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# ADDIS ABABA UNIVERSITY

## REGIONAL AND LOCAL DEVELOPMENT STUDIES (RLDS)

## ASSESSMENT OF FARMERS' PERCEPTION ON WATERSHED MANAGEMENT PROJECT INTERVENTIONS: THE CASE OF LAELAY ADIABO WOREDA OF NORTH WESTERN TIGRAY REGION.

**A Thesis submitted to the School of Graduate Studies in partial fulfillment for the Degree of Master of Art in Regional and Local Development Studies.**

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**Advisor: Welde Amlak Bewket (Ph.d)**

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**BY**

**ANTENEH ZEWDIE**

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## Abbreviations

| | |
|---|---|
| ADLI | Agricultural Development-Led Industrialization |
| AI | Artificial Insemination |
| DESCI | Dedebit Saving and Credit Institution |
| EHRS | Ethiopian High lands Reclamation Studies |
| FFW | Food for Work |
| FGD | Focus Group Discussion |
| FAO | Food and Assistance Organization of the United Nations |
| ISWC | Indigenous Soil and Water Conservation |
| MOARD | Ministry of Agriculture and Rural Development |
| NGOs | None Governmental Organizations |
| OARD | Office of Agriculture and Rural Development |
| REST | Relief Society of Tigray |
| RUG | Resource Users Group |
| SHG | Self Help Groups |
| SWC | Soil and Water Conservation |
| WDC | Watershed Development Committee |
| WFP | World Food Program |

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**Abstract**

This thesis presents the results of an assessment in watershed management intervention related to the impact brought on improvement of land degradation and livelihood of the community in Mai-Anbesa and Hadegti watersheds. The objectives of the study are: assess the impact of the project on conservation of natural resource and livelihood of the community; assess the institutional arrangement and its contribution to the project, assess community participation in the project process and suggest possible recommendations on the conclusion.

For this study, survey has been conducted in two watersheds, namely Kai-Anbesa and Hadegti. List of communities from the two watersheds has been prepared and systematic sampling technique used to determine respondents in each watersheds. The study has covered a sample of 100 respondent out of the total 2136 (5% 0f the population) population of both watersheds. Both primary and secondary data has been collected using different data collection techniques.

The study showed that despite some biophysical achievements, the watershed management project in the study area has failed to impact on the livelihood of the community as desired. This was as a result of two important problems. 1) Institutions were not well established, empowered. More ever they did not have the peoples acceptance rather they were machinery of the governments interest. 2) Communities participation from problem identification to benefit sharing was not established.

# 1. INTRODUCTION

## *1.1. Background of the Study*

Food security remains elusive for more than 1 billion people worldwide. Despite the benefits of the Green Revolution, declines in household food production are commonplace for about 60 percent of the rural population in tropical and sub-tropical countries. The reasons for these declines are manifold. However, poor land and water management practices and policies are partly responsible for accelerating degradation of agricultural lands and consequent decline in food production. While the effects of improper land and water use practices directly impact smallholders, they also cause off-site damage to downstream producers and the environment. It is well recognized that intensified land use in upper catchments, largely by poor farmers increasingly forced onto marginal lands, results in increased sediment discharge and elevated nutrient loads reducing water quality and availability downstream (MOARD, 2005)

In countries like Ethiopia where possibilities for economic development are mainly conditioned by the preponderance of agriculture, then the performance of the other economic activities depends upon the results achieved in the agricultural sector. The development of the agricultural sector, therefore, largely determines the pace of economic development of the nation (Admassie, 1995). Small-scale traditional agriculture dominates most of Ethiopia's rural economic system. This is characterized by very traditional production technologies.

Strained by population pressure, nearly all the arable highlands have been put under cultivation. Indiscriminate tree cutting, overgrazing, mono cropping of soil exploiting crops and crop residue removal off the farm has been practiced for centuries. Traditional farming, lack of soil and water conservation and improper land use often left soil barren and exposed to rainstorms. The land resources-population imbalance makes these land degradation processes self-reinforcing. Thus, an estimated 79% of the total arable highland areas are significantly eroded (EHRS, 1988). As a result, agricultural productivity per unit area has markedly declined. Consequently, cultivating any marginal steep slopes and dry lands become common practice. In the highlands of Ethiopia because of the topography most of the cultivated area is located within a watershed (EHRS, 1988).

Expanding human populations and their increasing demands for natural resources have led to exploitation and degradation of land and water resources. Revenga (1998), (as cited in Tsegazeab, 2003) emphasized that expanding human demands for resources have intensified watershed degradation, with the result that some of the watersheds with the greatest biological production are becoming the most seriously degraded. Development projects and programs by all types of organizations (national governments, multinational and bilateral agencies, nongovernmental organizations (NGOs), etc have proliferated in response to these problems.

## *1.2. Statement of the Problem*

Watershed management projects have been carried out under different programs launched by governmental and non-governmental organizations in some parts of Ethiopia. These watershed management programs have laid down their own separate guidelines, norms, funding patterns and technical components based on their respective and specific aims. While some projects focused on reforestation to arrest the growth of desertification others concentrated on soil and moisture conservation, pasture development, horticulture and agro-forestry, etc. Though the purpose of these projects differs, the common theme amongst these programs has been the basic objective of land and water resource management for sustainable production.

Watershed management project is a new approach in Tigray region that commenced in 1998 being implemented to tackle the problem of mismanagement of natural resources, to increase productivity of resources, to rehabilitate the degraded environment and thereby improve the ecology of the area.

Experience showed that tremendous efforts have been made in the Tigray Region in general and in Laelay Adiabo Woreda in particular in watershed management. However, watershed development through these projects has not been effective in terms of institutional arrangement and community participation. Hence, this study was initiated to fill these gaps.

## 1.3. Objectives

The general objective of the study is to assess the impact of the project on sustaining the livelihood of the communities in Mai-Anbesa and Hadegti watersheds. The specific objectives of the study are:

1. Assess the impact of the project on conservation of natural resource and livelihood of the community.
2. Assess the existing local and external institution
3. Assess the institutional arrangement and its contribution to the project.
4. Assess community participation in the project process.

## 1.4. Research Question

1. What biophysical and economical gain have brought after the project?
2. How and which institutions has established in the project area?
3. How was the institutional arrangement in the project area?
4. How did the institution function in the project process?
5. How did the community participate in the project process?

# 2. LITERATURE REVIEW

## 2.1. Watershed Management

A watershed can simply be defined as any surface area from which rainfall is collected and drained to a common point. There is no definite size for watershed as it may vary from a few hectares to several thousands of hectares. However, watershed sizes are generally classified in to three, namely, micro, mini and macro watersheds. A combination of micro watersheds makes a mini watershed, which in turn, is a part of the macro watershed before finally discharging into the seas or oceans (Morgan, 1986 as cited in Tsegazeab 2003).

The term 'watershed management' is usually used to refer to the management watersheds in practice, focusing on the protection of the upland watershed areas that form the headwaters of streams and rivers (Lal, 2000). The term 'watershed management' has often been the basis for top-down management approaches by outside agencies, particularly in South Asia and Southeast Asia. The presumption is that trees reduce sediment runoff and increase water infiltration, leading to higher dry season base flow and less sediment in lakes and rivers (Lal, 2000).

Managing watershed for rural development in developing countries is a relatively new concept. In many ways it is also much more complex than the original concept. It is concerned not merely with stabilizing soil, water and vegetation, but with enhancing the productivity of resources in ways that are ecologically and institutionally sustainable (Farrington, J. et al. 1999). In other words watershed management is not only conserving soil and water resources but also utilizing the conserved resources for better production in a sustainable manner.

## 2.2 Land Degradation

Land degradation is a value-laden term of which the perception is influenced by both culture and society. Since degradation is a perceptual term it must be expected that there will be a number of definitions in any situation. Several definitions forwarded to express land degradation echo its

negative impact on environment accelerated by human activities. Blaike and Brookfield (1987) defines land degradation as an environmental process influenced by human activity that will lower the actual or potential capability of agricultural land or land suitable for agriculture to provide goods and services in a suitable way or in the way land users demand. Purely environmental processes such as leaching and erosion occur with or without human interference, but for these processes to be described as 'degradation' implies social criteria that relate land to its actual or possible use by human beings (ibid).

According to the Convention to Combat Desertification (1997) land degradation, is the reduction or loss, in arid, semi arid and dry sub humid area, of the biological or economic productivity and complexity of rained cropland, irrigated cropland, range, pasture, forest and wood lands resulting from land use or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: soil erosion caused by wind and/or water; deterioration of the physical, chemical and biological or economic properties of soil; and long term loss of natural vegetation. Land degradation is also defined by Young (1997) in a broader sense. According to Young land degradation is defined as the temporary or permanent lowering of the productivity of land. Different types of land degradation are also indicated by Young that include soil erosion, soil fertility decline, salination, water resource degradation, forest clearance and degradation, pasture resource degradation, and loss of biodiversity. All definitions given by different authors whatever the cause might be relate land degradation to the lowering of land productivity. Blaike and Brookfield (1987) pointes out that the word degradation, from its Latin derivation implies "reduced to a lower rank". The rank is in relation to actual or possible uses, and reduction implicates reduced productivity of land as input resource for those who use the land in the process of production.

But all authors agreed that land degradation has created a challenging problem in agricultural production. It has become potentially a serious threat to food production and rural livelihood in most developing countries. Among these, soil erosion accounts for the major form of land degradation in developing countries (Blaike, 1985). Blaike and Brookfield (1987) reveales that approaches to land degradation follow a chain of explanation. The first is the explanation of land degradation in terms of population pressure and is the main concern of a number of influential theories. The second is very much more limited and different in character and explains degradation in terms of mal adaptation and ignorance of land managers themselves-the problem lies uniquely with them.

### 2.2.1 Soil and Water Conservation Practices

Soil and water conservation practices consist of biological measures, mechanical measures, and institutional arrangements. The first category refers to particular management practices that make use of agronomic skills and biological material rather than physical structures. Mechanical practices, on the other hand, refer to practices that involve physical structures, often with a barrier function. Institutional arrangements refer to land tenure arrangements, forms of labor sharing, and so forth that may also contribute to maintenance of soil fertility (Mazzucato and Niemeijer, 2000). According to Semgalawe (1998) soil conservation involves the use of biological and physical measures to offset the effect of land degradation. Biological or agronomic measures refer to farming practices, which help to minimize erosion, improve fertility and soil structures. Physical or structural measures include earthworks aimed at controlling and diverting the run off in the arable areas. These measures are applied to maximize infiltration, to drain excess water from rainstorms and to retain moisture in the soil.

Soil and water conservation interventions are first and foremost a response to the perceived land degradation problem (Mazzucato and Niemeijer, 2000). Basically, physical soil and water conservation practices are categorized into two: traditional (indigenous) and improved practices. Whatever the measures might be these measures aim to control run off, improve soil fertility and harvest water. According to Yohannes (1999) ISWC/indigenous soil and water conservation/ is defined to be a practice or idea generated locally or imported from outside and transformed by the local people and interpreted in their way of life.

The traditional SWC are simple structures of a short-term nature that could be reshuffled each year to make use of the soil captured above the structure and avoid rodent production (Wagayehu, 2003). These structures are much more flexible and tend to spread labor requirements for construction and maintenances (Scoones et al., 1996). They are frequently site specific and accordingly vary in purpose. They may harvest water in lowland areas (with the help of tied ridges, level physical soil conservation structures); conserve soil in-situ (traditional stone and soil bunds); dispose of excess water from croplands during heavy rains; improve drainage and conserve soil while simultaneously increasing soil fertility (agro forestry, mixed cropping and intercropping) (Hans-Joachim Kruger et al., 1996). The dynamic nature of the technologies and their adaptability to the changing conditions is the

fundamental feature of indigenous technologies. This dynamic interpretation of ISWC leads to a wide-ranging perspectives on technology (Yohannes, 1999). Unlike outsiders who often maintain a single objective, farmers are faced with multiple objectives in their livelihood. In addition, farmers' ISWC does not aim at merely protecting the soil or improving the moisture level. They make compromises with their multiple objectives, resources, level of the erosion problem, urgency of the household needs, profitability, etc. Therefore, 'the best soil conservation practice from farmers' perspective is not necessarily that which conserves the most soil. In view of this, farmers often favour SWC practices that give them a quick benefit, while minimizing soil erosion (Tesfaye, 2003).

The improved type of soil and water technologies refers to the recommended type of structures, which have standard length, width, and height (Wegayehu, 2003). These structures have specific design requirements and need major investments of labor in construction, often during a single period (Scoones et al., 1996). Hence, this particular measure has been widely constructed within the food for work (FFW) programme areas (Wagayehu, 2003). In most areas of Ethiopia, new SWC technologies were introduced more than two decade ago. During such span of time the introduced SWC measures have been under continuous modification, which makes it very difficult to trace them back to their origins to compare them with recent development (Yohannes, 1999). The modified type of structures refers to those practices in which farmers have constructed with their own preferred length, spacing and /or height that are different from recommended type (Wagayehu, 2003). Farmers' responses to externally imposed SWC methods are highly shaped by their indigenous practices that are embedded in their local institutions and culture (Tesfaye, 2003). On this issue Yohannes (1999) have found out that under small farming households different type of modifications are made in time and space. Some modifications are done at micro level (plot), where the local people are not easily observed by their surroundings let alone by an outsider. Hence, in this study also minor modifications of original technologies are referred to as adopted. The three SWC structures basically differ in their initial labor requirement, area lost to conservation structures, durability, flexibility and effectiveness of the structures. When Wagayehu (2003) analyzes these differences he found out that the recommended type of structure involves a higher cost in terms of both labor requirements and area lost to conservation structures.

### 2.2.2 Soil and Water Conservation Effort in Ethiopia

In many agricultural based developing countries, environmental degradation mainly takes the form soil nutrient depletion and loss of food production potential. Reversal of the erosion induced productivity decline and ensuring adequate food supplies to the fast growing populations in these countries posit a formidable challenge (Bekele, 1997). In developing countries problems related to soil erosion have been receiving more and more attentions in recent years. The emphasis on the problem may, however, vary from country to country depending on the importance of agriculture in the national economy and the level of technology applied in the sector. In Ethiopia, despite the increasing pace of degradation and consistent with the old development thinking, which down played the role of agriculture, prior to 1974, the issue of conserving an agricultural land was largely neglected (Bekele, 1997). On this issue Wagayehu (2003) further explained that prior to 1974; the conservation of agricultural land was largely neglected due to the singular dominance of policy to favour industrial growth over that of agriculture. According to Shiferaw and Holden (1998), the problem of land degradation attracted policy attention only after the devastating famine problem in 1973/74.

Awareness of the land degradation problem was incited mainly by the formation of a new socio economic order in 1974 and the devastating famine in the country. It was after that, the government has initiated a massive program of afforestation and soil and water conservation with the support of international organizations (Wagayehu, 2003). However, efforts to install conservation measures on erodible lands were initiated following the 1975 land reform and establishment of the peasant association which were instrumental for mobilizing labor and assignment of local responsibilities (Bekele, 1997).

The involvement of international donors especially like WFP that provides food for work (FFW) incentives for conservation activities have supported to expand the effort to promote SWC initiated by the government. The drought- prone regions (Tigray,Wello, Gonder, Shoa, Hararghe, Gemegofa and Sidamo) were put under FFW project, while the rest of the country was left under the public extension system. The watershed approach was followed in the entire conservation activities in the FFW regions. However, this approach failed to include the socio economic factors and operated on technical parameters only (Tesfaye, 2003). According to Bekele (1997) on croplands structural measures,

mainly earth and stone bunds, were built uniformly across regions with FFW incentives in food deficit areas of the highlands. Wagayehu (2003) reveales that packages of SWC programmes were prepared for implementation through food for work (FFW) schemes.

Despite the effort made by the government and international donors to conserve soil and water thereby to enhance farm and farmers productivity through use of appropriate conservation structures the acceptance and adoption of the practice by farmers had not been encouraging. Bekele (1997) reveales that during that time conservation activities were mainly undertaken in a campaign often without the involvement of the land users. Peasants were not allowed to remove the structures once built but maintenance was often carried out through FFW incentives. Even if considerable areas of erodible lands have been treated, maintenance of the structures has become a cause for concern to the implementing agencies. According to Yeraswork (2000) those achievements were later evaluated as only quantitative with minimal desirable outcomes and ineffective and unsustainable. The whole effort was, therefore, eminently a failure. Several factors have been identified as reasons for the failure. The most important of all is said to be the top down approach pursued in the planning and implementation processes. Wagayehu (2003) pointes out that the massive campaign in soil conservation and afforestation, with a huge layout of financial and man power resources under FFW does not seem to have succeeded either in triggering widespread voluntary adoption of the practices by farmers in a sustainable manner or in solving problems related to soil erosion. Following the fall of the Derg regime and the shift in priority of food for work projects, many farmers have abandoned, or at least adapted, their SWC structures which were implemented in the previous era (Scoones et al., 1996).

### 2.2.3 From Soil and Water Conservation to Watershed Management Approach

Since 1991, the Ethiopian government has embarked on an economic development strategy known as Agricultural Development-Led Industrialization (ADLI), which places greater emphasis on agricultural development. Within the framework of the ADLI, regional administrations have been able to draw economic strategies specific to their conditions. Conservation-based ADLI became the primary goal of economic development in Tigray, which focuses on conservation of natural resources and popular participation. The natural resource conservation and development effort in the region has been aimed at improving the management of soil and water resources, environmental rehabilitation

and protection through area enclosures and development of community woodlots, the development of irrigation through the construction of micro dams and river diversions, and reforestation. Other elements in the regional ADLI include improving productivity in agriculture through improved agricultural practices and inputs, promoting off-farm employment through diversification of the rural economy, and development of rural infrastructure (MOARD, 2005).

With a view to the above mentioned, since the early 1990s, the Regional Government of Tigray as well as various Non Governmental Organizations have launched soil and water conservation programs. In tackling the problem of land degradation, the Tigray Regional Government's approach has gradually moved from mere soil conservation to that of integrated land management. In the years that followed, the watershed, which was a compact homogeneous unit, became the obvious choice for planning and management of natural resources. The watershed concept went beyond a physical soil conservation approach to a wider perspective for development, conservation and management of land and water resources. Subsequently, watershed prioritization was taken up as a strategy for planning, and a national policy for watershed development was formulated to take into account the physical situation and availability of resources along with the needs of the people.

## *2.3 Institutional in Watershed Management*

Institutions are the rules and regulations that guide human interaction in society (North, 1990). Furthermore, institutions are essentially the rules of the game in a society, which are framed by people themselves. These rules and regulations when enforced form the basis of incentive structures in inter personal exchange in economic, social and political fields. Institutions are all pervading in society.

Institutions comprise a wide variety of formal and informal relationships that enhance social productivity by making people's interaction and cooperation more productive and effective. This social consensus includes the expectation of trust or dishonesty in particular social interaction (Narayan, 2000).

Watershed management is a multi disciplinary and multi institutional effort. Therefore, the crucial role of coordination and collaboration among various disciplines and institutions involved need not be

overemphasized, (North, 1990). This is easier said than achieved in practice however. This is partly due to lack of commonly shared vision of watershed management and lack of mutual appreciation of various institutions involved in the process. However, it is clear that watershed management involves diverse groups including farmers, state and central government institutions, quasi-government agencies and NGOs. Each group differs widely in objectives and interests but together they shape the face of watershed development. Because of weak inter-institutional linkages, there is, at times, duplication of efforts. Limited resources are thinly distributed with insignificant impact or even failure at the end.

In this regard, the types of institutions and the way they relate to each other in providing synergy become crucial. Basically, there are two kinds of institutions that need to link and interact frequently with each other in watershed management, one involving the internal stakeholders and the other involving the external stakeholders (Mascarenhas, 1999). The first is at village or community level in the form of self-help groups or user groups. Obviously, these need to be federated at the watershed level for providing a forum for collective action. Also, these need to be linked to local institutions.

The second set of institutions in watershed management consists of all those external stakeholders such as government departments, NGOs and donor agencies. Each of these institutions has a role to play in watershed management and brings with it certain strengths and areas of expertise. These institutions need to work together for synergy and to give top priority to capacity building and financial sustainability of village level institutions right from the beginning (Mascarenhas, 1999).

## *2.4 Participation in Watershed Management*

Participation by the people in the institutions and system which govern their lives is a basic human right and also essential for realignment of political power in favour of disadvantaged groups and for social and economic development (Burkey, 1996).

Similarly, Cohen and Uphoff (as cited in Aster, 1998) has defined participation as people's involvement in decision making process about what would be done and how, their involvement in

implementing the program by contributing various resources or cooperating in specific organizations or activities, their involvement in sharing the benefits, and finally evaluate such Program. Moreover, Cohen and Uphoff (as cited in Aster, 1998) assumed that participation is not a thing that exists in certain quantities, and that can be measured in a specific unit. FAO (1982) defines participation as process by which rural people are able to identify their needs, shares in decision-making, implementation and evaluation of the participatory action. In general, participation is an over arching concept which is best approached by looking its dimensions (types and level, extent and mechanisms) within the context which it appears.

Rural development strategies can be realized their full potential only through the motivation, active involvement and organization at grass-root level of rural people, with special emphasis on the least advantaged, in conceptualizing and designing policies and programs and creating administrative, social and economic institution including cooperative and other voluntary forms of organization for implementing and evaluating (Burkey, 1996).

Nevertheless government induced participation operates in opposite manners to the voluntary participation which lead to sustainable management of development programs as stressed by Burkey (1990) participation, if it is to really release the people's own creative energies for development, must be much more than the mere mobilization of labor force or the coming together to hear about pre-determined plans. Participation must be more than a policy statement- there must be a genuine commitment to encourage participation in all aspects and all levels of development work.

According to Lilja and Ashby (as cited in Aster, 1998) there are three ways in which participation is associated with watershed management:

1. Participatory watershed management: Stakeholders participate in development processes and decisions. For example, stakeholders such as farmers, local government leaders, representatives from local NGOs, and/or researchers jointly discuss and decide about watershed planning and set priorities for taking up development tasks, such as trying out a technology or methodology in a new location.
2. Participatory research on watershed management: researchers and other stakeholders work together in the process of developing new technologies or institutions for watershed

management. Although research is the focus, all stakeholders participate in the process and decisions are made jointly.

3. Research on participatory watershed management: Researchers collect materials from various projects applying participatory watershed management methods and carry out analyses in order to understand issues, such as collective action and how stakeholders negotiate and implement natural resource management. This research may or may not be participatory and therefore may or may not involve other stakeholders.

User participation can be categorized into five types: contractual, consultative, collaborative, collegial, and stakeholder experimentation Lilja and Ashby (as cited in Aster, 1998). The least participative is contractual, where outsiders make the decisions while local stakeholders are contracted to carry out the work. In the case of consultative participation, outsiders seek the opinions of other stakeholders, but the implementer makes final decisions. Collaborative participation involves both outsiders and local stakeholders in joint decision-making, in which the latter carry out the resulting actions. In the case of collegial participation, farmers and other community members make the decisions and implement them, though advice is given. However, the outsider intervenes on a collegial basis, expressing his or her opinion, but not manipulating or forcing decisions. Projects may use different types of participation at different stages of the process. There is no right type of participation. Different types are expected to have different advantages and disadvantages, and what type is best depends on the objectives of the specific project.

# 3. METHODOLOGY

## *3.1. Description of the Study Area*

### 3.1.1 Location, Population and Land use

Laelay-Adiabo is one of the Woredas of the National Regional State of Tigray. It is located in the Northwestern part of Tigray region. The woreda has about 117,140 populations, of which around 94.7% is rural population engaged in agriculture. In the woreda there are about 31,530 households, of which 42% are living below the poverty line. The total area of the woreda is estimated to be about 117,155 ha of which 49181ha is thought to be arable land. According to the Office of Agriculture and Rural Development forest area of the woreda is estimated to be about 34,945ha.

### 3.1.2. Topography, Climate and Soils

The agro-ecology, of the Woreda experiences kola and dry woina dega climate. The altitude of Laelay-Adiabo Woreda ranges from 700 and 2000 m. a. s. l. The topography of the area generally varies from flat in the Southern and Western to undulating and hilly escarpments in the Northern and the Eastern parts of the area. Length of growing period varies from 75 to 90 days and rainfall of the area ranges from 400 to 550 mm. The mean annual rainfall is about 450mm. The main rainy season in the area occurs in kiremt, June to September. The soils in the hilly areas are developed on sedimentary rocks and are of lithosols. On flat lands, luvisols are the dominant soil types. The soils are shallow and infertile in the hillsides and relatively deeper and fertile in flat areas.

### 3.1.3. Vegetation Cover

Laelay-Adiabo Woreda is among the most degraded part of Tigray and with some vegetation cover which is scarcely distributed in the Woreda. Climate, terrain and population pressure are considered the major factors influencing the natural vegetation cover of the area. The existing natural forests are concentrated in western and north western of the Woreda (these areas are within the Tekeze Drainage).

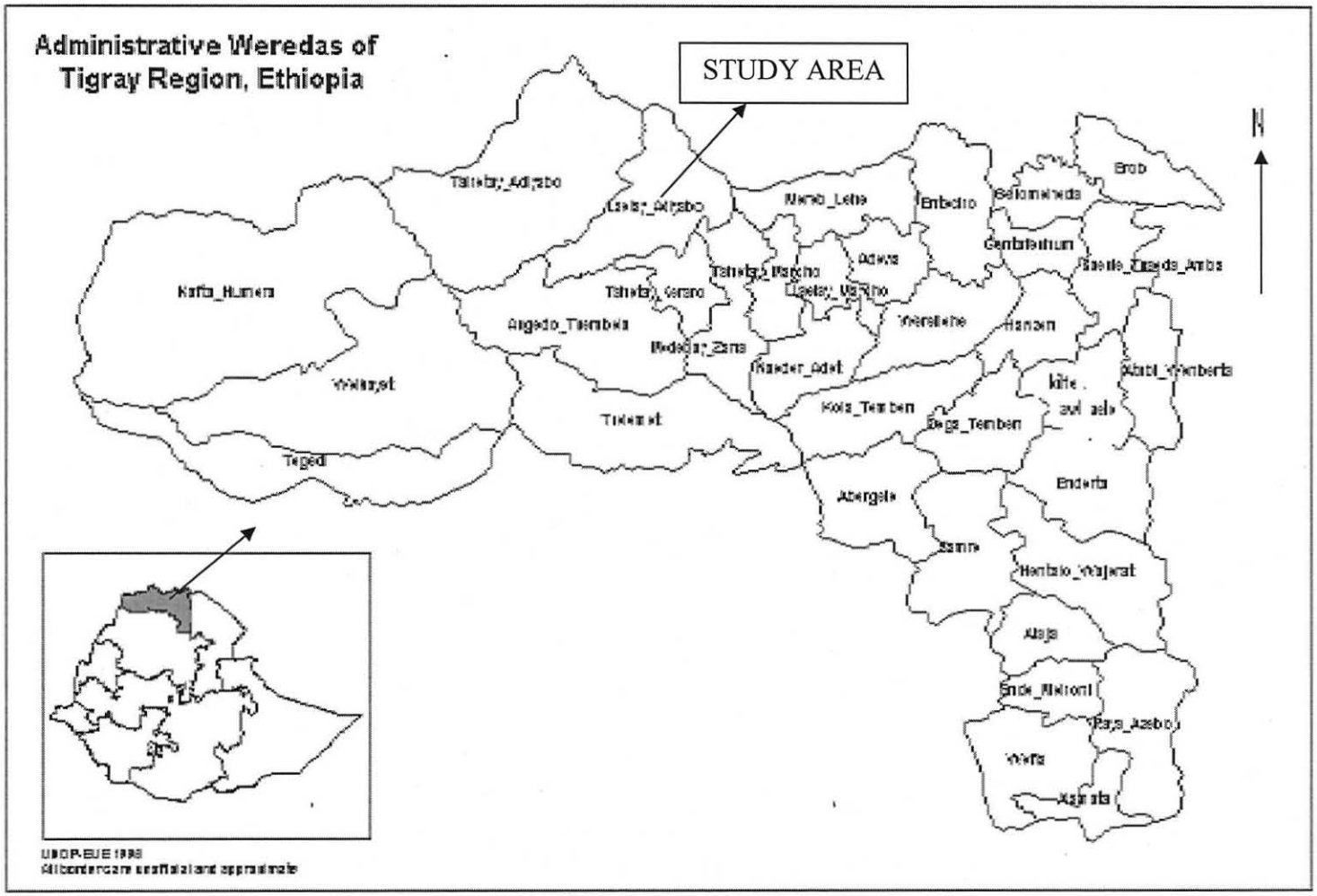



Figure1: Tigray Regional State Administration Map

### 3.1.4 Mai-Anbesa and Hadegti Watershed Project Background

The development project plan of Mai-Anbesa and Hadegti watershed was initiated by the interest of the regional government. These projects are part of the regional governments endeavor to achieve sustainable development and food security strategy. This project has been developed by the regional team (from Bureau of Agriculture and Rural Development). This team was a multi disciplinary team, which comprises experts of soil and water conservation, Agro-ecologist, Forestry, Animal Husbandry and agronomist.

Mai-Anbesa and Hadegti watershed management project were developed based on the objectives to identifying the major potential resources in the watershed and their constraints for development. Studding the level of environmental degradation and suggest possible technologies towards their improvement; designing possible integrated development intervention and to bring a sustainable economic resource management in the watershed and hence achieving food secured community in both watersheds.

On both watersheds selection criteria were specified. And these criteria were included:

1. Area of the watershed to be studied
2. Level of degradation
3. Size of human and livestock population
4. The intensity of gully erosion and its potential damage.
5. Interest of the woreda

**Development plan**

The project for both Mai-Anbesa and Hadegti watershed has included interventions on various areas of watershed development. These development activities were:

- Soil and water conservation techniques
- Crop production
- Livestock development
- Forest development

**Soil and water conservation techniques**

According to the project document soil and water conservation techniques were specified. These are

**Hill side terraces**

Hillside terraces was the first technique, which is physical structures constructed along the controls, generally suitable in steep degraded slopes and shallow soils suitable for tree planting and rather effective in controlling run off and erosion.

**Trench bund**

Trenches, which is the second technique in the project, are water harvesting structures constructed along the contours in a staggered position. According to the document it is suitable up to 50% slope and sometimes slightly above in slopes with stable soils. And accordingly the purpose of trenches was to protect cultivated fields located downstream from flood and erosion.

**Stone bund**

The stone bund was included in the activities of the project to reduce and stop the velocity of runoff and consequently reduces soil erosion and the steady decline in fertility and crop yields.

**Stone check dam construction**

The final technique in the document is stone check dam. According to the project stone check dam, which is a structure across the bottom of a gully or a small stream, which reduces the velocity of runoff and prevents the deepening and widening of the gully. And with the Sediments accumulated behind a check dam crops or trees/shrubs grass could be planted.

**Table1: Soil and Water conservation activities for Mai-Anbesa watershed**

| No | Activities | Unit | Total amount | Implementation | | |
|---|---|---|---|---|---|---|
| | | | | year 1 | Year 2 | Year 3 |
| 1 | Hill side terrace | km | 135.5 | 45.3 | 45.1 | 45.1 |
| 2 | Stone faced trench | km | 148 | 50.3 | 48.9 | 48.9 |
| 3 | Stone bund | km | 205.8 | 10.1 | 97.8 | 97.8 |
| 4 | Trench bund | km | 117.45 | 38.2 | 38.9 | 40.3 |
| 5 | Soil bund | km | 265 | 88.3 | 88.3 | 88.3 |
| 6 | Loose stone check dam | $m^3$ | 7,746 | 2,582 | 2,582 | 2,582 |
| 14 | Pond construction | No | 87 | 29 | 29 | 29 |
| 15 | Percolation pit | No | 108 | 36 | 36 | 36 |

**Table2: Soil and Water conservation activities for Hadegti watershed**

| No | Activities | Unit | Total amount | Implementation | | |
|---|---|---|---|---|---|---|
| | | | | year 1 | Year 2 | Year 3 |
| 1 | Hill side terrace | km | 124 | 41.4 | 41.3 | 41.2 |
| 2 | Stone faced trench | km | 134.5 | 45.7 | 44.4 | 44.4 |
| 3 | Stone bund | km | 225.75 | 11.1 | 107.3 | 107.3 |
| 4 | Trench bund | km | 153 | 49.8 | 50.7 | 52.5 |
| 5 | Soil bund | km | 324.25 | 108.1 | 108.1 | 108.1 |
| 6 | Loose stone check dam | $m^3$ | 6,550 | 2,183.3 | 2,183.3 | 2,183.3 |
| 14 | Pond construction | No | 74 | 24.7 | 24.7 | 24.7 |
| 15 | Percolation pit | No | 98 | 32.7 | 32.7 | 32.7 |

**Crop production**

The following main interventions are proposed in order to improve crop production in the watershed.

- Early land preparation
- Early tillage also reduces the need to high draft power requirement under the watershed conditions.

- Sowing of crops must be accomplished early as much as possible; depending on varieties of crop with different seed types have different planting depth requirements.
- At the same time cultivation, weed control, fertilizer and pesticides application can also be facilitated and efficiently performed.

**Forestry development**

The project document has specified the area planned to be planted. Accordingly 207ha And 176ha were the areas of planting to be undertaken in Mai-Anbesa and Hadegti watersheds respectively. The purpose of planting for both watersheds is clearly specified in the documents. And the major once are rehabilitation, fire wood, bee forage and forage for livestock. And the recommended species and lay out of planting was indicated.

Seedling requirement of Mai-Anbesa and Hadegti watersheds as indicated in the project are 370,000 and 345,000 respectively.

**Table3: Forest development activities by watersheds**

| S.no | List of activities | | Unit | Quantity by watershed | | Remark |
|---|---|---|---|---|---|---|
| | | | | **Mai-Anbesa** | **Hadegti** | |
| 1 | Seed collection | | kg | 95.45 | 87.5 | |
| 2 | Seedling production | | No | 370,000 | 345,000 | |
| 3 | Pitting | | No | 370,000 | 355,000 | |
| 4 | Seedling planting | | No | 340,000 | 340,000 | |
| 5 | Planting on bund | Coverage | Km | 146 | 146 | |
| | | Seedling | No | 30,000 | 30,000 | |

**Animal production development**

**1. Forage development**

The priorities of animal production in Mai-Anbesa and Hadegti watershed, according to the project document are improving the grazing land and developing feed. Based on the existing broad degree of degradation of the grazing land in the watershed the following options were incorporated for full utilization of the land resources to develop more grazing grasses and forage trees. Here are the proposed interventions of forage development.

**1.1 Grazing land improvement**

The main strategy indicated in the project with the intention of improving the grazing land was:-

- Artificial planting of grasses in the naked and overgrazed area.
- Aperture planting was also planned to be applied in those areas with spot of necked areas.
- Broadcasting way of planting will be applied. Rhodes, Phalaris, Desmodium, white clover and/or vetch were selected for this purpose. The seeding practice of these and other types of grasses is mentioned in the table below. Forge trees like Sesbania, Leuceania, pigeon pea etc. can be planted in the grazing land too.

Live fencing using forage trees like Sesbania Pigeon pea and Parkinisonia can be used at the surrounding edge of the grazing land to provide protection from expanding to cultivated land.

**1.2 Increasing crop residues production and utilization**

With the development of cultivated lands the proportion of crop residues yield such as barley, wheat and maize will be large. Besides use of improved crop varieties, assists the enhancement of productivity of the land. As a result, not only the output of grain but also the output of crop residues will be greatly increased. Therefore, more edible feed material can be supplied to animals.

**1.3 Increasing feeding material by planting in edges of cultivated lands ditches and gullies**

In order to promote soil and water conservation works, the ditches and gullies are going to be treated using the techniques of soil and water conservation. Inside these areas, one of the main treating mechanisms will be planting different dual purpose trees like Sesbania sesban, Prosopis juliflora, Pigeon pea and grasses, like Elephant grass and Vetiver. The number of trees planted in the gullies and

edges of ditches are … and … in Mai-Anbesa and Hadegti watersheds. The edges of the cultivated lands will be used for planting some forage feeds, like legume trees and grasses, which they can enhance the fertility of the land.

### 1.4 Develop homestead grazing land.

In this plan, farmers are called to develop their homestead grazing land. Feed trees and grasses advised to be planted together to increase the feeding material available for animals. According to the document, to achieve high output of feed from homestead grazing land, intensive management and planting should be applied.

### 1.5 Feed conservation

Cutting fresh forage at the optimum stage of maturity and feeding it directly to the animals year round would supply the highest quality and most palatable feed. In addition, field and storage losses would be the least of all methods of forage utilization.

On the other hand, storing forages as hay or silage gives lower field losses. Proper forage conservation is a problem in the watershed. Typically, there is a wet and dry season.

## 2. Animal production development program

### 2.1. Small scale dairy development

According to the project, improvement of dairy development will be conducted through application of systematic breeding. This involves selection of better performing indigenous cows in the area followed by artificial insemination (AI).

### 2.2. Sheep and goat development programme

#### 2.2.1. Sheep

Sheep play an important role in the rural economy in arid and semi-arid regions and largely in marginal and sub-marginal areas. Sheep by nature are gregarious animal and it generally produces twins or triplets at a time of lambing. The purpose of sheep rearing here was it gives helping hand to farmers at the time of crisis arising from crop failure.

Sheep rearing were recommended in the watershed especially to those in the hilly areas. Sheep farming through small and marginal areas will provide employment opportunities. This was recommended as subsidiary practice in the area and when applied in the mixed farming system, sheep forms an effective complimentary component in improving the economy of the farm.

### 2.2.2. Goats

Goats are used for meat production and to some extent as source of milk. Because of their short reproductive cycle, fast growing, and the ease of transporting them to livestock markets, they play an important role in satisfying the day-to-day financial needs of farming families. The objective of this programme was to increase the incomes of the rural poor in the watershed and to increase the scope for productive investment to satisfy the growing demand for meat by an ever increasing human population.

It can provide a means by which women can become more involved and can a quite more influence in the agricultural income generating process that will enable them to invest in profitable livestock schemes. The major strategy of goat development was distribution of crossbred dairy goats to poor farmers mainly women in the study area.

## 2.3 Poultry Development programme

A farmer keeps chickens for the production of eggs and meat; chickens are easily disposable and are the easiest means of getting income for farmers. The objective of this programme was to increase the capacity of egg and meat production of indigenous chickens by up grading their genetic potential. Under this programme the improvement of management (feeding, watering, and housing) of local chickens have been given special attention.

## 2.4. Development of Beekeeping programme

Beekeeping in the watershed is both traditional and modern systems. But the traditional beekeeping system is the dominant one. The objective of this programme is to increase the yield of honey by improving the existing management practice of beekeeping.

### 3. Animal health development

The formulation of animal health projects should focus on prevention and control of major animal diseases with minimal administration of drugs. Emphasis was given to major infectious diseases, and parasites in the project area. Based on this the following were planned to the study areas according to their priority with the objective, to improve the animal health condition of the project areas that enhances livestock production and productivity.

- Establishment of good veterinary service
- Strengthening the awareness and participation of the community on animal health programme
- Control of animal movement
- Sustainable animal health service

**Table4: Total investments required for the Mai-Anbesa and Hadegti watershed**

| no | Description | Mai-Anbesa /Birr | Hadegti /Birr | Remark |
|---|---|---|---|---|
| 1.1 | for soil and water conservation activities | 1,397,009.35 | 1,146,526.75 | Food for work |
| 1.2 | for agronomic interventions | 37,689.00 | 24,989.68 | |
| 1.3 | for livestock interventions | 450,560.00 | 432,670.00 | |
| 1.4 | for forestry interventions | 987,476.54 | 880,908.00 | |
| 5 | for purchasing of materials | 232,456.00 | 128,658.00 | |
| | total | 3,105,190.89 | 2,613,752.43 | |

From the total budget required the community participation will be 20% which is equivalent to 621,038.18 in Mai-Anbesa and 522,750.49 in Hadegti watersheds. Those costs for seed, fertilizers will be covered by the community with various credit systems.

### *3.2. Research Methodology*

#### 3.2.1. Types and Sources of Data

Both qualitative and quantitative data were used in order to answer the research questions and thereby arrive at valid and reliable conclusions. Concerning sources of data, both primary and secondary sources have been used in generating necessary and relevant data.

**Primary Sources**

Being the main input for analysis, primary data were collected through interview and focus group discussions. For this purpose, well structured questionnaire and checklist were prepared.

**Secondary Sources**: -

For the purpose of this study, published materials have been used to attain reliability. To mention some of them: Community Based Watershed Development, research papers, annual plans & performance reports of OARD and other related publications were put in place to collect secondary data required for this research.

#### 3.2.2. Research Design: data collection methods, sampling technique & methods of data Analysis

In order to have a full picture of the research problem different ways of crosschecking the reliability of the data has been applied. The different methods that had been employed the collection of primary data are described below.

#### 3.2.2.1. Sample Survey &Ssampling Technique

The sample unit for this study (data collection through questionnaire) is a household. A total sample of 100 households was taken from woreda Laelay Adiabo. The sample households are taken from two watersheds namely: Mai-Anbesa and Hadegti.

Accordingly, the list of the two watersheds were verified and prepared. Finally, the households to be interviewed were selected using systematic random sampling technique. The selected households were then identified and oriented by the interviewers.

Sample survey method was employed to make the paper work more reliable and representative. Moreover, structured questionnaire & checklist were used. Five enumerators were engaged in filling the survey questionnaire and the data collection took 10 days.

**3.2.2.2. In-Depth Interview**

In-depth interview was conducted with OARD and Local Administration officials and experts. These are the two institutions that are responsible for the overall control of the watershed management project.

**3.2.2.3. Focus Group Discussions (FGDs)**

Focus Group Discussions (FGDs) were also conducted with experts from women affaire, farmers' affair, youth affair, Administration and OARD. In addition, some selected sample respondents were included in FGDs so as to cross-check the data collected through questionnaire were relevant and reliable. For this purpose, checklists were prepared for all participants.

**3.2.3. Data entry and analysis**

The data collected through different methods were analyzed using appropriate quantitative and qualitative statistical techniques. Hence, descriptive statistical techniques like averages, frequency, and tables were used.

# 4. RESULTS AND DISCUSSION

## *4.1 Household Characteristics*

Collecting information on demographic characteristics is usually done in household surveys. Based on the collected data, estimated values of the population by sex, age, level of education etc is published.

### 4.1.1 Sample Respondents

For this study, 100 sample households were interviewed in Woreda Laelay-Adiabo. These household members are from both the two watershed of Woreda Laelay-Adiabo, namely Mai-Anbesa and Hadegti. Table5 below shows sample household members by sex and by watershed distribution.

**Table 5: Distribution of Sample Household Members by Sex and Tabia/kebelle**

| Sex Composition of Sample Households | Distribution by Watershed | | | | | |
|---|---|---|---|---|---|---|
| | Mai-Anbesa | | Hadegti | | **Total** | |
| | **Number** | **%** | **Number** | **%** | Num | **%** |
| Female | 11 | 20 | 19 | 41 | 30 | 30 |
| Male | 43 | 80 | 27 | 59 | 70 | 70 |
| **Total** | **54** | **100** | **46** | **100** | **100** | **100** |

Source: Survey Data, 2008.

In this study, the number of female interviewees showing 30% does not mean the female headed households in the Woreda is 30%

### 4.1.2 Demographic Characteristics of the Sample Households

#### 4.1.2.1 Family Size

The majority of sample farmers 69 percent had a family size between 5 to 8 persons. About 18 percent of the farmers reported that they had a family size of between 3 to 4 persons. Only 5 percent of farmers reported that they had a family size of between 1 to 2 persons. Similarly, those respondents

who reported that they had a family size greater than 8 accounts for 8 percent of farmers under watershed management project. The average family sizes of farmers were computed to be 5.3 (Table 6).

**Table 6: Average family size of sample respondents by age group**

| Age group | Farmers | | |
|---|---|---|---|
| | Mai-Anbesa | Hadegti | Average |
| Less than 10 years of age | 3.47 | 3.12 | 3.29 |
| 10-14 years of age | 2.12 | 2.31 | 2.22 |
| 15-65 years of age | 3.05 | 2.87 | 2.96 |
| Above 65 years of age | 1.50 | 2.25 | 1.88 |
| Average family size | 5.37 | 5.28 | 5.33 |

Source: Survey data, 2008

### 4.1.2.2. Age of Household head

The mean age of the sample respondents at the time of the survey was 45.9 years. The age structures of the sample farmer show that the largest proportion of the respondents (68 percent) were within the age bracket of 31 and 60 years, whereas only 24 percent were between the age bracket of 20 and 30 years. Sample farmers older than 60 years constituted 8 percent and the minimum and maximum age of respondents were 24 and 80 years, respectively (Table 7).

**Table 7: Distribution of Sample Respondents by Age and Farmer Group**

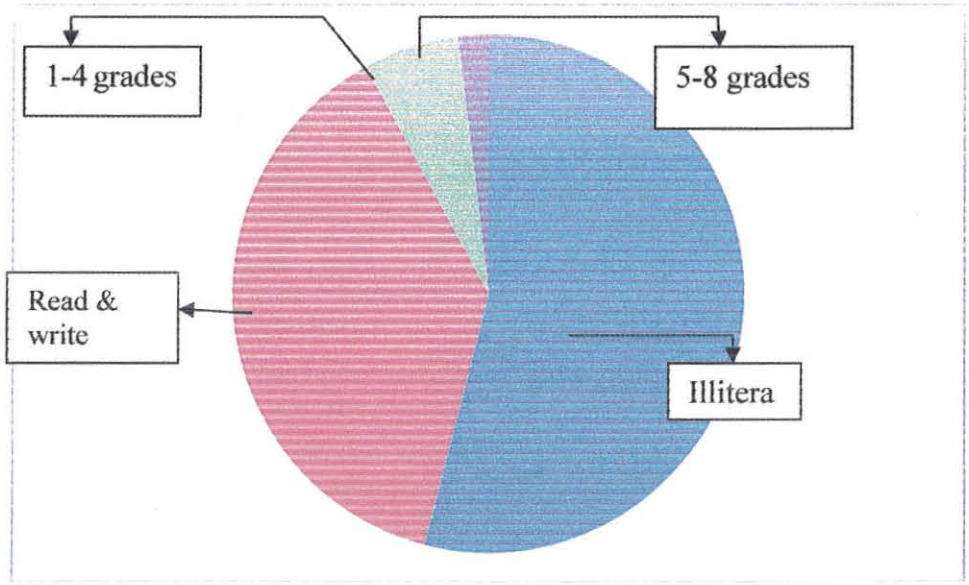
| Age Group | Respondent Farmers | |
|---|---|---|
| | Number | % |
| 20-30 years | 24 | 24 |
| 31-40 years | 27 | 27 |
| 41-50 years | 32 | 32 |
| 51-60 years | 9 | 9 |
| 61 years and above | 8 | 8 |

Source: Survey Result 2008

### 4.1.3 Education

The sample respondent's educational level shows that 54 % are illiterate, 38 % can only read and write while 6% of grades 1-4. Only 2 percent of the sample households have 5-8 grades.

**Chart 1: Educational level of Sample Households**




### 4.1.4 Household Land Holding

The average size of cultivated land owned by the sample respondents was about 1.5 hectare, where the minimum and the maximum being 0.5 ha and 2 ha, respectively.

### 4.1.5 Cropping Pattern

Table 8 below illustrates the cropping pattern and the relative importance of each crop in the farming system in terms of area coverage. Accordingly sorghum, maize, finger millet, and teff in that order, received the largest share of the cultivated land and most farmers grow these crops. In sum, cereals covered nearly 82% of the cultivated area while other crops and oil seeds filled the rest.

**Table 8: Cropping pattern of surveyed farms**

| Crop | Area coverage | |
|---|---|---|
| | Hectare | per cent |
| Sorghum | 35.87 | 26.4 |
| Maize | 32.64 | 24.0 |
| Finger millet | 23.90 | 17.6 |
| Teff | 18.69 | 13.7 |
| Other | 24.90 | 18.4 |
| Total | 136 | 100 |

Source: Survey data, 2008

### 4.1.6 Livestock Holding

According to the available data farmers in both watershed management projects had over a two-fold more of both total livestock and oxen holdings than the woreda Laelay-Adiabo average holdings. The average oxen holding for the Woreda for instance is 1 while 3 for Mai-Anbesa watershed. Meanwhile Hadegti watershed has an average ox holding of 2 0xen.

**Table 9: Population of livestock by type of livestock**

| S.N | Type of livestock | Number of livestock by watershed | | |
|---|---|---|---|---|
| | | Mai-Anbesa | Hadegti | Total |
| 1 | Cattle | 1647 | 1462 | 3109 |
| 2 | Small animals | 1539 | 1965 | 3504 |
| 3 | Transport animals | 198 | 144 | 342 |
| 4 | Poultry (Modern and traditional) | 25 | 98 | 123 |

Source: Laelay-Adiabo Agriculture and Rural Development office

On this study farmers were asked on their livestock holding. Based on that study the minimum livestock holding for all kind of livestock is none. On the other hand the maximum holding for cattle small animal transport animal and poultry is 4, 28, 5 and 15. More importantly oxen holding the

studied farmers has shown that farmers who doesn't have ox accounts 22%, farmers with one ox accounts 44%, with two accounts 24%, and those having above two oxen accounts 10%.

**Table 10: Oxen distribution by household**

| Number of oxen | Number of household |
|---|---|
| 0 | 22 |
| 1 | 44 |
| 2 | 24 |
| 3 and above | 10 |

Source: Survey data, 2008

### 4.1.7 Household Income

Table 11 shows that the great majority of the sample respondents earned less than 1000 Birr of on-farm cash income per year. The annual average farm income by sample farmers with watershed management project during the 2006-2007 production years was Birr 780.00. The earnings range from Birr 120.00 to Birr 4500.00 among the farmers under watershed management project. This income refers to the cash income that the farmers received from the sale of crop and animal in both groups, and the special income from vegetable crops as well as honey production for the farmers under watershed management project after fulfilling their subsistence requirements in the given production years.

**Table 11: Distribution of Sample Respondents by Annual On-farm Cash Income Category and by number of farmers in 2007-2008 Production Years**

| Income Category | Number of Farmers |
|---|---|
| Less than Birr 250.00 | 36 |
| Birr 251.00 - 750.00 | 49 |
| Birr 751.00 - 1000.00 | 8 |
| Birr 1001.00 - 1500.00 | 4 |
| Birr 1501.00 and above | 3 |
| Mean income | Birr 780 |
| Minimume income | Birr 120 |
| Maximume income | Birr 4500 |

Source: Survey Result 2008

The survey further indicates that 84.7 percent of the farmers under watershed management project had additional earning from various off-farm activities (Table 12). The annual average income of the farmers the project during 2007 - 2008 production years was Birr 430. The off-farm income for the farmers under watershed management project dominantly came from cash/food for work paid during the implementation of various conservation works in the areas.

**Table 12: Distribution of Sample Respondents by Annual Off-farm Income Category and by Farmer Group, 2007-2008 Production Years**

| Income Category | Number |
|---|---|
| Less than Birr 250.00 | 34 |
| Birr 251.00 - 750.00 | 47 |
| Birr 751.00 - 1000.00 | 19 |
| Birr 1001.00 - 1500.00 | - |
| Birr 1501.00 and above | - |
| Mean income | Birr 430 |
| Minimume income | Birr 0 |
| Maximume income | Birr 690 |

Source: Survey Result 2008

## *4.2 Biophysical and Economic Gains*

In this study various indicators of agricultural productivity, natural resource management and human welfare were examined as follow.

### 4.2.1 Decrease in Land Degradation

#### 4.2.1.1 Decrease in Soil Erosion:

In Ethiopia in general and Tigray Region in particular, soil erosion is the most widespread and most serious problem of land degradation. It is particularly extensive in Laelay-Adiabo woreda, affecting vast areas of arable and grazing lands. Such problem occurred due to deforestation, intense cultivation of steep lands, overgrazing, and poor management of soil and water resources. The efforts of the watershed management project in both watersheds were to reduce or eliminate soil erosion and maintenance and improvement in the productive capacity of soil resources. With this in mind the study has tried to assess the impact of watershed project undertaken in both watersheds. For this purpose

farmers under the study were asked to explain the benefit of the project in terms of reducing soil erosion. Accordingly, even though measurements have not been undertaken to estimate amounts of soil loss and gain due to intervention of the projects, based on the farmer's perspective the project has brought change both in water and soil conservation. Vast majority (more than 90%) of households in the both watershed projects sites reported that the effect of soil and water conservation along with regeneration of vegetation measures on sloppy land and wastelands was substantial. Runoff water and soil loss on barren hills pre-treatment was significantly reduced after treatment. The progressive reduction in soil and water loss and sediment yield as a result of quick recovery of vegetation on hill slopes and lands adjoining the foothills has resulted in a greatly improving surface and groundwater regime of the micro-watersheds.

Table 13 indicates the perception of respondents (both households and focus groups) on the extent of erosion control after the projects.

**Table 13: Soil Erosion Control after the Project.**

| **Watershed Site** | **Perceived Extent of Soil Erosion Control After the Project (Based on percent respondents)** | | | |
|---|---|---|---|---|
| | **No change** | **A little change** | **Better change** | **Much better change** |
| Mai-Anbesa | 8 | 44 | 26 | 22 |
| Hadegti | 9 | 48 | 28 | 15 |
| **Average** | **8.5** | **46** | **27** | **18.5** |

Source: Survey Result 2008

During the survey study households were asked whether they implement soil and water conservation privately on their private holdings or not: the summarized response indicated that 58% of the households respond 'yes' while 42% said 'no'. The main reasons for not practicing soil and water conservation privately, according to the survey, are shortage of manpower followed by lack of awareness respectively. And some respondents also indicated that as there is no payment for such activity farmers didn't practice soil and water conservation privately.

### 4.2.1.2 Improvement in Forest/Vegetation Cover

The other purpose in watershed management project undertaken in Mai-Anbesa and Hadegti watershed was improvement in forest/vegetation cover. The basic objective of this component in watershed project is to halt deforestation, provide vegetative cover on degraded land and supplement fodder and fuel-wood resources available to rural communities. According to the project history in both watersheds besides to the physical work to conserve water and soil new plants were planted. Data from Agriculture and Rural Development Office/OARD indicate that about 15,000 various new types of seedlings were planted besides to the 2,000 endogenous seedlings. Protection/ improvement of existing vegetal cover as well as rehabilitation of degraded areas were made.

Table 14 below indicates the extent of respondents who agreed that forest/vegetation cover improved after the project. Accordingly, more than 92% of respondents have said forest/vegetation cover after the project has changed. With respect to the type of forest/vegetation cover being improved in the project sites, most if not all of the respondents agreed that the natural regeneration of indigenous trees and shrubs have big domination over the deliberately planted trees/new type. This could be a result of two major factors; the recurrent drought that usually occurred in the woreda affects the planted seedlings on one hand, and long environmental adaptation of the indigenous species to the woreda on the other hand.

**Table 14: Improvement in Forest/Vegetation Cover after the Project.**

| **Watershed Site** | Perceived Extent of Improvement in Forest Cover After the Project (Based on percentage of respondents) | | | |
|---|---|---|---|---|
| | **No change** | **A little change** | **Better change** | **Much better change** |
| Mai-Anbesa | 5 | 47 | 30 | 18 |
| Hadegti | 10 | 55 | 20 | 15 |
| **Average** | **7.5** | **51** | **25** | **16.5** |

Source: Survey Result 2008

During the survey households were asked whether they plant trees on their private holdings for private use or not and the summarized response indicated that 53% of the households responded 'no'

while 47% said 'yes'. The main reasons for not planting trees privately are shortage of land for tree planting 72%, shortage of seedlings12% and shortage of labor for tending 16%.

### 4.2.1.3 Control in Gully Formation

In the treated watershed projects of Mai-Anbesa and Hadegti, different conservation techniques such as loose check dams, gabion check dams, rock plugs, score checks, retaining wall structures combining with vegetative measures used for erosion control including seeding with grasses and legumes, planting of fodder and fruit trees, and other similar strategies are effective for the existing gullies' rehabilitation and preventing new gully formation. According to the data from OARD about 2.5km of loose check dams, 500m gabion check dams were done. Similarly fodders (500 elephant grass, 340 alfa alfa and 400 saspania) fruits (100 papayas, 480 guavas) were planted. The vegetative measure (grasses planted along the river/drainage channels) in Mai-Anbesa and Hadegti, which is a source of fodder for the animals, makes short-term benefits possible to farmers. Like the improvement in forest/vegetation cover, table 10 below indicates the extent of respondents who agreed that gully formation control improved after the project. Accordingly, 90% of respondents have said gully formation control after the project has brought change while the rest disagree.

**Table 15: Control in Gully Formation after the Project.**

| **Watershed Site** | **Perceived Extent of Control in Gully Formation: After the Project** (Based on percentage of respondents) | | | |
|---|---|---|---|---|
| | **No change** | **A little change** | **Better change** | **Much better change** |
| Mai-Anbesa | 8 | 15 | 54 | 23 |
| Hadegti | 10 | 10 | 58 | 22 |
| **Average** | **9** | **12.5** | **56** | **22.5** |

Source: Survey Result 2008

### 4.2.2 Sustained Increase in Agricultural Production

#### 4.2.2.1. Crop Production

Laelay-Adiabo woreda receives an average of 500-700millimetres of rainfall each year, spread unevenly between April and August. Most of the watersheds' inhabitants depend on rain fed cultivation for their livelihood. Traditional dry land crops in the woreda are sorghum maize, finger millet, teff, and with few pulses. Farmers in the area, facing daunting natural conditions, generally follow traditional, low-risk cultivation practices that typically yield low returns. Rainfall is erratic and poorly distributed; soils are often severely eroded, infertile, and deficient in organic matter. Because of rapid population growth, cultivation of slopes and of even more marginal lands is an increasing trend that only accelerates erosion. Forests and other sources of natural vegetation are being stripped for fuel and fodder, while roads, marketing facilities, and other infrastructure remain in adequate.

The actual land holding size of farmers is too small in the study watersheds. Besides, recurrent drought and low soil fertility affect crop production. As a consequence, the annual harvests of all farmers could not adequately feed the household for the whole period of the year, even in good years. On the other hand, however, households do not only subsist on the crop enterprise; beehives, irrigation, cash for work/food for work and other off-farm activities are few of the other sources of income for some farmers in the study area.

Although it was highly affected by recurrent droughts which occurred year to year in the woreda crop production has improved. Accordingly, 45% of Mai-Anbesa and 30% of Hadegti households agreed that crop production had improved after the project.

Table 16 shows the impact of watershed projects over the crop production before and after the project. The period before and after the project refers: to three years average production in good, medium and poor years. The data is only on Kiremt[1] crop productions, as Belg[2] is not common in both watershed sites.

[1] *Kiremt* is the major raining and crop growing season (June – August)
[2] *Belg* is the second rain and crop growing season (February – May)

The survey result indicates that increase in crop production varies in both watersheds depending on the time of project commencement, position of the treated upper lands towards the location of the arable lands in the specific village, drought incidence, etc. Accordingly, a majority of the respondents reported that impact of the projects on crop production (comparing the situations before and after the project) in Mai-Anbesa and Hadegti watershed is insignificant. Thus, on average (of both watersheds) 60% of respondents from both watersheds reported that crop production had not improved after the project. On the other hand about 37% respondents agree that after the implementation of the watershed management project there is a clear increase in annual yield of crop. According to these respondents the annual increase relative to the past reaches up to 45%.

**Table 16: Perceived extent of Crop Production increase after the Project by respondent proportion**

| Watershed Site | Years of Commencement | Perceived extent of Crop Production increase after the Project by respondent proportion. | | |
|---|---|---|---|---|
| | | Agree | Disagree % | Neutral % |
| Mai-Anbesa | 1996 | 45 | 35 | 20 |
| Hadegti | 1997 | 30 | 55 | 15 |
| **Average** | | **37.5** | **45** | **17. 5** |

Source: Survey Result 2008

### 4.2.2.2. Livestock Production

Livestock production comprises beekeeping, dairy and poultry. In drought prone areas like Laelay-Adiabo woreda, the productivity of livestock usually depends on the availability of feed and disease control. Successful watershed management includes the development and demonstration of improved livestock production through an increase in quality and quantity of feeds, and the development of the extension system and modified trainings. According to the information from OARD there are 2 farmers training centres in both Mai-Anbesa and Hadegti watershed. The intention of these centres was to provide training for farmers on various agricultural practices and to serve as a demonstration centres for improved practices. However as the office disclosed me myself observed these centres are not ready to provide such service to the farmer. Materials are rarely available; capacity of development agent is low. As a result not only livestock production but also other agricultural activities are traditional.

The Woreda, particularly the watersheds understudy are endowed with huge animal population but according to the result obtained from the study shortage and unbalanced feed with poor production and management system and with spread of animal diseases sufficient advantage could not be exploited from it. More than 90% of respondent reported that there is no sufficient veterinary service; no sufficient feed and water. But on the contrary the project was about to brought better feed and water supply and health care service.

#### *4.2.2.2.1 Honey Production*

Woreda Laelay-Adiabo is potentially rich in honey production and colony multiplication. Beekeeping has been taken (by some farmers) as a good alternative because the average land holding of the farmer is low in all most all watershed projects. Although the quality of honey varies in the woreda, yield per local hive ranges from 4-6kg/hive.

In all watersheds response of households on the improvement of honey production after project is positive: the majority of households reported that the project has introduced modern beehives to them and as the result of flora content of the watersheds improving honey production both in quality and quantity increased. Table 17 shows the impact of watershed management projects on honey production. In Mai-Anbesa 38% of respondents said that they have adopted modern beehives and other related technologies, 85 % agreed that honey production in general after the project is improved and 25% prioritized honey production as the top means of income for their livelihood. These respondents believe that honey production has increase from the previous 4-6kg/hive to 9-10kg/hive.

In Hadegti the 13% of respondents said that they have adopted modern beehives and other related technologies, 45% agreed that honey production in general after the project is improved and 15% prioritized honey production as the top means of income for their livelihood. According to these respondents honey production has raised from its previous to 6-8kg/hive. Similarly honey production for those who introduce modern beehive production has become more attractive. Although there are farmers who found more than 20kg/hive from modern beehive, on average farmers agree about 14kg/hive has been produced from it.

Although the trend is promising in adoption of improved technologies as well as in farmers' attitudes starting to change, in conjunction with the potential of the areas it invites further improvements and interventions to be made.

**Table 17: Change in Honey Production**

| Watershed | Production (Kg/hive) Local Hive | | | Production (Kg/hive) Modern Hive | | |
|---|---|---|---|---|---|---|
| | Before project | After Project | Percent Increase (%) | Before project | After project | Percent Increase (%) |
| Mai-Anbesa | 5.36 | 9.72 | 81.34 | - | 14 | - |
| Hadegti | 5.12 | 8.03 | 56.83 | - | 10.5 | - |
| **Average** | **5.24** | **8.875** | **69.085** | **-** | **12.25** | **-** |

Source: Survey Result 2008

### *4.2.2.2.2 Grass and Fodder Production*

The major challenge of the study area is lack of enough feed resources for livestock. Grazing lands, the major feed resources of the area, are highly degraded due to soil erosion and overgrazing. In Mai-Anbesa watershed the degraded grazing land and the upper land becomes potential for feed resource (particularly grass). This project has brought a chance of an improved utilization of feed resources through the system of cut-and-carry and stall-feeding instead of free grazing. However, as 45% of respondent reported (particularly livestock small holders), due to well established resource use mechanism the objective has compromised.

On the other hand respondents in Hadegti watershed agree that the natural grazing land is decreasing from year to year. This is usually, according to 89% of the respondents, due to area enclosure made after the project aimed at stabilizing of conservation structures and protection of newly planted seedlings.

As table 18 demonstrates, in Mai-Anbesa before implementation of watershed projects people of these watersheds had to travel 6 kilometres to collect fodder for cattle and it was reduced to 3.6 kilometres after the projects. In the same watersheds before implementation of watershed projects farmers

experienced livestock feed shortage for a period of 7.5 months in a year and this was reduced to 5 months after the projects.

On the other hand in Hadegti watershed before implementation of watershed projects people of these watersheds had to travel 5 kilometres to collect fodder for cattle and it was reduced to 3.3 kilometres after the projects. In the same watersheds before implementation of watershed projects farmers experienced livestock feed shortage for a period of 7.1 months in a year and this was reduced to 5 months after the projects.

However this situation couldn't sustain longer as problem rose with the utilization of the common grazing land. For example the system of cut-and-carry and stall-feeding is violated by some farmers and the bye-law didn't function properly; and due to area enclosure made after the project aimed at stabilizing of conservation structures and protection of newly planted seedlings.. As a result the sustainability of the watershed become under question.

**Table 18: Extent of fodder Availability Before and After the Project**

| Watershed | Before the Project | | | After the Project | | |
|---|---|---|---|---|---|---|
| | Number of animals served with fodder from the W/S per household | Number of months of fodder worth for animals obtained from the W/S | Distance traveled to obtained fodder (KM) | Number of animals served with fodder from the W/S per household | Number of months of fodder worth for animals obtained from the W/S | Distance traveled to obtained fodder (KM) |
| Mai-Anbesa | 3.5 | 4.5 | 6 | 5.25 | 6.91 | 3.64 |
| Hadegti | 2.2 | 4.9 | 5 | 4.50 | 6.80 | 3.30 |
| **Average** | **2.85** | **4.7** | **5.5** | **4.87** | **6.85** | **3.47** |

Source: Survey Result

### 4.2.3 Water Recharge for Drinking and Irrigation

#### 4.2.3.1 Ground water

The effect of soil and water conservation measures on hill slopes and wastelands along with regeneration of vegetation has reduces runoff water loss on barren hills. As a consequence in Mai-Anbesa watershed the water table rises from year to year and people use this water for watering

animals, drinking and irrigation. According to the office of Water Resource Development and Mine and Energy, before the implementation of the project one has to dig up to 10-14m. After two to three years of implementing the project one can easily find water in 6-8 m.

The regional government considers irrigation development as one of its top priorities in the effort to ensure food security and environmental rehabilitation. Similarly in the Woreda although the priority is same, and there is a considerable potential for irrigation development in the area, existing experience on irrigation is very limited and traditional. The crop production in the woreda is almost entirely rain fed. Potential irrigable land of both watersheds is about 100ha/55% in Mai-Anbesa watershed and the remaining 45% in Hadegti watershed/. Meanwhile the actual irrigated land of both watersheds didn't exceed 25% of its potential as OARD data prevailed. This low performance partly is due to the inefficiency of extension service and partly due to the poor motive and determination of farmers in the watershed. According to OARD, since irrigation with hand dug wall require labour investment and day to day endeavour, farmers in the area are not committed to do so. But this couldn't be the root cause for that problem. Because, the governmental institution at that level of administration is responsible to brining these farmers back to business and appreciate the fruit of irrigation. Practical training, experience sharing with other areas could be arranged to make farmers more aware of the benefits of irrigation.

In the watershed sites the potential source of water for watering animals, drinking and irrigation are basically two types, ground and surface water. The latter is only in the form of springs, ponds and perennial rivers. The effect of successful watershed management projects is to increase the number and amount of streams on the surface as well as to raise the water table of ground water.

### 4.2.3.2 Surface water

Water held as runoff in the upper lands of the watersheds typically contributes to peak flows in lower watershed streams and rivers during the summer (June-August). Because of the concentrated rainfall in the three months, these streams are more reliable sources for late-summer irrigation. As shown in Table 14, 88.5% of the respondent households agreed that surface water in their watershed increased (prolonged the time of flow and increase in discharge rate of the surface water) because of the

conservation activities carried out by the projects. However the majority of respondent claim, what is the change if the conservation didn't brought tangible benefit.

**Table 19: Water Recharge for Drinking and Irrigation.**

| Watershed Site | Perceived Extent of Improvement in Water Recharge for Drinking and Irrigation (Based on percentage of respondents) | | | |
|---|---|---|---|---|
| | No change | Little change | Better change | Much better change |
| Mai-Anbesa | 12 | 58 | 18 | 12 |
| Hadegti | 11 | 69 | 12 | 8 |
| **Average** | 11.5 | **63.5** | **15** | **10** |

Source: Survey Result 2008

### 4.2.4 Employment Creation:

Watershed programs are aimed at alleviation of poverty of families living below the poverty line by providing them self-employment and wage-employment and also by development of natural resources such as land, water and vegetation. Self-employment programs, through a package, help a family to cross the poverty line within a few years. Wage-employment programs help a poor family to earn wages for those who are in need of work. Watershed programs help in conservation of natural resources and raising their productivity through their optimum use; besides, farmers are paid (7 Birr or 3 kilogram of grain per day) for their participation in the implementation of various watershed activities. But in the reality the amount of money or grain obtained from the cash/food for work are not enough to say there are wage employment, and more importantly paying community to participate in the conservation practices are seen as means of creating dependency. For activities with payment more people can be mobilized but in the absence of payment no one is committed to involve in such activities. What is important here is to build felling of ownership at community level.

In both watershed sites every capable member of the communities regardless of sex, age, wealth status and possession of land was participating in the implementation process of watershed activities and able to create short-term wage-employment until implementation of the watershed components is completed. The response of households on the point of employment creation of watershed

management projects in the both watershed areas was evaluated. The majority (75% of respondents) gave the prior rank to wage-employment cash or food for work, and the remaining to self-employment such as beekeeping, irrigation, poultry and dairy farming according to their importance respectively.

## *4.3 Watershed management and Institutions*

### 4.3.1 Watershed Institutions

#### 4.3.1.1. Inventory of Local and External Watershed Institution

The questionnaire has includes a section to record the number and type of local and external institutions and households' membership in these organizations within the study watersheds. Overall, 14 (9 local and 5 external) different types of formal and informal institutions were recorded in the Mai-Anbesa and Hadegti watersheds. The total membership in these organizations was 1934. Thus, the average households belonged to 2.5 groups and associations.

The landscape of local institutions is dominated by the mass associations (Farmer, Women and Youth Associations). These associations are largely perceived to be managing community resources ranging from land, forests, and water to resolving conflict as well as being the core group to mobilize people for any development activities. The number of memberships in mass associations varies by watershed according to the total population existing in specific watersheds.

Other local institutions established due to watershed management projects are watershed development committee and resource user groups.

With regard to the external institutions they can be divided in to four major categories: technically supporting institutions like extension, service-providing institutions like health and education and credit-providing institutions like DESCI (Dedebit Saving and Credit Institution) funding institutions like REST. The distribution of these institutions varies in both watershed according to the funding agency of the specific watershed management project and location of the watershed.

Households were specifically asked to identify in which of the local and external institutions are involved in the watershed management projects. According to the study most of the local and external institutions did not actively participated in the implementation of watershed management projects. The most commonly reported active stakeholders in both watershed projects were mass associations (Farmer, Women and Youth Associations). The remaining local institutions such as the watershed development committee, resources user group, Edire and Ekub are only nominal. Among the external institutions the funding NGO/REST belong to specific watershed projects/Mai-Anbesa/ to support the project in cash and material.

It is striking to note that the involvement of other external institutions such as education, water and health in the watershed management projects where they belong was reported as nil. This indicated the lack of multi-sectoral participation in the watershed management projects implemented in the woreda. As the name Integrated Watershed Management Project implies different local and external stakeholders should involve in a specific watershed area; whereas, in practice the implementation of watershed projects in the study area goes differently, most of the watershed project components are focusing on agriculture and agricultural related activities.

### 4.3.1.2. Local Institutions Development in Watershed Management Projects

To further understand which specific institutions were established after the watershed management projects, the sample households were asked which institution established due to watershed management project intervention. Nonetheless, watershed development committee and resource user groups are the only local institutions developed right after the project in Mai-Anbesa. What is important to note is that the creation of local institutions in all watershed areas seems to be very low and this will affect the sustainability of the projects. Moreover, the attempt of external institutions to build strong local institutions is insignificant.

More ever to assess the performance of the local institutions the author began by looking at structural and functional variables that may be linked to performance. Changes in group size may reflect the performance of a group in the sense that it seems reasonable to expect that where performance is low,

members are more likely to drop out. In Mai-Anbesa watershed, there are three groups (fodder, bee keeping and irrigation groups) while Hadegti watershed have two groups (irrigation and bee keeping). However each group lucks an active participation in the use and protection of the resource under their responsibility. They didn't monitor their resources and ensure every member gets equal share.

### 4.3.1.3. Importance of Institutions to Watershed Management Project

Since households belong to only 2.5 institutions/associations/ groups on average, and given the dominance of mass associations, it is not surprising that households consider most associations to which they belong as very important (Table 20a). When the distribution is examined only for the groups that households considered the most important, the pattern of results almost completely reflects the overall patterns of membership, i.e. mass associations emerge as the most important, followed by local administration, extension and NGO group. As mentioned above, the involvement of NGOs to support watershed management projects were specific only to Mai-Anbesa watershed areas. Basically REST is the only local NGO, which is involved in watersheds activities in the study area.

**Table 20a: Distribution (%) of Ratings of Importance of Institutions**

| | Very Important | Important | Not Important |
|---|---|---|---|
| Mass Association | 89.7 | 8.4 | 1.9 |
| Local Administration | 86.5 | 13.1 | 0.4 |
| Extension | 81.8 | 14.4 | 3.8 |
| REST | 68.4 | 22.6 | 9.0 |
| Cooperative | 61.3 | 27.9 | 10.8 |
| Watershed Development Committee | 51.2 | 36.4 | 12.4 |
| Resource User Group | 46.7 | 25.2 | 28.1 |

Mass association comprises = Farmer, women and youth associations

Resource user group = beekeepers, irrigation, fodder and gully.

Source: Survey Result, 2008

The distribution of the most important groups was also examined across the two watersheds. Consistent with other findings, Table 20b reports mass associations (31.4%) were the most prominent

in all watersheds. What is important to note is that mass associations appear at the top of this list despite the creation of these groups by TPLF almost 20 years ago, they have been in existence long enough to be considered by respondents as having been initiated by communities. The second group in the list is local administration, mentioned as the most important group by 23.8% of households for its coordinating and mobilizing of people and resource of the watersheds for development. Local extension, NGO groups/REST, DECSI and cooperatives respectively were ranked next in importance.

**Table 20b: Distribution (%) of Institutions Considered Very Important**

| Groups | Very Important | Initiated by Government, Community or Outside Community | Formal/Informal Group | Participation or Role |
|---|---|---|---|---|
| Mass Association | 31.4 | Government and Community | Formal | Implementer |
| Local Administration | 23.8 | Community | Formal | Administration |
| Extension | 16.2 | Government | Formal | Technical back up |
| NGOs Group/ REST | 14.3 | Outside Community | Formal | Funding |
| DECSI | 7.5 | Outside Community | Formal | Credit |
| Cooperative | 4.3 | Government and Community | Formal | Market stability |
| WDC | 1.6 | Community | Formal | Supervise all watershed activities |
| Resource User Group | 0.9 | Community | Formal | Resource utilization |

Source: Survey Result, 2008

The community is the source of most associations in all categories, except for external institutions-both governmental and nongovernmental organizations-which are seen as having been initiated outside the community. Government sponsored groups are of course categorized primarily as initiated by the state. In addition to official state bodies, this category includes sector lines created by the government structure. It is also striking that all categories of local associations in the watersheds rely strongly on a formal organizational structure. Only Ekub and Edir groups are informally organized.

### 4.3.1.4. Households' Membership in Watershed Institutions

The questionnaire has included a section to record households' membership in these institutions. According to the information obtained from Woreda Administration the total membership in these institutions was 1934. Thus, the average households belonged to 2.5 groups and associations. This density is lower in Hadegti watersheds. The disaggregation in categories of groups reported in Table 20 has shown for both watersheds to allow a comparison. However the rest of the report recombines groups to reduce the number of categories and to reflect a functional distribution of groups and memberships.

Table 21 reports the distribution of memberships across formal and informal institutions by watersheds of the sample respondent. Membership of households to local institutions was highly dominated again by the three mass associations (Farmers association 97%, women's association 90% and youth association 95.6%); as their name implies; every capable member of the communities regardless of sex, wealth status and possession of land at the age of more than 18 was participating in any of these three associations according to the already defined age boundary. Despite their age, females more than 18 years old were also participating particularly in women associations.

Membership in agricultural cooperatives is the next most prevalent category, totalling 55% of membership. These allow for any volunteer from the community to join the cooperative for his/her own benefit. Recently, cooperative promotion strategy of the country in general and Tigray region in particular has been reformed. Accordingly, cooperatives are acting as share enterprises, and a single household can have more than two shares if he/she is able to pay as per the rate of Birr/share. Consequently, some households were having more than two memberships within one cooperative and others may not have any participation. Cooperatives were originally created to supply goods and services in a relatively cheaper price, but now they are also involving in the supply of inputs like fertilizer and pesticides.

**Table 21: Memberships in Local Institutions, by Watersheds**

| Description | Mai Anbesa | | Hadegti | | All | Total % |
|---|---|---|---|---|---|---|
| Farmers Association | 42 | 97.7% | 26 | 96.3% | 68 | 97.1% |
| Women Association | 10 | 90.9% | 17 | 89.5% | 27 | 90.0% |
| Youth Association | 25 | 92.6% | 18 | 69.2% | 43 | 95.6% |
| Cooperative | 30 | 55.6% | 25 | 54.3% | 55 | 55.0% |
| Local Administration | 3 | 5.6% | 2 | 4.3% | 5 | 5.0% |
| Watershed Development Committee | 1 | 1.9% | - | 0.0% | 1 | 1.0% |
| Resource User Group | 26 | 48.1% | 18 | 39.1% | 44 | 44.0% |
| Edir | 4 | 7.4% | 2 | 4.3% | 6 | 6.0% |
| Ekub | 3 | 5.6% | - | 0.0% | 3 | 3.0% |

Source: Compiled by Author from data obtained in different sectors

More than 39% of households in Hadegti and about 48% of households in Mai-Anbesa are members in a variety of resource user groups. These include beekeepers group, irrigation users group and fodder users group. Smaller numbers of memberships are in the informal institutions Edir (6%) and Equib (3%). The total number of reported memberships of the sample respondent in informal institutions is surprisingly small.

In the sample study close to 42% of households said that the main reason for joining as member of institution is the expected impact on both household livelihood and the whole community that they anticipated (Table 22). On the other hand 30% said that they belonged to groups because membership was mandatory. And for the rest their reason was because they see everybody as member (23%) and anticipation of future benefit (5%). This result, together with the fact that most groups are seen as government-initiated, attests to the fact that most groups appear to be serving the purpose of the government.

**Table 22: Reasons for Joining the Most Important Local Institutions**

| Reasons for Joining (%) | Mai-Anbesa | Hadegti | Total |
|---|---|---|---|
| Impact on Household Livelihood | 16 | 9 | 25 |
| Impact on Community | 10 | 7 | 17 |
| Everybody Belongs | 11 | 12 | 23 |
| Mandatory | 14 | 16 | 30 |
| Future Benefit | 3 | 2 | 5 |
| Total | 54 | 46 | 100 |

Source: survey Result

### 4.3.1.5. Meeting

Meetings are often considered an indicator of participation. Meetings act as a forum for maintaining accountability and transparency of the institutions. Meetings remain one of the important forums for sharing information, for decision-making and towards effective implementation of the project. The numbers of meetings are generally high during the phase of physical implementation and gradually decrease after completion of the works. Table 23 shows 86.25% of households reported that their institutions have a regular meeting. Consequently, the mass associations have a regular meeting once in every month, while the remaining institutions like cooperatives have meeting once every year and watershed association and resource users groups have occasional or seasonal meetings.

The respondents were specifically asked whether they attended group meetings or not. Accordingly, the sample households responded that although every member has to attend the meeting, but most often with various reasons there are a lot of absentees. Male heads of households attend meetings more frequently than female heads of households. Meetings of cooperatives are generally attended slightly less frequently than those of other organizations. Leaderships and external institutions finalize the date and agenda for the meetings, which is then communicated to the members, through the immediate leaders. However, people (as 82.5% of respondents indicated) are not clear about the agenda of the meeting. As a result they are not active participant in the meeting.

**Table 23: Local Institutions Meeting by Watersheds**

| | Mai-Anbesa | Hadegti | All |
|---|---|---|---|
| **Does your Institution has Meeting** | | | |
| Yes | 85 | 70 | 86.25 |
| No | 15 | 30 | 13.75 |
| **Frequency of Meeting** | | | |
| Occasional | 85 | 65 | 75.5 |
| Every year | 35 | 15 | 30.63 |
| Every month | 80 | 65 | 32.5 |
| **Role of Members in a Meeting** | | | |
| Idea Sharing/Active participation | 5 | 0 | 2.5 |
| Organizing | 10 | 20 | 15 |
| Passive participation | 85 | 80 | 82.5 |

Source: Survey Result

### 4.3.1.6. Institution Byelaws

As shown in Table 24 below, 97% of households were agreed that most of their formal and informal institutions have enacted rules and regulations (community byelaws) governing the use of resources, collective actions, and institutional disciplines and to administer themselves in their watersheds. In relation with this, 54% of households reported that external institutions (Governmental sectors) had developed the community byelaws. While 29% of households reported that they themselves developed the community byelaws. Only 17% said that they had no idea who had developed the community byelaws. Households were asked to report on the frequency of rule violations. The majority of these incidences were related to lateness or absence for group meetings and collective action. Accordingly, 44% reported lateness or absence at group meetings, 44% lateness or absence for collective action and 12% delay in financial contributions. Moreover, 64% of the households noted that the institutions did not apply their byelaws rather their institutions apply the rules forcefully, which is even inconsistence.

**Table 24: Local Institutions Byelaw by Watersheds**

| | Mai-Anbesa | Hadegti | All |
|---|---|---|---|
| **Does your Institution have byelaw** | | | |
| Yes | 53 | 44 | 97 |
| No | 1 | 2 | 3 |
| **Byelaw was developed by** | | | |
| External organization | 31 | 23 | 54 |
| Members | 15 | 14 | 29 |
| Have no idea | 8 | 9 | 17 |
| **Frequency of rules violation** | | | |
| Absence of group meeting | 30 | 14 | 44 |
| Absence for collective action | 20 | 24 | 44 |
| Delay in financial contributions | 4 | 8 | 12 |
| **Application of Byelaw** | | | |
| By force | 34 | 30 | 64 |
| Based on the Agreement | 20 | 16 | 36 |

Source: Survey Result

### 4.3.1.7. Conflict Management and Resolution:

As table 25 describes the major cause of conflict in the study area was miss utilization of common resources (as 72% respondent reported). This kind of conflict arises basically when there is no clear common resource utilization bylaw. The other cause of conflict indicated by 28% of respondent is border conflict on private property like grazing and arable lands. The role of organizations in conflict resolution is viewed by 46% of households as negative, 24% neutral and 30% positive.

**Table 25: Conflicts and Role of Institutions to Resolve, by Watersheds**

| Conflicts and their Resolutions | Mai-Anbesa | hadegti | All |
|---|---|---|---|
| **Causes of Conflicts** | | | |
| Border conflict on private property like grazing and arable lands | 15 | 13 | 28 |
| Miss utilization of common resources | 39 | 33 | 72 |
| **Role of Institutions** | | | |
| Negative | 20 | 26 | 46 |
| Positive | 14 | 10 | 24 |
| Neutral | 20 | 10 | 30 |

Source: Survey Result

## *4.4. People's Participation in watershed management Project in the Study Area*

Despite recent efforts to include community representatives in catchment's area selection, the initial decisions in the identification of local needs and priorities, formulation of objectives and approaches used to involve local people in the project used to be decided by the government authority with major focus on environmental rehabilitation. The participation of the community was limited to the attendance at meetings to be informed on the decisions collaborating in and provision of labor and organization for implementation. The community was not given a clear responsibility to make decisions on issues pertaining to the issues of ownership, utilization, access to benefits, and related issues. As a result, the participation of the local people in the watershed management project has been passive.

The next section looks in the nature of participation being practiced in managing watershed in the study area. Specifically it presents results of the investigation regarding the identified constraints faced to both farmers and field level extension workers in managing watershed development projects. The next section looks into:

- Motivational reasons of households to participate in watershed management Project;
- Extent of households participation in watershed management project; and

➢ Mechanisms used to ensure popular participation in watershed management project.

### 4.4.1. Motivational reasons of households to participate in watershed management Project

The respondent farm households in the study area stated their motivational reasons for participation in watershed management Project. These reasons were: to obtain grain and oil through Food-for-Work Program in return to their participation in the activities, forced bylaw and threats of punishment that may follow in case of their absence from free labor demanding community mobilization work, and to obtain animal feed such as fodder grass from the forests and water were important among their reasons as indicated in Table 26 below.

**Table 26: Reasons given by respondents for participating in watershed management Project in order of their priority of importance**

| Order of priority | Reasons for participation in community forestry | Most Important | Important | Least Important |
|---|---|---|---|---|
| 1 | Food-For-Work | 15 | 73 | 12 |
| 2 | Forced by law& threats of punishment | 8 | 66 | 26 |
| 3 | Animal feed and water | 31 | 45 | 24 |
| 4 | Additional land | 33 | 47 | 20 |
| 5 | Income from the sale of wood | - | 32 | 68 |
| 6 | To meet demand of fuel wood | - | 11 | 89 |

Source: Survey results, 2008.

Table26 revealed that farmers mentioned that Food For Work, forced bylaws and threats of punishment and Non-wood Forest Products have been the most important motivational reasons while income from the sale of wood, influence of mass media and fuel wood have been among the least motivational reasons for participation of the respondents in watershed management project activities respectively in order of their priority of importance of the reasons based on their respective ranks.

**Food-For Work**

Farmers in the study area prefer to be paid to work in rehabilitation activities. Table 26, indicated 15% and 73% of the respondents replied that Food-For-Work was their most important and important motivational reason to participate in watershed management project practices while 12% of them put it as the least important reason for their participation. Due to the prevalence of poverty in the study area, the majority of the farmers ranked Food-For-Work as their primary motivational reason to participate in the program.

**Forced bylaws and threats of punishment**

It is known that the amount of time spent on a development activity by an individual will depend on the expected benefit accrued. In the absence of such benefits, it is difficult to expect voluntary participation for the people with food insecurity. Consequently, coercive (compulsive) measures such as forced bylaws and threats of punishment were applied on the people to mobilize them on the government initiated campaigns rather than facilitating new ways to address the issue. Respondents mentioned that individuals failing to contribute free labor during mass mobilization in SWC and tree planting works were penalized in cash or excluded from any benefits coming to the community including participation in temporary Food-For-Work opportunities. Accordingly, 8%, 66% and 26% of the respondents replied that participation for forced bylaws and threats of punishment was their most important, important and least important reasons for their participation in watershed management project practices respectively and ranked second in the hierarchy of the reasons for participation.

**Animal feed and water**

Animal feed and water ranked on the third in its priority of importance (Table 26). However, their legume composition is very low. In general, this study revealed that participation in watershed management project practices in the study area was mainly attached with the availability of tangible benefits accrued in return to participation.

### 4.4.2 Extent and levels of participation of stakeholders at different stages of the watershed management project

In this section, the extent of participation is examined in relation to field level responsibilities of the various participants (actors) especially the household farmers with respect to their levels of participation in watershed management at various stages of the project. The stages include planning, implementation, monitoring and evaluation and benefit sharing of the project.

#### 4.4.2.1. Participation in planning process

The Woreda OARD and Local Administration carry out the planning of watershed management activities of the project. Organization for mass mobilization of farmers by setting the amount and type of work to be achieved, manpower and resources needed and programming of the priority activities are among their major responsibilities.

The OARD and Local Administration have assumed that the mechanism of mass mobilization is used to stimulate local people's participation in the program activities and increase farmer's knowledge to foster attitudinal change. They organize motivate farmers for mass mobilization during village meetings. The development agents and government representatives present the summary of the preparations made for the proposed achievements. Then, as all respondent agree, the proposed amount of work and plan of activities allocated to the watershed is explained to them and persuaded to it. With this regard people were asked if they have a participation in the planning processes. Accordingly they have replayed as shown below in table27.

**Table 27: public participation in planning process**

| Watershed | Participation in planning | |
|---|---|---|
| | Yes | No |
| Ma-Anbesa | 10 | 90 |
| Hadegti | 4 | 96 |
| Average | 7 | 93 |

Source: Survey Result

### 4.4.2.2. Participation in implementation

Unlike to the planning process the implementation of the project was made in collaboration with the people in both watersheds together with the other residents of the kebelle/Tabia. At this level households will be convinced to do the standard work developed centrally in both SWC and planting of seedlings. With respect to tree seedling distribution, 75 percent of the seedlings has raised in government nurseries while the remaining 25% is allocated for community planting; and all tree seedling raised in communal nurseries are allocated for private tree planting. Tree planting is carried out in July, which is the main rainy season in the study area to accomplish the seasonal agricultural activities. Therefore, as farmers put it, competition for labor is relatively severe. Since the planting activity is carried out by mass mobilization in busy periods, and farmers are just obliged to fulfill their quota instead of taking adequate time to plant the seedlings properly. This inadequate coordination of the planting activities has led to improper planting and consequential mortality of seedlings.

Similarly, SWC activities were carried out per the interest of the government implementing body. Although majority (76%) of farmers agree that they have involved in the implementation process but in reality farmers are obliged to do what they are told to do or they did it to get grain or money from the project.

**Table 29 public participation in implementation process**

| Watershed | Participation in implementation | |
|---|---|---|
| | Yes | No |
| Ma-Anbesa | 77 | 23 |
| Hadegti | 75 | 25 |
| Average | 76 | 24 |

Source: Survey Result

### 4.4.2.3. Participation in monitoring and evaluation

According to the respondent (100%) reported, there is no participatory monitoring and evaluation of programs in the study area. A system was not also in place to monitor the distribution of benefits, to evaluate the efficiency and effectiveness of the enacting local rules (by laws). Assessment was not

made (i.e. whether they match or not with the presently emerging demands and expectations of the community beyond the protection objectives of the watershed).

### 4.4.2.4. Participation in benefit sharing

It has been indicated that local rules were being initiated by the OARD and communicated to the communities for the administration and management of the watershed focusing mainly on protection and grass utilization. The local rules specify the conditions under which the farmers can utilize forest products (both individually and in group), fines against illegal users, and presented the procedures to be followed for the utilization of the resources. But as described on previous sections benefits are not shared fairly.

# 5. CONCLUSION AND RECOMMENDATION

## *5.1 Conclusion*

Mai-Anbesa watershed, in terms of biophysical and economical gains had a significant improvement. Mainly soil erosion control, forest/vegetation cover improvement, gully formation control, water recharge improvement, and livestock production and on farm employment were dramatically improved in the areas. Comparatively Hadegti watershed has less success than Mai Anbesa in biophysical and economical gains. Nevertheless, crop production improvement of these areas is not significant and the impact of watershed projects on crop production is not as high as other successes. This is a reflection of the fact that crop production in the area is more affected by rainfall than any other factors and the harvest estimates vary significantly from year to year depending on the amount and distribution of rainfall in a specific year.

Regarding the second major criteria, which is the institutional development impact of the watershed projects Mai Anbesa had a better improvement than Hadegti watersheds. Meanwhile the level of institutional development in Mai Anbesa although getting improved, but is at its lower level.

The local institutions development in these watershed projects is limited. The attempt of external organizations to build local institutions is insignificant. This in turn affect to the watershed projects mainly in terms of managing, capacitating and resource utilization of the watersheds in general and sustainability of the project in particular.

Finally, Peoples participation in overall the project cycle is compromised. Farmers were not invited to participate on planning process rather they were communicated what they have to do in the implementation process. More ever all the stakeholders have no means to monitoring and evaluation the watershed management project. Benefits are not well shared among the resource users group.

Therefore although both projects have their own distinct benefit brought to the area, due to filer of establishing well developed local institution, lack of communities' participation on the overall planning process the project has faced sustainability problem.

## 5.2 Recommendation

Watershed development committee (WDC) should be strengthened to identify problems, prepare plans, implement and maintain the created assets. The WDC will be empowered to execute the watershed management program, resolve problems within the community to fulfil their basic needs and enable government to play a significant role. This consist of the multiple users' committee, such as water users committee, forest protection committees, fodder development committees, seed distribution committees, self-help groups (women and men) and social-cultural committees.

One of the significant ways to institutionalize watershed management is to train project staff and village leaders on the relevance of participatory approaches towards the watershed management, in contrast to delivery-based functioning of government programs.

Local institutions' development, be they formal or informal in terms of organizational set up, are needed for sustainable watershed management. Thus, from the beginning of watershed planning emphasis should be given to the local institutions' development for sustainability of the project.

Establishing self-help group, which is a group of individuals who come together voluntarily for a common purpose. Most common SHGs are constituted of members known to each other, belonging to the same village and community. Thus, they are homogeneous affinity groups, where economic homogeneity is the most common factor. SHG members pool their savings on a regular basis to form group savings. This group fund is then rotated as consumption, production and investment credit amongst the members through norms formulated by group members.

Providing autonomy for the local watershed institutions to mobilize user groups having major claims over resource use, formulating rules and regulations that suit the local conditions and situations, and promoting integrated resource management through complementary activities could be some of the measures.

Planning process in watershed management should provide the chance to participate all stakeholders. The early and continued involvement of watershed stakeholders is one of the most significant tools for

achieving the support and commitment needed to develop and implement the watershed management plan.

Integrated watershed management planning initiatives should incorporate an implementation strategy. This often involves the creation of some type of organizational or management structure responsible for guiding the development and implementation of the watershed plan over time. The established organization responsible for implementing and fostering the plan should be comprised of key stakeholders and decision makers like local administration, representatives from the watershed community as a whole, non-governmental organization, governmental sectors, etc. It is crucial to establish a management structure that can be sustained over the life of the watershed planning and management process. This can be achieved in part through involving key watershed stakeholders from the beginning of the planning initiative, fostering local ownership of the plan and familiarizing them with the process and components of watershed management

The watershed plan should be comprehensive, comprising different watershed components to be implemented based on their sequence of implementation. All stakeholders in the watershed should develop the components and it should not be focused on only agriculture and agricultural-related activities. Activities other than agricultural-related such as education, health, water sanitation and hygiene should be incorporated in the watershed planning from the beginning.

There is a need for the watershed management project to establish a community based participatory monitoring and evaluation system, using simple indicators that farmer themselves can understand and be able to monitor in a way that will not disrupt their normal livelihood activities. This would involve development of simple farm level monitoring sheets/formats by the project staff and the participation of various emerging resource users groups in the watershed.

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A. HOUSEHOLD INFORMATION

1. Name of household
2. Age of household head
3. Sex of household
4. Household size (number of people)
5. Number of males
6. Number of females
7. Literacy of household (this refers to the whole family)

| | | |
|---|---|---|
| 1. Illiterate | Female _____ | Male _____ |
| 2. Only read and writes | Female _____ | Male _____ |
| 3. Grade 1-8 | Female _____ | Male _____ |
| 4. Grade 8-10 | Female _____ | Male _____ |
| 5. Above grade 10 | Female _____ | Male _____ |

8. Are you sending any of your children to school?
   1. Yes
   2. No
9. Number of children being sent to school _____
10. Size of cultivated land _____
11. Do you lease cultivated land?

    Why?
12. Cropping pattern

| Type of Crop | Area Coverage | |
|---|---|---|
| | Hectare | Percent |
| | | |

13. Livestock holding

| Type | Number |
|---|---|
| | |

B. WATERSHED INFORMATION

1. When was the watershed project commenced? _____
2. Did you participate in planning of the project?
   1. Yes
   2. No
3. Did you participate in implementation process?
   1. Yes
   2. No

NOTE TO ENUMERATOR:

If the answer to question 3 is "yes" go to 4. If "no" skip question 4

4. In what components implementation did you participate?

   _____

   _____

   _____

5. Do you think that the project has brought benefits for you?
   1. Yes
   2. No

NOTE TO ENUMERATOR:

If the answer to question 5 is "yes" go to 6. If "no" skip question 6

6. Explain the benefits in terms of the following achievements?

1. Decrease in soil erosion _____

   _____

   _____

2. Improve in forest cover _____

_____

_____

3. Decrease in gully formation _____

_____

_____

4. Increase in crop production _____

_____

_____

5. Increase in livestock production

i. Honey _____

_____

_____

ii. Grass/fodder production _____

_____

_____

6. Increase in water recharge

a. surface water_____

_____

b. ground water_____

_____

7. Employment creation

On farm _____

Off farm _____

8. Size of land holding and crop production before and after the project[3]

| Crop | Before The Project (3 Years Average) | | After The Project (3 Years Average) | |
|---|---|---|---|---|
| | Area( Tsemdi) | Average Yield (Kg) | Area( Tsemdi) | Average Yield (Kg) |
| Barley | | | | |
| Millet | | | | |
| Teff | | | | |
| Maize | | | | |
| Others<br>_____<br>_____<br>_____ | | | | |
| Total | | | | |

9. Grass and fodder production.

| Before the project | | | | After the project | | | |
|---|---|---|---|---|---|---|---|
| No of Cattle | Source Of feed | No of months[4] | Distance Km | No of cattle | Source of feed | No of months [2] | Distance Km |
| | | | | | | | |

[3] Before and after the project refers to an average of three years production. That is for good, medium and poor years.
[4] No of months indicates the length of time cattle feed on the primary source of feed.

10. Honey production[5]

| Production (kg/hive) Local hive | | | Production (kg/hive) Local hive | | |
|---|---|---|---|---|---|
| Before project | After project | Percent Increased | Before Project | After project | Percent Increased |
| | | | | | |

11. Based on the length of time you have been associated with this watershed, would you say that natural resources in the watershed in the years pre-project a lot better, better, the same, a bit worse or a lot worse?

Why? _____

_____

_____

12. What has happened after the project a lot better, better, the same, a bit worse or a lot worse?

Why? _____

_____

_____

13. Did you implement soil and water conservation activities in your private land?

1. Yes
2. No

14. If yes what type of measure? _____

_____

15. Please explain your reason for your answer to Q 14?

_____

_____

[5] Before and after the project refers to an average of three years production. That is for good, medium and poor years.

16. Have you ever done private tree plantation in your own lands?

1. Yes
2. No

NOTE TO ENUMERATOR:

If the answer to question 16 is "yes" go to 18. If "no" go to question 17

17. What are your reasons for not planting tree privately in rank order?

| | | |
|---|---|---|
| ☐ | Food-For-Work | rank ☐ |
| ☐ | Forced by law& threats of punishment | rank ☐ |
| ☐ | Non-Wood Forest Products | rank ☐ |
| ☐ | Construction material | rank ☐ |
| ☐ | Income from the sale of wood | rank ☐ |
| ☐ | To meet demand of fuel wood | rank ☐ |

N.B: Put X in the left box, and rank number in the right box

18. Please explain your reason for your answer to Q 16?

_____

_____

19. Do you feel that your watershed successes are sustainable?

1. Yes
2. No

20. Please explain your reason for your answer to Q 19?

_____

_____

D. INSTITUTIONS INFORMATION

1. What are the local institutions/groups/associations available in your village?

_____ _____

_____ _____

_____ _____

2. What are the external institutions available in your village?

_____ _____

_____ _____

_____ _____

3. How many of them involve in the watershed management project?

| Name of institution | Local | External | Participation/role |
|---|---|---|---|
| | | | |

NOTE TO ENUMERATOR:

If he/she described local institutions in question 1 go to 4. If "no" skip question 4

4. How many of the local institutions/groups/associations established after the project?

_____ _____

_____ _____

_____ _____

5. Which institutions are important to your watershed (rank according to their importance, 1 as very important)

| INSTITUTION | RANK | WHY |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

6. Are you member of the local institutions?

1. Yes
2. No

7. What are the reasons you become involved with this/these watershed institutions/group/association?

A._____

B._____

C._____

D._____

8. What is your institution/s mission?

A._____

_____

_____

B._____

_____

_____

C._____

_____

_____

D._____

_____

_____

9. Does your institution/association have a regular meeting?

1. Yes in _____
2. No in _____

10. Who developed your institution?

1. Community
2. Government
3. Community and government

11. Does your institution/association have bye-laws?

1. Yes in _____
2. No in _____

NOT TO ENUMERATOR

If the answer to question 11 is no, skip to 13.

12. If yes who developed it? _____

13. Do you think that local institutions can manipulate the watershed project without external institutions support?

1. Yes
2. No

14. Have you ever remember any conflict over resource utilization in the watershed?

1. Yes
2. No

15. If yes explain _____ _____

_____

_____

16. What is the role of the institution in conflict resolution in your watershed?

1. Positively
2. Negatively
3. Neutral

17. Please explain your institution's role for sustainability of the project?

_____

_____

_____

18. Do you think that your institution is successful?

1. Yes
2. No

19. Please explain your reason for your answer to Q 18?

_____

_____

_____

). Please explain your institution's role in technologies transfer?

_____

_____