, transportation access and marketing opportunities (Rasul,2003, cited in Paudel and Thapa,2004). This is also reinforced by explanations of Tisdell (1996) and Johnson, Pemberton, and Seepersad(1999) who find adoption of land management practices influenced by a set of biophysical, socio-economic and institutional factors. Hence, decision on natural resource management is a complex process which involves several sequential steps, each influenced by various biophysical, personal, socio-economic and institutional factors. This study has tried to examine this complex process through case study at the woreda level by considering mainly the household level information.

The process of natural resource management starts with how the farmers perceive/understand the natural resource degradation/land degradation as a problem, which is influenced by the factors mentioned earlier. The decision whether or how to manage land resource depends on farmers' understanding/perception of land and its resources degradation as well as on their personal characteristics, socio-economic condition, institutional support provided and biophysical characteristics of land holdings. These factors also determine the effectiveness and extent of land management practices (Ervin and Ervin,1982).

Farmers; individual characteristics, feelings and aspirations considerably influence adoption of technologies(Giampietro, 1997, cited in Paudel and Thapa,2004). For instance those farmers who are literate and have relatively better exposure to society and local institutions are more adaptive than illiterate counter parts (Ervin & Ervin,1982; Rauniyar,1998, Mehta & Kellert,1998, Johnson et al , 1999,). Demographic characteristics of farm households like household labour force size, also play important roles (Rauniyar,1998).

Ownership of resources is another important factor determining the adoption of natural resource management practices (Savadogo,Reardon and pietola,1998,cited in Paudel and Thapa,2004). Resource rich farmers are normally apt to change, as their accumulated wealth enables them to make investment in conservation measures (Barker,1997).

Support services provision, like training and extension through line agencies is essential to enable the farmers to adopt natural resource management practices (Gafsi and Brossier, 1997). Usually , the adoption rate would be high, if farmers are regularly advised and informed about new technologies and practices by competent extension agents, with adequate supportive materials provided in a coordinated way (Barker, 1997).

CHAPTER THREE

3. *RESEARCH DESIGN AND METHODOLOGY*

3.1 *Selection of the study Area*

Highland Dangila woreda is selected as a study site purposively. The intention of the investigator is to look into the state of adoption of improved natural resource management technologies and to identify the main socio economic and institutional factors that have relationship or association with this adoption condition and the study site, where the problem of resource degradation is severe and management technologies are some how implemented. Hence, the main reasons for selecting this study area were:

1. It is among the highland area of the region with high population density, severe natural resource degradation and it is exploited for several millennia
2. The rehabilitation works have been undertaken nearly for three decades in this area. But, the achievement is not encouraging.
3. There was no comprehensive research (study) so far has been undertaken regarding this issue in this study area. Therefore, the investigator is stimulated/prompted/ to carry out this research work.
4. The investigator's familiarity with the setting and has good knowledge of the study area.

3.2 *Research Design*

To do an in depth examination of the socio economic and institutional factors associated with adoption of improved NRM technologies a case study approach was chosen. Hence, both qualitative and quantitative data gathering techniques were employed to collect appropriate data

3.3 The sources and methods of data collection

The data was collected on field survey of randomly selected household heads in five highland kebele peasant associations called; AbadraAgaga, Dubi Michael, Gumdri Abila Akena, Ziguda Gult, and ZubraQuandisha in Dangilla woreda. Focus group discussion with farmers and interview of experts at different levels was conducted. Thus, following the principle of methodological pluralism (triangulation), the study has been carried out using both quantitative and qualitative data colleting techniques.

3.3.1 *Primary Data Sources*

Primary data was generated through field survey carried out in the study area. 160 sample household heads interview/Survey/, focus group discussion with group of farmers, interview of experts at different levels and direct field observation by researcher were conducted. The survey of sample house hold heads (farmers) were randomly selected and interviewed by using formal and structured questionnaires consisting of both closed and open ended questions. The survey was conducted in respondents home at the time convenient to them. Five focus group discussions, one from each PA was held with farmers who implemented improved NRM technologies(three groups) and with those who do not implemented these technologies (two groups); with the aid of tape recorder and photo camera. On the other hand , interview was conducted with four Development Agents (DAs); one from each sample peasant associations (PAs) except one DA from the fifth sample PA, because of , sickness at the time /period/ of data collection. Interview was also, extended to natural resource conservation experts at different levels of agricultural and rural development bureaus(woreda, zonal and regional) level. Two experts at each level were interviewed. On top of that, direct field observation was conducted by the investigator himself using the pre-designed observation checklist.

Figure -1- One of the Focus Group Discussions with Farmers
(Photo, taken in March 2006)

3.3.2 *Secondary data sources*

Secondary data was collected from published and unpublished sources. Documents like annual reports of woreda office of agriculture and rural development, regional publications central statistics authority (CSA) publications, policy documents like, National and Regional Environmental policies, basic data records/profiles/at kebele and woreda level, working papers, journals, books, Maps, photos and other related literatures were used.

3.4 Sample size and sampling procedure

3.4.1 Sample size

Care was taken to make the sample size of the study to be as representative as possible in accordance with the time and budget allocated. Hence, out of 25 highland kebele peasant associations (with the altitudinal range of above 1500 meters above sea level); 5 (five) kebele peasant associations (PAs), were selected purposively. From which 160 household heads were selected for the survey. The rationale for deciding this sample size was based on factors like the homogeneity of population, cost of the survey, shortage of time , large number of factors to be analyzed and the precision level required . The total sample size of the study was determined using the following formula (Cochran,1977 in Belayneh, 2005 ,Kinfe, 2002).

$$n_o = \frac{z^2 pq}{d^2} \longrightarrow n = \frac{n_o}{1+\frac{n_o-1}{N}}$$

Where= n_o -is the desired sample size when the population is greater than 10,000

n - is number of sample size when population is less than 10,000

z - is 95% confidence limit i.e 1.96

P- is 0.1 (proportion of the population to be included in the sample, i.e 10%)

q – is 1 – p ,i.e 1- 0.1 =0.9

N – is total number of population

d – is margin of error or degree of accuracy desired usually set at 0.05

After the total number of households (population)to be studied was determined ,sampling was made in such away that it can generate representative generalizable and valid information from the structured questionnaire.

Thus ,the selected 5 highland peasant associations represented 20 percent of the total kebele peasant associations, which are 25 in number. On the other hand, the sample size (160 households) represented 3.30 percent of the population. But, out of the surveyed data of 160-sample household heads twelve (12) of them were invalid (rejected) when it was checked for its accuracy, completeness and importance. Thus, the data collected on 148-sample household heads was taken for further analysis.

Table 1 - Altitude, Agro- ecology & sample size and its proportion by peasant Associations (PAs)

No	Peasant Associations (PAs)	Altitude (m.a.s.l)	Agroeco logical zone	Total No of household heads (sampling frame)	Sample size			
					sample		%	
					Surveyed	valid	Surveyed	valid
1	Abdra Agaga	2238	Woina Dega	1240	40	36	100	90
2	Dubi Michael	1950	"	754	26	25	100	96.2
3	Gumdri Abla Akena	2210	"	1222	38	33	100	86.8
4	Ziguda Gult	2063	"	984	31	30	100	96.8
5	Zubra Quandisha	2252	"	684	25	24	100	96
	Total/Average			4884	160	148	100	93.2

Source:- Field survey,2006

3.4.2 *Sampling procedure.*

The study kebele peasant associations were selected purposively on their altitude level (high land), and geographical coverage. But the sample household heads were selected using simple random sampling techniques from the list of the peasant association household head members, which are actually served as an adequate sampling frame. However, since there was no list of household heads(HHHs) members in one (1) of the peasant associations, and it was incomplete in two (2) of the other peasant associations, the enumerators was forced to list the HHHs and complete the sampling frame in consultation with kebele administrators and DAs. The lists of members of household heads of five kebele peasant association (PAs) who have had land holding were taken as sampling frame, that is a total of 4884 household heads from five peasant associations were taken as the population of the study.

The number of female-headed house holds out of the total sample size were 15,representing 9.38 percent of the total sample size(160). In addition, attention has been paid to take proportional sample house hold heads from each PA, according to the total number of house hold heads it contains. Also, in each PA, the sample size was distributed proportional to each Got(sub-PA) in relation to the size(number) of house hold heads . This helped to provide equal chances for each house hold heads in the PA. After so doing, the sample household heads were selected using simple random sampling technique.

3.5 ***Instruments of data collection***

In the process of data collection the instruments used were:

- Instrument -1 : Structured questionnaires for target household heads with closed and open ended questions and it was pre- tested .
- Instrument -2 : Discussion checklist for kebele NRM agents (DAs).
- Instrument -3 : Discussion checklist for natural resource conservation experts of woreda, agricultural and rural development office .
- Instrument -4 : Discussion guide line for zonal and regional NRM experts
- Instrument -5 : Focus group discussion guide lines for five focus group Discussants in the five sample kebeles (7-10 group members for each FGD). That is, three groups from adopters of improved NRM technologies and the other two from non adopter groups.
- Instrument -6 : An observation checklist for direct field observation of 45 plots of the sampled HHHs was used. i.e , 20 plots from bund construction technology and 25 plots from tree planting in a wood lot technology were observed by the investigator himself directly to supplement the survey.

Questionnaire for target household heads was translated in to local language to increase the enumerators confidence and accuracy , by avoiding communication gap and understanding barrier. The enumerators who fluently speak and write the local language (Amharic) administered it. The investigator did close supervision and daily follow up upon household heads data collection tasks by enumerators. On top of that, each and every interview with DAs , conservation experts, at different levels and focus group discussions

with the farmers, as well as the direct on farm field observations of implemented NRM technologies were conducted by the researcher himself.

3.6 Field Survey

Two preliminary field visits were under taken by the investigator before the actual survey in the study area. The first field visit, was held between October 1-8,2005, to asses the over all feature of the study area. This visit helped to formulate the research objectives, hypothesis and research questions based on the current socio - economic and demographic settings .

The second field visit was under taken between January 6-16,2006. During this period the researcher got a chance to make preliminary observation on three house holds' on farm conservation activities in two different PAs (Abadara-Agaga and Bacha dimessa). In addition to this, three of the draft research instruments out of the six i.e the Questionnaire, DAs interview format, woreda conservation experts interview format , were pre-tested which enabled to omit some of the un-necessary questions and to include other essential questions.

The actual field work /data collection/ was under taken between beginning of February to end of March, 2006,by the investigator and other five enumerators. The field enumerators were selected on basis of their familiarity with the study area and by the work experience as well as their educational back ground. Four of them were development agents (DAs) with different and sufficient years of experience in rural works. The other , enumerator was a surveyor in land use and land administration with four years of experience. Two days training was also given by the researcher to these enumerators on how to conduct interview with farmers and record information. They were also familiarized with general key research techniques. The investigator was also monitoring and helping them by checking and inspecting the daily-recorded data sheets /questionnaires/ .

3.7 Measurement

In this subsection the measurement of the dependent and independent variables are explained. The dependent variable is the adoption of improved NRM technologies specifically, the bund and woodlot tree planting technologies. The independent variables are: household characteristics like age, educational status and attitude of the household heads towards the technologies as well as labour availability in the households. Resource endowments like land availability and

livestock size. Policy issues like agricultural extension service delivery (frequency of extension contacts), land tenure security, physical access of market and participation of the land users at planning stage of NRM works are investigated. Hence, the measurement of each variable in the study looks like the following:

Adoption

Adoption in this case study is to mean the implementation or non implementation of the technologies under investigation on the plot/plots of the farm lands of the households in their farming experience. This condition is assessed by the pre-designed formal questionnaire suppositions prepared intentionally to the households/farmers. That is, whether the farmer is implemented the improved NRM technologies or not on any of his/her plot of land after the land becomes his holding. If the farmers respond " yes" to the questions posed to them to that specific technology then they implemented the technologies and grouped as adopters and if they respond " No" they didn't implemented the technology at all and grouped as non adopters.

- *Age of the house hold heads:*

Since, age is a proxy to farming experience it was assumed that the older the farmer in his age the better will be the level of adoption to NRM technologies than the younger counter parts .

- *Labour Size of the Household .*

Active labour size of the households is viewed to be another chief component in decision-making strategies. Labour size is measured in terms of the extent of active labour size available for conservation related works. The respondents were asked to indicate those household members who are participating actively in labour intensive works beneficial to the households. Hence, supposedly the higher active labour size of the households , the better the state of adoption. Active labour size of the house hold considered in this study is the age group between 15-59 years old .

- *Land holding size*

Land holding size in terms of area of farm land owned or occupied by an individual in' timad' (one "timad"= 0.25 hactare) is regarded as a key factor in adoption decisions. Farmers were asked to indicate the approximate size of their holding. The assumption follows that the larger the size of the landholding, the better the state of adoption NRM technology like bund information and tree planting a woodlot .

- ***Livestock Resource size of HHs***

This factor is seen to be highly interrelated with other factors like HHs income level. Hence, the assumption is that the higher the number of livestock the better will be the adoption. This is because livestock is the source of income from byproducts, crop products and the direct sale of animals .Hence, the farmers will get confidence to try new/risky technologies on their farm lands .

Agricultural extension service delivery (frequency of extension contact)

Each respondent was asked to indicate the training provided by the woreda office of agriculture and rural development in the past years and extension contacts made in a year with NRM agents (DAs). It was assumed that the more the frequency of access to extension contact the higher will be the exposure and awareness of the farmers for the appropriate technology and its subsequent adoption.

Educational status of HHs

If a farmer was attended /attending formal education he /she will be exposed to new information and could understand the bad and the good . Hence, if the farmer attended/attending formal education, he/she will have better level of adoption.

- ***Land Tenure security***

Land tenure security or insecurity and its influence on adoption of improved NRM technologies was measured by the farmers response of their feeling on the current land tenure system. i.e whether they feel secured or not to the current land holding system . Thus, it was assumed that , farmers feel secured to their land holding, will invest their money and labour for permanent improvement of their land holding and hence, there will be better adoption decision of improved NRM technologies.

Physical Access of Market

The shorter the distance of market to the residence of the farmers or their farm plots and the presence or absence of all weather roads near the residence or farm plots could hindered /promoted the adoption condition of NRM technologies. Thus, it is assumed that the better the accessibility of this factor, there will be better rate of adoption of these technologies and vice versa.

-Participation of beneficiaries in planning of NRM activities

Responses in regard to their active participation levels in the NRM intervention efforts can be operationalized by asking farmers about their participation roles. Thus, the higher the participation in planning of improved NRM works, the better will be the state of adoption.

- Attitude

Attitude as indicated in (Belay 1992b:) is the positive or negative feelings, emotions and sentiments of farmers towards accepting or rejecting the implementation of natural resource conservation measures. Farmers' attitudes towards natural resource conservation may have an effect on their adoption decision of conservation measures. The attitudinal trend in regard to adoption of the envisaged conservation measures can be measured by using Liker scale. That is Strongly agree, Agree ,Neutral (undecided) ,Disagree, Strongly disagree Scale. Eight statements describing about the introduced NRM technologies; 4 positive and the other 4 negative were included in HHHs survey questionnaire. If higher percentage of farmers show agreement for positive statements and disagreement for negative statements, then it is assumed that farmers attitude towards improved NRM technology is favorable/Positive or vice versa.

3.8 Method of Data Analysis

The data gathered through different instruments was analyzed using quantitative and qualitative data analysis techniques. Firstly, the data, particularly the surveyed data through structured questionnaire was checked for accuracy, use fullness and completeness. Secondly, the raw data was post coded. It was followed by analysis employing, descriptive statistical tools using statistical package for social science for windows 10, (SPSS 1999). Frequency and percentage tables, descriptive statistics, cross tabulations, chi-square and t-test analysis results with their significance level were used. That is, since the analysis has the nature of comparison between the households who implemented NRM technologies on any of their fields and were identified and grouped as adopter and the households who do not implemented on none of their fields were identified and grouped as non-adopters; the cross tabulation technique(Norusis,1990) was used to compare the households and /or heads characteristics, their resource endowments and external institutional factors between the adopters and non-adopters. The statistical significance of the identified adoption factors was evaluated by the t-test and chi-squared (x^2) analysis methods. These methods compare the extent of differences and similarity between groups as the test statistics(Devore and Peak,1993). Qualitative analysis were also used to

achieve the stated objectives and to test the research questions and hypotheses. The study heavily relied for qualitative analysis on the tools of focus group discussions, discussion with NRM agents(DAs), and experts at different levels (woreda, zonal and regional level). Secondary data from kebele, woreda, zonal, regional and national offices has also served for the same purpose. Maps and photos were also used to support the results of analysis.

CHAPTER FOUR

4. The Study Area

Dangila is one of the high land woredas of Awi zone in Amhara Region (North Western Ethiopia). The area is exploited for several millennia. Some of the focus group discussants and informants state that, in the last three decades, the general standard of living of the rural people has been deteriorating. The reason, as described by farmers is the degradation of natural resources that further constrains the socio-economic development of the study area. Increasing population pressure on resources coupled with various practices including over cultivation, over grazing, deforestation with little(no) conservation, causes behind the land resources degradation. Hence, the study area looks like the following.

4.1 Physical conditions

Location

Dangila woreda is one of the highland woredas of Awi zone in Amhara region The woreda town Dangila is located some 487 kms and 80 kms to the north west of Addis Ababa and South western of Bahirdar respectively(WOAaRD). The geographical boundaries of the woreda include; Jawuy and Achefer woredas in the North , Fagitalekoma and Gaangua woreda in the South, Jawuy woreda in the west and Achefer and Mecha woredas in the east(See annex 7, the location map of Dangilla Woreda in the region). The total area of Dangilla woreda is about 1392.3 sq.km. (WOAaRD).

Topography

The altitudal range various from 1500 to 2400 m.a.s.l. The study area is characterized by an undulating plateau. Steep slopes are Common (WOAaRD)

Climate- Temperature and Rainfall

The mean annual temperature ranges between 16^0c and 27^0c for minimum and maximum respectively. The average annual rain fall of the area is 1481 mm/year (WOAaRD). Dominantly there are two seasons. Atypical dry season prevails between October and April .The summer(Meher Season) is between June and September. More over, in recent years, the area has experienced great variability in both the timing ,volume and distribution of rain fall. There is considerable inter annual variation in rainfall, although little evidence exists to support the

popular belief that rain fall in Dangilla woreda has been declining. This has disturbed the age-old practiced agricultural calendar of the area and has caused a decrease of agricultural production in some cropping seasons. The erratic nature and pattern shift of the rain fall also highly affects the crop production in most of the recent years.

Forest/Vegetation

Vegetation cover plays a major role in retaining soil and water and in modifying the extremes of local (Micro) Climate. The high lands of the study area, were once renowned for their thick forest of indigenous species. But, land pressure for agriculture and Settlement and consequent deforestation have resulted in their degradation and eventual transformation of most of original Vegetation into bush and grass lands. Deforestation has also contributed to a considerable acceleration in the intensity of the process of soil erosion and land degradation(WOAaRD). Hence, deforestation and degradation process are therefore, both wide spread. Some of the informants have witnessed that getting fire/fuel wood from natural forest is un thinkable now a days unless some eucalyptus trees are planted in the homesteads .Some of the poor households with out land for woodlots indicate that, they are forced to divert the little cow dung available for fuel consumption , although they are quite aware of its substantial use for fertilization of their farm lands.

Soil

In non-technical popular expressions there are three main types of soils. These are: red, black, brownish and gray soils. However, the dominant arable soil of the study area is red soil, that is estimated to cover about 50% of the study area. The soil is already depleted as a result continuous cultivation and the effect of erosion. Now a days, growing crops with out the application of either artificial or natural fertilizer is unthinkable, though the rate of application is not as expected.

Water Resources

The mountains in the study area are sources of some rivers and streams that flows in to the Abay River; However, as focus group discussants and some key informants observation during the dry seasons, the majority of the study PAs and sub PAs lack water for consumption of both human and livestock population . Fetching water for house hold in some PAs is a heavy task, which is sapping their energy and time. In some cases they should walk for more than 30 minutes to get a single pot of water in dry seasons(WOAaRD).

There are nine rivers and 35 springs in the study area. However the volume of this streams will highly decrease and the majority of the springs will be dried in dry seasons. Hence, using these water bodies for irrigation in some PAs is not possible since consumption for human and livestock itself is in question.

4.2 Socio – Economic Conditions

Demographic Features

According to the 1994 census result of the study area, the total population is 149,091(CSA 1996). The over all population density in the woreda is 107 persons/km^2 which is by far above the average population density for the country, which is 84 person per km^2 . The natural population growth of the woreda as a whole is also high and it is 2.9 percent per annum which is faster than the estimated natural growth rate of 2.7 percent per year for the nation as a whole(WOAaRD).

Economic Conditions

In the study area livelihoods are primarily agricultural. The traditional agriculture of the area is basically mixed agriculture. That is, crop and livestock production. In this subtopic some of the major economic activities are discussed below.

i) Farming System

Crop – Production

The farming system is thoroughly dominated by small scale, and subsistence agriculture with traditional ways of production. This strategy is however, doesn't help to increase agricultural productivity and satisfy (fulfill), the high needs of house hold consumption, which is growing with the increased households family size. Farmers in the subsistence farming system cultivate small quantities of hactarage but a large number of crops including cereals oil crops, pulses and root crops. Out of which cereal crops like maize, barely ,teff and finger millet are dominantly cultivated. (WOAaRD).

Livestock Production

The size livestock population of the study area is large and it is beyond the carrying capacity of the range /grazing lands available . For instance according to 2004/05 rural farm survey result of the study area by woreda agricultural and rural development office, the total number of livestock is estimated to be 300,724. Thus, Since the total area of grazing land is 236.78 km^2 , then the population density of live stock is 1270/km2, which is very huge in size (WoAaRD).

ii) Land use/land cover

According to the field survey result of this study area 97.9 percent of the land is used for cropping land and grazing land. However, the land which is covered by forest/vegetation is only 1.9 percent. Also, the land which could be fallowed annually is estimated to be 0.1 percent of the total farm land (Table-6).

iii) Natural Resource Management intervention efforts.

If we look into the major natural resource management intervention efforts like bund formation and tree planting activities of the study area; soil bund formation and tree planting in different systems are the ones implemented relatively in a wider extent both at on farm and off farm sites. For instance, the hectarage of soil bund formation by the farmers in the physical years of 2004, 2005 and 2006 was, 7117.5, 699 and 1137.5 hectares respectively and showing a decreasing trend . On the other hand, the hectarage covered by trees in the years of 2004 and 2005, was 390 and 650 Hectares respectively which was planted both at the household and community level (WOAaRD).

CHAPTER FIVE

5. RESULTS AND DISCUSSION

In the results and discussion part of this paper basic socio-economic, institutional and land characteristics of the sample households, the trend of natural resource use and farmers understanding of the resource degradation, types of major improved NRM technologies implemented in the study area , the state of adoption of these technologies and the socio-economic and institutional factors associated to adoption or affecting the incidence and intensity of adoption of two selected natural resource management technologies(one from soil management and the other from forest management technologies)are discussed . Only two improved NRM technologies are selected for discussion because of their wide application and economic as well as ecological importance in the study area.

5.1 Basic Socio-Economic Characteristics of the Sample Households.

In the study area, there were a total of 4884 household heads in five sample peasant associations(PAs). Out of which 160 sample households heads were selected and surveyed. But only the data of 148 sample household heads were taken for further analysis and discussion. This is because, 12 sample household data were deficient with the necessary information (Table-1).

The basic socio-economic characteristics considered in this investigation are; the social characteristics like background of the household heads (age and level of education) , family and labor size of the households and the economic characteristics like , land availability and land use type as well as livestock size of the households are considered.

The background information of 148 sample household heads (respondents) like, sex, age, marital status, educational level, experience in the study area(period lived in the PA) are indicated in Table-2 below .

Table 2- Back ground Information of the Sample Household Heads (Respondents)

Back ground	Count	%
➢ Sex of respondents		
o Male	133	89.9
o Female	15	10.1
Total	148	100
➢ Age category of respondents		
o 20 – 30 Years old	24	16.2
o 31 – 40 Years old	40	27.0
o 41 – 50 Years old	41	27.7
o 51 – 60 Years old	34	23
o above 60 year old	9	6.1
Total	148	100
➢ Educational status		
o Never attended formal education	119	80.4
o Attended/attending formal education	29	19.6
Total	148	100
➢ Marital status		
▪ Single	4	2.7
▪ Married	133	89.9
▪ Separated	5	3.4
▪ widowed	6	4
Total	148	100
➢ Period lived in the PA		
o 1 – 10 Years	-	-
o 11 – 20 Years	4	2.7
o 21 – 30 Years	26	17.6
o More than 30 Years	118	79.7
Total	148	100

Source- Field survey, 2006

As it is indicated in Table –2, the sex composition of sample household heads (HHHs) , from the five peasant associations (PAs), is 89.9 percent are males and 10.1 percent are females. With regard to age structure of sample HHHs, the majority of them are in the category of active labour age group. That is, 93.9 percent of the respondents are in the age category between 20 – 60 years old. As to the educational level, 80.4 percent of the sample household heads, never attended the formal education. Among the respondents those who attended/attending the formal education are

only 19.6 percent. On the other hand, 89.9 percent of the respondents are married and also 79.7 percent of the sample HHHs have lived in their PAs for more than 30 years (Table- 2).

The other social characteristics is, the size of family in different age category and the active labour age group (labor available) in the sample house holds.

Table 3 – Household size in Number and in the Age Category of the Sample House Holds including House Hold Heads by sex

Sex	Age group(age category)								Total	
	< 7		7 – 14		15 – 59		≥ 60			
	No	%	No	%	No	%	No	%	No	%
Male	147	13.6	210	19.4	234	21.6	9	0.83	600	55.4
Female	126	11.6	149	13.8	199	18.4	9	0.83	483	44.6
Total	273	25.2	359	33.2	433	40	18	1.66	1083	100

Source:- Field survey, 2006

Note :- Active labour age group is the age category of 15 – 59 , and it accounts only 40% of the total family size

- *From total family size 44.6% are females*

In the study area, from the total sample households 55.4 percent of the family members are males and 44.6% are females. Moreover the active labour age group (the age between,15-59) accounts for 40 percent of the total family size of the sample HHs .The children, below or equal to the age of 14 and the old people above or equal to the age of 60 account 60 percent of the total sample household size (Table-3).

The active labour age group in this study is in the age category of 15-59 years old. Hence, the active labour size of the sample households of the study area is shown Table 4 below

Table – 4 House Hold's labour size (active) in the age category of 15 – 59 Years old in Ranges

Labour size	Count	%
1(One)	**8**	**5.4**
2-3	**85**	**57.4**
4-5	**37**	**25**
≥ 6	**18**	**12.2**
Total	148	100

Source: - Field survey,2006

As it is shown in Table-4 , the majority (82.4 %) of the sample house holds possess 2-5 active labour size in their households . And, 12.2 percent of the sample house holds posses 6 or above 6 active labour size in their households .

As to the economic characteristics of the sampled households, since their economy is mainly dependent upon agriculture; land and livestock are considered as the basic assets.

According to the survey result shown in Table –5, the majority of the sample households, (68.3 percent) of them held less than or equal to 8 ' timad' (2 hectares). It is only 31.7 percent of the sample households had greater than 8 `timad` (above 2 hectares).

Table – 5 Land Availability(Holding size) of the HouseHolds Timad (Percent of Respondents)

Land Size in 'timad'	Count	%
< 2 timad	2	1.4
2-4 timad	38	25.7
5-8 timad	61	41.2
9-12timad	46	31.0
> 12timad	1	0.7
Total	148	100

Source :- Field survey,2006

Note :- One timad = 0.25 hectare

Moreover the mean land holding size of the study area is 7.01 'timad ' or 1.75 hectares as it is shown in Table 6 below. However, there is some difference between sample PAs in the mean

land holding size. Particularly, the two PAs (Abadra Agaga and Ziguda Gult) sample house holds possessed above average of the study area; i.e 8.66 timads and 8.2 timads respectively. The largest share that is, 80.9 percent of the total sample households land holding is used for crop production . It is only 19.1 percent of the land holding is used for other land use types; like grazing land, fallow land, forest (vegetation) land which is 1.9 percent, and land for other purpose such as house construction and its compounds, village roads...etc

Table – 6 The Mean Land Holding Size by each Land use type by PA in Number of " Timad"

Type of land use	Peasant associations and the mean land holding size in "timad"					Total	
	Abadra Agaga	Dubi Mikael	Gumdri Abila Akena	Zeguda Gult	Zubra Quandisha	Mean of woreda	%
➢ Cropping land	7.29	4.83	4.55	6.87	4.15	5.67	80.9
➢ Grazing land	1.15	1.24	1.11	1.10	1.44	1.19	17
➢ Fallow land	0.03	0.00	0.00	0.00	0.00	0.007	0.1
➢ Forest/Vegetation land	0.18	0.01	0.00	0.23	0.23	0.13	1.9
➢ Land for other purposes	0.01	0.00	0.05	0.00	0.00	0.01	0.1
Total	8.66	6.08	5.71	8.2	5.82	7.01	100

Source :- Field survey,2006
Note :- One timad = 0.25 hectare

Coming to the livestock population of the study area, the sample survey result indicated in Table - 7 revealed that the majority of the livestock holding is cattle population, which is, 82.7 percent of the total livestock .From the total cattle population 32.5 percent is the number of oxen, which are economically important to increase agricultural production for households food requirement as well as to enhance the income level that enabled the farmers to buy conservation tools, seedlings of trees and labour for NRM works, from crop product sales. The average (mean) size of total livestock size of the study area in TLU is 5.4 per household.

Table – 7 Size of live stock population in number and tropical live stock unit (TLU) equivalent

Type of live stock	Number of live stock and its TLU equivalent		
	No	TLU equivalent	
		TLU	%
Ox	324	259.20	32.5
Cow	285	256.50	32.2
Heifer and bull	239	143.40	18.0
Calf	191	19.10	2.4
Goat	77	7.70	0.97
Sheep	287	28.70	3.6
Equines	124	83.08	10.4
Total	1527	797.68	100.00
Mean	10.32	5.4	-

Source:- Field survey ,2006

Note : - Chicken owned was not included in the size of live stock population, because it was difficult to find reliable data

- *Conversion factors used for TLU equivalent are: dairy cow =0.9, Ox=0.8; heifer/bull=0.6; Calf=0.1 ,Sheep/ goat= 0.1 ,Equines (Horse ,Mule, Donkey)=0.67, according to Jahnke (1982).*

On the other hand, the total livestock condition of the study area, shown in Table-8 below tells us that,71.6 percent of the sample households possessed 3-10 livestock (TLU) per head. It is only 16.2 percent of the households possessed above 10 livestock per head. The rest (12.2 percent) of the sample house holds possessed as small as less than 3 live stocks per head.

Table – 8 Range of Total Livestock Size of HHs in TLU Equivalent (Percent of Respondents)

Range of live stock size in TLU	Percent of respondents	
	Count	%
Less than 3	18	12.2
3 – 6	62	41.9
7 – 10	44	29.7
More than 10	24	16.2
Total	148	100

Source:- Field survey,2006

5.2 Topographic Characteristics (Slope) of the Farm Land of Sample House holds

Farmers of the study area are cultivating farm lands with different slope categories as it is shown in Table-9 below. Among the total sample households, 95.3 percent of the farmers cultivate the land with a slope ranging from gentle to steep slope which requires construction of conservation works to control soil erosion. Especially, 85.2 percent of the farmers cultivate the land with its slope gradient from sloping ('betam tedafat') to steep sloping ('terarama'). That is they are holding the land with slope percentage of 8-50 percent gradient, which requires serious attention and care to control soil erosion in areas where there is torrential rainfall, susceptible soil type which is a typical characteristics of the study area (MOA,2001).

Table – 9 Slope Classification of the Farmlands(on average) of Sampled HHs (Percent of Respondents)

Slope of the land	Count	Percent
- Plain land('Medama')	7	4.7
- Gently sloping (' Tedafat')	15	10.1
- Sloping ('Betam tedafat')	29	19.6
- Moderately steep slope ('Dagetama')	80	54.1
- Steep slope ('Terarama')	17	11.50
Total	148	100

Source:- Field survey,2006

Note :- The percentages of the slope of the land according to Ministry of agriculture (2001) soil and water conservation manual (guide line for Ethiopia)

- *Plain land ('Medama') = 0 – 2.99 %*
- *Gently Sloping ('Tedafat') = 3 –7.99 %*
- *Sloping ('Betam tedafat') = 8 – 14.99 %*
- *Moderately steep slope (' Dagetama') = 15 – 29.99 %*
- *Steep slope ('Terarama') = 30 – 50 %*

5.3 Some Basic Institutional Characteristics of the study area related to NRM

Some of the basic institutional characteristics related to natural resource management activities considered in this study were Agricultural extension service delivery (frequency of extension contacts) of sampled house holds by conservation agents(DAs), access of primary schools, farmers training center (FTC), all weather roads and distance of PAs from woreda town are taken into account.

5.3.1 Agricultural extension service delivery(frequency of extension contacts) by conservation Agents (DAs).

The frequency of extension contacts by conservation agents to the farmers, particularly to the sample house holds of the study area was surveyed for each PA, by taking in to account the service delivered in the year 2004/ 2005,extension activities of conservation agents regarding the natural resource management issues. That is, the number/frequency/ of extension contact was analyzed by classifying it in to three categories of number of contacts i.e, less than 50, 50-100, 101-150(Table 10)

Table -10 Frequency of Agricultural Extension Contacts of Sampled HHs by Conservation Agents(DAs) in a year (2004/5) in PAs for NRM activities (Percent of Respondents).

No	PAs	Number of contact in a year in ranges						Total	
		<50		50-100		101-150			
		Count	%	Count	%	Count	%	Count	%
1	AbadraAgaga	35	29.9(97.2)	1	3.6(2.8)	0	0	36	24.3(100)
2	DubiMichael	25	21.4(100)	0	0	0	0	25	16.9(100)
3	GumdriAblaAkena	26	22.2(78.8)	6	21.4(18.2)	1	33.3(3)	33	22.3(100)
4	ZigudaGult	7	6(23.3)	21	75(70)	2	66.7(6.7)	30	20.3(100)
5	ZubraQuandisha	24	20.5(100)	0	0	0	0	24	16.2(100)
	Total	117	100(79.1)	28	100(18.9)	3	100(2)	148	100

Source:- Field survey,2006

Note :- Figures in parentheses are percentage shares for each range of extension contacts in each PA.

The majority (79.1 percent) of the sample households of the study area have got less than 50 contacts in the year 2004/5. The other group of sample households (18.9 percent) receive 50-100 contacts. The rest (2 percent) of the respondents have got 101-150 contacts in the year 2004/2005.

That is, most of the sample households of the study area received an extension service of less than one day in a week. This shows that the frequency of agricultural extension contacts provided to the farmers of the study area regarding natural resource management activities is very low. Thus, this kind of agricultural extension service delivery is insufficient to influence the farmers mentality and enable them to adopt improved NRM technologies .

5.3.2 Access of Some Basic Institutions (Infrastructures) and Distance of PAs from woreda town (Markets)

Accessibility condition of some basic institutions/infrastructures/ related to natural resource management activities, like, access of primary schools, Farmers Training enters (FTC), all weathered roads, and the distance of PAs from woreda town(Market) are indicated in Table-11 below.

Table-11 Access of Primary School ,Farmers Training Centers (FTCs) , All Weather Roads and Distance of PA from woreda Town to each Peasant Associations

No	Name of peasant Associations	Access of primary School	Access of farmers training center	Access of all weathered roads	Distance of PA from woreda Town
1	AbadraAgaga	Have access	–	No access	14 km
2	DubiMichael	Have access	–	Partially have access	12km
3	GumdriAblaAkena	Have access	Have access	Partially have access	11km
4	ZigudaGult	Have access	Have access	Partially have access	7km
5	ZubraQuandisha	Have access	Have access	No access	8km
	Total	5	3	3	-

Source:- Woreda Office of Agriculture and Rural Development, 2006

Thus, as it is indicated in Table - 11 above all sample PAs have access of primary schools, though it may not be sufficient for some wider PAs like Abadra Agaga to accommodate all the adults and children who need education. On the other hand, farmers training centers (FTC) which are very important institutions for farmers training and technology diffusion are built only in three PAs out of the five PAs . From these three centers themselves no center is functional currently, due to the problem of logistics.

With regard to access of all weather roads, three of the sample PAs do have partial accessibility. That is all weather roads are passing through some villages of the PAs of Dubimicheal, GumdriAbilaAkena and ZigudaGult. The other two PAs(Abadragaga and ZubraQuandisha) do not have all weather road access at all and hence transporting of agricultural products, particularly forest products like ,fuel wood, poles and logs to the market is a very difficult task for the farmers, as it is evidenced from FGD and NRM agents (DAs) discussion results.

The distances of sample PAs from Woreda town have also been assessed. The survey result have shown that, there is significant distance difference between the farthest and nearest PAs. For instance, the distance of the nearest PA from its center to woreda town is 7kms. Where as that of the farthest PA is 14 kms. As a whole, three PAs out of the five sample PAs have a distance of more than 10kms from the woreda center /town. The focus group discussant members

of these PAs suggested that, absence of all weather roads and the distance from the market have influenced them not to plant trees in a woodlot technology and hindered them to earn income from tree products.

Thus, accessibility of basic social and physical infrastructures like roads schools and farmers training centers could positively influence the land users to do long term investments like tree planting on their farm holdings

5.4 Trends of Natural Resource use and Farmers Understanding of the Degradation

The trend of natural resource use by the farmers of the study area and the extent of their understanding to the current feature of natural resources degradation is discussed in this part of the paper. The natural resources considered are; soil (land), forest (Vegetation), Pasture (range) land, and water resource.

As to the soil (land) degradation, the majority of the sample household heads(97.3%) confirmed that the quality of their farming land is becoming deteriorated from time to time(Table –12)

Table- 12 Farmers' Understanding Towards Farmland Degradation /Soil Degradation (Percent of Respondents)

Issue	Count	%
How do you view the quality of your land?		
- Still fertile	3	2.0
- Becoming poor	144	97.3
- Other	1	0.7
Total	148	100
Do you observe soil/land degradation in your farm land ?		
- Yes	137	92.6
- No	11	7.4
Total	148	100
What is the extent of degradation ?		
- Low	6	4.0
- Moderate	62	41.9
- Severe/high	73	49.4
- Do not know	7	4.7
Total	148	100
What are the manifestations or indicators of soil degradation ?		
- Loss of productivity	131	88.5
- Change of soil colour	1	0.7
- Gully formation	10	6.8
- Other	6	4.0
Total	148	100
What are the causes of soil degradation in your view ?		
- Miss management (miss utilization)	22	14.9
- Shortage of farm land to practice fallowing	69	46.7
- Sloppiness of the cultivated land	2	1.4
- Torrential rain fall	1	0.7
- All of the above	54	36.5
Total	148	100

Source:- Field survey,2006

As it is indicated in Table 12 above ,97.3 percent of the sample household heads farming land/land holding is becoming poor in its quality. This is because of the soil/land degradation problem, as 92.6 percent of the respondents responded to the question posed to them " Do you observe soil/ land degradation in your farm"? . On top of this, the extent of degradation is ranging from moderate to severe/high. That is 91.3 percent of the respondents experienced either moderate or severe degradation of their land holding. Particularly, 49.4 percent of the sample household heads responded that they have severe soil degradation problem. As the respondents response in Table 12 the main manifestations or indicator of soil degradation is loss of productivity followed by gully formation. The farmers had diverse views with regard to the causes of soil degradation (Table 12) . Some (14.9%) of them said that the cause is mis management, others(46.7%) believed that ,shortage of farm land is the cause, because they are

unable to practice fallowing. Still the other segments of the respondents(36.5%), said that a combination of factors are the causes. That is , miss management of the land, shortage of farm land, sloppiness of the cultivated land and torrential rainfall are the causes of soil degradation.

The sample household heads (farmers) were also asked whether they practiced soil enriching practices in their farm lands or not. Their response is indicated in Table-13 below.

Table – 13 Soil Fertility Enriching Practices by the Sample HH Farmers of the Study Area.

Practices	Count	%
Did you use much of the dung and crop residue you got for soil fertility maintenance?		
- Yes	65	43.92
- No	83	56.08
Total	148	100
If you do not use the dung and crop residue for soil fertility maintenance for what purpose do you use it ?		
- For fuel	30	36.1
- Crop residue for animal feed	49	59.1
- For both purposes	4	4.8
Total	83	100
Did you practice fallowing ?		
- Yes	16	10.8
- No	132	89.2
Total	148	100
Did you practice Crop-rotation		
- Yes	145	98
- No	3	2
Total	148	100

Source:- Field survey,2006

Note :- The total number of respondents may not add up148 for some of the questions since these questions may not be relevant to some of the respondents.

As it is shown in Table-13,56.08 percent of the respondents do not use dung and crop residue for soil fertility maintenance. Instead, they used it for fuel and some amount of the crop-residue for animal feed. For instance 59.1 percent of the respondents replied that, they used the crop residues for animal feeds because of the shortage of pasture or range lands. Moreover, due to the scarcity of farm land, 89.2 percent of the sample house hold heads did not practice fallowing. It is only 10.8 percent of the respondents that practice fallowing technique to maintain the fertility of the soil of their farm lands. As the survey result of direct field observation by the investigator, the size of the fallowed land itself is very small in its area coverage for each sample households.

The land use type of the sample household heads of the study area in Table- 6, also indicate that , it is only 0.1 percent of the mean total land holding size is fallowed in the given period. However, surprisingly enough,98 percent of the sample household heads practiced crop-rotation(Table-13)

The other natural resource is forest or vegetation As it is indicated in Table-14, 64.2 percent of the respondents primary fuel source is fuel wood. However,66.9 percent of these sample households faced the shortage to satisfy their fuel source needs.

Table – 14 Farmers' Understanding to Forest/Vegetation Degradation

Issue	Count	%
What is the primary source of your fuel ?		
- Fuel wood	95	64.2
- Crop residue	13	8.8
- Dung	30	20.3
- All of the above	10	6.7
Total	148	100
Do you face shortage of fuel wood ?		
- Yes	99	66.9
- No	49	33.1
Total	148	100
If you face shortage of fuel wood what is/are the reasons?		
- I do not planted my own trees (in wood lot)	25	25.3
- I used all the trees which were in my farm land	21	21.2
- Communally owned forests are exploited	36	36.4
- All of the above	17	17.1
Total	99	100

Source:- Field survey,2006

Note :- The total number of respondents may not add up 148 to some of the questions since these questions may not be relevant to some of the respondents.

The reasons given by the respondents to the shortage of fuel wood is different. As it is indicated in Table 14 again, some,25.3 percent of them said that, they did not plant trees in their land holdings. Others(21.2 percent) faced the problem since they cut all the trees which had been grown in their farm lands . Still, Others (36.4 percent) gave as a reasons for the shortage is that ,these days they can't collect fuel wood from communally owned forests; since these forests are highly exploited, because, the largest share of their fuel sources are communally owned forests. The focus group discussants from five PAs also confirmed that, now a days, the majority of the house holds in their PA can't satisfy their fuel wood needs. Rather, they are supplemented by

dung and crop-residues. The reason they forwarded is that, it is due to accelerated rate of deforestation, Particularly, upon communally and state owned forests.

As far as the pasture(range) land and its deterioration is concerned,91.9 percent of the respondents responded that ,they have shortage of feed for their live stocks. Only 8.1 percent of them relatively can feed their livestock satisfactorily (Table 15). Different reasons were given for the cause of the shortage. The majority, (52.2 percent) of the respondents believed that the cause is the transformation of range lands to cultivated lands . Others(6.6 %) believed that high live stock population size brought about the shortage. The other group of respondents (5.9%) of them said that the cause is problem of free grazing practice. However;33.8 percent of the respondents suggested that all of the above including the quality deterioration of the range land are the causes for the shortage (Table-15). Hence ,the respondents were asked to suggest the solutions to range land shortage problem in Table-15 . Thus, the majority (52.2 %) suggested that decreasing the size of local breed livestock to the manageable size and include few number of improved live stock breeds in the breeding system as a solution to reduce the pressure upon the pasture/range lands is recommended . However, only 1.5 percent of the respondents supported to follow zero grazing technique as the solution. The rest 30.9 percent of them suggested that, all the alternative solutions mentioned above including continuing to use the existing grazing lands with better management could be the solutions to the problem .

Table- 15 Farmers' Understanding to Pasture and Rangeland Deterioration

Issue	Count	%
Do you have shortage of pasture or feed to your live stock?		
- Yes	136	91.9
- No	12	8.1
Total	148	100
What are the causes of shortage ?		
- Range lands are transformed to cultivated lands	71	52.2
- High live stock population on existing range land	9	6.6
- Due to free grazing practice	8	5.9
- The quality of range land is deteriorated	2	1.5
- All the above	46	33.8
Total	136	100
If you have shortage of pasture/range/ land, what should be the solution in your view?		
- Follow zero-grazing technique	2	1.5
- Decrease size of live stock population	22	16.2
- Use manageable size of improved livestock breeds	49	36
- Continue to use the existing grazing land with better	21	15.4
- All of the above	42	30.9
Total	136	100

Source:- Field survey,2006

Note: The total number of respondents may not add up 148 for some of the questions since these questions may not be relevant to some of the respondents.

With regard to water resources depletion the sample household heads assure that, there is stream flow decrease from time to time and this creates water shortage both for irrigation and consumption(Table –16).

Table – 16 Farmers' Understanding to Water Resources Depletion

Issue	Count	%
Do you have shortage of source of water for irrigation ?		
- Yes	136	91.9
- No	12	8.1
Total	148	100
Do you face water shortage for the house hold and live stock?		
- Yes	110	74.3
- No	38	25.7
Total	148	100
What are the possible reasons for the shortage ?		
- Springs and small rivers dried in dry seasons	106	78.0
- There is water source problem around the locality	3	2.2
- There is large human & live stock population size	6	4.4
- All of the above	21	15.4
Total	136	100

Source:- Field survey , 2006

Note :-The total number of respondents may not add up 148 for some of the questions since these questions may not be relevant to some of the respondents .

As it is shown in Table 16 above, among the sample household heads 91.9 percent of them responded that there is shortage of water for irrigation in the study PAs. It is only 8.1 percent of them have access of water for irrigation. The shortage is not only for irrigation water but also for consumption both for the house hold members and live stocks, i.e, only 25.7 percent of the respondents do have better access of water for house hold and live stock consumption. The rest (74.3%) of the respondents have water shortage problem for consumption(households and livestock) during dry seasons. The major reasons for the shortage, as 78 percent of the respondents response is that springs and small rivers dry in dry seasons. As the focus group discussants suggestions(opinions) , Large human and live stock population pressure upon the existing streams, natural resource degradation, particularly forest resource deterioration at the heads and sides of stream flow brought about water resource depletion problem.

5.5 Improved NRM Technologies Practiced in the Study area

Some of the types of improved natural resource management technologies practiced in the study area are bunds, tree planting in a woodlot ,agro-forestry, compost making and using, constructing water harvesting structures and zero- grazing to the live stocks. The mode of implementation of these technologies has got two features in the study area . The first is house hold level implementation, and the other is community level implementation upon communally owned resources. Especially, the soil conservation structures and tree planting are practiced in both modes of implementation . Improved technologies implemented dominantly in the study area are bunds ,particularly, soil bunds from soil conservation technologies, woodlot tree planting and scattered trees /dispersed trees/ from tree planting technologies.

This study is basically based on the household level implementation of the improved NRM technologies. As the survey result of sample HHHs shown in Table-17, the implementers (adopters) percentage of bund technology is 79.2 percent and that of non implementers(non adopters) is 20.8 percent. The implementers(adopters) percentage of tree planting in a wood lot technology is 77.4 percent and that of the non implementers(non adopters) is 22.6 percent from total sample house hold heads. In the agro forestry techniques, 93.8 percent of the sample house holds practiced it in the form of scattered/dispersed/ trees on their crop land, range land or around their homesteads. Dispersed trees on the cultivated lands or range lands is a well adopted type of technology in the study area, as it is evidenced from the surveyed data, the suggestions of focus group discussants of five PAs as well as from the opinions of key

informants from PAs level to regional level. The rest three improved NRM technologies, i.e compost making and use, constructing water harvesting structures and zero-grazing technique are implemented in a lesser extent. The percentage of the implementation of these three technologies from the total surveyed sample households is 37.2 percent,1.6 percent and 16.1 percent respectively (Table-17).

Table – 17 Improved NRM Technologies Implemented in the Study Area (Percent of Respondents)

Technology	Have you implemented the following technologies?					
	Yes		No		Total	
	Count	%	Count	%	Count	%
Bund construction	114	79.2	30	20.8	144	100
Tree planting in a wood lot	103	77.4	30	22.6	133	100
Agro forestry practice (scattered trees on farm land)	136	93.8	9	6.2	145	100
Compost making and use	54	37.2	91	62.8	145	100
Constructing water harvesting structures	2	1.6	127	98.4	129	100
Applying zero-grazing technique	23	16.1	120	83.9	143	100

Source :- Field survey ,2006
Note :- The total number of respondents may not add up 148 for some of the questions since there were missing.

In this investigation ,two improved NRM technologies which are implemented in the study area are selected for further investigation and analysis. That is , to look the state/ incidence/ of adoption of these technologies and to identify the socio economic and institutional factors that are associated with the adoption condition of these two technologies are selected . These selected technologies for the analysis are:

1. Bund formation/bund construction/, as improved physical soil conservation, technology and
2. Tree planting in a wood lot as improved tree plantation technology.

The reasons for selection of these two technologies were: relatively, their wide application (implementation) in the study area, their economic and ecological importance to increase crop

and tree production, emphasis given to these technologies by policy makers and policy implementers at different levels, the adoption of these technologies is affected by different factors, time constraint, and the other three technologies out of the six are practiced/implemented/ in a lesser magnitude. However, agro forestry (dispersed trees), which is widely implemented and well adopted out of all the six technologies practiced in the study area, with little influence by the socio-economic and institutional factors as it is proved by the focus group discussants, and key informants is not included in this analysis, because it is well adopted and less constrained technology by socio economic factors in study area.

The investigator has tried to look into the survey results of the sample households responses upon implementation or non implementation of improved NRM technologies, by classifying a sample population into adopters (implementers) and non-adopters(non- implementers) to a specific technology in question for its adoption condition and analyze the factors associated with the adoption or non adoption of the technology. This is because, the decision on whether or not to adopt agricultural technology is influenced by many factors and their interactions(Workneh,2000). Hence, adoption needs a careful evaluation of a large number of technical, socio – economic and institutional factors. Potential adopters may be confronted with constraints such as lack of information and communication links with product and input markets. Moreover effective use of improved technological choices depend on capacities, which naturally are not symmetrically distributed across peasant households. Peasant's capacities are functions of their endowment profiles because technology claims resources (Abebe and Mulate,2003). It is not only the endowments available/capacities/ affect the scope or state of adoption but also are the social, political and institutional factors. Hence ,among the many socio-economic and institutional factors of adoption of improved NRM technologies, the main ones and related to the study area are considered. The socio-economic factors like age and education of the household heads , labour size (active) of the household, land availability/holding size/, physical access of market, livestock size, attitude of the beneficiaries towards technologies were considered Among the institutional factors or policy issues land tenure security, agricultural extension service delivery(frequency of extension contact by conservation agents) at the field level, participation of beneficiaries in planning of improved NRM technologies were taken for further investigation. These factors might promote or hinder the state of adoption of the above

selected NRM technologies in the study area. Thus, each and every factor related /associated with the adoption of bund technology or tree planting in wood lot will be treated separately.

5.5.1 Improved Physical Soil Conservation Technology/Bund Technology /

5.5.1.1 The Sate of Adoption of Bund Technology

The types of bunds practiced/implemented/in the study area on the basis of material used for construction are classified into soil bund(embankment), stone bund, and stone-faced soil bund. Among the sample households of the study area 79.2 percent of them had implemented this technology on their land holding. However, 20.8 percent of the households did not practice the technology in their land holding at all(Table- 18)

Table-18 Implementation/Adoption Incidence of Improved Physical Soil Conservation Technologies/Bunds/by Farmers/Percent of Respondents/

Issue	Count	%
Did you treat your farm lands/cultivated lands with improved physical soil conservation technologies(bund) after it becomes your holding		
- Yes	114	79.2
- No	30	20.8
Total	144	100
Can you mention the types of bunds you implemented		
- Stone bund	1	0.9
- Soil bund	101	88.6
- Stone faced soil bund	11	9.6
- Other(Specify)	1	0.9
Total	114	100
If you treated your lands with bund, approximately, how much proportion of your land holding is treated with this technology?		
- ½ of your holding	10	8.9
- 1/3 of your holding	30	26.5
- ¼ of your holding	39	34.5
- Less than 1/4 of your holding	34	30.1
Total	113	100

Source:- Field survey,2006

Note : - The total number of respondents may not add up 148 for some of the questions since there were missing .

As it is indicated in Table-18, among the farmers who adopted bund technology the majority of them (88.6%) preferred to implement soil bund embankment. This is because, as the majority of focus group discussants suggestion the material available for them is soil to form the bund. On the other hand, when we look the approximate proportion of land which is treated by bund, it

is only 35.4 percent of the adopters implemented the bund technology up on ½ - 1/3 of their land holding. However ,the majority (64.6 percent) of the adopters treated less or equal to ¼ of their land holding with the bund .

Thus, the above figures tell us that, even though, the adoption incidence of bund technology in the sample house holds looked like encouraging (79.2 percent); the adoption intensity is weak enough to solve the soil degradation problem as quickly as possible which is severe and covers the largest area of the study area. Moreover, all of the farmers in the study area did not implement(adopt) the bund technology. That is, 20.8 percent of the sample house holds did not adopt the technology(Table-18). The focus group discussants from five PAs, and all of the key informants, also confirm that , only insignificant area of land is treated with bunds when it is compared with the total area of land which needs treatment. The investigator also witnessed this fact during the direct field observation survey. On the other hand ,from the implementers themselves there were farmers who implemented the technologies on their farm lands with out there willingness.

Hence, why the adoption incidence (the percentage of users of the technology) and adoption intensity(area coverage) and farmers willingness difference is observed among the sample house hold farmers were the basic questions that must get answers. Obviously, this is due to the socio-economic , institutional and other related factors that could hindered/ promoted the state of adoption of bund technology. Thus, some of the main socio economic and institutional factors affecting the adoption condition of the technology in the study area are discussed as follows.

5.5.1.2 Socio-economic and Institutional Factors Affecting the Adoption of Improved Physical Soil Conservation Technology (Bund)

Among the socio-economic and institutional factors that are considered in this study are :age of house hold heads ,active labor size ,land holding size ,live stock size ,agricultural extension service delivery(frequency of extension contact) , educational level of the house hold heads ,land tenure security ,physical market access, participation of beneficiaries at the planning stage of NRM works , attitude towards the technologies .

i) Age of the Household Heads

The effect of age of the farmer on adoption decision can be taken as a composite of the effects of farming experience and planning horizon. Longer farming experience as equated with older farmers is expected to have positive effect on adoption. Younger farmers, on the other

hand, may have longer planning horizons and hence, may be more likely to invest on conservation of natural resources.(Lapar and Pandey ,1999). Different empirical studies indicated that a relationship between adoption of technologies and age; stage of life or farmer experience is mixed. However, age is still an important factor to the decision of adoption of conservation technologies. In this study, it was assumed that the age of head of the sample house holds is to be a proxy for experience and thus be positively correlated with adoption decision of NRM technologies. The finding is indicated in Table-19 .

As it is shown in the descriptive statistics result ,the mean age of adopters is 44.09 years old with standard deviation of 10.71 and that of the mean age of non-adopters is 47.59 years old, with standard deviation of 12.29. From this data, we can see that difference is slight in the ages between adopters and non-adopters of bund technology. The t-test analysis also shows that there is no statistically significant difference in the ages of adopters and non-adopters of the bund technology . That is, there is no significant relationship between the age of sample house hold heads and the adoption decision of bund technology (t=-1.469,P = 14.4%).

On the other hand, the discussion result of the majority of Natural resource management DAs, and conservation experts, from woreda, Zonal ,Regional level regarding the relationship between age of the farmer and the state of adoption of bund technology was mixed some of them agreed that the younger farmers are better adopting new technologies, since they do have longer planning horizon and labor access as well as probably could have better education opportunity than older farmers since primary education is expanded now a days in rural kebeles. Other groups of the above practitioners agreed that, well experienced farmers are sensitive to resource degradation and they are better to adopt the improved technologies to solve the degradation problem.

Other empirical findings of similar studies indicated different results. Some studies have found that as age of the farmers increase, then the level of adoption of conservation technologies also increase (Amsalu and Graaf,2006). The other studies have found that there is negative relationship between adoption of NRM technologies like soil conservation structures and the age of the farmer (Gould etal,1989: Shiferaw and Holden,1998) Cramb. etal,1999, Lapar .and Pandey,1999, Tenge,etal,2004). The insignificant association of age and adoption decision upon bund technology in this study area is probably due to the fact that age difference of sample adopters and non-adopters is not far apart from each other.

Table- 19 Descriptive statistics for Adoption of improved soil conservation technology (bund) and factors Affecting /Associated with it/

Variables	Adopters		Non-adopters		T-Value	Signif icance
	Mean	St.dev.	Mean	St.dev.		
➢ Age of the respondents in years.	44.09	10.71	47.59	12.29	-1.469	0.144
➢ Active labour size of the house hold in number	2.95	1.36	2.90	1.67	0.161	0.872
➢ Land holding size in ' timad'	7.26	2.92	6.28	2.81	* 1.647	0.102
➢ Live stock size in TLU	5.70	2.42	4.46	1.86	*** 2.612	0.010
➢ Number of extension contacts in a year by conservation Agents (DAs).	31.22	27.43	14.73	28.46	*** 2.906	0.004

Source:- Field surey,2006
Note :- One timad is approximately= 0.25 hectare
*** - *Indicates significance level at 1%*
* - *Indicates significance level at 10%*

ii) Labour size/Labour Availability/ of the Household.

In subsistence agriculture, household members are the suppliers of labour needed for the farming operation . Lack of adequate family labour accompanied by inability to hire labour, can seriously constrain adoption of improved physical soil conservation technologies/practices. Since soil and water conservation works demand high labour, its availability in the house hold is a major factor. Yet, it is the factor generally considered available at the planning stage, and under valued at the stage of evaluation of soil and water projects (Stocking and Abel, 1989 , cited in Woldeamlak, 2001). However, such a view on labour availability to soil and water conservation works is proved to be wrong. For instance, Stocking and Abel (1989) cited in Woldeamlak 2001, estimated that construction of bench terraces on one hectare of steep sloping land will require 1800 man days. On top of this, Seasonal peaks in labour requirement occur at the time of planting, weeding and harvesting in the house hold. Labour bottleneck particularly active labour of HHs can thus be a constraint to adopt or not the physical soil conservation technologies. Thus, in this study, active labour age group of the house hold only is taken into consideration for further analysis. The assumption was that the size of active household labour could affect the

adoption condition of bund technology. That is, the larger HHs active labour size, the higher will be the implementation of bund technology . The descriptive statistics result in Table- 19 shows that the mean active labour size of adopters of bund technology is 2.95 in number and that of non adopters is 2.90, indicating that there is no visible difference in the active labour size between the adopters and non-adopters. The t-test analysis also shows that there is no statistically significant difference in active labour size of the house holds of adopters and non-adopters of bund technology (T=0.161, P=87.2%). It means active labor size did not significantly vary between adopters and non adopters in the adoption of improved physical soil conservation technologies, like bunds in the sample house holds. However , the result was not as expected (assumption). That is because active labor size of the household was expected to have significant association with bund formation but, the result becomes different from this assumption.

However ,the focus group discussant farmers from all sample peasant associations (PAs) suggested that labor is a very crucial factor whether to adopt or not the improved physical soil conservation technologies like bunds . Most of the FGD members strongly explained that the majority of the households in the study area are constrained by active house hold labour shortage. They added that, this is due to the reason that adult male children who can participate in soil and water conservation works are students at high school level and they are living in the woreda town which is away from their village. They also mention that the majority of the rest of the household members are small children and females, who can not participated in conservation works . Surprisingly enough this idea is forwarded both from adopters and non adopters groups

The soil and water conservation experts at different levels(woreda, zone, and region) are not in line with the idea of focus group discussants with regard to the issue of active labour size of the house hold as a factor of adoption of bund technology. The reasons forwarded by them were: firstly, there is no labour shortage problem in the study area, rather ,disguised unemployment is a problem. Secondly, though, there may be adoption intensity difference among the sample house holds proportional to the labour size they have, there should not be difference in the incidence of adoption of conservation technologies like bunds. Thirdly , wives and adult female children will not participate in conservation works . This is because if the farmers were willing to adopt the technology , they could adopt it on a certain plot of their farm land in relation to the size of labour they have.

Empirical findings of other similar studies on the issue of labour and adoption of NRM technologies concluded in two different ways. Some studies like, study conducted by Amare(1988) and Mulugeta(1992), are concluding that labour supply and adoption of physical soil conservation technologies are positively and significantly associated. Where as, study conducted by Shiferaw and Holden(1998) have found that, there is negative and significant association between adoption of physical soil conservation structures and house hold labour size.

To conclude this part of the discussion, the study result showed that active labour size has no statistically significant relationship with adoption of bund technology in the study area even though, the focus group discussants indicated that labour is a factor which could constrained the effort of NRM activities in the study area. This is probably due to disguised unemployment and other socio-economic and institutional factors that could be more critical to adoption of bunds than active labour size of the house holds.

iii) Land Availability/Land Holding Size

Land is the basic source of livelihood in rural Ethiopia. Land availability often influences farming practice and affects the land degradation process and it has effect on the adoption of improved NRM technologies. Increasingly positive argument developed in the related flourishing literature is that, any NRM intervention designed to address the land degradation problem of small farmers should take in to account the land holding size as a very important variable. There are two types of contentions with regard to land size and implementation of conservation measures by different scholars. Some researchers agreed that too small land holdings and unequal land holdings can affect the adoption decision of conservation measures(Hudson,1992,Yeraswork,1995). Other researchers like Pearce(1986)cited in Warford(1989),does not accept the above finding and note that small farmers with limited plot sizes are better than farmers with large plot sizes, in adopting conservation measures. In this study it was hypothesized that the farmers with larger farm holding size would be better in adopting improved physical soil conservation technologies like bunds than small farm land holders.

Hence, as it is shown in Table-19 , the descriptive statistics result indicates that the mean land holding size of adopters is 7.26 "timad" and that of non-adopters is 6.28 "timad" with standard deviation of 2.92 and 2.81 respectively, showing that there is difference in the land holding size of the two groups of respondents. The t-test analysis also showed that land holding

size difference between adopters and non-adopters is significant at 10 percent level (t=1.647, P=10%).That is, adoption of bund is associated with size of land holding (Table-19).

Moreover, the sample households were asked whether their land holding is increasing or decreasing from time to time and if it is decreasing, would it influence them not to practice improved NRM technologies or not. Hence, as it is indicated in Table -20 below,73.3 percent of the respondents replied that, their farm land holding is decreasing from time to time. The rest 26.7 percent only responded that their farm land remained in its original state. But, there were no house holds who responded that there is an increase in their land holding. In addition,80.4 percent of the house holds, whose land was decreasing from time to time mentioned that declining of their farm land influenced them not to practice improved NRM technologies like bunds and tree planting in a woodlot.

Table – 20 Land Availability and NRM activities

Issue	Count	%
Is the size of your land holding increasing or decreasing from time to time ?		
➢ Increasing	-	-
➢ Remain the same	39	26.7
➢ Decreasing	107	73.3
Total	146	100
Do declining of a land holding has influenced you not to practice improved NRM technologies like soil conservation technologies(bunds) and tree planting		
➢ Yes	86	80.4
➢ No	21	19.6
Total	107	100

Source:- Field survey,2006

Note :-The total number of respondents may not add up 148 for some questions since these questions may not be relevant to some of the respondents .

The majority of the members of the focus group discussants from the non adopters group and some of the members from the adopters group confirm that land holding size affected the extent of implementation (adoption) of improved physical soil conservation technologies (bunds). This is because bund formation will consume considerable size of the plots of land since many numbers of bunds are formed with in the same plot of land in shorter vertical interval across the slope. The discussants underlined that this condition is very serious upon the farmers with small farm size and their land holding topography is steep sloppy that forced the farmer to build the

bund with in very short vertical interval of the farm land which wastes the cropping land. The majority of the farmers witnessed that farmers who implemented improved physical soil conservation technologies like bunds in their PAs are those who have relatively larger land holding size. Hence, they conclude that farm land holding size have direct association with adoption of bund technology. The non – adopters and some members of adopters of focus group discussants raised other problems of bund formation on their farm lands. That is, bund will serve as the encroachment of grassy weeds which also wastes the cropping land and it competes for nutrients available to crops . They added also that bund served as a place for habituation of moles. It has also compatibility problem to the existing farming system; that is, it inhibits the up and down plowing of oxen plow. These group of farmers believe that for all these reasons, bund technology will waste the cropping land which had been used for crop production otherwise. The discussants added that most of the farmers who are with shortage of farm land are not motivated to adopt the improved physical soil conservation technologies like bunds or they will remove it or left with out maintenance since they do not wont it which had been built forcefully through obligation by PA administrators and DAs.

On the other hand NRM DAs and experts from woreda ,zonal and regional level do not agree with the ideas of farmers regarding the side effects of bund technology . This is because to achieve the target of conservation of natural resources, bunds should be built according to the specification. They also added that the land which is lost because of bund construction is insignificant compared to the benefit gained from bunds. However, the experts have practically seen that, farmers with relatively larger land holding size adopted the bund technology better than the farmers with smaller holding size. This fact was also witnessed by the researcher him self during his direct field observation of the plots of some of the sampled house holds in the study area.

The finding of this survey is as it was expected (assumption) and it is in line with other similar empirical findings like study conducted by Shiferaw and Holden(1998) Amsalu and Graaf(2006),in central high lands of Ethiopia which found that land holding size have positive and significant influence to the adoption of conservation technologies.

In conclusion land holding size is associated with the adoption condition of bund technology, even though it needs an extension intervention to teach the farmers with negative attitudes to

wards the technology by comparing and contrasting the advantages and disadvantages of bund technology for sustainable agricultural production.

iv) Live stock size

Livestock size is an important component of the farming system in the study area, Since the farming system is mixed in its nature(crop-production and animal husbandry). Therefore, live stock is considered as an asset since it served in the production process and useful as source of income and food of the house hold . This could help the land user, to enhance for conservation investment, by providing security(lowering risk). Thus in this study it was assumed/hypothesized/ that the larger the size of live stock the farmers have, the better will be the adoption decision of bund technology.

The descriptive statistics result in Table –19 shows that ,the mean livestock size of adopters and non-adopters of bund technology is 5.70 and 4.46 respectively. The t-test analysis in the same table also showed that livestock size of adopters and non adopters of bund technology was found to be significantly differ at 1% significance level (t=2.612,p=1%). That is the adopters have larger livestock size than the non adopters . This shows that, there is strong and statistically significant association between livestock size and adoption decision of bund technology.

Focus group discussants from all the peasant associations(PAs) have agreed that since live stocks are used for draft power, source of food, source of cash to buy hand tools and labour for conservation works, seedlings, chemical fertilizers to enrich depleted soils as well as they are sources of manure/dung/,then, it highly determines the decision power of the land user/farmer/ whether to invest or not the conservation measures on their farm lands. Hence, it could affect the rate/level/ of adoption of NRM technologies; like bunds. Off course, the focus group discussants, do not deny that, too large livestock size in particular area might be a cause for natural resource degradation; if the resource available can't support the existing population. Furthermore, the majority of the NRM agents(DAs) also shared the opinion/Suggestions/ of focus group discussants.

Empirical findings of other similar studies have found different results. For instance, regression results of Amsalu and Graaf(2006) in central high lands of Ethiopia showed that, the effect of live stock size on adoption decision was significantly negative. Where as study conducted by Tenge, etal(2004) in Tanzania which is in line with this research result, has shown that smallness of the size of live stocks has negative effect on the adoption of soil and water

conservation measures; since manure was traditionally required by farmers for the application of newly constructed terraces in that study area of Tanzania.

v) Agricultural Extension Service Delivery/Frequency of extension contact/

Access to good agricultural extension services will provide farmers with the necessary information about natural resource conservation innovations. Farmers who know nothing about a practice can not be expected to adopt it unless they understand its expected costs and benefits. Hence, the diffusion of information on available technological options for abating resource degradation like soil erosion had a significant effect on keeping conservation structures(Shiferaw and Holden,1998). Extension services provided to and training attended by farmers are institutional factors that could significantly influence the adoption of land management technologies; particularly, soil and water conservation practices. Thus, contacts with extension agents and a proxy for access to information is likely to contribute to farmers' conservation decisions (Amsalu and Graaf,2006).

In this study also, it was assumed that high frequency of contact with farmers, sufficient, accurate and timely information dissemination through capable natural resources conservation agents will influence the farmers' decision positively on adoption of conservation technologies.

The NRM extension service delivered in the study area is measured using the number(frequency) of contact of conservation agents(DAs) in a year time period. Thus, as it is indicated in Table-19 , the mean number of extension contacts per year of adopters and non-adopters of bund technology is 31.22 and 14.73 respectively, showing that there is a wide variation in extension accessibility of the adopter and non-adopter groups of bund technology. The t-test analysis in the same table also shows that the number(frequency) of extension contacts is statistically and significantly related (1% significance level) with the adoption decision of improved physical soil conservation technologies (bunds) in the study area (t=2.906,P=0.4%). That means , there is strong and positive association between number of extension contacts by conservation agents and adoption of bund technology by the farmers .

On the other hand, sampled house hold heads were asked about the adequacy of training they received and the use fullness of technical assistance delivered by the extension personnel of the study area (Table 21).

Table – 21 Extension Service/Training and Technical Assistance/Regarding the Implementation of Improved NRM Technologies.

Responses	Issues					
	Have you got training about improved NRM technologies for the last three years		Was the training adequate to implement improved NRM technologies		Was the technical assistance/advice/ use ful to implement improved NRM technology	
	Count	%	Count	%	Count	%
Yes	65	45.1	44	67.7	118	94.4
No	79	54.9	21	32.3	7	5.6
Total	144	100	65	100	125	100

Source:- Field survey, 2006.

Note :- The total number of respondents may not add up 148 for some of the questions since there were missing .

Thus, the response indicated that with regard to the training received by farmers about improved NRM technologies for the last three years, only 45.1 percent of them have got the training. The rest 54.9 percent of the respondents did not received any kind of training at all. The adequacy of the training itself is not accepted by 32.3 percent of the respondents who already received the training. However, as to the usefulness of technical assistance provided by NRM agents, the respondents have got positive outlook to it , i.e 94.4 percent of the respondents who got the technical assistance and implemented NRM technologies have got it useful to practice the technologies, like bunds on their farmlands Table 21.

Moreover, the focus group discussion result with farmers from all sample PAs also showed that the training delivered to the farmers focusing on NRM related topics was minimum in the last three years. However, the frequency of extension visit was better than the training, although it was not sufficient. Yet ,they assure that it is still important for them for technology adoption. On top of this, the conservation agents who were interviewed also confirm that provision of training to the farmers concerning natural resource conservation now a days is almost none. This is because of budget constraint. However, they added that the frequency of extension contact is better accomplished as compared to training.

Interview of natural resource conservation experts at different levels(woreda, zonal and Regional level)also supported the suggestions of focus group discussants and DAs . They also added that the focus of current extension system is to crop production and animal husbandry activities. That is the frequency of extension contact is much more biased of crop production and animal husbandry related activities. In addition to this, conservation agents at PA level are still scarce. In some of the PAs the development agents trained in crop production and animal husbandry are still forced to perform the conservation works together with crop production and animal husbandry activities. However, they added that since the DA is evaluated for his/her achievement of the production and productivity of crop and live stocks, he/she will not provide the necessary attention to the NRM activities as that of production activities. And yet, extension contact helps the farmers to adopt NRM technologies in areas where better extension service is delivered.

The finding of this research is as it was expected and it is in line with other many similar empirical studies conducted in and outside Ethiopia that have found , extension contact had positive and significant relationship with adoption decision of soil and water conservation technologies(Shiferaw and Holden,1998,Baidu,Forson 1999, and Paudel and Thapa,2004).On the other hand, some empirical studies conducted in central Ethiopian highland at Berressa water shed, by Amsalu and Graff(2006) are against this finding .That is, a study conducted at Berressa water shed by these authors upon adoption and continued use of stone terraces revealed that , extension contacts did not show significant influence on both adoption and continued use of soil and water conservation technologies like stone terraces.

vi) Educational Status of the Household Heads

Educational status of farm house hold heads is another important social factor influencing the adoption of NRM technologies. Farm house hold heads who have opportunity to attend formal education for long period could acquired more knowledge and strengthened their analytical capacity. Besides, their capability to seek information and get necessary support from governmental and non-governmental organizations were also improved. Hence, better education levels may be associated with greater information on conservation measures and the productivity consequences of erosion, and higher management expertise (Ervin and Ervin,1982,Feder etal,1985,as cited in Lapar and Pandey,1999) .As a human capital variable, education affects the efficiency of adoption of conservation practice .Hence, in this study it was assumed that there

will be better adoption of soil conservation technologies like bunds as the educational status of house hold heads improved.

The association between adoption of improved physical soil conservation technology (bund) and educational status/level/ of sample house hold heads indicated in Table -22 shows that, there is no magnified difference in the percentages of adopters and non-adopters as a result of educational status differences of respondents. For instance, for those sample house holds who attended formal education, the percentage of adopters is 21.9 percent and that of non-adopters is 13.3 percent. Also, the percentage of adopters and non-adopters who never attended/attending formal education is 78.1 percent and 86.7 percent respectively. The chi- square analysis result in the same table also showed that, there is no statistically significant difference between adopters and non adopters of bund technology as a result of educational status of respondents (x^2 = 4.850, P=18.3%). That means , there is no statistically significant association between adoption of bund technology and educational status of the sample house hold heads of the study area.

On the other hand, other empirical findings of similar studies out side Ethiopia have found that level of education affects the land users positively (Gould etal,1989,Lapar and Pandey,1999,Cramb, etal,1999,Paudel and Thapa,2004). They found that better educated farmers are aware of several kinds of natural resource conservation measures through their good personal contacts with agencies involved in NRM works. Illiterate and low educated farmers can not get such opportunities, which inhibits them from the adoption of conservation technologies.

The insignificant association between educational status and adoption of bund technology in this investigation is probably due to the quality and orientation of education system of the country and it is only very few sample house hold heads were attended /attending formal education that could not bring significant impact or relationship between adoption of bund technology and educational level of the farmers . That means educational system is not oriented to the NRM and environmental protection issues and those house hold heads who got the chance to attend formal education are few in number . The farmers who attended/attending formal education, will follow the same pattern of agricultural production processes(traditional) which is exploitative in its nature with no/minimal involvement of them in natural resource management activities , but with high effort to maximize benefit from their farmlands using traditional ways of production system than investing to the land

Table 22 -Cross tabulation Results of the Association between adoption condition of improved soil conservation technologies(Bund technology)and factors Affecting it.

Variables	Adopters (n=114)		Non-Adopters (n=30)		X^2 Value	Significance level	Total	
	Count	%	Count	%			Count	%
➢ Educational status of ,HHHs (formal education)								
- Attended/Attending	25	21.9	4	13.3	4.850	0.183	29	20.2
- Never attended	89	78.1	26	86.7			115	79.8
➢ Land tenure security								
- Feel secured	59	51.8	6	20	*** 7.516	0.006	65	45.1
- Do not feel secured	55	48.2	24	80			79	54.9
➢ Physical Access of market								
- Have access	51	44.7	12	40	0.106	0.745	63	43.7
- No access	63	55.3	18	60			81	56.3
➢ Participation of beneficiaries in planning of NRM activities on their farm lands								
- Participated	32	28.1	1	3.3	*** 84.382	0.000	33	22.9
- Not participated	82	71.9	29	96.7			111	77.1

Source:- Field survey, 2006

Note :- X^2 = Chi-square

**** - Indicates significance at, one % level.*

vii) Land Tenure security

Land tenure security might be the most important determinant of the length of the farmers' planning horizon. Hence, it influences farmers' decision to practice long term investments, like implementation of improved physical soil conservation technologies. Empirical studies in Ethiopia indicated that ,land tenure insecurity had significantly influenced farmers' decisions on land management activities. The absence of clear property ownership rights was one of the causes for the failure of past environmental rehabilitation attempts (Kebede 1989,cited in Woldeamlak,2001). Belay(2000),cited in Woldeamlak(2003b) has identified the insecure land tenure system as having contributed to the accelerated soil erosion from cultivated fields in the south wello high lands of Ethiopia. Dejene and Tefferi(1995) had also confirmed that, the type of land tenure system determines the efforts towards the conservation of environmental resources.

Hence, different studies at different times in the country have shown that security of land tenure is a critical variable determining incentives to conserve the land quality.

In Ethiopia land has been under the state control since 1975. The farmer do have only usufruct right/holding right/. For instance current federal constitution of Ethiopia promulgated that land is under the state and public ownership. Yet, citizens do have usufruct right(FDRE,1995). Hence, land can be re-distributed among the landless farmers (citizens) when required. This creates uncertainty whether one would have access to the land he/she is currently holding(cultivating) in the future. Thus, in this study it was assumed/hypothesized that/this kind of uncertainty and feeling of insecurity might discourage the land users from making any kind of long term investment like improved physical soil conservation practices, on the land they cultivate to day for long-term benefits. Hence the farmers in the study area were asked whether they feel secured or not up on their land holding in the future (the feeling of them up on the current land holding system).

Thus, the cross tabulation result in Table-22,revealed that the percentage of sampled house holds who feel secured to their current land holding and adopted the bund technology are 51.8 percent and that of non- adopters is 20 percent However, those house hold heads who do not feel secured but adopt the bund technology are 48.2 percent and that of non-adopters is 80 percent. This showed that the majority of adopters of bund technology are those farmers who feel secured upon the current land holding system. Where as the majority of non-adopters are those who do not feel secured upon the current land tenure system. The chi-square analysis in the same table (Table-22) also reveals that there is statistically significant relationship at 1% level between land tenure security and adoption of bund technology (x^2 =7.516,P=0.6%). That is, there is strong and significant association between land tenure security and adoption decision of bund in the study area. Thus ,farmers with better land tenure security adopt NRM technologies better than those who do not feel secured .

The majority of focus group discussants , from adopter groups, i.e , from the PAs of Ziguda gult, Zubraquandisha, Abadraagaga, concluded that they feel secured to the current land holding system . The reasons forwarded by them were; they are provided with land certification card, they can lease their farm lands up to 25 years, they can transfer to their heirs when required... etc. But ,the majority of discussants from two non adopter groups i.e , from PAs of Dubi-Michael and Gumdriabelakena do not feel secured to the current land holding system and to their

current land holdings, even though user right certificate is provided to them. They were strongly argued that unless there is owner ship right to their farm holdings they do not feel secured. They added that, state/government can redistributed to the other landless and youth farmers and therefore, long term investment on their land holding like putting soil conservation structures ,which requires huge labor is a mere wastage of their labour. However, among the group members who do not feel secured to their land holding ,there were farmers who implemented improved soil conservation measures like bunds through obligation of the PA administrators and DAs. But ,as it is observed in the field by the investigator himself during direct field observation, these kinds of farmers left the structures with no maintenance or they deliberately destroyed them when they plowed the farm lands. Hence, in this case we can say that there is no real adoption of bund technology with these group of farmers who implemented with obligation and without their willing .

Furthermore, interviews of different practitioners from DAs level to conservation experts from woreda up to regional level confirm that land tenure security is vital for adoption decision of improved physical natural resource management technologies particularly to soil and water conservation technologies in the high lands including the study area.

From this all, it is possible to conclude that, land tenure security positively affected the adoption decision of improved physical soil conservation technologies like bunds and could make a difference between adopters and non-adopters in their level of adoption .

Different empirical findings also support this fact. For instances, Lapar and Pandey(1999), who conducted a study in Philippine uplands in adoption of soil conservation technologies confirm that, the existence of well defined and enforceable property rights to lands is necessary condition for the adoption of conservation technologies .Also, the study made in different parts of Ethiopia, attributed the low level of success of natural resource conservation to land tenure insecurity (Yearswork,2000,Woldeamlak 2003[b]) . Gebremedhin and Swinton(2003) ,have found that, long term investments in stone terraces in Tigray region was influenced by land tenure insecurity. Hence, securing land use rights might be an incentive for the farmers to adopt improved physical soil and water conservation technologies.

viii) Physical Access of Market

In rural part of Ethiopia infrastructure is poorly developed to facilitate small holder farmers access to the market. Many of the urban towns in the country do not have all weather roads

connecting them to the surrounding rural areas in Ethiopia. Only 20% of the country can be reached by modern transport(Lirenso,2001). Usually farmers have to travel for hours and days on foot carrying their produce on their backs(women) or head (men) to sell on the market and to buy inputs and consumables from the market. Thus, distance to markets and absence of all weather roads were taken as indicators of market transition costs and proxy for the quality of other public services and considered for whether a technology is adopted or not. This is because market access factors affect the relative profitability of investment in conservation practices (Gebremedhin and Swinton,2003). For instance, roads often reduce marketing costs thus it helps in improving income-earning opportunities from agriculture and promoting land conserving investments. Hence, in this investigation it was assumed that, as the market distance decreases, and as there is all weather road access, there will be better adoption decision of improved physical soil and water conservation technologies, like bunds.

As it is shown in Table-22, the percentage of the sample households who have physical access of market and adopted the soil conservation technology(bund) is 44.7 percent where as that of non adopters is 40 percent .However ,the percentage of adopters who do not have physical market access is 55.3 percent, while that of the non adopters is 60 percent, showing that there is no visible difference between adopters and non adopters found in the same category . The chi-square analysis in the same table have shown that, there is no statistically significant variation between adopters and non-adopters in adoption level of bund technology , as a result of the physical access of market of the study area .(x^2 =0.106 ,P=74.5%).That is, there is no statistically significant association between physical access of market and adoption decision of bund technology in the sample house holds of the study area .

The suggestions of the focus group discussion members both from the adopter and non-adopter groups also support this fact .That is , the majority of them suggested that physical access of market will not affect them from adoption of improved physical soil conservation technologies, like bunds . They also added that, even though there is market inaccessibility in there locality to sale there crop products, they will not be hindered to increase their agricultural production using any kinds of means including soil fertility maintaining mechanisms ,like constructing improved physical soil conservation technologies . However, they underlined that other socio –economic and institutional factors like land availability and its security problem could seriously affect their adoption decision .

Moreover, all the DAs from four PAs who had been interviewed had also the same opinion as that of the focus group discussants (farmers). That means they observed that there is no as such visible difference in adoption decision of a farmer to improved soil conservation technologies, whether he/she has market access or not. For this, they added that there are many farmers who did not adopt bund technology but living around the woreda town(8 kms), and even with the access of all weather road to them. On the other hand, there are farmers who adopted the bund technology but living very far from woreda town (25kms) and with no accessibility of all weather roads. This fact is also supported by woreda NRM experts, who have long experience from all the PAs of the study area. Hence, physical accessibility of market didn't have significant association with adoption decision of bund technology in the study woreda.

However, the research result is not consistent with the assumption of this study and other similar empirical studies. For instance regression result of a study conducted in northern Ethiopia (Tigray Region) by Gebremedhin and Swinton(2003) have shown that, market access was found to be important for adoption of soil bund.

In conclusion, the non-significant result of this study might be due to the fact that, the yield increment or non-increment effect of soil conservation technology(bund) is not visibly observed by farmers. This could happen due to different reasons. Firstly, the effect of soil conservation technologies on yield increment of crops is long-term. Secondly, the conservation work might not be achieved its target due to specification and implementation problem. Thirdly, farmers could transport the farm produce to the market on animals back, and inaccessibility of market might not be a problem to them .... etc. Thus, farmers might be affected less by market inaccessibility on their adoption decision of soil conservation technologies, like bunds .

ix) Participation of Beneficiaries/farmers/ in Planning of NRM Activities

Technical change must be accompanied by people's participation and improved institutional capacity for rural development to occur. Promoting participation is viewed as both a means and an end. As an end, it fulfills a basic human need since people wont to be part of the processes that shape their lives. As a means participation allows people to have a role in decision making. It also can reduce the costs of project or program development and implementation as well as promote sustainability and replicability (Mulate 2001). Thus, participation of local people is found to be among the most important factors for the success of newly launched conservation

measures(improved NRM technologies). Hence, in this investigation, it was assumed that participation of beneficiaries in planning of conservation works (NRM activities) will affect the adoption decision of farmers up on improved physical soil and water conservation technologies.

The research result in Table 22 indicates that there is variation in between adopters and non-adopters who participated in NRM activities at the planning stage. That is, the percentages of adopters who participated in planning of conservation works is 28.1 percent and that of non-adopters is 3.3 percent. Also, the percentage of adopters who did not participate in planning of conservation works (NRM activities) is 71.9 percent whereas that of non-adopters is 96.7 percent. This shows that, there is visible variation in percentages of adopter and non-adopters, even though, the over all participation in the planning stage of conservation works is very low in the study area . The chi-square analysis in the same table also shows that, there is statistically significant difference between adopters and non –adopters of bund technology (x^2=84.382,P=0%) in terms of their participation upon planning of NRM activities. That is, participation of beneficiaries in the planning stage of NRM activities is strongly and significantly associated with adoption decision of bund technology at 1% level.

The majority of the focus group discussants from all sampled PAs both from the adopters and non –adopters groups have strongly suggested that, there is little or no participation of beneficiaries (farmers) at the time of planning of conservation works; be it site selection, technology selection, time(season) of implementation. They also added that , draft plan is initially planed by the PA administrators and DAs and will be submitted to woreda office of agriculture and rural development .Then, the officials and experts from woreda office will reject even this kind of plan and will prepare their own new plan and send back to the PAs for implementation by the beneficiary farmers, through influencing mechanisms such as punishment with money, exclusion from input supply such as improved seeds that can be obtained from Ethiopian seed enterprise... etc. This creates conflict rather than collaboration between beneficiaries (farmers) and PA administrators as well as with DAs.

All the interviewed NRM agents (DAs) also did not deny that the plan is top-down. That is, even though, they planned an initial plan with PA administrators, woreda office of agriculture and rural development officials and experts will reject this plan completely and they will send their own new plan to the PA for implementation . The conservation experts interviewed at woreda level also confirmed that, the plan is both bottom –up as well as top-down approach .

The reason given by them was the beneficiary farmers and PA administrators will plan only small quantity of hectares that can be treated by bunds. However , they argued that the soil degradation problem is severe in the study area that requires very quick response by the land operators(farmers) . Hence, amendments will be made at the initial plan by woreda experts and officials . They also added that, this kind of planning approach is believed by zonal and regional level officials of bureau of agriculture and rural development as well as by woreda administration heads because of the severity of soil erosion problem in the study area .

The finding of this study is as expected. Other similar empirical findings conducted in Ethiopia and outside Ethiopia have found the same result as the finding of this research. For instance, study conducted by Woldeamlak(2003) at chemoga watershed, in north western Ethiopian highlands have found that, more than 50% of the participants in conservation works were participated forcefully without their willing by PA administrators and DAs. That means, since the work had not taken participatory principles into account the majority of farmers were disinterested in the conservation works. The farmers were participated simply because they were forced to do so by the village (PA) administrators and the DAs. They participated not for the sake of conserving their farm lands, but rather to meet the demands of the government's five-year development program. The other empirical study conducted by Alemneh(1990) among the peasants of wollo revealed that, most peasants perceived ' area closure' method for rehabilitation of grazing land as another outside intrusion to their lives and were resentful of such programs particularity because local people were not consulted at all during planning and even at the time of implementation of this measure. A Study conducted out side Ethiopia assures this fact as well. For instance, Deerutins(1992), based on empirical study on land management projects in Sir Lanka concluded that, successful planning and implementation of conservation measures largely depend on the participation of target population in all fields right from the beginning.

To conclude this part of the discussion, this study and other empirical studies have shown that, different methods and mechanisms that encourages the participation of the beneficiary population should be formulated. This is an indispensable tool for sustainable management of natural resources. That is, the farming population should be enabled to take the initiatives in identifying the problems, plan and implement conservation practices.

X) Attitude of Beneficiaries (Farmers) Towards the Bund Technology

Farmer' attitudes toward environmental quality and conservation issues should reflect their concerns about resource use and consequently, may affect their perceptions of erosion problems and their farm conservation actions. That is, the farmer mentally applies the new idea or innovation to the present or anticipates future situation, before deciding whether or not to try it (Rogers,1983). Hence, attitudes of beneficiaries towards improved conservation technologies is crucial as to whether to adopt or not a particular natural resource management technology.

In this investigation, it was assumed that positive attitude of the farmers towards the improved conservation technologies will enhance adoption level/rate/ . The research results are indicated in table 23(a) and 23(b) below. That is, to asses the attitude of farmers towards improved soil conservation technologies, like bunds, four statements(two positive, in Table,23(a) and the other two negative in Table 23(b)) were designed based on Likert/Summated scale, by the investigator and informants were asked to express their attitude(feelings) according to their own choice regarding bund technology. Their agreements and disagreements in percentages are summarized according to the cross tabulation result of adopters and non- adopters of bund technology to the respondents response for the positive and negative statements.

Table- 23 (a) Beneficiaries Attitude Towards Positive Statements to Improved Soil Conservation Technologies (Bunds) Percent of Respondents.

Statements (positive)	Adopters					Non-adopters				
	SDAG	DAG	N	AG	SAG	SDAG	DAG	N	AG	SAG
Improved physical soil conservation technologies(bunds)are efficient in arresting soil erosion than traditional practices	-	5.3	0.9	69.3	24.5	20.2	66.8	6.3	6.7	-
I will continue to implement improved physical soil conservation technologies (bunds) in my farm land.	4.4	7.3	15.8	56.3	16.2	54.3	38.9	3.4	3.4	-
Mean(Average)	2.2	6.3	8.4	62.8	20.4	37.3	52.9	4.9	5	-

Source:- Field survey,2006

Note :- Abbreviations at the top of the columns represents the following

- *SDAG - Strongly dis agree*
- *DAG - Dis agree*
- *N - Neutral*
- *AG - Agree*
- *SAG - Strongly agree*

Table- 23 (b) Beneficiaries Attitude Towards Negative Statements to Improved Soil Conservation Technologies, (Bunds); Percent of Respondents.

Statements (Negative)	Adopters					Non-adopters				
	SDAG	DAG	N	AG	SAG	SDAG	DAG	N	AG	SAG
Constructing improved physical soil conservation structures (bunds) is laborious and tire some to implement on the farm lands . so it is dis advantageous	26.1	56.8	0.9	6.3	9.9	-	-	23.1	50	26.9
Improved physical soil conservation measures (bunds) will take part of the cropping land out of production that had been helping to full fill the food requirement of the house hold	33.5	64	2.5	-	-	-	-	33.7	53.4	13
Mean	29.8	60.4	1.7	3.2	4.9	-	-	28.4	51.7	20

Source:- Field survey,2006

Note :- Abbreviations at the top of the columns represents the following

- *SDAG - Strongly dis agree*
- *DAG - Dis agree*
- *N - Neutral*
- *AG - Agree*
- *SAG - Strongly agree*

Thus, as it is indicated in Table-23(a) above the mean results of positive statements about improved soil conservation technologies,(bunds) revealed that 83.2 percent of the adopters showed their agreement (agree or strongly agree). The rest are either neutral or showed their disagreement. However, the majority of the non-adopters (90.1 percent of them) did not agree with these positive statements. At the same time for negative statements in Table 23(b), the mean results of adopters showed that 90.2 percent of them showed their disagreement. That is, they are either disagree or strongly disagree to the negative statements . However, 71.7 percent of non-adopters showed their agreements to these negative statements. But, the rest 28.4 Percent of the non adopters were unable to decide. From this we can conclude that the majority of the adopters could understand the benefits of bund technology and have good attitude towards it and they showed their mental readiness to implement it on their farm lands. However, the majority of non

adopters still have no positive attitude towards bund technology. This negative attitude might be due to labour and land shortage in the house holds and insufficient and unequal extension service for all beneficiaries.

The focus group discussants from the five peasant associations(PAs) have both positive and negative attitudes towards bunds. For instance, the majority of the discussants from three PAs(adopter groups i.e from Ziguda-gult, Abadra-agaga and Zubra-Quandisha, showed positive attitude towards the bund technology. The reasons given by them were, bunds could conserve soils, reduce- run- off and help to percolate moisture to the soil, it protect the artificial and organic fertilizer from being washed away by run - off ... etc . However the majority of the discussants from the other two PAs(non adopter groups), that is, from Dubi-Michael and Gumdri-Abela Akena showed negative attitude towards bund technology. The reasons given by them were, bunds take part of the land out of crop production, bund formation is a tedious and hard job , erosion is severe when the flood is overtop the bund and broke it . However, as a whole the positive attitude was greater compared to the negative attitude among the farmers who had been participating in all of the focus group discussions concerning bund technology.

Moreover, natural resource management agents (DAs) from four PAs do have two kinds of views regarding attitude of the farmers towards bund technology. That is, DAs from ziguda-gult and Zubra-quandish respond that the majority of the farmers have positive attitude, where as DAs from Dubi-Michael and Gumdri Abela Akena respond that most of the farmers in their PA have negative attitude towards bund technology. The DAs response is in line with the result of focus group discussant farmers for each respective PA. The conservation experts at woreda level also responded that the majority of the beneficiary farmers have positive attitude towards bund technology. But , they added there is problem of implementation /adoption, due to other socio-economic and institutional problems.

On the other hand ,empirical findings of similar previous studies have found both positive and negative results. For instance, Mulugeta (1992), Bahiru (1993), Shiferaw and Holden (1998) have found that there is positive attitude of beneficiaries and successful adoption of conservation technologies. Other similar studies on the other hand have shown that, there is negative attitude of beneficiaries towards improved NRM technologies (see Bekallu,1994 for agaw areas of Gojjam and Alemneh,1990 for wollo).

Thus in this study it was found that the majority of the sample house holds , particularly ,the adopters of bund technology have positive attitude towards it . Hence, positive attitude seems a prerequisite for adoption of improved physical soil conservation technologies , like bunds in the study area.

Figure -2- Bunds which were constructed but left with out maintenance and partly destroyed
(Photo, taken in March, 2006)

5.5.2 Tree Planting in a Woodlot Technology

Tree planting in a woodlot is the second type of technology investigated in this research work as one of the natural resource management technologies .

Wood lots could be, community level wood lots or household level woodlots. Woodlots are increasingly important source of woody biomass, income ,as well as it helps for soil and water conservation investment to slow down erosion and gully formation . That is, it highly helps for biodiversity preservation (maintenance) and environmental sustainability(Jagger,etal ,2003).In this study, house hold level wood lots were taken into account.

5.5.2.1 The State of Adoption of Tree Planting in a Woodlot

The adoption condition of tree planting in a wood lot is nearly similar to that of bund technology . That is, the percentage of sample households, who implemented (adopted) tree planting in a woodlot technology is 77.4 percent. However, 22.6 percent of the sample house holds did not implement (adopt) it (Table-24)

Table-24 Status of Tree Planting in a Woodlot (Adoption Incidence)

	Did you plant trees in a form of wood lot in your land holding?	
Responses	Count	percent
Yes	103	77.4
No	30	22.6
Total	133	100

Source: Field survey,2006

Note : The total number of respondents may not add up 148 for some of the questions since there were missing .

As the suggestions from focus group discussants of all sample PAs and conservation agents(DAs) as well as ,woreda conservation experts, this much percentage of adoption doesn't mean the area covered by woodlot tree planting or tree planting as a whole is vast in the study area. This is because it is only insignificant area (size) of the plots of the majority of farmers of the study area are covered by woodlot tree planting. This fact is also witnessed by the investigator himself. That is, from the direct field observation of 25 woodlots of HHs of the adopters themselves 21 plots(84 percent) of them practiced the technology on only less than 1/10 of their land holding size . On top of this 22.6 percent of the sample house holds did not try to implement the technology at all.

Thus, why is this so ?, is the basic question. That is, why some house holds adopted wood lot tree planting and why others did not and also why the implementation level it self is very low , are the basic questions that should be investigated.

This might be due to the influence of socio-economic and institutional factors. Hence, some of the basic socio-economic and institutional factors affecting the state of adoption of tree planting in a wood lot are discussed here under.

5.5.2.2 Socio-economic and Institutional Factors Affecting the Adoption of Tree Planting in a Wood lot

Among the socio-economic and institutional factors that could affect or related to the adoption condition of tree planting in a wood lot are: age of the house hold heads in years , active labour size of the house hold in number , land holding size in 'timad'; live stock size in TLU, number of extension contacts in a year by conservation agents, educational status of house hold heads(whether he/she is attended/attending or not formal education), land tenure security, physical access of market, participation of beneficiaries in planning of NRM activities and attitude of the farmers towards the technology will be discussed as follows.

i) Age of the Household Heads

It is believed that adoption decision of NRM or conservation technologies could be affected by age of the house hold heads since it influences their planning horizon. Hence, age is one of the factors that must be considered for adoption decision of long term investments of NRM technologies , like tree planting in a wood lot technology.

The descriptive statistics result of Table 25 shows that the mean age of adopters of tree planting in a wood lot technology is 44.45 years and that of non adopters is 48.96 years old; showing that there is difference in the mean age of the two groups. The t-test analysis in the same table also indicates that there is statistically significant age difference between adopters and non adopters at 10 percent level (t= 1.850, P=6.7%). That means, there is statistically significant and negative association between age and adoption of tree planting in a wood lot technology. That is as the age of the farmer increases , there is a tendency not to plant trees in a form of wood lot.

The discussion with NRM agents(DAs) and experts at woreda ,zonal and regional levels also confirmed this fact. However, the result was not as expected . Because the assumption was , as farmers becomes well experienced ,they could understand NRM degradation problem and its

consequences and will be initiated to practice management technologies . However, the finding of the survey result becomes the reverse. This is probably due to shorter planning horizon of the older farmers than younger farmers.

Empirical results of other similar studies showed mixed results for the relationship of adoption of tree planting and age of the HHHs. Regression result found by Alemu(2003) in Ethiopia has indicated that age and experience of the house hold heads increases the probability of growing trees. That means there is positive relationship between age and adoption of tree planting. On the other hand, study conducted by Woldeamlak (2003) in north western Ethiopia have shown that there is a negative association between ages of the house hold heads and number of trees planted (adoption of tree planting). This is in line with the survey result of this study .

Table 25- Descriptive Statistics for Adoption of Tree Planting in a Woodlot Technology and Factors Affecting it.

Variables	Adopters n=103		Non adopters n=30		T-Value	Significance level
	Mean	St.dev.	Mean	St.dev.		
Age of the respondents in years	44.45	10.52	48.96	12.81	-1.850 *	0.067
Active labour size of the house holds in number	2.88	1.26	2.97	1.81	-0.286	0.775
Land holding size in ' timad'	7.48	2.88	6.08	2.55	2.390 **	0.018
Live stock size in TLU	5.51	2.25	4.83	2.34	1.445	0.151
Number of extension contacts in a year by DAs	31.68	28.39	15.07	27.95	2.830 ***	0.005

Source: Field survey,2006

Note : one timad is approximately= 0.25 hectare

*** ⟶ *Indicates significance level at 1 %*

** ⟶ *Indicates significance level at 5 %*

* ⟶ *Indicates significance level at 10 %*

ii) Labour Size/Labour Availability/ of the Household

Labour plays an important role in determining the profitability of tree cultivation because its costs typically represent a large share of the total cost of cultivating trees (Godoy,1992). Household labor force represents an important constraint in fostering on farm tree management activities.

As it is indicated in Table-25, the mean active labour size of adopters of tree planting in a wood lot technology is 2.88 in number and that of non adopters is 2.97 in number, which shows that there is no visible difference in active labour size between adopters and non adopters. The t-test analysis also shows that, there is no statistically significant difference of the active labour size of adopters and non adopters (t= -0.286,P=77.5%) (Table 25). This shows that there is no statistically significant association between labour size of the house holds and adoption decision of tree planting in a wood lot technology .

Findings of other similar studies have shown different results. For instance, study conducted in Kenya at Muranga district by Patel etal (1995) have found that house holds with more labour tend to grow more trees. Also, study done in Kansas farms outside Ethiopia by Featherstone and Goodwin (1993), indicates that larger farm house holds are more likely to make conservation investments like tree planting. Alemu(2003), who studied tree planting in rural Ethiopia has also found that shortage of labour was major obstacle to tree planting. On the other hand, study conducted in north western Ethiopia at Chemoga watershed by Woldeamlak (2003) indicated that the association between house holds labour size and number of trees planted was not significant and this is in line with this research finding .

iii) Land Holding Size

Land holding size plays a vital role in small holders decision to integrate trees in the existing land use patterns. Hence, as it is indicated in Table 25, the mean land holding size of adopters is 7.48 " timad" and that of non-adopters is 6.08 " timad" ; showing that there is a difference in the land holding size between adopters and non-adopters. The statistical analysis (t-test analysis) also shows that there is statistically significant difference in land holding size between adopters and non adopters of wood lot tree planting technology at 5 percent significance level(t=2.390,P=1.8%) (Table 25). That is, the statistical test shows that the adopters of the technology have better land holding size than the non-adopters and there is significant association between land holding size and adoption decision of tree planting in a wood lot technology.

The discussion with FGD, DAs and experts from woreda level to regional level also suggested the same thing as the survey result of the sample house holds. All of them indicated that land holding size is crucial for adoption of tree planting in a wood lot since, it

consumes considerable size of land. Hence, if a farmer has shortage of land, he/she will not be motivated to share part of the land holding to tree planting. This means that, probably the priority is given to produce annual crops for the house holds food requirement.

Empirical studies on similar issues have found various results. For example, study conducted in north western Ethiopia by Woldeamlak (2003) indicated that the association between number of trees planted and size of land holdings was not significant . However, study conducted in rural Ethiopia by Alemu (2003) has found that the majority of the small holder farmers who do not grow trees were because of shortage of land. That is, the house holds with land more than the average per capita for the site grow more trees. Alemu's research result is the same as the survey result of this study .

iv) Live Stock Size

Size of live stocks is a proxy for wealth (in come) of the house hold which helps to fulfill in puts required for long term investments, like tree planting.

The descriptive statistics result inTable-25 indicates that the mean live stock size (TLU) of adopters and non-adopters of tree planting in a wood lot technology of sample house holds is 5.51 and 4.83 respectively which shows that there is no visible difference between adopters and non adopters . The t-test analysis in the same table reveals that there is no statistically significant association between live stock size of the sample house holds and adoption decision of tree planting in a wood lot (t= 1.445,P=15.1%).

Empirical studies on similar issues indicated that livestock size affects conservation investments either positively or negatively. For instance, study conducted outside Ethiopia by Featherstone and Goodwin (1993) have found that, livestock size affects conservation investment negatively. On the other hand, study done in north western Ethiopia at chemoga water shed by Woldeamalak (2003) indicated that the number of trees planted and number of cattle owned by the sample house holds was positively correlated. However, in this study, livestock size and adoption of tree planting in a wood lot technology have no statistically signification association . This is probably due to the fact that tree planting requires less input and labour to implement it as compared to constructing physical soil conservation technologies, though, livestock are sources of cash (income) and energy (food) of the house holds.

V) Agricultural Extension Service Delivery(Frequency of Extension Contacts)

Access to information and tree planting /forestry technical assistance/ could improve the house holds willingness to decide on accepting new technologies (Amacher,1993).

The mean number (frequency) of extension contacts in a year by NRM agents for adopter and non adopter farmers of tree planting in a wood lot technology is 31.68 and 15.07 respectively, showing that there is visible variation in extension access between the two groups(Table-25). The t-test analysis also indicates that there is statistically significant difference at 1 percent level of extension access between adopters and non adopters (t= 2.830, P=0.5%) (Table 25). That means, there is strong and positive association between frequency of extension contacts and the adoption decision of tree planting in a wood lot technology by farmers of the sample house holds and this was as expected (assumption)of this study before hand ,since access to new information is a prerequisite to technology adoption. Moreover, the focus group discussants, NRM agents , and experts at different levels (woreda, zonal and Regional level) also agreed with the survey result.

Other empirical studies on similar fields of study also have found the same results as the finding of this study. For instance, study conducted in mountain water sheds of Nepal on land management practices by Paudel and Thapa(2004) have found that extension service provided to and training attended by farmers have significantly influenced the adoption of land management technologies.

Vi) Educational Status of Household Heads

Education improves the quality of house hold labour. Quality improvements effectively increase the factor endowment and improve house hold willingness to try a risky new technology (Amacher, 1993). Thus, there can be a relationships between education and the adoption of conservation farming practices. That means innovations tend to be adopted more quickly by farmers with better levels of educations (Good win and Schroeder,1994).

According to the survey result ,the percentage of sample household heads who attended/attending formal education and adopt tree planting in a wood lot technology is 16.5 percent , where as that of non adopters is 10 percent. On the other hand, the percentage of house hold heads who never attended formal education but adopt the technology is 83.5 percent and that of non adopter is 90 percent(Table-26) . In the same table, the chi-square

analysis also shows that there is no statistically significant difference in education level of adopters and non adopters (x^2= 5.001, P= 17.2%). This means that, there is no significant association between educational status and adoption decision of farmers to plant trees in a wood lot technology. This might be due to the fact that very insignificant number of households who have attended/attending formal education so as to bring significant effect /association between education and adoption decision of tree planting in a wood lot.

Other similar empirical studies have shown the results which are different from this study. For instance, study conducted in north western Ethiopian high lands at Chemoga water shed by Woldeamlak(2003) indicated that there is a positive relationship between number of tree planted and literacy of house hold heads. That is, literate farmers are more motivated to plant their own trees than their illiterate counter parts. Also, regression results of a study conducted in rural Ethiopia regarding tree planting and construction of soil conserving structures by Alemu(2003) has indicated that literacy of household heads increases the probability of growing trees .

Table -26 Cross tabulation Results of Adoption Condition of Tree Planting in a Woodlot Technology and Factors Affecting it.

Variables	Adopters n=103		Non adopters n=30		X^2 Value	Significance level	Total n = 133	
	Count	%	Count	%			Count	%
Educational status of HHHs(formal education)								
-Attended/Attending	17	16.5	3	10	5.001	0.172	20	15.1
-Never attended	86	83.5	27	90			113	84.9
Land Tenure security								
-Feel secured	55	53.4	4	13.3	*** 14.764	0.000	59	44.4
-Do not feel secured	48	46.6	26	86.7			74	55.6
Physical Access of Market								
- Have access	60	58.3	12	40	** 11.027	0.026	72	54.1
- No access	43	41.7	18	60			61	45.9
Participation of beneficiaries in planning of NRM activities on their farm lands								
-Participated	40	38.8	4	13.3	*** 21.650	0.000	44	33.1
-Not participated	63	61.2	26	86.7			89	66.9

Source: Field survey, 2006

Note : X^2 = chi-square

*** ⟶ *Indicates significance level at 1 %*

** ⟶ *Indicates significance level at 5 %*

vii) Land Tenure Security

The degree of tenure insecurity of land is expected to be an important, though not the only determinant factor of tree growing behavior. Many studies suggest that small holders must enjoy security over land or trees before they cultivate and care for trees (Godoy,1990 as cited in Godoy 1992)

Farmers decision to practice long term investments on their farm lands is influenced by current land tenure system. The cross tabulation result in Table – 26 shows that the percentage of sampled household farmers who feel secured to current land holding system and adopted tree planting in a wood lot technology is 53.4 percent and that of non adopters is

13.3 percent. However, the percentage of sampled households who do not feel secured and adopted tree planting in a wood lot is 46.6 percent and that of non adopters is 86.7 percent. This shows that there is visible difference in the percentage of adopters and non adopters. The chi-square analysis in the same table also shows that there is statistically significant difference at 1% level in tenure security status of adopters and non adopters of tree planting in a woodlot (X^2= 14.864, P= 0.0%) . That means , there is strong and significant association between land tenure security and adoption decision of planting trees in a wood lot.

The majority of FGD from the adopter groups of PAs of zigudagult, zubraquandisha, Abadra agaga conclude that they feel secured to the current land holding system because of the land certification card they are provided with and they have the right to lease up to 25 years. However, most of the non adopter groups from PAs of Dubi-Micael and Gumdriabela akena do not feel secured to the current land holding system, though, they are provided with use right certification card. This is because they believe that, use right does not mean property right .They further argued , for instance , in 1997 their land holding had been re-distributed to others by the regional state and the size of land they retained is highly reduced. They also added that ,they have the fear of ,the current land holding size they possessed could be sub divided and redistributed to others in the near future . Hence, they concluded putting long term investment on their land holding is not important for them. Because there is no guarantee for their current land holding in the future.

Discussion with NRM DAs, woreda, zonal and Regional conservation experts indicated that the current land tenure system do not encourage the land users to do long term investment like tree planting in their land holding. It highly influences the farmers to plan in a long term basis. Hence, in the study area, land/tree tenure is an important factor for long term investment of farmers on their land holdings like tree planting in a wood lot.

Other similar studies conducted on this issue in and outside Ethiopia have found different results . For instance, study conducted outside Ethiopia by Place and Hazell (1993), shows that land rights were not found to be significant factors that determine investments in land improvements. On the other hand, study conducted in north western Ethiopia by Woldeamlak(2003), indicates that, due to tree/land insecurity problem, some of the sample

house holds did not plant any kind of trees in the chemoga water shed. This result is in line with the survey result of this study.

viii) Physical Access of Market

Households in the neighborhood of improved roads or otherwise improved market access may also encouraged to invest more in uncertain new technologies. Market access (easier exchange), therefore, increases the external demand for local producer goods, forest products in this case (Amacher,1993).

Physical access of market could be considered as the distance to the markets and absence/presence of all weather roads to the markets. Hence, since market access affects the relative profitability of investment in conservation practices, it can influence the adoption decision of long term investments like tree planting in a wood lot technology.

Thus, the percentage of the sample households of the study area who have physical access of market and adopted tree planting in a wood lot technology is 58.3 percent compared to 40 percent of non adopters. However, the percentage of sample house holds who do not have physical access of market and adopted tree planting in a wood lot is 41.7 percent and that of non adopters is 60 percent (Table 26). The chi-square analysis in the same table also shows that there is statistically significant difference at 5 percent level between adopters and non adopters (X^2= 11.027,P= 2.6%) as a result of access of market . That is, there is a statistically significant association between physical access of market and adoption decision of tree planting in a wood lot technology in the sample house holds. This is due to the fact that transporting tree products like fuel wood, logs and poles to the market is a very difficult task since tree planting in a wood lot is practiced both for the ecological and commercial use

Most of the focus group discussants from the adopter and non adopter groups suggested that market accessibility will encourage them to plant trees in a wood lot because of its economic benefit. However, the adopters group believe that tree planting in a wood lot is not only for the market but also it is used for self fuel wood consumption and construction of houses of the house holds as well as it has ecological advantage.

Discussion with NRM agents and conservation experts from woreda, zonal and regional level have confirmed that Physical access of market(distance from the market and absence or presence of all weather roads) is a determining factor to plant or not trees in a wood lot

technology by the farmers . This is because tree products such as logs and poles are bulky to transport to the market.

ix) Participation of Beneficiaries/Farmers/in Planning of NRM Activities

Participation allows people to have a role in decision making. That is, participation of beneficiaries is among the most important factors for the successful implementation of improved natural resource management (NRM) technologies like tree planting in a wood lot, particularly at the planning stage . The finding of this study, indicated that the percentage of beneficiaries who participated at the planning stage of NRM activities like tree planting in a wood lot and adopted it is 38.8 percent where as the percentage of the non adopters is 13.3 percent. On the other hand, the percentage of beneficiaries who did not participate in the planning stage of NRM activities and adopted the technology is 61.2 percent and that of non adopters is 86.7 percent(Table-26) . The chi-square analysis in the same table shows that there is statistically significant difference between adopters and non-adopters at 1% level as a result of participation (X^2=21.650,P=0%). That means there is strong and significant association between participation of beneficiaries at the planning stage and adoption decision of tree planting in a wood lot .

The majority of focus group discussants from the adopter and non adopter groups, the NRM agents, and conservation experts at woreda zonal and regional levels also believe that participation of beneficiaries is an indispensable issue for all development activities, particularly to NRM activities like tree planting in a wood lot, and physical soil conservation measures since it requires the willingness, the resource and labour of the target groups.

x) Attitude of Beneficiaries(Farmers) Towards Tree Planting in a Woodlot Technology

The Conservation behavior of farmers and willingness of them to apply alternative resource conservation techniques are largely determined by their over all attitude and perception(Belay,1992). Hence, the knowledge of the attitude of local people towards innovations in general and improved natural resource management technologies, like tree planting, in particular is critical for the success of rehabilitation activities being undertaken.

To asses the attitude of sampled house hold farmers towards tree planting in a wood lot technology, four statements , two positive in Table 27(a) and other two negative in table 27(b) were designed based on Likert/ Summated scale, and informants were asked to express

their attitude(feeling) according to their own choice regarding the technology. The agreements and disagreements in percentages are summarized according to the cross tabulation result of adopters and non adopters of tree planting in a wood lot to the respondents response for positive and negative statements.

Table – 27 (a) Beneficiaries Attitude Towards Positive Statements to Tree Planting in a Woodlot Technology ; Percent of Respondents

Statements (Positive)	Adopters					Non adopters				
	SDAG	DAG	N	AG	SAG	SDAG	DAG	N	AG	SAG
Planting trees in a form of wood lot on degraded lands will help the land to rehabilitate it.	-	-	-	94.3	5.7	6.6	36.7	56.7	-	-
Planting trees in a wood lot technology has economical and ecological benefit. Hence I have to plant trees on my land holding	-	-	-	76.7	23.3	6.6	76.6	16.8	-	-
Mean/Average/	-	-	-	**85.5**	**14.5**	**6.6**	**56.7**	**36.8**	-	-

Source: field survey,2006

Note: Abbreviations at the top of the columns represents the following:

- *SDAG* ⟶ *Strongly dis agree*
- *DAG* ⟶ *Dis agree*
- *N* ⟶ *Neutral*
- *AG* ⟶ *Agree*
- *SAG* ⟶ *Strongly agree*

Table – 27 (b) Beneficiaries Attitude Towards Negative Statements to Tree Planting in a Woodlot Technology ; Percent of Respondents

Statements (negative)	Adopters					Non adopters				
	SDAG	DAG	N	AG	SAG	SDAG	DAG	N	AG	SAG
Planting trees in a wood lot technology will take part of the land out of crop production which had been helping to full fill the food requirement of the house hold.	25.8	61.3	12.9	-	-	-	-	-	67.7	32.3
Planting trees in a wood lot technology is not useful, for it has no market access to its tree products.	23.3	42.1	25.8	8.8	-	-	-	6.6	66.8	26.6
Mean/Average/	**24.6**	**51.7**	**19.4**	**4.4**	-	-	-	**3.3**	**67.3**	**29.5**

Source: field survey, 2006

Note: Abbreviations at the top of the columns represents the following:

- *SDAG* ⟶ *Strongly disagree*
- *DAG* ⟶ *Disagree*
- *N* ⟶ *Neutral*
- *AG* ⟶ *Agree*
- *SAG* ⟶ *Strongly agree*

As it is shown in Table 27(a), the mean results of positive statements about tree planting in a wood lot technology indicates that, 100 percent of the adopters showed their agreement. However, 63.3 percent of non adopters showed their disagreement and 36.7 percent of them were unable to decide. In the same way, responses for negative statements in Table 27(b) indicates that the mean percentage of adopters who showed their disagreement to statements is 76.3 percent and 19.4 percent of them were unable to decide about the issue. However, the majority of the non adopters, that is, 96.7 percent of them showed their agreements for negative statements about tree planting in a wood lot. It is only 3.3 percent of them that were unable to decide about

the statements. Thus, the survey result tells us that the majority of the adopter groups have positive attitude towards tree planting in a wood lot technology. Where as, the majority of the non adopter groups have negative attitude towards the technology. This shows that there is association between adoption of tree planting in a wood lot and attitude of farmers towards the technology.

The focus group discussants from adopter and non adopter groups suggested that nearly the same opinion as that of bund technology. That is, most of the discussants from adopter groups showed positive attitude whereas the majority of the discussants from non adopter groups showed negative attitude towards tree planting in a wood lot.

Moreover, natural resource management agents and conservation experts from woreda, zonal and regional level also confirm that the majority of the farmers of the study area have positive attitude to tree planting in a wood lot , except the problem of other constraining factors like tenure security and land holding size that could hindered them to implement/adopt/it.

In sum, the majority of the sample house holds, especially the adopter groups have positive attitude to wards tree planting in a wood lot technology.

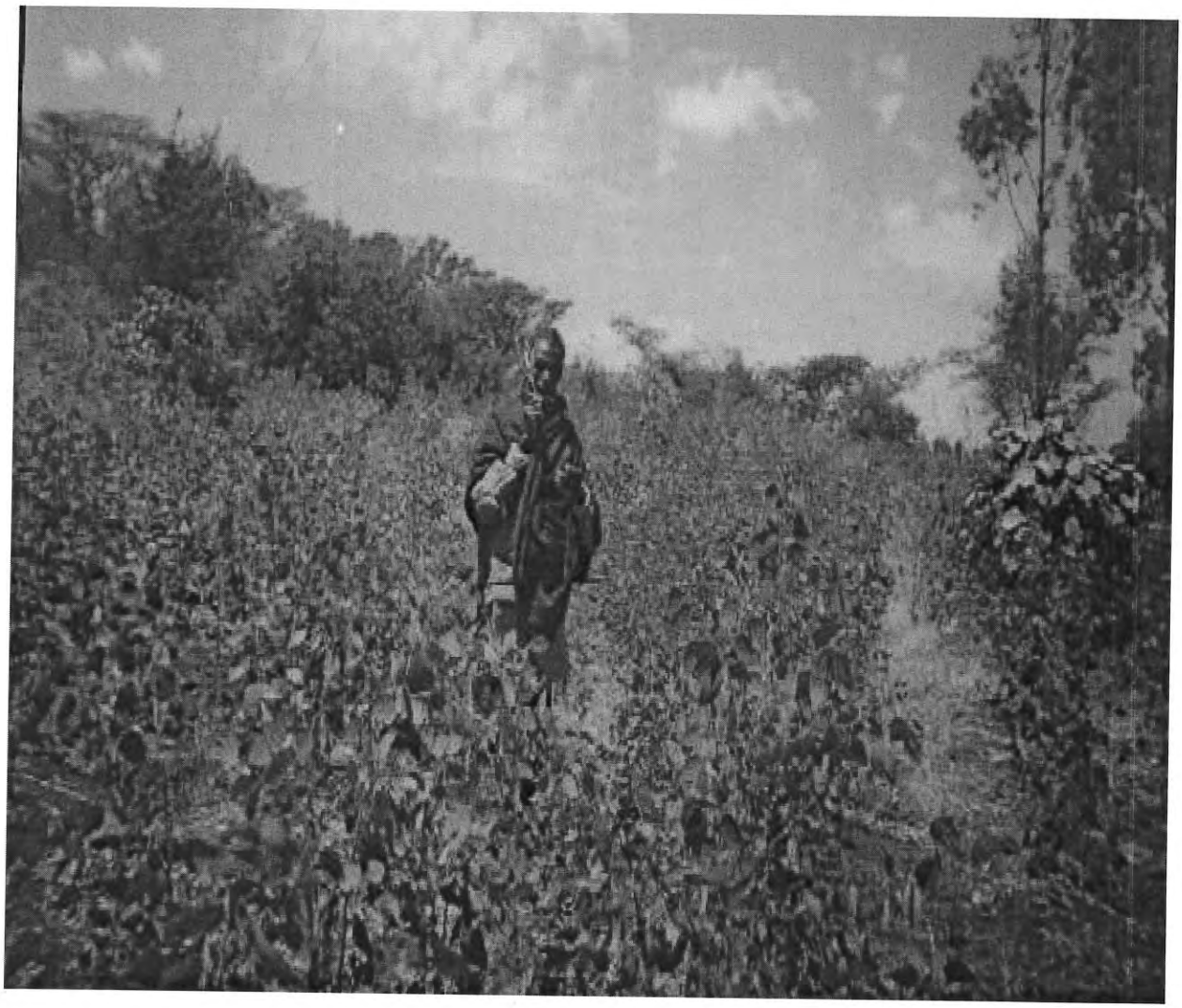

Figure -3 One of the Woodlot tree plantings by households
(Photo, taken in March 2006)

CHAPTER SIX

6. SUMMARY, CONCULUSION AND RECOMMENDATIONS

This study has attempted to examine the currently important issue of natural resource degradation and its management intervention efforts particularly, on the issue of the adoption of natural resource management technologies and factors affecting it in Dangila woreda. Dangila woreda is located in northwestern Ethiopian high lands in Amhara region. The study had been conducted in five peasant Associations (PAs) which were selected purposively covering 4884 households and which have homogeneous population . Applying simple random sampling technique 160 sample household were selected from five PAs to represent the target population of which the data of 148 sample households is analyzed . In addition focus group discussions with framers interview of conservation agents (DAs) and NRM experts at different levels as well as direct field observation techniques were also used to supplement the survey . The summaries of major findings conclusion and recommendations are presented here under .

6.1 Summary and Conclusion

Natural resource degradation in the highlands of Ethiopia including the study area is a critical problem. Particularly, deforestation and soil erosion are considered to be two of the most important environmental problems in Ethiopia in general and in the study area in particular. Hence, different kinds of natural resource management intervention efforts like construction of physical soil conservation structures and tree plantings were carried out in the study area for the last three decades to reduce the degradation problem and conserve the natural resources. However, these efforts were not satisfactory and did not achieve the desirable out come. This is partly due to lack of adoption of improved conservation (NRM) technologies and effective participation of people who are in away directly and indirectly responsible to such degradation and resource mining. Hence, the limited success of different efforts necessitates the investigation of the state of adoption of improved NRM technologies like bund construction and tree planting in a woodlot and some of the basic socio- economic and institutional factors that are associated .

Thus, the socio-economic and institutional factors like, age and educational status of the households heads, active labour size of the household, land availability/holding/ size, physical access of market, livestock size, attitude of beneficiaries towards the technologies, land tenure security, agricultural extension service delivery/frequency of extension contacts/, participation of

beneficiaries at the planning stage of improved NRM works/activities/ were considered to see their association with the adoption condition of the two types of technologies mentioned above .

The study result have shown us that, 79.2 percent of the sample households implemented the bund technology on their farm lands either voluntarily or force fully in the period of their farming experience. However, 20.8 percent of them did not practice/implement/ the technology at all. However, from those who implemented/adopted/ the technology themselves the majority(64.6 percent) practiced it on a very small size of their farm lands. That is, they treated on less than or equal to ¼ of their land holding size only. That means, even though the adoption incidence of bund technology seems encouraging (79.2 percent), the adoption intensity is weak enough to solve the soil degradation problem as quickly as possible. That is ,the area of land which is treated with bunds is little compared with the total area of land which needs treatment . This shows that, the adoption of bund technology is not satisfactory in the study area. This is partly because of the effect of some of the basic socio-economic and institutional factors. For instance out of the ten socio-economic and institutional factors investigated in this study, those which were found to be associated to the adoption condition of bund technology and creates statistically significant variation between the adopter and non adopter groups are: land holding size, livestock size, frequency of extension contacts by conservation agents, land tenure security, participation of beneficiaries at the planning stage of NRM activities/works on their farm lands and attitude of farmers towards the technology.

Tree planting in a woodlot is the second type of technology which was investigated thoroughly in this study. The research result shows that the adoption condition of this technology is nearly similar to that of bund technology. That is, 77.4 percent of the sample HHs implemented/adopted it, where as 22.6 percent of them did not implemented/adopted it. However, even though 77.4 percent of the household heads implemented the technology, the area covered by the majority of sample households with this technology is very small. For instance, as it was observed in the field by the investigator using the pre-designed checklist, out of the observed 25 sampled plots,21(84 percent) of them practiced the technology on less than 1/10 of their land holding size only . On top of this, as it is mentioned above 22.6 percent of the sample households did not practiced or adopted the technology at all. This is obviously due to the influence of the socio-economic and institutional factors. Thus, the socio-economic and institutional factors which were investigated in bund technology were also applied on this

technology to observe the relationship. Hence, out of the ten factors seven of them were found to have association with the adoption condition of tree planting in a woodlot technology. These factors were: age of the household heads, land holding size, frequency of extension contacts, land tenure security, physical access of the market, participation of beneficiaries at the planning stage of NRM activities, attitude of farmers towards the technology were found to be statistically and significantly related.

In sum, the majority of the farmers of the study area implemented the improved NRM technologies like bunds and woodlot tree plantings on their farm plots. However, the mode of implementation was both forceful as well as on voluntarily basis. Some of the farmers who participated in the focus group discussion have explicitly explained that, they implemented the NRM technologies, specifically bund formation not on their own full willing but with certain enforcement mechanisms by the PA administrators and conservation agents (DAs) . For this type of adoption the PAs administrators and DAs put a phrase in amharic " Bego-tetsieno". It means influencing the farmers for good thing . Thus, even though all the implementers of improved NRM technologies are taken as adopters for the simplicity of the study, it doesn't mean that all the farmers adopted it based on their free decision. That means there were farmers who were forced to decide and implemented the technologies. On top of this , even though the majority of farmers implemented the technologies on some of their farm plots, the area treated by these technologies, specifically by bund and woodlot tree planting is not as expected and it is very little compared to the land which needs treatment in the study area. In addition to this there are also farmers who didn't adopt the NRM technologies at all. Thus, the research result have shown us that, adoption decision of farmers to the improved NRM technologies specifically, bund formation and woodlot tree planting is influenced by a range of socio-economic and institutional factors. For instance, among the factors which were commonly associated to both kinds of NRM technologies were: land holding size, frequency of extension contacts by conservation agents, land tenure security, participation of beneficiaries at the planning stage of NRM activities/works and attitude of the farmers towards the technologies were statistically and significantly associated. However, some socio-economic factors were not commonly associated to both kinds of technologies. For instance, livestock size was significantly associated with bund technology, but it was not significantly related with tree planting in a woodlot technology. On the other hand age of the household head and physical access of market were significantly associated with tree

planting in a woodlot but were not associated with bund construction technology .This shows that the local conditions of the study area were not given due emphasis during the natural resource management intervention efforts that have been taking place in the past years .

As a whole ,the research result of adoption condition of both technologies by the farmers and the socio-economic and institutional factors associated to this adoption condition high-lights us that ,blanket approach to natural resource management intervention efforts with out considering the situations at the ground could make the measures inappropriate to local conditions and could be unacceptable by the land users /farmers/. Hence, local specific, household focused and technology based approaches have to be followed in order to enable to tackle the socio-economic and institutional factors that affect the adoption decision of farmers upon improved NRM technologies for sustainable management and use of natural resources .

6.2.**Recomendations**

The adoption of improved NRM technologies in the study area at present signify that addressing multi-dimensional socio -economic and institutional constraints of farmers at the household level targeted to natural resource conservation is required besides the technical feasibility of conservation measures. The solutions seem to be complex and may require multi-sectoral approach in planning and implementation of NRM works. In light of this the following recommendations are forwarded:

1. The inherent dependence of sustained development on the conservation of natural resources has to be appreciated more than it does at present. The development strategies, plans, polices, projects, and institutional arrangements, even with in the agricultural sector were formulated and implemented with out reference to conservation objectives or effects. At the farm level, decisions and methods on the use of land, whether for cropping grazing or forestry, were not related to the need to conserve resources. This basically reflects insufficient understanding of the causes, processes, consequences and solutions of natural resource degradation in the study area in particular and in other highland areas of the country in general. Thus, creating sufficient and clear understanding of the causes, processes, consequences and solutions of natural resource degradation to the land users is an indispensable task of natural resource conservation practitioners and other concerned bodies.

2. The issue of land tenure insecurity has been important in the debate about the causes of natural resource conservation and it was identified to be one of the main constraints for the farmers adoption decision/condition/ of both bund formation and tree planting in a wood lot technologies i.e it was strongly and significantly associated with adoption decision of the farmers. There fore , securing rights on farm lands have to be provided to the farmers to enhance the adoption level of natural resource management technologies. This is because, it is important to recognize that awareness and knowledge in itself is not enough to motivate the farmers to invest on NRM works. In this study area, among those farmers who are aware of about NRM technologies and their benefits, there were some who were reluctant to under take/implement/ or adopt these technologies because of land tenure security problem . Securing the farm landholdings to the land users will help to provide the farmers the assurance of use rights over sufficiently long periods of time during which they could benefit from their long term investments up on their farm holdings . Hence, the farmers will get guarantee to do long term investment over their farm lands.
3. Participation of beneficiaries at the stage of planning of natural resource management activities/ conservation interventions is at the center for adoption decision of conservation technologies of the study area . This is because , the research result has shown us that, participation of the farmers at the planning stage of NRM works is strongly and significantly associated/ related with the adoption condition of both bund formation and tree planting in a woodlot technologies. The approach to be followed shouldn't be top-down, it has to be bottom-up . Other wise if the plan is top down the role of farmers will be limited to labour contribution at the implementation stage of NRM works . Thus, farmers have to be participated at the planning stage and convinced as much as possible to the need for NRM works , the site selection , the types of technologies to be implemented , time of implementation, the way how the technologies to be implemented.. etc should be considered together with the beneficiaries. By so doing , it is possible to assure real adoption and sustainable use of the technologies and able to conserve natural resources. Thus , the reassessment and reorientation of the approach being followed towards real participatory process is important to ensure the sustainable utilization of the technologies by the land users.

4. A greater awareness on natural resource degradation problem and the extent and severity, of the problem as well as the long term benefits of conservation works needs to be created among the farmers of the study area through agricultural extension service delivery systems like training and technical assistance, demonstrations, posters and exchange visits. The extension agents/conservation agents have to capacitate the local people by allowing them to identify their own problems and they should be part of the solution rather than receiving readymade remedies to existing problems they have. Thus, the extension service provision have to be oriented towards the advisory and training system rather than directing and providing ready made solutions to the farmers' problems. Hence, based on this notion the frequency of extension contact by natural resource management agents (DAs) to the farmers have to be increased from its current level (which is less than one day in a week). This is because, the research result have found that, frequency of extension contacts is significantly and positively associated with the adoption decision of NRM technologies. Thus, sufficient, accurate and timely extension service/ information dissemination is critical in the study area. To provide sufficient, accurate ,and timely extension service regarding natural resource management activities, DAs who trained in diploma level in this specific field of study have to be assigned in each PA .
5. Natural resource management technologies that helps to reduce soil erosion and enhance soil fertility are vital to increase agricultural production. However, economic returns from conservation activities are long term in nature . On the other hand, , the poor always looks for short term benefits to support their life. Thus, technologies like wood lot tree planting that directly increase farmers' income in relatively shorter period of time as compared to physical soil conservation technologies, like bunds have to be advised to the farmers along with the motivation of long term investments. By so doing, it is possible to achieve both economic and ecological advantages or benefits in relatively shorter period of time.
6. There is a need to set up strong institutional framework that enables the farmers to benefit from marketing of agricultural products particularly, from tree products(like wood, log and poles). Hence, improvement of basic social and physical infrastructures has direct implication for better adoption of NRM technologies. Construction of all

weather roads in the PAs connecting them to the near by towns/markets facilitates the adoption condition of NRM technologies like tree planting in a woodlot technology, since it helps to transport the tree products to the market.

6. Disguised unemployment of labor like non participation of women (wives) and adult female children who are in the active labor age group in conservation works have to be given due emphasis by household heads and conservation agents (DAs) and PA administrators. Some of the farmers who concluded that they have active labor shortage problem in their households is due to the wrong perception that women (wives) and adult female children could not participated in conservation works . Hence, women and adult female children should be initiated to participate in NRM works by the conservation agents (DAs), PA administrators , household heads in the study area . On the other hand ,the current soil and water conservation strategy designed by policy makers advocated that conservation works on the individual farm plots should be practiced on household basis. However, the household heads who are old, disabled and that didn't have sufficient labor power in their households could not be able to practiced conservation works by themselves sufficiently .

Hence , group working on individual farm plots should be also advocated /encouraged by the policy makers and implementers to practice the improved NRM technologies specifically the soil and water conservation technologies like bunds sufficiently and conserve the natural resource base of the study area .

8. Sustainable management and use of natural resource have to be at the center of the struggle for reduction of country's poverty reduction efforts and rural development policies. Hence, the priority accorded to arresting the degradation of natural resources is most deserving since it is one of the most serious impediments in attaining the broader objective of sustainable agriculture and rural development in the Ethiopian highlands in general and the study area in particular.

9. Blanket approach to natural resource management intervention efforts with out considering the situations at the ground could make the measures inappropriate to local conditions and could be unacceptable by the land users /farmers. Hence, local specific, household focused and technology based approaches have to be followed in order to enable to tackle the socio-economic and institutional factors that affect the adoption

decision of farmers upon improved NRM technologies for sustainable management and use for natural resources.

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Annex - 1

Instrument- 1

Household Heads Survey Questionnaire

Objective of the Questionnaire:

This questionnaire is designed for the purpose of gathering / collecting information regarding the state of adoption of improved natural resource management technologies and factors affecting it in the high land agro-ecosystem of North Western Ethiopia with particular reference to Dangilla Wareda of Awi Administrative Zone in Amhara national Regional State. This study will help to identify and investigate the Socio-economic and intuitional factors that hinder/ promote the adoption of improved natural resource management technologies by the farmers of the study area. Finally, based on the findings, tentative solutions will be recommended that could help to combat natural resource degradation in the locality under investigation in particular and the region in general. You are therefore kindly requested to provide accurate and reliable information as much as possible. The final document that will be produced based on the information you have provided is intended to serve for an academic purpose to the partial fulfillment of the requirement for a Master of Arts (MA) degree in Regional and local development studies / RLDS/.

Instruction:

Use 'X' mark for answers of questions with various alternatives in the space provided and write the specific issue when required in its appropriate place.

- PA's name _____
- Altitude above sea level in meters
  - 1) 1500m – 2300m ☐ (3) Above 3201m ☐
  - 2) 2301m -3200m ☐
- Agro ecological zone
  - 1) Woina Dega ☐ (3) Wurch ☐
  - 2) Dega ☐
- Date of interview _____
- Name of Enumerator _____
- Code No _____
- Time Spent for interview _____

I- Personal Data

1. Name of Respondent (N RESP)_____

2. Sex of the respondent

(1) Male ☐ (2) Female ☐

3. Age of the respondent _____

4. Marital status of the respondent

(1) Single ☐ (3) Separated ☐

(2) married ☐ (4) widower/d ☐

5. Educational level of the respondent

(1) Illiterate ☐ (4) Grade 9 – 12th completed ☐

(2) Can read and write only ☐ (5) Other (Specify) _____

(3) Grade 1-8 ☐

6. For how long have you lived in this locality (PA)?

(1) Less than 1(one) year ☐ (4) 21 – 30 years ☐

(2) 1-10 Years ☐ (5) More than 30 years ☐

(3) 11 – 20 years ☐

II- Trends of natural resource use and Farmers Understanding to its Degradation

- Soil Degradation:

7. Do you have your own land holding?

(1) Yes ☐ (2) No ☐

8. How do you classify the slope of the majority of your farm plots/land holdings?

(1) Plain land /'Meda'/ ☐ (4) Steep slope/'Terrarama'/ ☐

(2) Gentle slope/'Tedafat'/ ☐ (5) other (specify) ☐

(3) Moderate slop/'Daget'/ ☐

9. How do you view the quality of your land?

(1) Still it is fertile ☐

(2) Becoming poor ☐

(3) Other (specify) ☐

10. Do you observe (perceive) the soil / land/ degradation in your farm land?

(1) Yes ☐ (2) No ☐

11. If your answer to Q – 10 is yes, what is the extent of degradation?

(1) Low ☐ (3) severe /high/ ☐

(2) Moderate ☐ (4) I do not know ☐

12. What are the manifestations /indicators/ of soil /land/ degradation in your cultivated land?

(1) Loss of productivity ☐ (4) gully formation ☐

(2) change of soil colour ☐ (5) Other (specify) ☐

(3) Stoniness ☐

13. What are the causes of soil erosion/ land degradation/ in your view?

(1) Miss management / no use of conservation measures ☐

(2) Shortage of farm land to practice fallowing ☐

(3) Sloppiness of the cultivated land ☐

(4) Torrential rain fall ☐

(5) Other (Specify) _____

14. Have you taken any one of the following measures as a result of soil/land degradation problem?

(1) Abandoned to cultivate part of your land ☐

(2) Expanded to plow the range lands ☐

(3) Expanded to Plow forest / vegetative areas ☐

(4) Have taken off-farm employment ☐

(5) Other (specify) _____

15. Do you use fire as part of your land management practice?

(1) Yes ☐ (2) No ☐

16. If your answer to Q – 15 is yes, name the type of use?

(1) Clearing of new land ☐ (4) 1+2+3 ☐

(2) Clearing of weeds ☐ (5) other (specify) _____

(3) For pasture re-growth ☐

17. Did you use Much of the dung and crop- residue young of for soil

fertility maintenance?

(1) Yes ☐ (2) No ☐

18. If your answer to Q- 17 is No for what purpose do you use the dung and crop residue

(1) For fuel ☐ (3) Crop- residue for animal feed ☐

(2) For market (Sale) ☐ (4) Other (Specify) _____

19. Did you practice fallowing on your farm land?

(1) Yes ☐ (2) No ☐

20 If your answer to Q – 19 is No Why?

(1) Due to shortage of farm land ☐

(2) Since it has no use / importance/ ☐

(3) Because the land will be virgin to re-cultivate ☐

(4) Since the annual harvest of the house hold will decrease, I have to plant all of my land holding ☐

(5) Other (specify) _____

21. Do you practice crop – rotation on your farm land?

(1) Yes ☐ (2) No ☐

22. If your answer to Q- 21 is No Why?

(1) Because it has no any use ☐

(2) Since I gave focus to high value crops and plant them regularly ☐

(3) Since I gave emphasis to productive crops ☐

(4) Since I used artificial and natural fertilizers to maintain the soil fertility ☐

(5) Other (Specify) _____

Forest/Vegetation Degradation

23. What is the primary source of your fuel?

(1) Fuel wood ☐ (4) kerosene ☐

(2) Crop – residue ☐ (5) other (specify) _____

(3) Dung ☐

24. Where do you collect fuel wood ?

(1) From communally owned forest ☐

(2) From wood lot I planted ☐

(3) From natural trees grown in my farm land ☐

(4) other (specify) _____

25. Do you face the shortage of fuel wood?

(1) yes ☐ (2) No ☐

26 If the answer to Q – 25 is yes, what is /are the reasons?

(1) I do not planted my own trees in a wood lot on my farm land ☐

(2) I exhaustively used all the trees in my farmland ☐

(3) Communally owned forests are exploited and deteriorate ☐

(4) other (Specify) _____

- **Pasture and Range Land Deterioration**

27. Do you have shortage of pasture or feed for your live stock?

(1) Yes ☐ (2) No ☐

28. If your answer to Q- 27 is yes, what are the causes?

(1) Range lands are transformed to cultivated lands ☐

(2) I have high population size on the existing range land ☐

(3) I used free grazing practice ☐

(4) The quality of rage land deteriorated ☐

(5) 1+2+3+4 ☐

(6) Other (specify) _____

29. If you have shortage of pasture / range land, what should be the solution in your opinion?

(1) Follow zero- grazing principle ☐

(2) Decreasing size of live stock population ☐

(3) Use improved live stock breeds ☐

(4) Continue to use the existing grazing land ☐

(5) 1+2+3 ☐

(6) Other (Specify) _____

- **Water Resource Depletion**

30 Do you have shortage of source of water for irrigation?

(1) Yes ☐ (2) No ☐

31. Do you face water shortage for the house hold and live stocks?

(1) Yes ☐ (2) No ☐

32. If your answer to Q-30 and Q – 31 is yes, what are the possible reasons for the shortage in your view?

(1) In recent periods springs and small rivers dried in dry seasons due to natural resource degradation ☐

(2) There is water source problem around the locality ☐

(3) There is large human and live stock population size that uses the existing water sources ☐

(4) Other (Specify) _____

III Labour Size of the House Hold

33. Indicate the size of your house hold members including you with respect to their age and sex; in the following table

No	Sex	Age group/category/				Total
		< 7	7 – 14	15 - 59	≥ 60	
1.	Male					
2.	Female					
	Total					

34. Do you participate in natural resources conservation activities?

(1) Yes ☐ (2) No ☐

35. If your answer to Q-34 is yes, who else from the permanent members of the house hold participates in the natural resource conservation activities other than you?

(1) Male adults ☐ (3) your wife ☐

(2) Female adults ☐ (4) other (specify) _____

36. Do you have sufficient labour force for both agricultural production and natural resource conservation activities

(1) Yes ☐ (2) No ☐

37. If your answer to Q – 36 is No, then how do you over come the shortage of labour in the house hold

(1) I will provide priority to agricultural activities ☐

(2) I will share the house hold labour force for both activities ☐

(3) I will buy daily labourers ☐

(4) I will postponed natural resource conservation activities to the other season of the year ☐

(5) No conservation work ☐

(6) Other (Specify) _____

38. Do you Think that natural resources conservation activities should not be given equal emphasis to agricultural activities?

(1) Yes ☐ (2) No ☐

39. If the answer to Q – 38 is yes why?

(1) We should produce for our consumption first ☐

(2) Natural resource management works can be postponed to another seasons or years ☐

(3) The effect of natural resource management works will be seen in a long term ☐

(4) Others (Specify) _____

40. For female headed house holds; if you do not participate in natural resource conservation, what is/ are the reasons?

(1) Cultural influence ☐

(2) I do not have sufficient labour power /strength/ to do so like males ☐

(3) The PA administrators do not initiate me to participate ☐

(4) other (Specify) _____

IV Land Holding Size

41. If you, have your own land holding, approximately how many 'timad' / 'Kada' /do you hold?

(1) Less than 2 timad' ☐ (4) 9 – 12 timad' ☐

(2) 2 – 4 timad ☐ (5) Greater than 12 timad' ☐

(3) 5 – 8 timad' ☐

42. For what purposes do you used your land holding in 2004/ 05 cropping season. Indicate the type of use in number of 'timad' / Kada'/ approximately?

No	Type of land use	Number of 'timad'
1	Cultivated (cropping) land	
2	Gazing land	
3	Fallow land	
4	Forest / Vegetation/ land	
5	Other purposes	
	Total	

43. Is the size of your land holding increasing or decreasing?

(1) Increasing ☐ (3) Decreasing ☐

(2) Remain the same ☐

44. If your land holding size is decreasing what are the reasons?

(1) It is re-distributed to others ☐

(2) It is taken for social infrastructures ☐

(3) It is communally owned for range land purpose ☐

(4) It is communally owned and afforested ☐

(5) I my self shared to my mature male children ☐

(6) 1+2+3+4+5 ☐

(7) Other (Specify) _____

45. Do declining of a land holding size has influenced you not to practice improved NRM technologies, like, soil conservation technologies and tree planting

(1) Yes ☐ (2) No ☐

46. If your answer to Q – 45 is yes, how does it affects?

(1) It is difficult to apply improved conservation structures on small plot of land ☐

(2) I can not plant trees in a separated wood lot because of shortage of land for annual crops production. ☐

(3) The improved conservation structures will share part of the smallest land holding size it self ☐

(4) I can not grow fodder plants in a separated plot of land to practice zero grazing ☐

(5) other (specify) _____

V Land Tenure Security

47 Do you feel that the land you hold belongs to you?

(1) Yes ☐ (2) No ☐

48. If your answer to Q- 47 is No what are the reasons?

(1) Because I have no property right ☐

(2) It can be re-distributed to others by government ☐

(3) other (Specify) _____

49. Did you do an investment, to improve your land holding permanently like constructing irrigation canals, planting trees, constructing check dams, water harvesting structures , and bunds, ... etc

(1) Yes ☐ (2) No ☐

50. If your answer to Q – 49 is No, what are the reasons

(1) I better exploited the land before I dispossessed ☐

(2) Investment on the land is not profitable, because it demands high expenditure ☐

(3) It demands high labour power and I do have shortage of it in the house hold ☐

(4) Others (Specify) _____

VI Credit Service

51. What is your source of finance?

(1) Your own ☐ (3) Other (specify) _____

(2) Credit ☐

52. A there any organizations or institutions that can provide you credit for natural resources management activities in your woreda do you have credit access/?

(1) Yes ☐ (2) No ☐

53. If your answer to Q- 52 is yes, name the organizations?

(1) woreda office of agriculture ☐

(2) Amhara credit and saving institution ☐

(3) Farmers' co-operatives ☐

(4) other (specify) _____

54. If your answer to Q 52 is No how do you solve your financial problem?

(1) Borrow from individuals ☐

(2) No purchase ☐

(3) Other (specify) _____

VII Physical Access of Market

55. For what purpose do you plant trees in terms of its economic value?

(1) Self consumption ☐ (3) 1+2 ☐

(2) Market (Selling) Purpose ☐ (4) Other (Specify) _____

56. Do you have physical access of market for the tree and other agricultural products?

(1) Yes ☐ (2) no ☐

57. If your answer to Q – 56 is No, what is / are the reason / reasons?

(1) There is no road access to transport the products to the near by market ☐

(2) The demand is less ☐

(3) Other (Specify) _____

58. If you do not have physical market access to forest (tree) products, and other agricultural products would you stop planting trees, compost making, and construction of soil conservation structures?

(1) Yes ☐ (2) No ☐

62. If your answer to Q – 58 is yes, what about for other purposes, like reduce soil erosion, soil fertility maintenance, fodder, construction materials, fuel wood… etc

(1) I am not interested ☐ (3) It is not profitable ☐

(2) I planted some ☐ (4) Other (Specify) ----------

VIII Live- Stock size

60. If you have the live stocks, indicate the type, number/ size/ and use of the live stock you owned in the following table

No	Type	Number (Size)	Use
1	Ox		
2	Cow		
3	Heifer and bull		
4	Calf		
5	Goat		
6	Sheep		
7	Equines		
8	Chickens		
9	Others		
	Total		

61. Do you have sufficient pasture or range land to feed these live stocks?

(1) Yes ☐ (2) No ☐

62. If your answer to Q – 61 is No what are the reasons?

(1) Number of livestock population increased ☐

(2) Range land size decreased ☐

(3) The quality of pasture or grazing land is deteriorated ☐

(4) 1+2+3 ☐

(5) Other (Specify) _____

63. How do you deal with this problem?

(1) I used crop – residues as supplementary source of feed ☐

(2) I will plant fodder trees ☐

(3) I will plant forage crops ☐

(4) I will prepare hay from grass ☐

(5) I used the existing range land ☐

(6) 1+2+3+4 ☐

(7) Other (specify) _____

64. If you have shortage of pasture or range land why do not you decrease the number (size) live stocks

(1) I need the size of live stock for prestige ☐

(2) I need it for labeling of cropping land to saw small seed crops ☐

(3) Large size helps as reserve for disease out break ☐

(4) I will get better live stock product and drafting power ☐

(5) 1+2+3+4 ☐

(6) Other specify_____

IX Extension Service delivery (Training and Technical Assistance):

65. Have you received any kind of training on natural resource management technologies by woreda agricultural and rural development office and other organizations for the last three years?

(1) yes ☐ (2) No ☐

66 If your answer to Q- 65 is yes, was it sufficient?

(1) yes ☐ (2) No ☐

67. If your answer to Q – 65 and 66 is No then how did you implement the NRM technologies

(1) Simply by looking my neighbor's farm plot ☐

(2) With technical assistance of DAs ☐

(3) Assisted by other trained farmers ☐

(4) Others specify) _____

68. How often, agricultural extension workers/ assist or visit you with regard to the natural resource conservation activities like in soil conservation and tree planting, with in a year.

Refer 2004/05 Cropping season for your response.

Technical assistances / extension workers	**# of visit (contact) per year**
Extension Communication experts	_____
Natural resource management(Conservation) experts	_____

Natural resource management agents(DAs) _____

69. Do you find the technical assistance /advice/ you received from extension workers useful in implementing the improved natural resource conservation technologies /measures/?

(1) yes ☐ (2) No ☐

70. If the answer to Q- 72 is No, what are your reasons?

(1) Since I can not plough my farm land up and down, in which bund structures are constructed I ploughed the structures and hence the advice do not provide solution to the problem ☐

(2) The advice do not provide the solution to labour shortage problem for the implementation of improved NRM technologies ☐

(3) Some of the advices were not important to me to implement because of shortage of farm land, money and input ☐

(4) other (specify) _____

X Participation in NRM Activities

71. Have you been participated in planning of natural resource management activities, like identification, selection, prioritizing of NRM technologies and sites of its implementation for the last three years.

(1) Yes ☐ (2) No ☐

72. Have you been participated in implementation of improved NRM techniques or conservation structures ?

(1) Yes ☐ (2) No ☐

73. If your answer to Q – 72 is yes, is your participation voluntarily or forceful

(1) Voluntarily ☐ (2) forceful ☐

XII – Attitude

Instruction: - For the questions 74 – 81 below, rate either *strongly dis agree (SDAG), Dis Agree (DAG), Neutral (N), Agree (AG)* or *strongly Aree* (SAG). Use 'X' in the space provided.

No	Indicators/ Statments	SDAG	DAG	N	AG	SAG
74	Improved physical soil conservation technologies(bunds) are efficient in arresting soil erosion than traditional practies					
75	I will continue to implement improved physical soil conservation technologies (bunds) in my farm land.					
76	Constructing improved physical soil conservation structures(bunds) is laborious and tire some to implement on the farm lands. So it is dis advantageous					
77	Improved physical soil conservation measures(bunds) will take part of the cropping land out of production that had been helping to full fill the food requirement of the house hold					
78	Planting trees in a form of wood lot on degraded lands will help the land to rehabilitate it.					
79	Planting trees in a wood lot technology has economical and ecological benefit. Hence I have to plant trees on my land holding					
80	Planting trees in a wood lot technology will take part of the land out of crop production which had been helping to full fill the food requirement of the house hold					
81	Planting trees in a wood lot technology is not useful, for it has no market access to its tree products.					

82. Generally, how do you rank the efficiency of improved NRM technologies in relation to traditional ones in natural resource conservation

(1) Better ☐ (3) Worse ☐

(2) The same ☐ (4) I have no idea ☐

XII Adoption

83. Did you or you ancestors put any kind of traditional soil conservation structures on your land holding ?

(1) Yes ☐ (2) No ☐ (3) I do not know ☐

84. If your answer to Q- 83 is yes, does it help you to arrest the soil degradation?

(1) Yes ☐ (2) No ☐

85. Did you treated your farm lands / cultivated lands / with improved physical soil conservation structures (bunds) after it becomes your holding?

(1) yes ☐ (2) No ☐

86. If your answer to Q – 85 is yes, can you mention the types of bunds implemented?

(1) stone bund ☐

(2) Soil Bund ☐

(3)stone faced soil bund ☐

(4) Other (Specify) _____

87. If you treated your farm land with bunds; approximately how much proportion of your land holding is treated with this technology?

(1) more than ½ of your holding ☐

(2) ½ of your holding ☐ (5) less than ¼ of your holding ☐

(3) 1/3 of your holding ☐

(4) 1/4 of your holding ☐

88. How is the level of soil erosion on your farm land, after its treated by bunds

(1) Increasing ☐ (3) Decreasing ☐

(2) Remain the same ☐

89. If you do not treated your farm lands with improved physical soil conservation

technologies, (bunds) Why?

(1) I am not interested to implement these technologies because of land shortage. ☐

(2) There is problem of labour shortage in the household ☐

(3) They are not efficient to arrest soil erosion ☐

(4) Other (specify) _____

90. Which Method/ Methods/ would you prefer to conserve your farm land from soil erosion in a better way?

(1) Improved soil conservation – technologies ☐

(2) Tradition soil conservation measures ☐

(3) Both of them in combination ☐

(4) Other (specify) _____

91. If your answer to Q- 90 is improved soil conservation technologies, why?

(1) Because improved soil conservation technologies are more – efficient to arrest soil erosion than traditional ones ☐

(2) Farm lands (plots) which are treated with improved soil conservation technologies are providing better yield than traditional ones ☐

(3) others (specify) _____

92. If your answer to Q- 90 is traditional soil conservation measures, why?

(1) Traditional soil conservation measures are more efficient than improved soil conservation technologies in arresting soil erosion ☐

(2) Traditional soil conservation activities are easily applicable and demands less labour than improved ones ☐

(3) Traditional soil conservation measures do not waste cropping areas as that of improved soil conservation technologies ☐

(4) Traditional soil conservation measures are suitable for up and down plowing of the farm than improved soil conservation

technologies ☐

(5) Others (specify) _____

93. Did you Make and use compost to your farm land to enhance the fertility and productivity of the soil.

(1) Yes ☐ (2) No ☐

94. If your answer to Q- 93 is No why?

(1) I have no know how to prepare it ☐

2) I have no interest to prepare it ☐

(3) I have no sufficient labour in the house hold to prepare it ☐

(4) Shortage of raw materials ☐

(5) I will use chemical fertilizer instead of it ☐

(6) I will use animal manure / dung and crop residue instead of it ☐

(7) Other (specify) _____

95. Did you grow /plant/ trees on your farm land, in a form of Agro forestry?

(1) Yes ☐ (2) No ☐

96. If your answer to Q-95 is No, Why?

(1) I do not have sufficient farm holding ☐

(2) I do not have access to different tree species seeds and seedlings ☐

(3) I have no time to grow / plant trees, because of other agricultural activities ☐

(4) I do not have market access to sale tree products ☐

(5) Other (Specify) _____

97. If your answer to Q-95 is yes, for what purpose/ Purposes do you Grow trees?

(1) Fuel wood ☐ (5) Fruits / nuts ☐

(2) Construction /building/ materials ☐ (6) wind brakes ☐

(3) Fodder ☐ (7) Shades ☐

(4) Soil fertility maintenance ☐ (8) other (specify) _____

98. Do you practice zero-grazing techniques to your live stocks?

(1) Yes ☐ (2) No ☐

99. If your answer to Q. 98 is No, Why?

(1) I have no other means other than free grazing ☐

(2) I have no sufficient land holding to grow fodder trees and grasses for forage and pasture ☐

(3) The size of live stocks I have is large, that I cannot manage it with zero-grazing technique ☐

(4) other (specify) _____

100 Do you have shortage of water for irrigation, and consumption of your family and live- stocks

(1) yes ☐ (2) No ☐

101. If your answer to Q- 100 is yes, do you constructed water harvesting structures to harvest water during rainy seasons to alleviate the shortage?

(1) Yes ☐ (2) No ☐

102. If our answer to Q 101 is No why?

(1) I have no access to get construction materials for water harvesting structures ☐

(2) It is high labour and money demanding that I can not afford it ☐

(3) It will be source of malaria ☐

(4) 1+2+3 ☐

(5) Other (Specify) _____

103. Did you grow/plant trees in a form of wood lot in your land holding

(1) Yes ☐ (2) No ☐

104. If your answer to Q-103 is No. Why?

(1) It is high labor demanding ☐

(2) I used other means, like Agro forestry technique. ☐

(3) It will share part of cropping land ☐

(4) I will provide priority to crop production activites ☐

(5) Other (specify)_____

105. Have you observed any change after the application of improved

NRM technologies at your farm or land holding?

(1) Yes ☐ (2) No ☐

If your answer to Q – 105 is yes, rate the trend of socio economic indicators for the questions 106 – 113 below by indicating either, *Increasing (INC), Remain the Same (RSAM), Decreasing (DEC)* or *I Do Not Know (IDK).*

No	Indicators	INC	RSAM	DEC	IDK
106	The level of erosion on your main treated plot / farmland				
107	The soil fertility in the main treated plot/ farmland				
108	The crop-yield from the main treated plot / farm land				
109	The house hold' s income from farm sources				
110	The vegetative cover of the form stead and home stead				
111	The forage supply of the household				
112	The household's energy supply from trees/access to fuel wood				
113	The house hold's access to water supply				

XIII Sustainability issues

114. Do you maintain the improved soil conservation structures like bunds which have been made on your cultivated land holding regularly?

(1) Yes ☐ (2) No ☐

115. If your answer to Q – 114 is No, Why?

(1) I do have labour shortage problem in the house hold ☐

(2) I have no interest to maintain, because I do not wont the

structures ☐

(3) The structures need no maintenance ☐

(4) other (specify) _____

116. Do you plough all or some of the Soil conservation structures like ,bunds which had been made in your cultivated land?

(1) Yes ☐ (2) No ☐

117. If your answer to Q- 116 is yes, why? or for what reasons?

(1) Because of the habituation of moles and other pests in the conservation structures ☐

(2) Because of the difficulty of up and down plowing of the farm land ☐

(3) Because of slight soil erosion on that particular farm land ☐

(4) Because of wastage of cropping area by the physical structures ☐

(5) Because of encroachment of grasses and other weeds in that particular farm land ☐

(6) other (specify) _____

118. Do you manage /protect/ the trees you planted (owned) up on your plot or farm land, like wood lot tree planting ?

(1) Yes ☐ (2) No ☐

119. If your answer to Q-118 is No, Why?

(1) I do not have sufficient time ☐

(2) Trees can grow with no need of management ☐

(3) I do not have the culture to do so ☐

(4) Other (specify) _____

120. Are you belonging to farmer's associations or some kind of local associations/ working groups/ that are engaged in improved NRM technologies and which are supported by government and non-government organizations

(1) Yes ☐ (2) No ☐

121. If your answer to Q-120 is yes, are you interested to continue with

these associations and their activities if the supporting organizations stop or reduce their support?

(1) Yes ☐ (2) No ☐

122. If your answer to Q- 121 is yes, what benefits do you got or will you get out of it? List some of the benefits?

(1) Group work helps to alleviate labour shortage problem of the household for natural resource management activities ☐

(2) I will share experience from others ☐

(3) There is better material and technical assistance from different organizations ☐

(4) 1+2+3 ☐

(5) Other (specify) _____

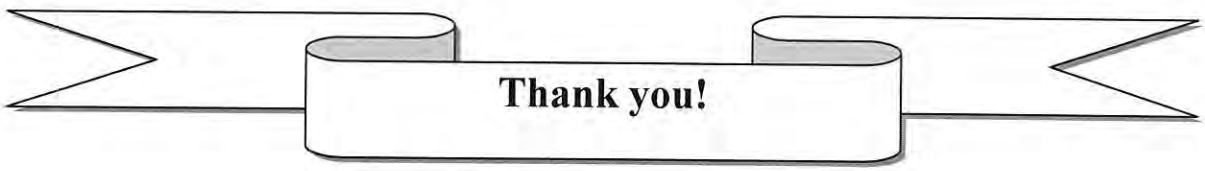
123. If your answer to Q – 121 is No, Why?

(1) I didn't get any benefit out of it ☐

(2) I was a member because of obligation, so that I am not Interested to continue ☐

(3) If the support of organizations stop, I will withdraw from the associations because the incentives will also stop ☐

(4) Other (specify) _____



Annex - 2

Instrument – 2

Discussion Checklist for NRM Agents (DAs)

Interviewer ---------- Date ---------- Time Spent ----------

Personal Information

1. Name ----------
2. Educational background ---------- Qualification----------
3. Work experience (in years) ----------
4. For how long have you worked in this area ----------

Age of the household heads

5. How is your observation in relation to age of the farmers and adoption situation of NRM technologies ?

Educational level of the household heads

6. What is the relation ship between adoption of NRM technologies and the level of education of farmers in this locality?

Labour size of the households

7. Do you observe that farmers faced labour shortage problem both for agricultural and NRM activities in this PA/locality/.
8. If yes in what seasons ?
9. Do you believe that labour is a factor for the non adoption of NRM technologies in this locality ?
10. Do the wives and adult female children participate in NRM works in this PA?

Land holding size

10. Is there land shortage in this locality ?
11. If yes, do you think that it inhibits the farmers to implement NRM technologies like bund formation and tree planting in a woodlot?
12. If yes, why ?

Land Tenure Security

13. Have you heard any objection by farmers to the current land holding policy ?
14. If yes, for what reasons?
15. If the answer to Q-13 is yes do you agree with the farmers opinion. If yes why ?

Physical Access of Market

16. Do the farmers have market access to agricultural products particularly to forest/tree products
17. If your answer to Q-16 is No why? Does it affects technology adoption decision of farmers.

Livestock size

18. Is there sufficient range land to livestock population in this PA? If yes, how do the farmers overcome the shortage ?
19. What is the relation ship between livestock size of the house hold and NRM technology adoption decision?

Access to Basic Infrastructures

20. Are there primary Schools, farmers training centers, all weather roads in this PA?
21. If your answer to Q-20 is no, do it affect the NRM technology implementation like bunds and tree planning in a woodlot?

Agricultural extension service Delivery /frequency of extension contacts

22. What is the approximate frequency of your contact to one household head in a year or a week?
23. Do you think that this much contact is sufficient to influence farmers mentality and able to adopt the improved NRM technologies in this PA?

Participation

24. Do the farmers of the PA are encouraged to participate in the planning process of natural resource conservation activities?
25 . If your answer to Q-24 is No, who else have planned the land treatment plans of the PA? Why?
26. What is your major role in land treatment plan ?
27. Do conflicts arise between what you consider technically sensible to do and what farmers are ready to accept ?

Attitude

28. How do you rate the attitude of the farmers towards improved NRM technologies? Positive in what ways? Negative in what ways?

Adoption

29. What is the adoption level of farmers for bund construction and tree planting in a woodlot in your PA?

Sustainability Issues

30. Do the farmers manage the woodlots they planted and maintain the bunds they constructed regularly ?
31. If your answer to Q-30 is no why ?
32. Do the farmers plow or destroy the physical soil & water conservation structures like bunds? If yes Why?
33. In your opinion what should be done to implement NRM technologies like bunds and woodlot tree planting by farmers sustainable and cure the environmental ills.

Annex - 3

Instrument – 3

Discussion checklist for Woreda NRM experts

Interviewer ---------- Date ---------- Time

Spent ----------

Personal Information

1. Name ----------

2. Educational Background ---------- Qualification----------

3.Work experience (in years) ----------

4. For how long have you worked in this area ----------

Age of the household heads

5. How is your observation in the relationship between the age of the farmers and adoption condition of NRM technologies, like bunds and tree planting in awoodlot ?

Educational level of the household heads

6. What is the relation ship between adoption of NRM technologies and the level of education of farmers in this locality?

Labour size of the households

7. Do you think/observe/ that farmers faced labour shortage for NRM works.

8. If your answer to Q-7 is yes, in what seasons ?

9. Do you believe that ,it is the labour shortage problem that inhibits the farmers to implement improved NRM technologies ?

10. Do the Women/wives and adult female children participate in NRM works in this PA?

Land holding size

10. Is there shortage of the farm land in the woreda and do the farmers complain for the shortage ?

11.Do you believe that land shortage inhibits the farmers from adopting 0f NRM technologies?

Land Tenure Security

12. How do you see the current land holding system? Does it has an implication on the adoption of NRM technologies by the farmers ?

13. Have you heard any complain by the farmers about the current land tenure system? If yes what is thier complain?

Physical Access of Market

14. Do the farmers have market access to crop and forest/tree products (fuel wood, poles, longs ..... etc) in the study area.
15. If your answer to Q-14 is No why? Does it affects the farmers to implement improved NRM technologies like woodlot tree planting?

Livestock size

16. What is your opinion about the effect of the size of livestock in relation to NRM technologies adoption ?like bund formation and woodlot tree planting ?
17. Is there sufficient pasture/feed in this woreda for the existing livestock population?
18. If your answer to Q 17 is No, how do the farmers over come this problems? What is your suggestion with this regard?

Access to Basic Infrastructures

19. Are there access of primary Schools, all weather roads, farmers training centers...etc, in the PAs particularity in the PAs of Abadra Agaga, ZigudaGult, ZubraQuandisha, GumdriAbela Akena,Bubimicael?
20. Is the absence of these infrastructures influence the adoption of farmers to NRM technologies?
21. If your answer to Q-20 is yes how?

Agricultural extension service Delivery

22. How is the conservation agents technically assists the farmers? How do you evaluate the frequency of contact Is it? Sufficient or insufficient? How?

Participation

23. Do the farmers of the study area encouraged to participate in the planning process of natural resource conservation activities?
24 . If your answer to Q-23 is No, who else have planned the land treatment plans? And why?
25. What is your major role in land treatment plan ?

Attitude

26. How do you rate the attitude of the farmers towards improved NRM technologies? Positive

in what ways? Negative in what ways?

Adoption

27. In your observation have most of the farmers adopt the improved NRM technologies in this woreda/the study area? Particularly bund formation and tree planting in a woodlot??

Sustainability Issues

28. Do the farmers manage the woodlots and maintain the bunds and other structures regularly in the study area? If No why?
29. Do the farmers plough/ destroy the soil & water conservation structures intentionally? If yes Why?
30. Is there conducive policy environment to practice or promote improved NRM technologies in the region.
31. If No what is your opinion? If yes does it help for natural resource conservation works.
32. In your opinion what should be done to implement NRM technologies like bunds and woodlot tree planting by farmers sustainable and cure the environmental ills?

Annex - 4

Instrument – 4

Discussion Checklist for Zonal and Regional NRM Experts

Interviewer ---------- Date ---------- Time

Spent ----------

Personal Information

1. Name ----------

2. Educational Background ---------- Qualification----------

3.Work experience (in years) ----------

4. For how long have you worked in this area ----------

Age of the household heads

5. From your observation what is the relationship between age of the household farmer and adoption decision of NRM technologies ?

Educational Status of the HHHs

6. Does educational status difference among the household heads of farmers creates a difference in NRM technology adoption?

Labour size of the households

7. Is labour a factor influencing the majority of households in adoption of NRM technologies in this zone/Region?

8. If yes to Q-7 ,How? If No why ?

Land holding size HHs

9. Do you observe the relation ship between land holding size and improved NRM technology adoption in this zone/Region?

Land Tenure Security

10. Is there any association between the current land tenure system and NRM technology adoption decision of the farmers ? If yes how ?

11. What is the preference of the majority of farmers of the zone/region to the properly right of land? is it owner ship right or use right? why?

Physical Market Access

12. Have you observed that, the market distance and road access problems influenced farmers adoption decision of NRM technologies?

Livestock size of the HHs

13. Is there any relation ship between livestock size of the HHs and adoption of NRM technologies?

Agricultural Extension Service

14. Did the current extension system helps to successfully implement improved NRM technologies like bunds and wood lot tree planting? How?

Participation

15. What is the mode of planning of NRM works in this zone/Region? Top-down, bottom-up or both ? why?

Attitude

16. Can you rate the attitude of adopter farmers and non-adopter farmers towards bund technology and woodlot tree planting in this zone/Region??

Sustainability Issues

17. In your opinion what should be done to implement improved NRM technologies sustainable by farmer and cure the environment/manage the natural resources for future use?
18. Do you think that the improved NRM technologies are compatible to farming practices of the farmers?
19. It your answer to Q-19 is No, Why? And what should be the solution?
20. Is there convenient Policy environment to implement improved NRM technologies in the region? If Now why?, If yes how it is implemented?
21. In Your View, what should be the roles and responsibilities of different stake holders so as to manage the natural resources and use them in a sustainable way?

Annex - 5

Instruments –5

Questions for Focus Group Discussion(FGD)

I- Natural Resource Use and Farmers Understanding to the Resource Degradation.

- **Soil Degradation**

1. Do you observe soil degradation or erosion in your locality? If yes what is/are the causes of degradation, how is its extent?
2. If your answer to Q-1 is yes, does it has an effect on agricultural production ?
3. If your answer to Q-2 is yes, what should be the solution in your view?

- Forest/vegetation Degradation

4. Do you observe(perceive) forest degradation in your locality? If yes what is/are the causes of degradation ? what is its extent and effect on agricultural production?
5. Are there natural forest in your locality ? Do it increase or decrease?
6. What should be the solution to reduce forest degradation in your opinion?

- Pasture and Range land deterioration

7. Do you have sufficient grazing lands in your PA, either communally or privately owned. If No, Why?
8. If there is problem of grazing lands what should be the solution in your opinion

- Water Resources Depletion

9. Is there sufficient water source both for irrigation and consumption? If No why?
10. How do you over come the shortage?
11. What should be done in the long-run to alleviate the shortage in your view?

Labour size

12. Is there sufficient labour Power in the households both for agricultural production and NRM works?

Land Holding Size

13. Does Land holding size hindered you to practice improved NRM technologies like bunds and tree planting in a woodlot?

Land Tenure Security

14. What is your opinion to the current land tenure system? Do you feel secured? If No why?

15. Does the current land holding system inhibit you to practice improved NRM technologies? If yes how?

Physical Market Access

16. Is your village far from near by town(Market)? Approximate the distance?
17. Is there all weather road passing through your PA(Village)?
18. If there is no near by market and all weather road, will it inhibit you not to practice/implement improved NRM technologies like woodlot tree plantation.

Livestock Size

19. Does the size of livestock size have an implication on adoption of improved NRM technologies like bunds and wood lot tree planting?

Agricultural Extension Service

20. Do you get sufficient extension service by conservation agents ? If No why? And how do you implemented the improved NRM works?

Participation of Beneficiaries

21. Do you participate in planning of natural resource conservation activities? Like on technology selection, site selection? Time of implementation? If No, why?
22. How do you implement the on farm and off- farm conservation works? Voluntarily or forcefully?

Attitude

23. Which one would you prefer to implement on your turn lands? Traditional conservation measures or improved NRM technologies like bunds and woodlot tree planting ?

Adoption

24. Do you implemented improved NRM technologies on your farm lands? If No why ? If yes cite examples?

Sustainability Issues

25. What are the best alternatives to sustain off farm conservation activities in your opinion
26. Do you maintain the on farm and off farm soil conservation structures regularly?

Annex - 6

Instrument – 6

Observation Checklist/guide line/ for sample plots of the Households

Date of observation ----------

PA ----------

Household Head(Name) ----------

For Bund Construction Plots

1. The total Land holding size of owner of the selected Plot.
2. Over all conditions of bunds at the plot, i.e whether it is destroyed, Maintained
3. The rank of the bund by the investigators judgment
   - Poor ☐
   - Average ☐
   - Good ☐
4. Attitude of the owner of the plot to bund technology(Positive, negative).
5. How was the implementation approach of the bund on the plot?(Mode of implementation), Voluntarily, forcefully?
6. The Distance of the plot from town/from all weather roads(near, medium, far)
   - Near(it less than 5kms) ☐
   - Far(it above 10kms) ☐
   - Medium (5-10kms) ☐

For Woodlot Tree Planting Plots

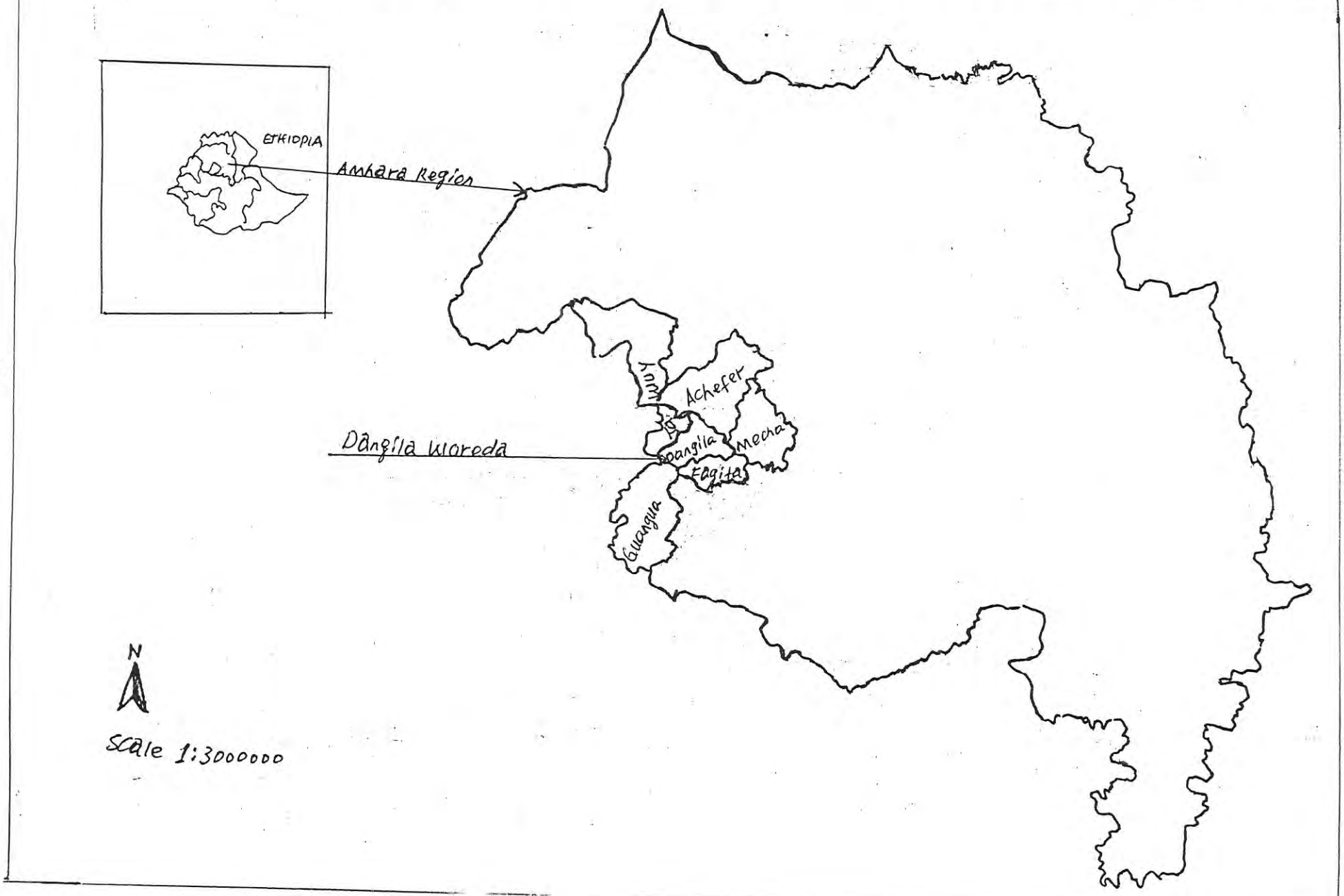
1. The total land Holding Size of the owner of the selected plot
2. Woodlot Plot size
3. Woodlot area coverage compared from total land holding size of the household
   - More than 1/8 of the holding ☐
   - 1/8-1/10 of the holding ☐
   - less than 1/10 of the holding ☐
   - Other ☐
4. The management condition of wood lots(Spacing, weeding etc)
   - Poor ☐
   - Average ☐

- good ☐

5. Access of market for woodlot tree products (for fuel wood, logs, poles…etc).i.e Distance of plot from market/woreda town and presence of all weather roads passing in the PA
   - Near(it less than 5kms) ☐
   - Far(it above 10kms) ☐
   - Medium (5-10kms) ☐
   - There is road access if road passes through the PA, no access other wise
6. Mode of implementation of woodlot, Voluntarily, force fully?
7. Attitude of the household head to woodlot tree planting(positive, Negative)

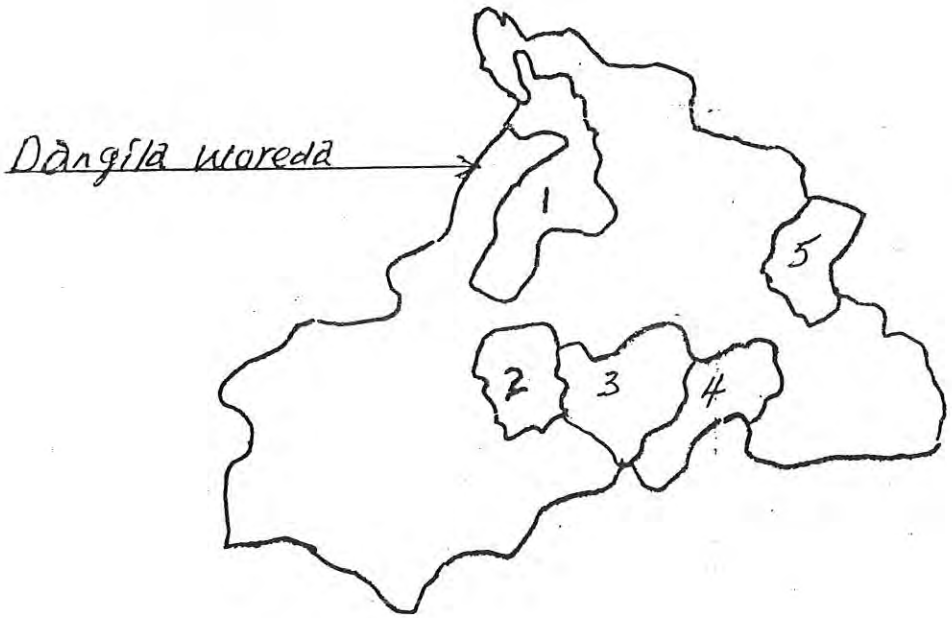
Annex-7

Aproximate Location Map of Dangila Woreda in Amhara Region



Annex-8

Approximate Location map of Sample PAs in Dangila Woreda



N

Key

1. Abadra Agaga
2. Dubi Michael
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Declaration

I, the undersigned, declare that this Thesis is my original work and has not been presented for a degree in any other University and all the source of materials used for the Thesis have been dully acknowledged.

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This Thesis has been submitted for examination with my approval as University advisor

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