FARMING SYSTEMS, RESOURCE MANAGEMENT AND HOUSEHOLD COPING STRATEGIES IN NORTHERN ETHIOPIA

Preliminary Report of a Social and Agro-Ecological Baseline Study in Central Tigray

Prepared by the Relief Society of Tigray (REST) in collaboration with NORAGRIC at the Agricultural University of Norway

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Foreword

A keen observation of nature reveals that each ecosystem develops according to its own particular rhythm determined by the dynamics of the living organisms existing within it as well as by climate, soil, water and atmospheric changes. The development of human societies naturally has an impact on each of these factors, whether direct or indirect, immediate or long-term.

The complexity of these interactions requires an interdisciplinary and holistic analysis based on continuous and regular observation.

A constant monitoring of the development of major environmental factors and their relationships with social, cultural and economic factors, can promote a better understanding of the development of nature and society in relation to each other, and a more accurate forecasting of the consequences of human intervention.

The effect being made by REST and NORAGRIC to generate baseline study on the social and Agro-Ecology of Central Tigray will definitely contribute to the enhancement of the planning process for development.

For planning any long term development the need for data base is imperative. The information collected can be a base for measuring the actual changes in productivity and monitoring the natural resources of the region.

The baseline study conducted on seven weredas of Central Tigray reveal complex and interacting environmental and human factors constraining agricultural productivity. Understanding and analysing these complex problems can indicate options for interventions.

I hope the information contained in the report will be useful not only for planning but also for researchers and development agents.

Mitiku Haile
Dean, MCDANR
November 1994
Mekelle

CONTENTS

Figures (in Order of Appearance)

Annexes

A) Altitude ranges

Degua ("highland"), connotes an altitude of at least 2500 meters above sea level, with a minimum annual average rainfall of more than 600 mm. This zone is characterized by a cool climate and crops consisting mainly of wheat, barley, and ***taff***. For small ruminants, sheep are predominant. The major part of Degua Tembien and some parts of Adi Ahferom fall within this altitude range.

Hawsi degua, literally meaning "partially degua", connotes a geographic area which is warmer than the degua, and with an altitude ranging between 1500 - 2500 meters. This zone has relatively high populations and contains the majority of the agriculture land in Central Tigray. Annual average rainfall ranges between 500 - 900 mm. Many types of crops are grown, and cattle predominate. Most of Hahaile, Keyih Tekli, Embaseneyti, and Endabatsahma are within this altitude range.

Kolla. This zone is characterized by low annual rainfall ranging from 300 - 450 mm. per year, and sparser population. Cattle are raised, and goats predominate for small ruminants. Some parts of Keyih Tekli, Embaseneyti, Endabatsahma, and most of Abergelle are within this zone.

B) Seasons

Kiremti, the main rainy season, usually falling within the months June - Mid September.

Kewie. the harvesting and threshing period, from October - December/January.

Hagay, the dry period of the year, characterized by few agricultural activities, and covering the months January - March.

Azmera, the season which commences after the end of ***Hagay*** and finishes before the start of ***Kiremti***. It is the major ploughing period.

C) Dates

The Ethiopian calendar differs significantly from the Gregorian calendar, consisting of 12 months of 30 days each, and a 13th month, ***Pagumen***, of five days (six days if i is a leap year). Further, yearly dates in Ethiopia run between seven and eight years behind those of Europe. For example, the Ethiopian transition from 1986 to 1987 ***Hadush Amet*** ("New Year") will be celebrated on the 11 of September, 1994. There is thus a present difference in calendars of eight years. This report mainly uses Ethiopian (and specifically ***Tigrinya***) names for specific months. Year dates are given according to the Gregorian Calendar, unless otherwise indicated by the abbreviation Eth. Cal. An explanation of month names is provided below:

Ethiopian Months (in *Tigrinya*) for the Ethiopian Year 1986

Meskerem	- 11 September	- 10 October
Tikimti	- 11 October	- 9 November
Hidar	- 10 November	- 9 December
Tahsas	- 10 December	- 8 January
Tiri	- 9 January	- 6 February
Yekatit	- 7 February	- 9 March
Megabit	- 10 March	- 8 April
Miazia	- 9 April	- 8 May
Ginbot	- 9 May	- 7 June
Sene	- 8 June	- 7 July
Hamle	- 8 July	- 6 August
Nehase	- 7 August	- 5 September
Pagumen	- 6 September	- 10 September

The Ethiopian year 1987 begins on 11 September, 1994.

D) Other key terms

Kushet, a village, comprised of nucleated settlement in a single neighborhood, or more dispersed settlement in several neighborhoods.

Tabia, an area comprising an average of 3-4 ***kushets***, and the most basic unit of administration characterized by a ***baito*** or people's council.

Wereda, formerly called a sub-district, and comprising an average of 15 ***tabias***. The ***wereda*** is the next level of administration from ***tabia***, and has branch offices of all major Bureaus. In terms of the delivery of services, it is the most important administrative unit.

Baito, or "people's council". In addition to the ***tabia baito***, elected from residents of ***kushets*** in that ***tabia***, ***baitos*** also exist at ***wereda*** level. ***Wereda baitos*** are elected from residents of ***tabias*** in that ***wereda***. In addition, there is regional ***baito***, elected from ***wereda*** residents throughout Tigray, which constitutes the legislative branch of Regional Government.

TPLF, Tigray's People Liberation Front

Miwfar, A term that refers to the renting of land, usually for payment in-kind constituting a percentage of the harvest. Actual payment practices differ from area to area. ***Tewefari*** refers to the person who is renting the land of another.

Gibri, Literally, "a share". This term refers to the share of land allotted to adults under the present land tenure system. The actual size of a ***gibri*** varies from area to area.

Gebar, taxpayer or farmer. The person, male or female, that has received a *gibri*-share.

Tsimdi, A term that is frequently used by peasants to connote the amount of land that be ploughed by a team of oxen in a day; a farmer will thus say his land constitutes x number of ***tsimdi***. ***Tsimdi*** is also used to refer to a team of oxen itself.

CHAPTER 1: INTRODUCTION

1.1 General introduction

Tigray, as other parts of northern Ethiopia, belongs to that zone of the African drylands which is often called the Sudano-Sahelian region, and, as such, faces the same problems as the whole region since dryland environments denote distinctive challenges to development. The drylands are driven by sparse, highly uneven distribution of seasonal rainfall, and by the erratic occurrence of drought. Though some soils are rich, most are poor and thin. Attacks of pests are unpredictable and sometimes devastating (UNSO 1992: 6).[1]

The Sudano-Sahelian region faces three major environmental predicaments:

> **Drought**: a period of two years or more with rainfall well below average.
>
> **Desiccation:** a process of aridification resulting from a dry period lasting on the order of decades. Such a period has been experienced in the northern Sudano-Sahelian region since about 1968.[2]
>
> **Dryland degradation**: a process caused mainly by inappropriate land use under delicate environmental conditions. Land degradation implies a persistent decrease in productivity of vegetation and soils.

During the last century Tigray has - at least for extended periods - experienced an interaction between drought, desiccation and dryland degradation. While desiccation and dryland degradation have become rather permanent features, drought has been experienced as more acute attacks at irregular intervals.

There are several causes that together have composed this syndrome. One that is often mentioned is population growth evolving as a consequence of rather stable crude birth rates but decreasing death rates. When population levels were low, it can be argued in developmental terms, economics were controlled more by man-made capital and by labour, but as populations grew, economies became more limited by the availability of "natural capital" (UNSO 1992: 8).

For quite some time, there has been a theoretical view held by many observers that when population densities were less, there was an ecological equilibrium between populations and the natural resources within their environments. But it is difficult to substantiate such a

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[1]Some farmers interviewed in Degua Tembien were of the opinion that the famine in that area in 1984/85 was caused more by damages performed by the army worm infestation than from lack of precipitation.

[2]This kind of desiccation has not been unusual in the history of the Sudano-Sahel. There were dry periods in the 1660s, 1740s, 1750s, 1820s, 1830s, and 1910s. See S. Nicholson (1989): "Long-term changes in African Rainfall," *Weather* 44, 46-56.

view. Recent studies seem to point to the fact that ecological dynamism, i.e. that natural resources and populations are in a constant dialectical interchange, has more been the pattern than ecological equilibrium.

As far as we know, Tigray is on par with the rest of the Sudano-Sahelian region when it comes to a rapid population growth. This has direct consequences for the environment as it leads to an ever increasing demand for land, fuelwood etc (UNSO 1992: 49). But the relationship between land degradation and population density is seldom direct: more people may also mean more labour to conserve and improve the land, for instance through terracing activities, afforestation measures, dam building, road construction, etc.. While population density may be one cause of land degradation, it is rarely the primary one and never alone. The environmental impact of people is a function of their livelihood systems.

Besides population growth, the most cited cause for the present environmental situation has been diminishing rainfall. There seem to be clear evidence that there has been below average rainfall in Ethiopia since the mid 1970s (UNSO 1992: 28)

But not only has the rainfall become less, the effectiveness of rainfall depends almost as much on its timing. For instance can a false start in May followed by a dry spell in June be quite disastrous. Even worse for Tigray, it may seem, is if the rains stops in August instead of September. The prevailing cropping systems, to be somehow effective, require evenly distributed rains from early June to early/mid September. To escape the prevailing ecological fragility created, at least to some degree, by the present production systems and turn them into more robust and compatible livelihood systems, both crops, cropping systems, technologies and sociocultural patterns have to be adapted to the prevailing bio-physical environments.

In Tigray, the prolonged interface between man-made enterprises and endemic natural factors have, undoubtlessly, created a non-conducive environment. Partly as a result of this, the dry highlands are probably among the most severely damaged areas within the Sudano-Sahelian region. Not only are slopes steep, but a history of cultivation and erosion extends for centuries, if not for millennia (UNSO 1992: 33). Consequently, today the local population have no effective means to secure a living.

From an agronomic point of view, a serious impact of dryland degradation is the negative balance of nutrient inputs and outputs. Within the predominant agricultural system, all nutrients are removed from the land either in the form of grains or stalks. Little or no nutrient are at all returned to the soil in the form of manure, compost or chemical fertilizers. If outputs in crops are greater than inputs of fertilizer then it can be assumed that the soil nutrient store is being degraded. In a medium to long term perspective, this will mean a slow suffocation of the local communities.

Hence, land resources in Tigray are under increasing pressure due to two factors: (1) population growth; (2) drought and desiccation that have caused farmers to penetrate into vulnerable environments in order to increase the cultivated area for, in this way, to compensate for low yields. In some *weredas* in Central Tigray, up to 90 per cent of the land is used for agricultural purposes on a permanent basis, giving nature little room for regeneration.

A conspicuous feature in regards to this is the disappearance of the fallow system. In general, today, we might say that fallowing is not practiced anymore in Central Tigray. Together with the causes mentioned above, this signifies that the complete natural resource foundation for the social and economic life of the whole region is depleted.

The encroachment of cultivation into the more marginal lands have two consequences. First, they curtail the areas that supplies fuelwood, and it decreases grazing land of village herds, thus putting more pressure on the remaining, usually poorer rangeland. Village herds fulfil many functions: meat, milk, draught, manure. They need grazing beyond the fields, especially in the crops season. Lack of grazing also adds to lack of fertilizers. If manure was to be produced in sufficient quantity to fertilize the fields of the region, about 8-10 ha of grazing land is needed for every 1 ha of crops (UNSO 1992: 51). From the survey data we know that not one of the weredas in Central Tigray is even close to this ratio.

To sum up so far, we may say that in general there are four major sets of constraints on all forms of production, whether on crops, pastures or fuelwood in the African drylands. The first is the shortage and the unreliability of rainfall. In addition to creating a vulnerable environment for traditional crop production, it also makes investments in fertilizers, materials and even labour, hazardous. The second major constraint is soils. Because soils are poor in nitrogen and phosphorus, only 10 to 15 per cent of the rainfall can be used for green biomass production. The third major constraint is the limited supply of ground and surface water. The fourth constraint consists of pests and diseases such as locusts, birds and Striga. Pests are particularly rife in erratic environments because of the unstable nature of predatory-prey relations (UNSO 1992: 64). An additional problem for the Tigrayan Highlands are regular the hailstorms which can damage large amount of crops within a short time spell.

On the social level, lack of land security is an element that may discourage the farmers who have only temporary usufruct of land, to invest in land improvement activities. Land ownership law has been highly complex in Tigray for centuries with a combination of land tenure rights given to the church and the aristocracy (*gulti*), entitlements to land through inheritance (*risti*), and more communal types of land tenure. This traditional mixture of aristocratic, communal and descent based land rights overlain by colonial and post-colonial systems have today been exchanged with a uniform and fully communal system which, from a democratic viewpoint, may be faire, but may from an ecological and economic perspective be non-sustainable. Quite objectively, it must be seriously looked into if a land reform is, if not sufficient, at least necessary for improved land management.

The present baseline survey and the subsequent follow-up studies will give an important look into this state of affairs, and also suggest means to solve the problems according to the needs and aspirations of the local communities. But some changes must also take place regarding national legislation, allowing new kinds of land tenure and responsible management, initially in a more experimental manner. The decision to suspend a new phase of land allocation in Tigray is here a first and necessary step. But it requires that the landless must be followed up closely to give them other options.

The above mentioned situation seem to suggest a Malthusian scenario: population expanding beyond the capacity of the land to support it; and expanding onto poorer land, giving lower returns per hectare for labour and other investments, and probably more drought susceptibility (UNSO 1992: 51), resulting in a vicious circle which, for every year ahead, will lead to a more vulnerable and precarious situation for the people of Tigray. But we must not forget that Tigray has a big possibility to counteract this process if its human and natural resources and potentialities are fully utilized. To map and reveal these resources has been the main objective of this survey.

1.2 Objectives of the Survey

Research should be incorporated as a major component of any long term development program, in order to measure actual changes in productivity and the condition of natural resources, as well as tangible improvements in the living standard of farming communities. At the same time, such research should both describe and incorporate pre-existing local knowledge, and be guided in terms of its direction by local concerns.

There has been virtually no comprehensive research conducted in Tigray over the last two decades[3]. This was due mainly to the constraints imposed by the on-going civil war in the region. Further, figures produced for Tigray by the former government are not reliable. The result is that even the most basic data is lacking for adequate development planning. For example, there are no detailed statistics on cropping and livestock patterns, crop yields, household farm and livestock assets, crop rotation practices, division of labor, labor availability and composition, or basic infrastructure and services. This is especially a problem for comparisons between present data and previous years, in order to identify trends.

The goal of this survey was to address this problem of lack of data by conducting a baseline study in sample *weredas* of central Tigray, where REST's Integrated Agricultural Development Program (IADP) is being implemented. The objectives of the survey were:

- To collect basic information on socio-economic, cultural, and natural resource variables, in order to be able to map resources available for development and identify developmental constraints.

- To obtain an overall picture of the IADP area so as to refine and improve technical and operational plans of the program.

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[3] An exception is the 1975 comprehensive Tigray Development Study, undertaken by the Land and Water Resource Consultants of the British Hunting Technical Service Limited. After the end of civil war in 1991, a helicopter-assisted survey was also undertaken by Save the Children (UK). This survey provides a useful snapshot picture of the food economy of northern Ethiopia as a whole, including Tigray and parts of Wollo and Gondar. See "Making Ends Meet: A Survey of the Food Economy of the Ethiopian North-East Highlands", Save the Children (UK). However, there have been no Tigray-specific comprehensive studies since the end of the war.

- To create the possibility of measuring and evaluating the results of development efforts in the selected *weredas*.

In addition, two other objectives included:

- The creation of data to be used as an input for a Geographic Information System (GIS) that REST is intending to establish in the near future.

- The establishment of a data bank that will be useful for other organizations, and the Regional Government, in planning both long and short-term development programs in the survey areas so as to reflect more accurately local needs and priorities.

Given that this is a baseline study, the potential statistical analyses that could be carried out with the survey data is large. However, given time constraints, it has not been possible in this report to do more than present preliminary findings, in the form of frequency tables for the most important indicators and variables. Our aim here is to lay down a general framework of understanding.

In addition to further, detailed analysis, data from the survey also needs to be complimented by additional research in specialized areas of study, which will constitute a second phase. Such "specialized studies" are now being planned.

1.2 Methodology

1.2.1 Components of the Survey

The survey was undertaken at three levels: household, *tabia* and *wereda*. Questions to households comprised the most basic component of the study, and dealt primarily with social, economic, and agricultural practices of the farming community. At this level, information was collected on: crop production and cropping systems, livestock holdings, literacy, health status, and other social and economic variables. The *tabia* and *wereda* level enquiries included question related to: demography of the area, natural resources, land tenure, crop production and livestock potentials, agricultural constraints, roles of women in the farming community, community issue prioritization, and development potentials of the area.

1.2.2 Sample Stratification

The survey employed a three stage stratification. The first stage stratification was based on geographic considerations, including agro-climatic, topographic, and demographic conditions. Accordingly, seven *weredas* which were considered to represent the overall features of central Tigray were selected. The second stage stratification relied on administrative sub-divisions within *weredas*; that is, *tabias* were randomly selected from each of the selected *weredas*. The third stage of stratification involved the random selection of households from within each *tabia*.

1.2.3 Sampling Strategy

One of the initial problems faced by the study was the difficulty in applying statistical tools to determine the sample size of an unexplored target population. As this survey was the first of its kind in the particular zone, we were forced to make a judgement concerning a sample size that both allowed for extrapolation to the larger population with reasonable confidence, and was reasonable in terms of cost of implementation. Accordingly, it was agreed that 1% of the population household size from each of the selected *weredas* be covered by the survey. Further, it was agreed that 30% of the *tabias* from each of the selected *weredas* would be surveyed.

1.2.4 Sample Selection

After determining the sample size, the next step was the selection of *tabias* and households. This required the development of population frame lists at each sampling stage. *Tabia* lists of the selected *weredas* were available, and it was easy to select the sample *tabias* before the commencement of field work. In selecting sample households, household lists of the selected *tabias* had to be ascertained in the field in discussion with *tabia baito* members. Hence, households were selected at field level. In both cases, a simple random sampling technique with the aid of random number tables was used.

1.2.5 Sources of Data

This report is based on both primary and secondary data sources. Secondary data is derived largely from the different *wereda* branch offices of the regional bureaus, including the Bureau of Natural Resources and Environmental Protection, Bureau of Agriculture, Bureau of Health, Bureau of Education, Relief and Rehabilitation Commission, and the *wereda baitos*.

Primary data was collected through intensive, repeat-visit interviews spread over seven weeks during 1994, with 643 households, 33 *tabia baitos* and 7 *wereda baitos*. Data collection was undertaken with a team of 12 enumerators, closely supervised by 6 full-time *wereda* level supervisors. The overall co-ordination, technical supervision and direction of the field work as well as the post survey activities was undertaken by the REST's Research Officer. The enumerators and the supervisors (both male and female), were trained and had practical experience in two other surveys launched before.

Socio-economic interviews can be distressing to respondents. However, care was taken to get to know respondents, to spend as much time as possible with them, and to be sensitive during interviews. Moreover, to reduce respondent fatigue and non-response rates, the questionnaire was designed so as to comprise the most important variables, and avoid questions that would tend to make respondents suspicious and give biased responses.

CHAPTER 2 - OVERVIEW OF TIGRAY REGION

2.1 The Setting

Tigray is situated in the north of Ethiopia between latitudes 12^0 20'N and 14^0 40'N and longitudes 36^0 E and 41^0 30'E. It borders Eritrea in the north, the Afar Region of Ethiopia to the east, Sudan to the west, and the Amhara Region of Ethiopia to the south.

Tigray is divided into five administrative zones (*zobas*), 81 *weredas*, 1,089 *tabias*, and more than 3,500 *kushets*. The Western zone (Zone 1) incorporates the (former) districts Welkayit and Shire. The Central zone (Zone 2) includes the (former) districts Axum, Adua, and Tembien. The Eastern zone (Zone 3) includes the (former) districts of Agame and Kilte Awlaelo. The Southern zone (Zone 4) includes the (former) districts Raya and Enderta. Mekelle town and the proximity rural areas of M[illegible] considered as Zone 5.

The topography of the region is characterized by mountain plateaus. The mountains in the center vary in altitude from 2000 to 3000 meters above sea level. The western plateaus comprise mostly lowland areas with depressions in the boundaries of the Afar Region, ranging in altitude from 100 - 150 meters above sea level.

Kiremti is the main rainy season of the region. In addition, many south - eastern parts of the region receive ***belg*** ("small") rain during the months February - April. The amount of annual rainfall of the region increases from 100 mm to 1000 mm. as one goes from east to west.

Tigray is estimated to have a total area of 80,000 sq. km, and a population of from 3.4 - 4.0 million[4]. The average life expectancy of the region at birth is estimated to be 46 years. and the average population density is approximately 46 persons per sq. km (source: document on the 1986 Eth. Cal. regional budget plan prepared by the bureau of planning and economic development, August 1992) ***Tigrinya*** is the language spoken by the majority of the people, while, ***Afar***, ***Kunama***, ***Saho*** and ***Agew*** are spoken in some parts of the region. About 88% of the population is Orthodox Christian, and the remaining 12% are Muslim.

Over 90% of the economy of the region depends on agriculture; mixed arable farming is the most common agricultural practice. Given sufficient rain, many kinds of crops can be grown, including *taff*, maize, wheat, barley, finger millet, sorghum, pulses, and beans. In the agricultural sector, animal husbandry plays an important role, especially as oxen are the source of power for traction during ploughing.

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[4] This figure represents the Regional Government's estimate. Other estimates for population of the region differ by as many as a million people. An accurate population figure will not be known until the results of the national census are available next year.

2.2 Development Constraints and Issues

In the last two decades, the GNP (Gross National Product) of Ethiopia has continually declined. Agriculture in particular, which contributes some 45% to the national economy, has been severely affected due to lack of improved agricultural practices, improper Governmental policies, and dependence on seasonal rainfall. For Tigray, this scenario has been exacerbated by several decades of neglect and under-development that were part and parcel of the policy of former regimes.

At present, the natural resources of Tigray are under extreme stress, and are no longer able to support the ever-increasing population of the region. Steep slopes are over-used for cultivation, and many areas have lost their protective vegetation cover. Grasslands have been over-exploited, and the livestock support capacity of the region considerably diminished. Soil run-off from slopes has caused severe erosion. Further, rural water supply for both human and animal consumption is an acute problem due to the drying of springs and general lowering of water tables.

The net effect of these factors is a significant decline in the crop production and animal husbandry potential of the region, activities upon which the vast majority of the population depend. The consequence has been a series of both localized and regional disasters, characterized by drought, famine and famine-associated population displacements. These disasters were also exacerbated by a recent history of civil war. Among the regional calamities of the modern era are famines of 1957-58, 1971-75, and 1984/85. These events have each resulted in profound socio-economic collapses in the region, and have led to food security becoming a priority issue for the Tigrayan people.

A number of urgent interventions are required to alter this scenario. Among the priority areas for intervention is the strengthening of the natural resource conservation program. This would include an improvement in the techniques used for conservation, as well as broadening of the scope of the program. In particular, the on-going destruction of forest areas should be halted by encouraging the adoption of tree planting and various protection measures, including planting of legumes and fruit trees. Further, community wood lots should be expanded to meet the fuel wood demand.

Present rain-fed agricultural practices cannot provide an adequate food supply for the region. Hence, small-scale interventions that aim to improve practices, and introduce irrigation where appropriate, should be implemented. The development of small-scale irrigation in specific areas can provide additional sources of food and income for farming communities.

With regard to livestock development, forage management techniques could be disseminated to farming communities. Extension work that involves the introduction of new crop and animal husbandry practices must, however; be based on local community perceptions and understandings, so that local knowledge and initiative provides the main impetus for interventions.

Social services, especially rural water supply, is also a priority area. The domestic water supply could be improved in a number of ways. The local construction of earth dams can provide drinking water supplies by incorporating water treatment systems. An analysis of geologic, topographic, and other factors can also point to specific improvements, such as spring capping, hand dug well excavation, or the development of ponds; as a final option, drilling of bore holes could be undertaken, assuming financial resources are available. Rural health services also require urgent attention, specifically the expansion of mother and child programs, targeting especially vulnerable groups of women of child bearing age and children under five.

The health aspect should also focus on the ever increasing population of the area and the dissemination of family planing programs is a crucial issue requiring priority. Current improvements in the education should also be strengthened, including upgrading the quality of local schools. To encourage economic expansion and facilitate the delivery of services, expansion of rural access roads is also crucial.

These interventions are considered not only urgent but essential if the disaster-prone trend of the region is to be reversed. They are also appropriate in scale and technology, locally controlled, and locally implemented. Indeed, Tigray is perhaps unique in having a well-established system of grassroots mobilization, led by local *baitos*, wherein people are highly motivated to tackle development problems. This legacy of grassroots organization, set-up during the armed struggle, is continuing today in the struggle for development.

2.3 Central Tigray - The Survey Area

The survey covered seven *weredas* in central Tigray[5]. Central Tigray comprises highlands that are an extension of the highlands of central Ethiopia. Elevation varies from 1300 meters in lowland areas of Southern Tembien, to 3000 meters in the highland areas of central Adua. Although the higher altitude zones have favorable amounts and distribution of rainfall, the rising altitude causes the temperature to fall. The midland plateau area has a cool, sub-tropical climate, allowing for a wide variety of crops. The lower altitude areas enjoy warmer weather conditions, where maize, sorghum, and other sub-tropical crops are grown. The dominant soil type of the area taken as a whole is sandy and silty. Clay soil is also common in a few highland areas such as Degua Tembien and Adi Ahferom.

The main IADP program area falls into the middle altitude range. About 22% of the total area is estimated to be in the lowland altitude range, and 49% and 29% respectively are in the medium and highland altitudes. Except *wereda* Abergelle, some parts of Egella, Adi Arbaete, and Embaseneyti, the Central zone is outside the lowland altitude range. Hence, it is relatively free from malaria and most animal diseases. Moreover, it is highly suitable for human and animal settlement, and as a result has the highest population and density. The zone is also characterized by vulnerability to food shortages, drought, and famine. These are the main reasons for giving priority in implementing the IADP to this zone.

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[5] See Annex section of the report for a map indicating *wereda* boundaries.

CHAPTER 3: WEREDA PROFILES

To get a birdseye view into the prevailing status of the surveyed *weredas*, we will in this chapter present some key information.

3.1 **Adi Ahferom**

Altitude	1,900 - 3,000 meters
Topography	Mountainous/steep hills
Total Area	4,349 hectares
Arable Land	3,993 hectares
Arable land exposed severe to erosion	1,001 hectares
Forestry/woodland/grassland	24 hectares
Non-agricultural Area	332 hectares
Local set-up	10 *tabias* and 34 *kushets*
Population	22,067 people
Population Density (per sq. km)	507
Total number of households (HH)	4,260
Average household size	5.18 people
Percentage of Women-headed households	19.64%
Percentage population of working age[6]	37.76%
Main Crops	barley, horse beans, *taff*, wheat
Average Land per household	0.58 hectares
Average Yield Per Hectare	4 quintals (400 kgs)
Average food and seed needs/HH/year	11.24 quintals (1124 kgs)
Average actual yield per HH per year	2.32 quintals (232 kgs)
Percentage of food deficit per HH	79.36%
Total No. livestock units (LU)	26,627
Average Livestock Holding Per HH	6
Oxen Holdings	3 oxen for 5 households
Average Distance To Water	25 minutes
Average Distance to Health Clinic	85 minutes
Number of Health Facilities	1 clinic
Number of Schools	5 (all elementary)
Number of Students	3,891 (March 1994)
Literacy Rate	43.75%
Average Distance to All-Weather Road	360 minutes
Average Distance to Nearest Market	78 minutes

[6] Working age here means between the ages of 15 and 64 years.

3.2 **Embasneyti**

Altitude	1,800 - 2,100 meters
Topography	Valleys/plains and mountains
Total Area	9,316 hectares
Arable Land	5,686 hectares
Arable Land Exposed to Severe Erosion	2,677 hectares
Forest/woodland/grassland	2,742 hectares
Non-Agricultural Areas	888 hectares
Local set-up	17 *tabias* and 44 *kushets*
Population	44,277 people
Population density (per sq. km)	475
Total number of households (HH)	8,891
Average HH Size	4.98 people
Percentage of Women-Headed Hhs	31.58%
Percentage Population of Working Age	52.33%
Main Crops	Barley, f.millet, ***taff***, ***Hanfets***
Average Land Per HH	0.69 hectares
Average Yield Per Hectare	4.13 quintals (413 kgs)
Average Food and Seed Needs/HH/Year	10.83 quintals (1083 kgs)
Average Actual Yield/HH	2.85 quintals (285 kgs)
Percentage of Food Deficit/HH	73.68%
Total No. of livestock units	68,724
Average livestock holding per HH	7.7
Oxen Holdings	3 oxen for every 4 households
Average Distance to Water Supply	26 minutes
Average Distance to Health Clinic	132 minutes
Number of Health Facilities	1 clinic and 1 health post
Number of Schools	7 (6 elementary and 1 junior sec.)
Number of Students	4,182 (March 1994)
Literacy Rate	37.72%
Average Distance to All-Weather Road	375 minutes
Average Distance to Market Center	141 minutes

3.3 **Endabatsahma**

Altitude	1,900 - 2,100 meters
Topography	Major part valleys and hills
Total Area	16,624 hectares
Arable Land	7,383 hectares
Arable Land Exposed to Severe Erosion	3,707 hectares
Forest/woodland/grassland	5,994 hectares
Non-Agricultural Areas	3,247 hectares
Local set-up	17 *tabias* and 54 *kushets*
Population	50,337 people
Population Density (per sq. km)	303
Total Number HH's	10,642
Average HH Size	4.73 people
Percentage of Women-Headed Hhs	27.62%
Percentage Population of Working Age	52.02%
Main Crops	barley, F.millet, ***taff***, sorghum
Average Land Per HH	0.66 hectares
Average Yield Per Hectare	3.84 quintals (384 kgs)
Average Food and Seed Needs/HH/Year	10.32 quintals (1032 kgs)
Average Actual Yield/HH	2.53 quintals (253 kgs)
Percentage of Food Deficit/HH	75.48%
Total No. of livestock units (LU)	59,394
Average LUs per HH	5.58
Oxen Holdings	3 oxen for every 4 households
Average Distance to Water Supply	53 minutes
Average Distance to Health Clinic	143 minutes
Number of Health Facilities	1 clinic and 2 health posts
Number of Schools	10 (9 elementary and 1 junior sec.)
Number of Students	4,517 (March 1994)
Literacy Rate	34.88%
Average Distance to All-Weather Road	286 minutes
Average Distance to Market Center	147 minutes

3.4 **Hahaile**

Altitude	1,800 - 2,100 meters
Topography	Mountain/some plain and rivers
Total Area	6,784 hectares
Arable Land	6,070 hectares
Arable Land Exposed to Severe Erosion	4,139 hectares
Forest/woodland/grassland	590 hectares
Non-agricultural Area	124 hectares
Local set-up	14 *tabias* and 76 *kushets*
Population	37,083 people
Population Density (per sq. km)	547
Total number of households (HH)	8,624
Average HH Size	4.3 people
Percentage Women-Headed HHs	37%
Percentage Population of Working Age	51.86%
Main Crops	barley, h.beans, sorg.,taff, wheat, *hanfeths*
Average Land Per HH	0.5 hectares
Average Yield Per Hectare	3.7 quintals (370 kgs)
Average Food and Seed Needs/HH/Year	9.36 quintals (936 kgs)
Average Actual Yield/HH	1.85 quintals (185 kgs)
Percentage of Food Deficit Per HH	80.24%
Total No. of livestock units (LU)	30,529
Average LUs per HH	3.54
Oxen Holdings	1 oxen for every 2 households
Average Distance to Water Supply	43 minutes
Average Distance to Health Clinic	122 minutes
Number of Health Facilities	1 clinic
Number of Schools	9 (all elementary)
Number of Students	5,207 (March 1994)
Literacy Rate	28.25%
Average Distance to All-Weather Road	224 minutes
Average Distance to Market Center	117 minutes

3.5 **Abergelle**

Altitude	1,300-1,550 meters
Topography	Plain/more rivers and no mountains
Arable Land	No information
Arable Land Exposed to Severe Erosion	No information
Forest/woodland/grassland	No information
Non-Agricultural Area	No information
Local set-up	14 *tabias* and 58 *kushets*
Population	42,393 people
Population Density (per sq. km)	No information
Total number of households (HH)	9,548
Average HH size	4.44 people
Percentage of Women-Headed HHs	28.77%
Percentage Population of Working Age	56.35%
Main Crops	sorghum, maize, *taff*, sesemun
Average Land Per HH	1.86 hectares
Average Yield Per Hectare	2.73 quintals (273 kgs)
Average Food and Seed Needs/HH/Year	9.71 quintals (971 kgs)
Average Actual Yield/HH	5.08 quintals (508 kgs)
Percentage of Food Deficit Per HH	47.68%
Total No. of livestock units (LU)	99,789
Average LUs'per HH	10.45
Oxen Holdings	1 oxen for every household
Average Distance to Water Supply	51 minutes
Average Distance to Health Clinic	142 minutes
Number of Health Facilities	2 clinics
Number of Schools	4 (all elementary)
Number of Students	891 (March 1994)
Literacy Rate	15.82%
Average Distance to All-Weather Road	432 minutes
Average Distance to Market Center	152 minutes

3.6 **Degua Tembien**

Altitude	2,400 - 2,600 meters
Topography	Mountain/steep & some plains
Total Area	17,843 hectares
Arable Land	13,335 hectares
Arable Land Exposed to Severe Erosion	8,164 hectares
Forest/woodland/grassland	3,206 hectares
Non-agricultural Area	1,302 hectares
Local set-up	15 *tabias* and 57 *kushets*
Population	61,824 people
Population Density (per sq. km)	347
Total number of households (HH)	13,440
Average HH Size	4.6 people
Percentage Women-Headed Hhs	19.44%
Percentage Population of Working Age	50%
Main Crops	barley, horse beans, *taff*, wheat
Average Land Per HH	0.74 hectares
Average Yield Per Hectare	7 quintals (700 kgs)
Average Food and Seed Needs/HH/Year	10.04 quintals (1004 kgs)
Average Actual Yield/HH	5.18 quintals (518 kgs)
Percentage of Food Deficit/HH	48.41%
Total Livestock	72,240
Average Livestock Holding/HH	5.38
Oxen Holdings	3 oxen for every 4 households
Average Distance to Water Supply	27 minutes
Average Distance to Health Clinic	126 minutes
Number of Health Facilities	1 clinic
Number of Schools	8 (7 elementary and 1 junior sec.)
Number of Students	2,896 (March 1994)
Literacy Rate	21.33%
Average Distance to All-Weather Road	125 minutes
Average Distance to Market Center	125 minutes

3.7 **Keyih Tekli**

Altitude	1,660 - 2,000 meters
Topography	More valleys/mountains,plain
Total Area	16,571 hectares
Arable Land	10,141 hectares
Arable Land Exposed to Severe Erosion	2,468 hectares
Forest/woodland/grassland	3,962 hectares
Non-agricultural area	2,468 hectares

Local set-up	17 *tabias* and 58 *kushets*
Population	54,366 people
Population Density (per sq. km)	328
Total number of households (HH)	11,050
Average HH Size	4.92 people
Percentage Women-Headed HHs	16.20%
Percentage Population of Working Age	50.07%
Main Crops	barley, f.millet, ***taff***, maize, sorghum
Average Land Per HH	0.95 hectares
Average Yield Per Hectare	4.05 quintals (405 kgs)
Average Food and Seed Needs/HH/Year	10.71 quintals (1071 kgs)
Average Actual Yield/HH	3.85 quintals (385 kgs)
Percentage Food Deficit/HH	64.05%
Total Livestock	108,324
Average Livestock Holding Per HH	9.8
Oxen Holdings	1 oxen for every household
Average Distance to Water Supply	33 minutes
Average Distance to Health Clinic	186 minutes
Number of Health Facilities	1 clinic
Number of Schools	7 (all elementary)
Number of Students	1,750 (March 1994)
Literacy Rate	20.34%
Average Distance to All-Weather Road	297 minutes
Average Distance to Market Center	234 minutes

3.8 Summary and Brief Comparisons

Some of the main topographic features of the surveyed *weredas* include:

Adi Ahferom and Degua Tembien are characterized by mountains and steep slopes. These are the major contributory factors for the relatively higher exposure of arable land to severe erosion in these areas. With regard to natural forest cover, only the *weredas* of Abergelle, Adi Ahferom, Endabatsahma, and Keyih Tekli have remnants of natural forests. When we see the land use system, of the total area of land in *wereda* Adi Ahferom, about 92% is used for cultivation. On the other hand, only about 44% of the total area of *wereda* Endabatsahma is under cultivation.

Adi Ahferom has the highest population density. While there is no current numerical information, Abergelle is expected to have the lowest population density. The average household size of central Tigray is calculated to be 4.73 people. Survey results show that in *wereda* Adi Ahferom, a household on average has about 5.18 people. *Wereda* Hahaile, on the other hand, has the lowest household size of about 4.3 people. There is no

significant variation in the proportion of the population in the working age group between *weredas*. The highest percentage of women-headed households is recorded in *wereda* Hahaile, and the lowest in Keyih Tekli.

Generally, there are relatively larger land holdings per household and lower output per hectare in the lowland areas. The largest land holding per household is in *wereda* Abergelle, and the smallest in Hahaile. For the same land size, there is higher productivity in *weredas* Degua Tembien and Adi Ahferom. Based on the 1986 harvest (Ethiopian Calendar), only *weredas* Abergelle and Degua Tembien had the lowest food deficits, meaning approximately 50% of actual food requirements were produced. This illustrates the point that crop production in most areas of Tigray, and especially the central highlands, has probably not for ages topped subsistence level, even at times of adequate rainfall.

There are higher livestock populations in *weredas* Abergelle and Keyih Tekli than in the rest of the surveyed area. Shortage of plough oxen is acute in *wereda* Hahaile, with about 1 oxen for every 2 households. Plough oxen holding is relatively better in Abergelle and Keyih Tekli, with an average of 1 ox for every household.

Domestic water supply is the crucial issue in the lowland areas of Abergelle, Embaseneyti, and Endabatsahma. Survey results show that in *wereda* Abergelle, some households travel 4 hours one-way (8 hours round-trip) in search of drinking water. Other social services and infrastructures, such as schooling, health services, access roads, and marketing are of low standard. The highest and the lowest literacy rates, 43.75% and 15.82% respectively, are observed in *weredas* Adi Ahferom and Abergelle. All *weredas*, except Abergelle, have only one health clinic. Abergelle, followed by Embaseneyti, are the most remote areas in terms of rural access roads, and this in turn is constraining not only market interactions, but the dissemination of agricultural inputs and the expansion of social services as well.

CHAPTER 4: NATURAL RESOURCES

4.1 Climate

The climate of Tigray is highly unpredictable with unreliable rainfall. Droughts have affected the region approximately every 10 years through this century.[7]

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[7]Rural elders express surprise at the current climatic situation. During informal discussion, most elder inhabitants of the survey sites noted that, in the past, the climate of central Tigray was characterized by a rainy season of at least three months length, followed by nine months during which little rain falls. But, these elders note, nowadays the duration and intensity of rains has declined, and in most years, a rainy season of 40 to 50 days only is observed. Hence, many areas that were green 20 years ago are now bare.

Temperatures have also increased. Although temperatures anyway fall during the cold months, an increase in radiation and wind speed results in high evapotransportation rates, and hence a decline in the ground water level and soil humidity.

With regard to measuring rainfall, there is unfortunately no detailed time series data that allows us to chart changes in both rainfall and temperature patterns over time. However, some information from the National Meteorology Authority, on average annual rainfall in Tigray, is available for the span of years from 1961 - 1987. This data indicates that the region's average rainfall is 578 mm., as compared to the national average of 921 mm. This means that in most years Tigray received 37% less precipitation than the national average. Moreover, the variability of rainfall from year to year was very high.

National and Regional Rainfall Averages and Variabilities for the Period 1961 -1987

	Mean annual rainfall	% of Eth. average	Standard Deviation	Coeff. of variation	1984 rain
Tigray	578	63	162	28	44%
Ethiopia	921	100	71	8	78%

N.B. The 1984 annual average is presented as a percentage of the 27 years' average.

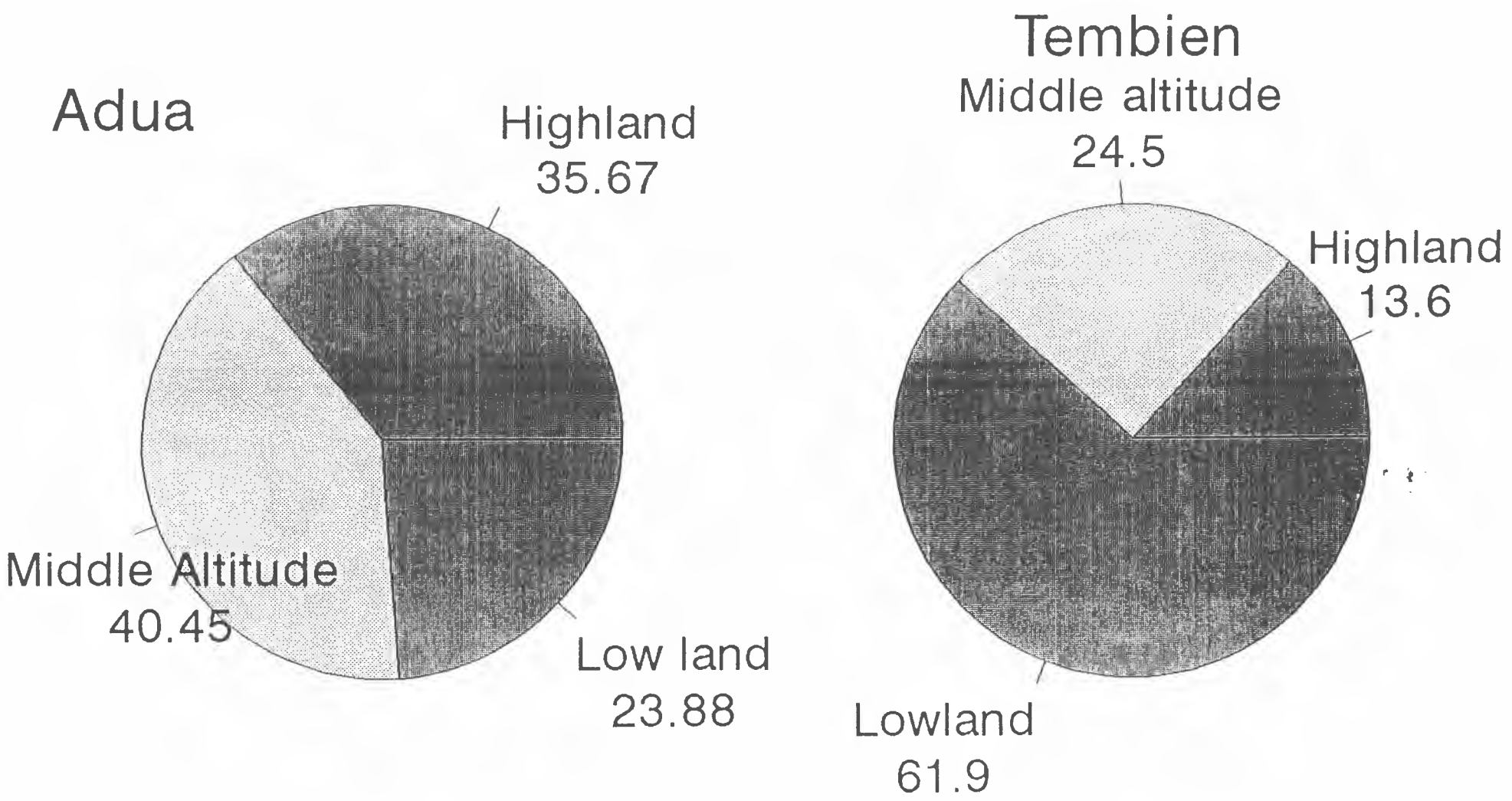
Source: National Meteorological Authority

4.2 Land Resources

Detailed information on land form, land use mapping, and soil series classification is only really obtainable through aerial photographical interpretation, supported with professional field surveys. Instead, this study provides only general and physically observable topographical features of the program area (for further details, see chapter 6: Agriculture).

Fig. 11 Distribution of Households by Altitude

in the Sampled Weredas of Central Tigray



4.3 Vegetation

When we talk of "forest", we mean localized patches of woodland around churches and in remote places. This is because the natural forest of the area has been largely destroyed, in part through the encroachment of subsistence cultivation. Only the *weredas* of Abergelle, Adi Ahferom, Endabatsahma, and Keyih Tekli have some remains of natural forest. Natural forest cover of Adi Ahferom and Endabatsahma is 0.15% and 1.15% respectively. Deforestation is greater in Degua Tembien, Hahaile, and Embaseneyti. In Degua Tembien and Hahaile, this is due to the shortage of fuel wood. Cutting of trees to expand agricultural area is a factor in the deforestation in Embaseneyti. The vegetation of Abergelle is decreasing rapidly, due to cutting trees for house construction and agricultural implements.

In order to preserve and regenerate natural forest, area closure is being practiced, and promising results are seen. In the surveyed *weredas*, a total of 14,709.55 ha. of land is kept under area closure. Of the different tree species, Eucalyptus is widespread, since it is fast maturing and has a relatively higher cash value; farmers grow Eucalyptus nearby their houses and in their fields. Acacia etbaica (*Seraw*), Acacia amythethophylla/seyal (*Chea*) and Euclea schimperi (*Kliaw*) are also seen, as they are drought-resistant trees. On the other hand, Olea Africana (*Awlie*), Junipers procera (*Tsihdi*) and Ficus vasta(*Daero*) are becoming extinct.

Table 2 - Tree Species Commonly Used as a Source of Fuelwood

wereda	TREE SPECIES
Adua	
Adi Ahferom	Eucalyptus, Euclea schimperi
Embaseneyti	Acacia etbacia, Olea africana, Rhus glutinosa
Endabatsahma	Acacia etbacia, Dodonaea angustifolia, Ankeba^{x}, Euclea schimperi
Hahaile	Rhus glutinosa, Acacia etbacia, Carisa edulis, Euclea schimperi
Tembien	
Abergelle	Acacia etbacia, Acacia amythethophyla/seyal, Tsalwa^{x}
Degua Tembien	Eucalyptus, Acacia etbacia, Acacia amythethophyla/seyal, Olea africana, Rhus retinorrhoea/natalensis
Keyih Tekli	Acacia etbacia, Dodonaea angustifolia, Acacia amythethophyla/seyal, Albizia malacophylla

N.B. the superscript x is used to signify the vernacular names

Table 3 - Tree Species Commonly used for Construction

WEREDA	TREE SPECIES
Adua	
Adi Ahferom	Eucalyptus, Olea africana, Cordia africana
Embaseneyti	Eucalyptus, Croton macrostachys, Ziziphus spina-christi, Olea africana, Ficus sycomorus/vasta
Endabatsahma	Cordia africana, Eucalyptus, Acacia etbacia, Ziziphus spina-christi, Weyba[x], Olia africana, Croton macrostachys, Acacia albida
Hahaile	Eucalyptus, Olea africana, Cordia africana, Acacia albida, Croton macrostachys, Rhus glutinosa
Tembien	
Abergelle	Sibkana[x], Weyba[x], Commiphora africana
Degua Tembien	Eucalyptus, Ficus sycomorus/vasta, Sagla[x], Cordia africana, Euphorbia abyssinica
Keyih Tekli	Eucalyptus, Sagla[x], Olea africana, Cordia africana

Table 4 - Tree Species Commonly used for Making Farm Implements

WEREDA	TREE SPECIES
Adua	
Adi Ahferom	Eucalyptus, Olea africana, Croton macrostachys, Acacia lahay
Embaseneyti	Eucalyptus, Ziziphus spina-christi, Olea africana
Endabatsahma	Cordia africana, Acacia etbacia, Ziziphus spina-christi, Weyba[x], Acacia amythethophyla/seyal, Dodonaea angustifolia, Euclea schimperi
Hahaile	Eucalyptus, Olea africana, Cordia africana, Croton macrostachys, Rhus glutinosa, Acacia amythethophyla/seyal
Tembien	
Abergelle	Shisha[x], Sibkana[x], Weyba[x], Tsalwa[x]
Degua Tembien	Eucalyptus, Olea africana
Keyih Tekli	Acacia albida, Olea africana, Cordia africana, Ziziphus spina-christi

Table 5 - Tree Species Commonly used as Fodder

WEREDA	TREE SPECIES
Adua	
Adi Ahferom	Shibaka[x], Cordia africana, Dodonaea angustifolia
Embaseneyti	Ficus sycomorus/vasta, Aloe spp., Ficus palmata/capraefolia
Endabatsahma	Ziziphus spina-christi, Cordia africana, Acacia amythethophyla/seyal, Acacia albida, Sagla[x]
Hahaile	*Lusinya*, *Susbaniya*, Cordia africana, Shibaka[x], Acacia amythethophyla/seyal
Tembien	
Abergelle	*Malkuza*, Acacia amythethophyla/seyal, Acacia etbacia, Ziziphus spina-christi
Degua Tembien	Olea africana, Acacia etbacia, Dodonaea angustifolia
Keyih Tekli	Albizia malacophylla, Acacia albida

Table 6 - Tree Species with Edible Fruits

WEREDA	TREE SPECIES
Adua	
Adi Ahferom	Cordia africana, Kumel[x], Carissa edulis
Embaseneyti	Ficus palmata/capraefolia, Cordia africana
Endabatsahma	Cordia africana, Ziziphus spina-christi, Carisa edulis, Liham[x], Boswellia papyrifera
Hahaile	Ziziphus spina-christi, Cordia africana, Ficus palmata/capraefolia, Ficus sycomorus/vasta, Sagla[x]
Tembien	
Abergelle	Ziziphus spina-christi, Mimusops laurifolia, Boswellia papyrifera
Degua Tembien	Cordia africana, Ziziphus spina-christi, Ficus sycomorus/vasta
Keyih Tekli	Cordia africana, Ziziphus spina-christi, Liham[x], Kumel[x]

Table 7 - Tree species which have different uses

WEREDA	TREE SPECIES	PURPOSE
Adua		
Adi Ahferom		
Embaseneyti	Euphorbia abyssinica, Ficus sycomorus/vasta	For fencing
Endabatsahma	Ziziphus spina-christi, Eucalyptus, Melia azedarch, Cordia africana	Have medical value
Hahaile	Eucalyptus, Croton macrostachys, Cordia africana, Ziziphus spina-christi, Carisa edulis, Eka[x]	Have medical value, for fencing & for making rope
Tembien		
Abergelle	Boswellia papyrifera	Medical value & for washing clothes
Degua Tembien	Eucalyptus, Olea africana	Local medical value
Keyih Tekli		

4.4 Wildlife

Recurrent drought has been one of the main factors in the disappearance of most wildlife in the area. Moreover, as there was no effective wildlife protection measures, there was a great depletion of wildlife resources by local communities. However, as a result of area closure, an improvement in the variety and number of wildlife has been observed. The majority of large wild animals are found in the Tekeze border areas of Abergelle, in the Werie valley, and in the lowland areas of Embaseneyti[8].

4.5 Water Resources

Scarcity of water is affecting millions of humans and animals, and is a more acute problem than loss of soil and natural vegetation. Almost all drought and famine events in Tigray are linked to inadequate rainfall. This report does not provide details of water resources, but instead notes topics of study that should be followed during specialist survey work. In particular, emphasis should be given to critically analyze the status of ground water resources, including depth, seasonal variations, recharge rates, and quality.

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[8] Annex 4 shows the distribution of wildlife in each of the surveyed *weredas*.

Large rivers like the Giba, Werie, Mereb, and Tekeze are the major perennial rivers that pass through central Tigray. However, these rivers are presently not utilized for agriculture. At the same time, it is difficult to conceive of a sustainable development in agriculture that depends on rainfall alone. Hence, an intensive assesment of potentially irrigable land is crucial.

4.6 Soil Erosion

The steep and hilly topography of the area, compounded with increasing population, has led to severe soil erosion. Survey results show that 65.20% of the total area surveyed is used for agriculture. Since most of this area is steep and hilly, it can be seen that slopes are being used for cultivation; hence, the resulting high erosion rate. With population increasing at 2.9% per annum (CSA's report of 1984's census), and with no other viable alternative for livelihood than agriculture, rural people have few options except over-exploitation of land.

Table 8 - Cultivable Land (in ha.) Exposed to Severe Erosion

WEREDA	Total Area(in ha.)	Size of Arable land	Arable land ed to sever erosion	% ofland exposed
Keyih Tekli	16,570.50	10,140.50	2,468.25	24.34
Degua Tembien	17,843.20	13,335.00	8,163.82	61.22
Hahaile	6,784.39	6,069.84	4,139.20	68.19
Adi Ahferom	4,349.10	3,993.10	1,000.90	25.07
Embaseneyti	9,315.75	5,686.50	2,677.00	47.08
Endabatsahma	16,623.60	7,383.10	3,707.00	50.21
Average				**46.02**

Source : Respective *Wereda*'s Agricultural and Natural Resources and Environmental Protection bureau offices.

From the above, it can be estimated that approximately 46% of cultivable land is exposed to severe erosion. Moreover, previously cultivable lands have been, or are being, turned into waste lands due to the formation of wide and close-spaced gullies, and loss of top soil. Large deposits of stones in many places may be a good indicator of the degree of severity in erosion. Furthermore, the denuding of browse and other vegetation on non-arable land is causing erosion problems on arable land.

There are no recent studies that examine levels of erosion in the program area. However, according to a study launched by Huntings Institute twenty years ago, the amount of soil eroded from a hectare of land in a year in Tigray was estimated to be 17 tons. At present, given increased exposure of the area to high population pressure and intensive agricultural practices, unmatched by environmental protection programs, a higher erosion rate is expected.

Today, farmers of the program area are conscious of erosion, including its long and short term impact, and they are also aware of means of decreasing its severity. They repeatedly note, for example, that the erosion rate has greatly accelerated over the last two decades. Current measures of soil and water conservation are encouraging, and tangible results are being seen. At the same time, the rate of erosion still outstrips protective measures. Hence, further efforts are needed to narrow the gap, especially considering that agricultural production and the effect of erosion on productivity is a central issue in the lives of some 90% of the region's people.

CHAPTER 5: HUMAN RESOURCES

5.1 Population and Labor Force

One of the crucial variables in designing a social and economic development programs is the population and its distribution. However, as noted earlier, Tigray lacks reliable population figures. The Relief Society of Tigray (REST) claims a population of 4.8 million. This was based on a 1988 report which compiled population sizes of *tabias* as reported by *tabia baitos*. An extrapolation was then made taking into account a 2.9% national growth rate. Some adjustments were also made to accommodate new, post-war regional boundaries. The Central Statistical Authority (CSA), on the other hand, claims a population for Tigray of 3 million, based on the 1984 national population census and extrapolating to the present. Recent reports from the Regional Government estimate a population of 3.4 - 4 million.

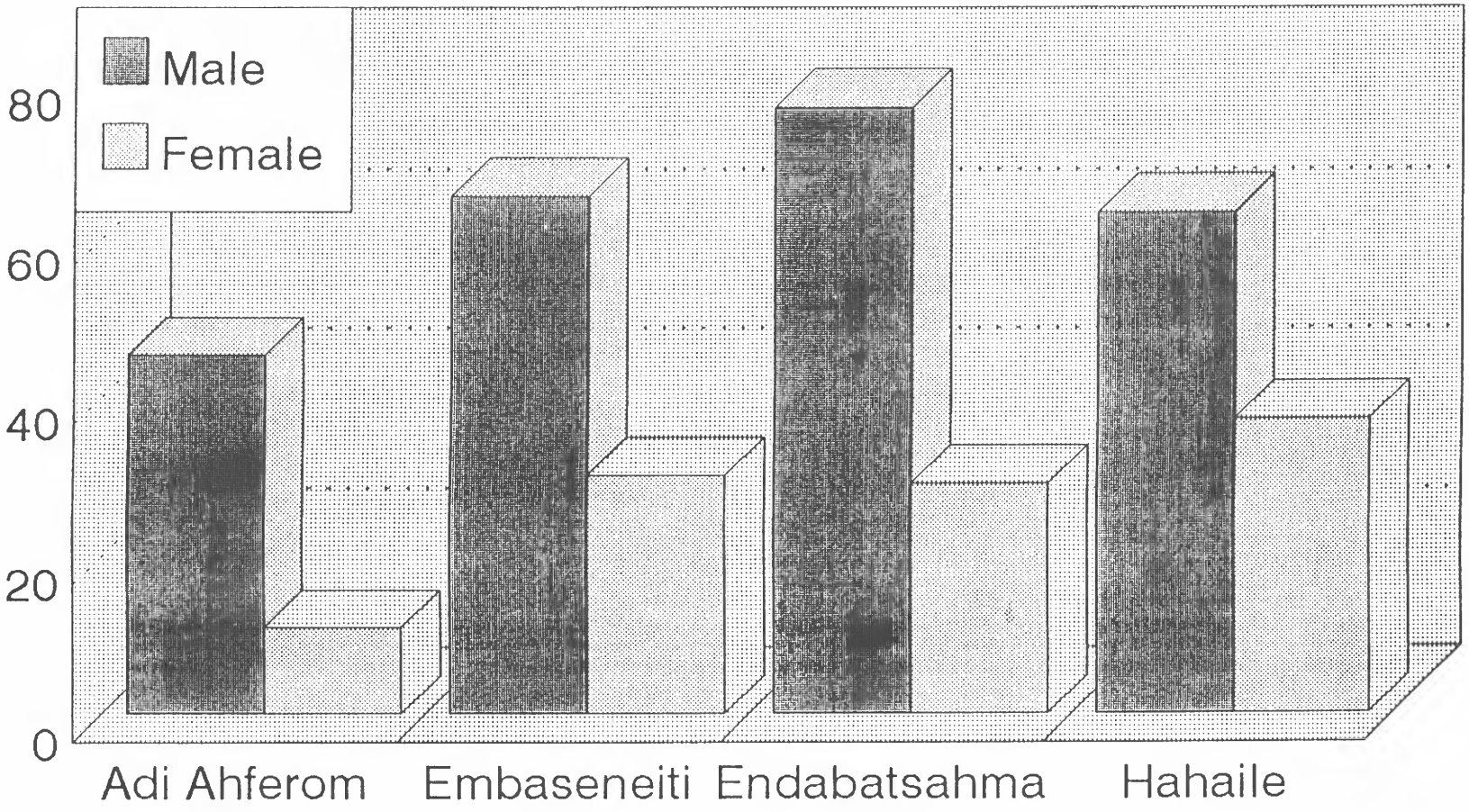
With regard to this survey, we do not intend to make any estimate of population based on our findings for a specific part of the region. The National Population Census, which will be launched in October/December of 1994, will instead serve as the reliable point of departure for our population figures. Meanwhile, it has been possible to calculate population density from survey findings for each *wereda*:

Table 9 - Population Size and Population Density Per Hectare of Cultivable Area

WEREDA	No. of *tabias*	No. of *kushets*	Popul. size	Total Cult. Area (in ha.)	Persons per cult. ha.
Keyih Tekli	17	58	54,366	10,140.5	5.36
Degua Tembien	15	57	61,824	13,335.0	4.64
Abergelle	14	58	42,393	9,807.0	4.32
Hahaile	14	76	37,083	6,069.8	6.11
Adi Ahferom	10	34	22,067	3,993.1	5.53
Embaseneyti	17	44	44,277	5,685.5	7.79
Endabatsahma	17	54	50,337	7,383.1	6.82
WEREDA Average	15	54	44,621	8,059.14	5.54

Fig. 1A Distribution of Household Heads by Sex

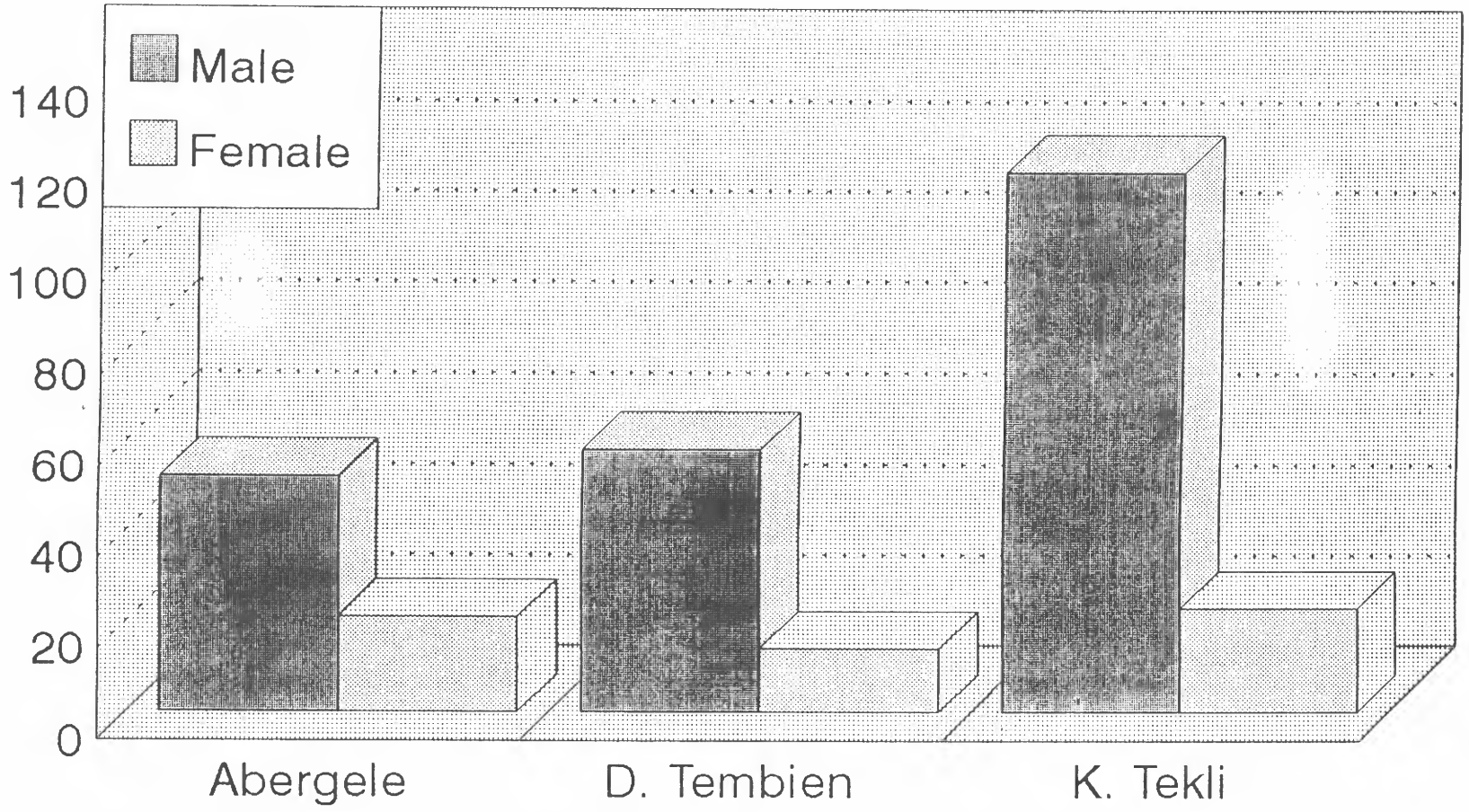
in the Sampled Weredas of Adua



Male	45	65	76	63
Female	11	30	29	37

Fig. 1B Distribution of Household Heads by Sex

in the Sampled Weredas of Tembien



Male	52	58	119
Female	21	14	23

Table 10 - Household Size and Sex Distribution

wereda	H.Hold / *tabia*	H.Hold/ *wereda*	No. of per./h.h	Percentage by sex	
				Males	Females
Keyih Tekli	650	11050	4.92	51.07	48.93
Degua Tembien	896	13440	4.60	50.00	50.00
Abergelle	682	9548	4.44	52.32	47.68
Hahaile	616	8624	4.30	45.58	54.42
Adi Ahferom	426	4260	5.18	48.90	51.03
Embaseneyti	523	8891	4.98	48.73	51.27
Endabatsahma	626	10642	4.73	48.79	51.21
wereda average	631	9494	4.73	49.34	50.66

Table 11 - Percentage Sex Distribution of HH Heads and Marital Satus of HH Members

WEREDA	SEX OF FAMILY HEAD		MARITAL STATUS						% OF ABSENT HH MEMBERS
	MALE	FEMALE	SINGLE	MARRIED	DIVORCED	WIDOWED	SEPARATED PHYSICALLY	CHILDREN	
Adua									
Adi Ahferom	80 36	19.64	10 7	33.4	2.4	3 1	0.3	50 00	0 3
Embaseneyti	68.42	31.58	15.3	29.4	1.9	5 5	0.8	47.00	4 0
Endabatsahma	72.38	27.62	7.7	32.9	3 6	4.2	1.0	50.6	4 6
Hahaile	63.00	37.00	13.3	32.8	2.8	7.2	-	44 0	2.8
Adua Average			11.75	32.13	2.68	5 00	0.53	47 91	2 93
Tembien									
Abergelle	71.23	28 77	10.5	40.9	2.5	5.0	-	41.2	0 3
Degua Tembien	80 56	19 44	5.5	36.7	3.0	3.3	0.3	51.2	5.5
Keyih Tekli	83.80	16.20	7.3	35.3	2.1	4.3	-	50.9	0.4
Tembien Average			7.77	37.63	2.53	4.20	0.1	47 77	1.00
Zone Average		-	9.76	34 88	2.61	4 60	0.32	47 83	1.97

The proportion of males to females of the surveyed area is estimated at 49:50, and the sex ratio (total male/total female) x 100 is found to be 98. A household, on the average, comprises 4.73 persons.

Significantly, results show that approximately 25% of households are headed by women. When asked why this is the case, most *baito* members suggested that many men were killed during the civil war. However, the Amercian anthropologist Bauer, after his 1969 fieldwork, notes the prevalence of women-headed households in his village of study to be 20%. Hence, we can guess that women-headed households are a feature of Tigray social organization, although losses during the war may have exacerbated this phenomenon.

The great majority of households are engaged in farming. Only 1.1% of surveyed households were engaged in non-agricultural activities. On the basis of survey results, it can be estimated that there are on average 176 households per *kushet*.

At present, there are a number of landless adults who have reached the legal age for allocation of land, but who have not yet received their adult share due to the fact that they reached adulthood after the last land re-distribution. In addition, there are also landless households, comprising: households headed by ex-soldiers, returnees from settlement areas of the ex-regime, and repatriates mainly from Sudan and Eritrea. These groups of households depend primarily on relief food assistance, and selling their labor daily; in addition, some own oxen and are able to hire land from other households to farm. Petty trading of consumer goods is also another means of survival for such households.

To take a closer view of the human component, the following tables provide detailed information on the age and sex distributions within the surveyed households:

Table 12 - Age distribution of the members within the surveyed households

Age group	*WEREDA*							%
	Adi Ahferom	Embaseneyti	Endabatsahma	Hahaile	Abergelle	Degua Tembien	Keyih Tekli	Percentage
0 - 4	51	69	82	69	51	58	119	16.41
5 - 9	52	72	74	63	37	56	107	15.16
10 - 14	36	66	64	55	45	37	104	13.39
15 - 19	32	69	62	52	45	36	82	12.43
20 - 24	18	34	45	41	34	20	47	7.86
25 - 29	16	23	29	28	21	15	37	5.56
30 - 34	9	14	22	14	14	19	29	3.98
35 - 39	11	22	15	18	17	22	29	4.41
40 - 45	13	16	12	13	10	10	33	3.52
45 - 49	13	18	22	19	12	15	33	4.34
50 - 54	8	15	18	15	12	8	27	3.39
55 - 59	11	26	17	8	10	11	17	3.29
60 - 64	7	10	16	15	7	9	16	2.63
65 & above	13	18	18	20	8	14	19	3.62
Total	**290**	**472**	**496**	**430**	**323**	**330**	**699**	**100**

Table 13 - Sex Distribution of Household Members Surveyed

WEREDA	SEX		PERCENTAGE		SEX RATIO (MALE/FEMALE) X 100
	MALE	FEMALE	MALE	FEMALE	
Adua					
Adi Ahferom	143	147	49.3	50.7	97
Embaseneyti	230	242	48.7	51.3	95
Endabatsahma	242	254	48.8	51.2	95
Hahaile	196	234	45.6	54.4	84
Adua Average			**48.00**	**52.00**	**92**
Tembien					
Abergelle	169	154	52.3	47.7	110
Degua Tembien	165	165	50	50	100
Keyih Tekli	358	341	51.20	48.8	105
Tembien Average			**51.18**	**48.82**	**105**
Zone Average	**1503**	**1537**	**49.44**	**50.56**	**98**

N.B. Sex ratio: The number of males for 100 females

Table 14 - Available Special Skills in the Surveyed *Weredas*

WEREDA	TYPE OF SKILL						OTHER
	MASONRY	CARPENTRY	BLACK SMITH	WEAVING	POTTERY	BASKET MAKING	
Adua							
Adi Ahferom	989	-	76	-	-	609	609
Embaseneyti	1313	-	-	-	188	1126	375
Endabatsahma	1218	-	101	-	-	2131	304
Hahaile	690	-	-	-	259	259	345
Adua Average							
Tembien							
Abergelle	787	262	-	-	262	1312	262
Degua Tembien	937	-	-	187	560	1105	1686
Keyih Tekli	1633	78	78		-	4667	389
Tembien Average							
Zone Average							

5.2 Social organizations and Institutions

5.2.1 Characteristics of the Rural Community

In rural Tigray, the *sidra bet* (literally, "people of the house") has essentially the same meaning as a "household". It is the most fundamental social unit of rural society.[9] In Central Tigray, household size is usually grouped into three categories, big; medium; and small. Big households have at least 8 members, a medium household ranges between 4 and 7 members, and a small household have 3 members or less.

The traditional rural household usually consisted of a compound containing a dwelling for sleeping, and a dwelling for cooking. Nowadays, most newly-established households have only one dwelling which serves for both functions. Four types of dwellings are typical of Central Tigray:

[9]In this survey a household is defined as a group of persons (in rare cases it may be one person) living together in one house or in some cases in nearby houses, having the closest social and economic links. Quite regularly they work, store, and consume their food/produce together. The household most commonly has a family unit as its nucleus.

Adarash, A one-story house with walls constructed from stones, and a wooden roof. Mostly used for receiving guests, sleeping, etc. Mainly owned by rich households.

Hidmo, A house with walls constructed from stones and a roof made from wood covered with sand; it usually has a rectangular shape, although in some cases it may be circular. The same function as the former, but smaller. A house common to most families.

Sekella, The upper storey of a *hidmo*.

Guji, Has the structure of a hut, meaning it is round. Walls and roof made mostly from wood. The roof is thatched. Used for living for poor people, for rich it is an additional house.

Most houses are used both for living, sleeping and cooking.

These houses require much wood for the making of pillars, ceilings, roofing, and thatching. Thus, deforestation can in part be linked to the cutting of trees for house construction.

5.2.2 Wealth Status in the Rural Community

In most parts of rural Tigray, the number of livestock, and especially cattle, is used as a major indicator of household's wealth status. However, in *wereda* Adi Ahferom, ownership of the tree Rhamus prinoides (*gesho*), used for brewing local beer, is commonly used as a measure of wealth. In the lowland areas, such as for instance *wereda* Aberegelle, goats tend to be more important than other livestock as a wealth measure.

Although there are other indicators of wealth besides livestock, (for example, the amount of crops in the field, cash savings, capital assets such as gold), for the purposes of a baseline survey we have taken livestock as the appropriate point of departure to classify households into three categories: rich, imddle, and poor. Although wealth is a relative term, and will vary over time and from *wereda* to *wereda*, such broad categories enable us to first obtain a general picture of households in the survey area. The following table provides details in this regard:

Table 16 - Wealth Classification by *Wereda*

WEREDA	Rich (mini. possession)	Poor (max. possession)
Keyih Tekli	2 oxen, 3-4 cows and 20-30 sheep/goat	No. ox, or other cattle adding up to the value of 1 ox
Degua Tembien	3 oxen, or at least the equal value of 3 oxen in other cattle	1 Ox or the equal value in other cattle.
Abergelle	100 goats, 3 oxen and 5 cows	5 goats, 1 ox (or the equal value of 1 ox in other cattle)
Hahaile	2 Oxen, 2 cows and 20 goats	0 ox, and the value of other cattle less than the value of 1 ox
Adi Ahferom	25 *gesho* trees	10 *gesho* tress
Embaseneyti	2 oxen, or at least the equal value in other cattle	0 ox, and the value of other cattle less than the value of 1 ox
Endabatsahma	2 oxen, or at least the equal value in other cattle	0 ox, and the value of other cattle less than the value of 1 ox

5.2.3 Community Organizations

The rural community is internally divided into smaller units, beginning with the household, *sidra bet*. Above this unit, there are other social groups or associations that function to provide social and mutual assistance. These include the ***gorebet*** or neighborhood; ***mahber,*** which is an association of neighbors, relatives, or friends who gather monthly to feast in honor of a particular saint; ***lifinti***, which is the name given to a reciprocal exchange between two people of either an ox or labor for farming. Other non-formal organizations which are more common in the *wereda* towns are ***ekub***, a local cash savings association, and ***edir,*** an association for assistance in the case of death of a household member.

In terms of formal social organization, the *baito* is the most important structure. *Baitos* are organized at each administrative level, including *tabia*, *wereda*, *zoba* and region, with the regional *baito* functioning as the supreme council or legislature of Tigray. The *tabia baito* is the basic level of government, and is accountable to the people of the *tabia*. It is also responsible for organizing people for community development programs, and for reflecting the needs of the community during program planning.

Other formal organizations of the rural community include: the Farmers Association, Youth Association, the Democratic Association of Tigrayan Women, TPLF Fighters Family Association, and different cooperatives such as peasant service cooperatives and small-scale co-operatives. Merchants, Daily laborers, Handicrafters, and Teachers Associations are also common in the *wereda* towns.

5.2.4 Land Tenure

The present land tenure system of Tigray is communally based, and was initiated by TPLF during the war. Hence, in areas administered by TPLF during the war, land re-allocation began in 1977; the most recent re-allocation was undertaken in *wereda* Keyih Tekli during 1991.

The TPLF land distribution was unique in Ethiopia, in that it allotted land not to households, but to individual adults. This meant, for example, that women gained rights in land regardless of their marital status. This land could not be alienated or affected by divorce. The land redistribution also had profound effect on other socio-economic aspects of the society.

At present, the criteria to obtain land is that a person should have reached a certain age, which differs for men and women. Ages are not fixed throughout Tigray, but differ from *wereda* to *wereda*, depending on the decision of the people through the *wereda baitos*. The minimum ages are 15 years for women and 22 years for men respectively. But in Adi Ahferom, it is 25 years for men and 18 years for women.

During the war, the number of re-allocations implemented also varied from area to area, depending on demographic, and in some cases, security considerations (meaning allocations had to wait until relative peace or calm came to an area before they could be implemented effectively) In *wereda* Embaseneyti, for instance, land was re-allocated four times in the 10 years between 1977 and 1987. On the other hand, only one allocation was performed in *wereda* Degua Tembien, as the area was mainly under the control of the former military government.

With the exception of Keyih Tekli, where there was a land re-allocation during 1991, all land re-allocations took place before the fall of the Derg's regime. The last re-allocations in Endabatsahma, Embaseneyti, Adi Ahferom, Abergelle, and Hahaile took place in 1987. Hence, in these *weredas*, seven years have already passed since the last re-allocation; consequently, those men and women who reached the age limit for obtaining land after 1987 are presently landless.

For those who have not been able to receive a formal allocation of land, a variety of strategies are employed. For people returned from re-settlement camps in the south of Ethiopia, internally displaced who have returned, or refugees returned from Sudan, food assistance is a key means for survival. For young people who are waiting to receive their "adult" share of land, some are able to live independently by renting land from households who lack the capital, especially oxen, to farm themselves, while others remain dependent on their parental households; still others

migrate to towns to seek labor employment. During interview with *wereda baitos*, it was repeatedly stressed that this is a major issue requiring attention, and that there should be means available so that these households can engage in more sustainable occupations.

One important survey finding is that the area of land allocated to an adult was observed to decline in each successive re-distribution. Generally, an adult is given a 1/2 *gibri* (literally, "share") of land, meaning that a husband and wife between them will receive a full 1 *gibri*. An additional 1/4 *gibri* is allocated for each 2 children in the household. However, a *gibri* is not standardized in size, but depends on the total land available and the number of households. For instance, the size of one *gibri* in *wereda* Abergelle is larger than the size of one gibri in *wereda* Adi Ahferom.

5.2.5 Activity Calendar of the Rural Community.

The survey recorded approximately 20 types of major domestic and agricultural activities conducted by the household; the majority of these are accomplished by women. They include:

Grinding, the hardest task for rural women. More than 85% of rural women are estimated to grind by hand using a large stone, since motor-powered grinding mills are mainly located in *wereda* towns. To save time, women also grind at night or early morning.

Water fetching, which is a woman's routine daily activity, especially for younger women who are mainly responsible for carrying out this task. However, in some households, young unmarried men also bring water. In most areas surveyed, water fetching takes more than one-third of available time during a day.

Child care, which is considered essentially the same as food preparation. Young women and mothers-in-law may also assist a mother in feeding, bathing, carrying, and other tasks.

Collection of firewood, the responsibility of both male and female children. Where there are no children, however, women of the household will typically be responsible for this task. It is estimated that households on the average collect firewood twice in a week.

Food preparation, culturally considered to be the complete responsibility of women, meaning that men do not assist in food preparation at all. The fact that women are responsible for food preparation also means that they have primary responsibility for managing and stretching grains and other food resources from harvest to harvest, a task of critical importance to the household.

Other routine domestic activities which consume women's remaining time each day include spinning cotton, basket making, washing clothes, and cleaning of the compound.

Agricultural activities are seen as mainly the responsibility of men. However, with the exception of ploughing, most agricultural work is undertaken by both men and women, although variations are seen between *weredas* in the extent of women's participation, and even between households. With regard to ploughing, only one women (head of a household) in the entire survey was found to plough by herself.

Ploughing (***mihras***) is carried out by men in almost every month of the year. Periods of ploughing vary mainly depending on the type of crop to be planted.

Collection of plant debris (***migulgual***) is mostly undertaken at the time of ploughing; typically, while men plough, women collect the plant debris. Sometimes, young men assist women in this.

Hoeing (***mikuskuas***) is mainly done on vegetables, and sometimes on maize. This is the duty of both women and men.

Weeding(***tsahyay***) is carried out by both men and women, as well as children. Aside from ploughing, it is one of the most labor intensive of farming activities. Weeding is done in the months of June, July and August.

Harvesting/Cutting(***atsid***) is performed by both men and women, and is also very labor intensive. Often the entire household will be in the field for most of the day during harvesting, taking food with them, and returning after dark. The women then have to prepare an evening meal, with grinding to be done for next day's ration before daylight. Harvesting usually commences in September, but for some types of crops it may start in August. Harvesting ends in January.

Preparation of threshing ground (***awdee midilaw***). The digging of the ground is done by men, while the smearing with mud and smoothing is mostly done by women.

Threshing (***mizbat***) is performed when the days are sunny and rainless, so that crops do not be wet. It usually starts in October, but sometimes in September for some types of crops such as barley. It continues usually up to January (in rare cases up to March). Both woman and men participate in threshing, although typically men will throw stalks onto the threshing floor and winnow, while women will drive oxen around the threshing circle.

Remaining agricultural activities are conducted by both men and women, with children especially responsible for livestock herding.

Although the domestic and agricultural work burden of rural people is very great, work is not done every day throughout the year. Rather, religious holidays (for both Christians and Muslims) are observed where work should not be conducted (see table 6.xx).

CHAPTER 6: AGRICULTURE

6.1 Introduction

Abiotic factors such as climate and soils constitute important natural opportunities and constraints on agricultural production. As earlier stated (chap. 3), climatic conditions in Tigray are often very variable as the timing of precipitation is highly irregular. The rains are confined almost entirely to the period between July and September, but quite often the rains may finish in August. The period between October and February is almost completely without rains, and there are long periods of very dry weather (low humidity) between November and early March. (see tables from Central Statistical Office, CSO, 1984).

The soils in northern Tigray province are generally stony loams, sandy loams or loamy sands often with a low productivity due to low contents of organic matter and nitrogen. The soils range from slightly acid to moderate alkaline. (FAO 1961)

In comparison with many other African countries, the Tigrayan standard of agriculture is high as proved by the relative good condition of most of the soils after millennia of use. Ox-cultivation has been a main feature for more than two thousand years, and terracing has been practiced in the highlands of Tigray for an extended period of time. Traditionally the terraces did differ widely in shape, from very small terraces (less than 1 meter wide) found north of Maichew, to very wide ones found on the slopes west of Adigrat (FAO 1961: 140-147). Most of these terraces were wholly or partly damaged due to lack of maintenance during the civil war, but within large areas, terraces have now been reconstructed.

The prevailing agricultural system in Tigray is characterized by the following features:

(1) scarcity of arable land, which again have lead to an extremely intensive land use pattern dominated by small farms that are divided into minor plots scattered over an extensive area;

(2) it is dominantly rainfed (some areas have small irrigated areas along permanent steams);

(3) it is completely based on animal traction;

(4) cereals are the dominant crops with pulses as secondary in importance. While exotic vegetables are cultivated in small amounts in area where irrigation-water is permanent or semi-permanent, root crops are almost totally absent, the same goes for fruit trees;

(5) the production process is family (household) based;

(6) land is formally state owned, but with a communally based tenure system where individuals have cultivation rights;

(7) livestock (except for plough-oxen) plays an important but secondary role. Generally, the livestock component increases in importance in the lowlands as the grazing areas become more extensive, and crop production becomes more vulnerable (due to a somewhat drier climate).

During the rest of this presentation, most of the analysis will be centered around statistical data from the different weredas in Central Tigray where the baseline survey was undertaken. It is, however, important to notice that each of the weredas are not agro-ecologically homogenous. Some of them cover more than one altitudinal zone (for instance Adi Afherom), and some of them incorporates both arid areas with mostly shallow soils, and sub-humid areas with deep, fertile soils (e.g. Degua Tembien). The statistical results is averaging out such variations.

6.2 Land as production factor

6.2.1 Land use

To give an idea about the prevailing land use pattern, table 6.1 (see below) describes the most typical land usages in Central Tigray

Table 6.1: Land use and size (in ha and percentage)

Name of Wereda	Land use			
	Agricultural	Range & woodland	Non-agricultural	Total
Keyih Tekli	10,140.50 61.2%	3,961.75 23.9%	2,468.24 14.9%	16,570.50 100%
Degua Tembien	13,335.00 74.7%	3,206 00 18.0%	1,302.00 7 3%	17,843 00 100%
Hahaile	6,069.84 89.5%	590.00 8.7%	124.55 1.8%	6,784 39 100%
Adi Ahferom	3,993.10 91.8%	24.00 0 6%	332.00 7.6%	4,349 10 100%
Embasneyti	5,686.50 61.0%	2.741 75 29.4%	887 50 9 5%	9,315 75 100%
Endabatsahma	7,383 10 44.4%	5.993.50 36 1%	3,247.00 19.5%	16,623 60 100%
Sum total	**46,608.04**	**16,517.00**	**8,361.30**	**71,486.34**
%	65.20%	23 11%	11 69%	11.69%

Source: Respective wereda "Agricultural and Natural Resources and Environmental Protection" offices.

Notes: 1. Non-agricultural land incorporates, villages, roads, water surfaces and wastelands.

2. Abergelle is missing from table 6.1 because data is not available in the bureaux of Agriculture and Natural Resources and Environmental Protection at wereda level

As can be seen from the table, the pattern of land use differs rather radically from area to area. While in Endabatsahma about 44 % of the land is used for agriculture, this amount is around 90 % in Adi Afherom and Hahaile. Correspondingly, we find that while less than one per cent of the land in Adi Afherom is range and woodland, this part amounts to about 36 % in Endabatsahma. What can be said in general about the pattern of land use for the whole of central Tigray is that the high percentage of agricultural land imply a strain on the natural resources as the landed resource has little chance to be put at rest to recover strength. We experience, for example, that fallowing is rarely practiced in Central Tigray, and from the land use pattern, we understand why. When we, in addition, know that manure is not extensively used, and that chemical fertilizers, as a rule, are absent from agricultural production, then the present land use pattern can not support a sustainable production system.

The following chart shows the percentage of plots in the survey area treated with manure, other locally avaialable fertilizer materials (compost and green manuring), and chemical fertilizers:

Response category	**Adua**	**Tembien**
Treated with manure	29.15%	18.87%
Other local fertilizer	10.5%	8.9%
Chemical fertilizer	15.03%	5.90%
Untreated plots	45.24%	66.33%

Table 6.2 (below) describing the diminishing acreage of arable land for the farming households during the last couple of decades does also point to the unsustainability of the present system.

6.2.2 Land tenure

The possession of land in Tigray has traditionally been intimately linked with the whole structure of the society as it enters, as a paramount factor, into distinctions of social status and forms of social unity.

Traditionally, there existed two systems of land tenure in Tigray as a whole: village ownership where land was distributed by the village head (see e.g. Bauer 19xx); and *risti*, family ownership with individual inheritance of land rights.[10] The first system implied that every

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[10]According to some information we have from Hahaile, the inheritance system, *risti* and the village, there called *koli*, existed together. While *risti* covered the land up in the mountains and the foothills, *koli* covered the poorer sandy soil in the lowlands. The latter land was distributed by the village head (*chicashum*), but also to people from outside the village if they paid some tribute to him.

family in a village had rights to a share of the village land; the second system, which seems to have been the most common, implied that only the descendants of the person who was recognized as the first settler in an area were entitled with land rights. The first system meant that only people living in the village received a share of land; the second that people outside the village might have "restenya", i.e. rights to a share of land even if they did not live in the village. The *risti* system lead to a great number of judicial land disputes over land and to a rather substantial degree of absent landownership. *Risti* represented much more than merely economic benefits. Its derivation from an original first occupation gave it an important social significance, i.e. that of a qualification for enhanced social status which is permanent and inalienable. It invested in the *ristenya*, the *risti*-possessor, a status of a member of the hereditary families, almost of a landed aristocracy.

In the village-ownership system all land was considered to be the common property of the village. Descent played no part as land tenure was based entirely on residence. Every member of the village community (*gebar)* who resided in the village had rights to share in the village land. The share, *gibri*, is basically of equal size. According to this system, strangers and original inhabitants were placed on the same level regarding land rights. The system precluded multiple ownership of land within the village area. No *gebar* could own more than one share of communal land or belong to more than one village. Hence, no resident member could be refused his share. But it was possible to combine a village share in one place with a *risti* title elsewhere.

The members of the village received their share of the communal land by means of a periodical redistribution of village land. The individual usufruct was limited to the periods between the redistributions. The period of redistribution regularly followed the cycle of cultivation and fallow with re-allocation taking place after the fallow period. As land must be left fallow for a certain period of time, a family had to possess several fields to have at least one field under cultivation each year. The general rule seemed to be that each family occupied three fields simultaneously.

Both young members of the community entering the *gebar* age, and strangers who moved to the village had to wait till the next redistribution before they could receive their share.

Two important principles of this land tenure system was that it excluded the sale of land, and it excluded the land rights of absentees.

Today, the whole region has only one common land tenure system. The basic principles of this system are very close to the traditional village-ownership system. The present system was enforced for the whole of Tigray under the Dergue, and was somehow refined by TPLF during the war. The main difference between the system of today and the 'cigurafigoses' arrangement, is that now every adult person, irrespective of sex, instead of every household, has equal rights to an equal share of land. To secure these rights, land has even today to be re-allocated at certain intervals, on average around every seven year.

As the land is considered to belong to the village communities, there is a great variation from tabia to tabia regarding the quantity and quality of land each person (or household) is allocated. The basic component within the system is, however, that each adult person should be allocated 1/2 *gibri*[11] (share) of land, implying that a couple receives one full gibri. Then, with every two children under the legal *gibri*-age, the couple is allotted an additional 1/4 gibri, up to a total of one extra gibri.[12] At the death of the land owner (*gebar* = taxpayer, the person to whom land has been allocated), land is passed to her/his children, but only up to the next allocation.

The present land tenure system was, as earlier stated, effected during the TPLF armed struggle. In the major TPLF liberated areas in Central Tigray, land allocation commenced in 1977 and the latest allocation was undertaken in wereda Keyih Tekli during 1991.

As the "TPLF" system was initiated, the criteria for a person to have land was that he or she was married and established a household. Later, it was comprehended that this might encourage youngsters to marriage at lower ages. Consequently, age was applied as the criteria for land allocation. Initially, the limits of 25 years of age for males and 18 years of age for females were generally applied. Today, this has in many weredas been lowered to 22 years of age for men, and 15 for women.

The variations occur because it is the respective wereda councils (*baitos*) which have the prerogative and rights to determine such matters based on the existing situation within the individual wereda.

The number of allocations depended on the rate of youngsters reaching the age limit, and in some areas also on the political stability of the area. In wereda Embasneyti for instance, land has been allocated four times within the period 1977 - 1987. On the other hand, only one allocation has taken place in Degua Tembien. This is mainly due to the fact that the area was under the control of the ex-regimes implying that land allocation was not possible until the area was taken over by TPLF in 1987. Except for wereda Keyih Tekli, where a land allocation took place during 1991, all other land allocation took place before the fall of the Dergue regime.

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[11]The local name for a farmer is *gebar*.

[12]It is not only the size of gibris which varies tremendously from wareda to wareda. The same goes for the quality of the soil. Quite commonly, each share of land is divided into plots belonging to three soil categories: *regud*, "rich" (fertile, deep soils); *maekelay*, "medium", and *rekik*, "poor" (poor and shallow soils).

The last land allocation year in the weredas of Endabatsahma, Embasneyti, Adi Ahferom, Abergelle and Hahaile was in 1987. As seven years have now passed since the last allocation, most males who were then under 22 and most females who were then under 14 years of age, are currently landless. This is the most important factor behind the high proportion of landless adults in those weredas, as explained by the wereda baitos.

The survival strategies of these landless households vary, but the majority depend on the food for recovery programme where relief food is distributed linked to participation on communal development activities like terracing, reafforestation, work in nurseries, construction of micro dams, etc.. In spite of lacking land, some of the youngsters have established their own households and are leading their life by hiring in lands from other households who may lack oxen, labour power and/or seeds. Some are still depending on their families. Some have migrated to towns to seek wage work.

Table 6.2: Land holding trends: allocation year; size of a gibri; holding per person (in ha).

Wereda	Allocation year	Size of one *gibri*[13] (in ha)	Holding per *gebar*[14] (in ha)
K Tekli	1980	1.50	0 75
	1991	1 00	0 50
D Tembien	1990	0.38	0 19
Abergelle	1981	1 00	0 50
	1987	1.00	0 50
Hahaile	1977	1 00	0.50
	1980	0 75	0 38
	1987	0 63	0 32
A Ahferom	1977	0 50	0 25
	1980	0 38	[illegible]
	1987	0 25	0.13
Embasneyti	1977	0 75	0.38
	1978	0.75	0.38
	1980	0 75	0 38
	1987	0 50	0 25
Endahatsahma	1978	1.25	0.63
	1979	1.25	0 63
	1987	0 75	0 38

Source: The respective wereda baitos

Notes: 1. It has to be noted that there has been allocation to some individuals in between the major overall allocation years. Such type of allocation called "Mishigishag" was undertaken by taking a partial of land from certain households and allocating to the new ones.

2. There seems to be a constant land holding size in both periods in wereda Abergelle. This is mainly due to the fact that there was land left unallocated after the allocation 1981.

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[13]*Gibri* is traditionally the share of land allocated to each household within a tabia. As allocation today is directed toward adult individuals, each adult will receive 1/2 gibri. Both the size of a gibri and the productive quality of it will vary from village to village depending on the amount and quality of the land under its jurisdiction.

[14]*Gebar* is an adult person who is allocated 1/2 gibri of land. The gebar-age varies from wereda to wereda: 15-18 years for a woman; 22-25 years for a man. In addition, for every two children, an extra 1/4 of a gibri, up to a total of 1 gibri, is allocated. As a child becomes adult, it has the right for a full share, i.e. 1/2 gibri, but they must wait until the next redistribution takes place.

As can be seen from the table, the size of the land allocated to a couple, which even initially was very small, has dropped significantly in Central Tigray from 1977 up to today.[15] With the exception of Abergelle and Degua Tembien (from the latter we have only data from the allocation in 1990), the reduction of the share allocated to each couple has dropped by from about one third to about one half. When we, in addition, see that the farms were already small from before, and we know that the quality of the soils are low - and decreasing, it is obvious that the situation is serious both for the individual farmer, and for Tigray.

To comprehend the prevailing distribution of land among the families in the surveyed area, table 6.3 (below) gives an impression. In this table we see that the average size of a land holding for a family in 1993 (1986 Et. Cal.) ranged between half a hectare in Endabatsahma and almost two hectares in Abergelle. What can be said about Abergelle in general is that within this low lying arid wereda, population density per hectare of cultivable land is lower than average with thence land availability above average. The most constraining agro-ecological factor is rain, which is more precarious here than in the other weredas. Due to the important agricultural constraints caused by climatic factors, Abergelle is the wereda in Central Tigray where livestock plays the most important role.

An important feature regarding allocation of land is that the total land distributed within a village will be of different quality, therefore land in any area is usually divided into three fertility categories, rich (*ragud*), medium (*maekelay*) and poor (*rekik*).[16] In principle, all families will receive the same amount of land from each category. The aggregate result of this allotment for each wereda can be seen in "Plot fertility status" in table 6.4.

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[15]During the interviews with the wereda baitos, most of them were not in support of a further re-allocation of the communal land as the size of holdings had considerably diminished the last one-two decades. It was repeatedly suggested by the wereda baitos that this is one of the major issues requiring a priority, and that there should be developed other means than agriculture by which households could be enabled to perpetuate a sustainable livelihood.

[16]The fertility status of a plot is generally a function of its shallowness/deepness. But type of soil and micro climatic factors are also important.

Table 6.3: Average land holdings (size of farms) per household (in ha and *tsimdi*; 1 ha = 4 tsimdi)[17]

WEREDA	SIZE RANGE		AVERAGE SIZE OF FARM (ha)	AVERAGE SIZE (tsimdi)	AVER.NO. OF PLOTS PER FARM	AVER. SIZE OF A PLOT (ha)
	MINIMUM	MAXIMUM				
Adua						
Adi Ahferom	0 125	1.625	0.69	2.76	3.05	0.19
Embasneyti	0.125	1.750	0.66	2.64	3.00	0.23
Endabatsahma	0 125	1.500	0.505	2.02	2.64	0.25
Hahaile	0.125	1.125	0.585	2.34	2.18	0.13
Adua Average	**0.125**	**1.50**	**0.61**	**2.44**	**2.72**	**0.20**
Tembien						
Abergelle	0.250	5.375	1.875	7.50	3.02	0.62
Degua Tembien	0.125	2.50	0.743	2.97	2.64	0.28
Keyih Tekli	0.250	2.00	0.953	3.81	2.44	0.39
Tembien Average	**0.125**	**5.375**	**1.190**	**4.76**	**2.70**	**0.43**
Zone Average	0.125	5.375	0.90	3.60	2.71	0.30

Regarding the number of plots per household, the general pattern is that each household cultivates three parcels of land. But some household may hire in extra land while others hire out.

Quite commonly, there is a difference between a *gibri* (the share of the land allocated to a couple) and the actual size of a farm allotted to a household (see footnote 4) as the household will be given additional land according to the number of children it has. A couple with two children will be given an extra quarter of a gibri; a couple with eight children or more will be given a full gibri extra. Also the land of adult children with gebar status will be added to the land of the household as long as they live together with their parents.

In general, each and any household will cultivate all their land. But there are some exceptions. Female headed households lacking adult sons, old male headed lacking sons, and disabled can not use oxen for cultivation, therefore a majority of them will hire out all or some parts of their land. Also many poor households without oxen do often hire out some or all of their land. Quite often the land owner and the ox-owner share the crops on an agreed basis (see *tewefari*, table 6.7). The amount of plots hired out and in can be seen from table 6.4 (below).

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[17] *Tsimdi* is both the name of a team of oxen and the area a pair of oxen is reckoned to plough in one day

Table 6.4: Distribution of plots by type of possession and soil fertility status

WEREDA	PLOT OWNERSHIP			PLOT FERTILITY STATUS[16]		
	Own	Hired out	Hired in	Rich *Ragud*	Medium *Maekelay*	Poor *Rekik*
Adua						
Adi Ahferom	96 5	3.5	-	13.5	38.00	48.50
Embasneyti	86.5	10.8	2.9	5.7	25.1	69.2
Endabatsahma	78.6	20.7	0.7	2.5	14.3	83.2
Hahaile	85.0	15.0	-	8.8	27.8	63.4
Adua Average	**86.65**	**12.50**	**0.85**	**7.63**	**26.30**	**65.22**
Tembien						
Abergelle	85.9	8.20	5.90	3.6	12.7	82.7
Degua Tembien	77.2	13.80	9.00	22.8	22.8	54.5
Keyih Tekli	87.7	10.50	1.70	3.1	21.1	75.8
Tembien Average	**83.60**	**10.83**	**5.57**	**9.83**	**18.87**	**71.30**
Zone Average						

Farmers prefer to hire out plots to relatives, i.e. a widowed aunt to the sister's son. Quite often these relatives live in other tabias. This may be a partial explanation to the differences in hiring out and in. Hiring out means poor, hiring in means rich. This can also be an explanation.

[16]It must here be remembered that this categorization is indigenous to each area, implying that a plot which is considered medium or poor in one village can be considered rich in another, depending on the general state of the soils in the respective areas. It is quite obvious, for instance, that land in certain parts of Degua Tembien, e.g. Hagere Salam, is of considerably higher quality than land throughout most of Abergelle.

6.3 Labour as a production factor

6.3.1 Composition of the labour stock

As people are the most basic resource in any type of social endeavor, to map the human resource within the agricultural system is of importance. Generally, what can be said about this component in Central Tigray (as probably for the rest of the region) is that a limited number of fully productive persons must take care of a rather substantial number of less productive persons (children, sick and elderly). For a household to be fully viable (economically self-sustained and "independent"), it needs, as an absolute minimum, one male to do the ploughing, sowing and threshing, and a female to do the domestic chores. With this level of labour input, the household will occasionally need additional labour power, especially for weeding and harvesting (cutting) to finish off these tasks adequately. In addition it needs a pair of oxen with necessary equipment; at least one hectare of land with about one third of it belonging to the "rich" category; some additional livestock to be used as security and as a means of exchange at the market; access to pasture for oxen and other livestock; a compound with at least a living house (*hidmo)* and a kitchen-house (*enda magogo*); an adequate store of grain which can supply the household with basic food-stuff between the harvests; and basic farm tools such as sickles and hoes.

The basic farming unit is the household, most regularly constituted around a nuclear family. The smooth functioning of the household unit is therefore of utmost importance to keep it viable.

In table 6.5 (below) we distinguish between categories of members within farming households. First, we separate between members that are older or younger than 10 years as this age is customarily considered by the locals to be the age when children start to participate in agricultural work. Then, for the members above 10 years of age, we have listed their level of participation in agricultural activities according to four categories, "none", "some", "half", and "full". Of course these categories are not very precise, but they give a certain picture of the situation. The level of participation mirrors in many respect the age composition of the working group.

Further, to be in line with internationally recognized standards,[19] we have singled out two groups of household members belonging to the category of *dependents*: children, those younger than 15 years of age*; and old, those older than 64 years of age. Dependent, in this respect, means individuals that can not sustain their livelihood on their own because, for example, they are too young to own land, or too old and weak to produce the means for their livelihood.

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[19]See e.g. The World Bank/Oxford University Press *World Development Report 1991*, table 26, p. 254-255).

Table 6.5: Household members' level of participation in agricultural activities (including members 10 years of age or older)

WEREDA	SAMPLE POPULATION		LEVEL OF PARTICIPATION H.HOLD MEMBERS > 10 YRS (in per cent)				PERCENTAGE OF DEPENDENTS		ADULTS 15-64 years	Depen-dency ratio
	< 10 yrs	> 10 yrs	None	Some	Half	Full	Child. 0-14yrs	Old > 64 years		
Adua										
Adi Ahferom	103 35,5%	187 64,5%	4.79	16.49	28.19	50.53	57.76	4 48	37 76	0.62
Embas-neyti	141 29,9%	331 70,1%	12.69	16.31	11.18	40.18	43.86	3.81	52.33	0.48
Endabat-sahma	156 31,5%	340 68,5%	13.24	26.47	19.12	41.17	44.35	3.63	52.02	0.48
Hahaile	132 30,7%	298 69,3%	16.11	17.11	21.81	44.97	43.49	4.65	51.86	0 48
Adua Average	31.9%	68,1%	11.71	19.10	24.98	44.21	47.37	4.14	48.49	0.52
Tembien										
Aber-gelle	88 27,2%	235 72,8%	3 43	13.30	7.30	75.97	41.18	2.47	56.35	0.44
Degua Tembien	114 34,5%	216 65,5%	10.65	25.93	12.04	51.38	45 76	4.24	50.00	0 50
Keyih Tekli	226 32,3%	473 67,7%	8.25	22 41	17.55	51 79	47.21	2.72	50.07	0.50
Tembien Average	31.3%	68,7%	7.44	20.55	12.30	59.71	44.72	3.14	52.14	0.48
Zone Average	31,7%	68,3%	9.58	19.83	18.64	51.95	46.05	3.64	50.31	0.50

* 15 years can be also considered as the transition age between childhood and adolescence.

Notes:

(1) What we see from the table is that labour-wise, household members can be divided into three classes: (1) the *pre-productive* (including, in general, children less than 15 years old), and comprising about 45% of the total population; (2) the *productive* (including, in general, adults from 15-64 years of age, and comprising about 50% of the population; and (3) the *post-productive*, comprising about 5% of the population.

(2) There are some remarkable variations between the weredas in this table. First, we see that in Abergelle, very few persons above ten years of age are non-participatory (3.43%). This percentage increases substantially when coming to Hahaile (16.11%). Correspondingly, we find that in Abergelle more than three quarter of the population is engaged fully in agricultural

activities. This amount decreases to far less than half in Embasneyti, Endabatsahma and Hahaile There are several explanatory factors that must be attended to in order to comprehend these differences. School attendance, for instance, is very low in Abergelle (about 2.1% of the total population as against 14% in Hahaile and more than 17% in Adi Afherom, see table xx, chapter 7). It is reasonable to believe that low school attendance will lead to higher participation in agricultural tasks. Another factor is land availability, which is high in Abergelle, and low in Embasneyti, Endabatsahma and Hahaile (see table 6.3: Estimated population size, cultivable area and density per hectare...). High land availability means that more persons can be employed fully in agricultural pursuits, low land availability means that more persons have to seek employment outside farming. The third factor to be recognized is the importance of livestock as an activity to employ the local labour force (see table 6.25). In Tembien livestock is much more important than in Adua, and in Tembien, Abergelle and Keyih Tekli are, in this respect, outstanding. A high number of livestock means also a high number of care-takers, e.g. herders. Very often, youngsters function as herders, especially for the smallstock around the villages. This, of course, increases the amount of people engaged in agricultural activities.

6.4 Capital as a production factor

6.4.1 Ox-Cultivation

As oxen, including ploughing equipment, are the most crucial capital items in Tigrayan agriculture, special emphasis will be put on this factor.

6.4.1.1 Training and use of oxen

The training of bulls for ploughing usually starts when they are at the age of 3-4 (sometimes up to 5) years depending of their strength. At this stage the weight of the bulls is approximately 250-300 kilogrammes. By now, the bulls are physiologically mature, implying that they can breed.

Usually the bulls are castrated at the age of 6 years (sometimes down to 5 if they are considered to be strong enough). At this stage the weight of the bulls are usually between 300-400 kilogrammes. The oxen are now fully utilized for ploughing.

There are mainly two reason given for the castration at this age: (1) The bulls have the "strength" to be castrated, i.e. they are fully grown, and the castration will not effect the strength, growth and viability of the beast.
(2) The breeding capacity of the bulls have been utilized for 2-3 years.

The bulls are at the height of their strength, efficiency and "cleverness" when they are between 8-9 years. They then weigh about 450 kilogrammes.

The bulls usually continue to plough up to the age of 10-12, sometimes even up to the age of 14.

It is more the nutritional status than the type of breed that determines the delayed ploughing age for the Tigrayan oxen. During the dry season they only feed on straw from the cereal crops, and some amount of hay. They compensate during the rainy season by feeding on, among other things, rich leguminous grasses.

6.4.1.2 Ploughing pattern

Ploughing pattern depend on type of crop, altitudinal zone and status of the rainfall.

The common plough used throughout the highlands of Ethiopia and Eritrea belongs to the category of 'breaking' ploughs. Instead of turning the soil, it breaks it. Thus ploughing has to be repeated three to four times before an adequate seedbed is prepared. The first ploughing take place in the dry season. This ploughing, which crumbles the soils, is meant to increase the rate of rainfall absorption and reduce the speed of run off water. (FAO 1961: 141) After broadcasting the seeds, they are covered by means of another ploughing, which becomes a substitute for harrowing. This does include taff and finger millet as these seeds are so small that another ploughing would "drown" them.

The depth of the ploughing varies between 5 to 10 centimeters, and the traction-power requirement is 150 to 250 kilograms under normal soil conditions, but is very much higher when the soil is dry. The weight of the plough is between 17 to 21 kilograms. Almost every farmer prepares the wooden parts of the plough himself.

The area worked with the plough is 150 to 300 square meter per hour, and as ploughing has to be prepared four times, a large amount of working time is needed. Although the plough implements are rather simple and rudimentary, there are three main reasons why they have been used for so long: they are very cheap; they are light; and they can easily be repaired. Most of the threshing is also done by oxen, which trample the outspread sheaves until the grain drops out. (FAO 1961: 153-163)

6.4.1.3 Ploughing intensity

A good or "clever" farmer, i.e. a hard-working farmer with sufficient ox-power, will plough a total of four times[20]:
(1) September-October[21], i.e. right after harvesting;
(2) January-March (to ensure the easy percolation of the Asmara rains, if any; to up-root weeds; to prepare the seedbed);
(3) March-May (to ensure the easy percolation of the main rains, plus the same reasons as above); and
(4) May/June/July (last preparation of the seedbed and to cover the sowed seeds).

Ploughing four times does not mean that *each field* is ploughed four times. While the legume fields are, on average, ploughed once, highest priority is given to taff and finger millet, which is ploughed four times. Earlier, finger millet was ploughed up to six times as this crop was generally the first to be sown after fallowing. The fallowed fields needed more preparation than fields in use. Most of the land left fallow is ploughed before the end of the rains in preparation for the next season,

The survey area encompasses different altitudinal zones, with different soil types. Hence, there is a variation in the ploughing intensity for the same type of crop from area to area.

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[20]Usually the farmers plough when there are some soil moisture, i.e. after a rainfall, or when there are still some moisture left after the crops have been harvested. This beause moist soils are easier to plough than dry soils. Fields that have been fallowed will be ploughed even if no rains have fallen. But fallowing is generally not practiced anymore.

[21]This is most common for the fields that have been cropped with barley as this crop matures so early that some soil moisture will still be left after it is harvested.

Table 6.6: Average number of ploughings of the major crops at different periods in the agricultural cycle

TYPE OF CROP	NO. OF PLOUGHINGS		
	BEFORE SOWING	AFTER SOWING	AFTER HARVEST
Taff	2	N.A	2
Wheat	3	"	2
Barley	3	"	2
Finger millet	3	1	2
Sorghum	2	1	2
Maize	2	1	2
Horse been	1	N.A.	2
Chick pea	2	"	2
Linseed	1	"	1

Notes: 1. This table does not show the correct picture as the farmers were confused by the question, e.g. "after harvest" is at the same time "before sowing".

2. Post-harvest ploughing depends primarily on the household's ploughing capacity, i.e. the chances for a household with their own yoke of oxen to perform post-harvest ploughing is considerable, while the changes of a oxen-less household to do the same is slim, and secondarily on the type of crop harvested and on the type of crop the household intends to plant in the subsequent agricultural season. As a rule, plots planted with legumes are ploughed after harvest to take advantage of the mulching effect of the crop residues that are ploughed back into the soil. If, on the other hand, the crop residues are used for fodder, which is most common for the cereals, the incentive for post-harvest ploughing decreases. In addition, the plots that will be planted with taff the next season will be given first priority to undergo post-harvest ploughing; second priority is given to wheat. Least priority is given to maize and sorghum.

Table 6.7: Average hours of ploughing per day for the household sample

HOURS OF PLOUGHING	NO. OF HOUSEHOLDS	PERCENTAGE
1 - 3 hours	8	1.3
3 - 6 hours	149	23.9
6 - 8 hours	268	43 0
9 - 12 hours	198	31.8
Total	623	100.0

Table 6.8: Average time of ploughing per day in the different weredas within the survey area

WEREDA	AVERAGE TIME IN MINUTES
Adua	
Adi Ahferom	472 (7h 52min)
Embasneyti	386 (6h 26min)
Endabatsahma	373 (6h 13min)
Hahaile	452 (7h 32min)
Adua Average	**421 (7h 01min)**
Tembien	
Abergelle	520 (8h 40min)
Degua Tembien	424 (7h 04min)
Keyih Tekli	511 (8h 31 min)
Tembien Average	**485 (8h 05min)**
Zone Average	**453 (7h 33min)**

Table 6.9: The average number of days spent for ploughing and the respective proportion of households

NUMBER OF DAYS	NO. OF HOUSEHOLDS	PERCENTAGE
Zero ploughing	42	6.5
Less than 1 day	4	0 7
1 - 3 days	212	33
3 - 7 days	200	31
7 - 10 days	106	16.5
11 - 15 days	52	8.1
16 - 20 days	18	2.8
21 - 30 days	4	0.6
Above 30	5	0.8
Total	643	100

Comparing with the information from FAO (FAO 1961: 153-156), a pair of oxen can plough 150-300 square meter per hour. As each farm is on average , 0.9 ha, 30-60 hours are required per farm. But as each field is ploughed at an average 3 times, this implies a total ploughing time of 90-120 hours per farm. When two farmers pair their oxen, this will then imply that the team of oxen will be used 180-240 hours per year. Within an average ploughing time per day of 7.5 hours, this means 24-32 working days per year. This corresponds well with local opinions saying that a pair of oxen have power and endurance to work from about 25 to a maximum of 50 days per year.

Knowing that each farm household on average has 3 fields which optimally should be ploughed 3-4 times. it is quite obvious that the three first categories (zero ploughing, less than 1 day, and 1-3 days), altogether about 40%, are clearly under-cultivating their land; the 3-7 days category is at a medium level ploughing each field 1-2 times; whereas only the categories from 7-10 days and onwards cultivate their field according to a somewhat accepted standard. Proper cultivation, i.e. to cultivate all three fields 3-4 times would need 12-16 days of ploughing.

6.4.1.4 The importance of ox-ploughing

Ox-cultivation has been a common practice in Tigray since the inception of the Axumite civilization more than 2000 years ago, and today, agricultural production is completely dependent upon the oxen and the ploughs. The deforestation of the cultivated zones observed today can, to a large extent, be
referred back to the prolonged use of the plough which have required fields cleared of trees.

Oxen are, however, much more than just a source of energy. For the local people, ownership of plough-oxen is related to economic viability, to independence and self-sufficiency, to status and prestige, and the opportunity to earn material wealth. A common way of classifying people is to use the criteria of ownership to oxen. This implies that within the majority of villages in Central Tigray, a family that owns a pair of oxen by themselves is considered to be rich. A family with one oxen which is they usually pair with a neighbour's oxen, is considered to be medium in wealth. Oxen-less people are generally regarded as poor. Using these local status and wealth divisions on the tables below (especially table 6.6 and 6.7), we may conclude that about 36% of the farm families in the survey are considered poor[22]; about 17% are considered rich; and about 47% are considered middle.[23] A large proportion of middle households will.

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[22]Among the poor households, the poorest will be those that lack both oxen and male cultivation labour. These households will quite regularly hire out all their land, and thus be totally dependent on others for their survival.

[23]According to Save the Children (1993): "Making Ends Meet", a survey undertaken in Northern Ethiopia (including most of Tigray), 49% of the households owned no oxen; 29% owned one ox; and 19% owned two or more oxen. According to Hendrie (n.d.), doing field work in two tabias within Degua Tembien wereda (one of the

in demographic and socio-economic terms, either be expanding, i.e. on their way up, or decreasing, i.e. on their way down.

People give the highest preference to be self-sufficient with animal power, but having one oxen which they can pair with another oxen owned by another household, is considered to be a partly viable condition as they themselves then can, to a substantial degree, plan and programme their farming activities.

To be oxen-less is to be non-viable as you depend on other families for your own survival. The situation for these poor households, who also need to have their fields ploughed, is extremely difficult and vulnerable as they themselves can not plan and perform agricultural activities at optimum stages. They depend entirely on the good-will of others from whom ploughing services can be borrowed, hired, bought, or "exchanged" with land, labour, straw or hay. Their first priority when it comes to get access to plough-oxen is to seek assistance from relatives, usually fathers, brothers (including cousins), sons, fathers- and brothers-in-law.

Oxen holdings are important regarding a household's strategies for securing its survival and continuity. Oxen-less households with enough male labour may exchange labour days for ploughing days. They may also exchange straw or hay for ploughing days. If there is no male labour, or if this resource is scarce, a household may rent out all or some proportion of its land for a certain part of the yield (see the *tewefari* arrangement below, table 6.xx). A household with surplus of ox-power may rent out their services to others for money, grain, labour, straw, hay or a certain proportion of the yield.

As the availability of plough-oxen greatly affects a household's cropping calendar, and as oxen-less households are forced to seek assistance from others who will prioritize their own farms, the poor households are recognized for late ploughing. Lack of oxen does not only affect the timing and scheduling of ploughing, but also on the number of ploughings. Consequently, poor households not only plough too late, but also too infrequent, resulting in poor yields. When we, in addition, know that they often have to pay a significant part of their yields to the owners of the oxen (see table 6.8), the situation for poor farmers is utterly vulnerable.

The following tables describe the ownership to oxen, ploughing intensity and coping strategies of the survey area.

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sample weredas for this study) in the period of June 1993-January 1994, found that the variation between a well-off tabia in the highlands and a poor tabia in the mid-lands was the following regarding oxen: 33.6% and 39.2% respectively owned no oxen; 43.0% and 41.2% owned one ox; and 23.5% and 19.7% owned two or more oxen.

Table 6.10: Distribution of households' ownership to plough-oxen, 1986 Et. Cal.

WEREDA	PROPORTION OF HOUSEHOLDS		Aver. no. of oxen per h.hold
	Without oxen	At least one ox	
Adua			
Adi Ahferom	44.64	55.36	0.57
Embasneyti	34.74	62.26	0.76
Endabatsahma	41.90	58.10	0.76
Hahaile	56.00	44.00	0.51
Average Adua	**44.38**	**55.62**	**0.66**
Tembien			
Abergelle	23.29	76.71	1.04
Degua Tembien	40.28	59.72	0.74
Keyih Tekli	22.70	77.30	1.11
Tembien Average	**27.27**	**72.73**	**0.99**
Zone Average	**35.83**	**64.17**	**0.83**

Also regarding the possession of plough-oxen we see substantial differences between the weredas. Whereas the households in the livestock rich weredas of Abergelle and Keyih Tekli are rather well-off regarding oxen, the situation is more critical for the weredas in Adua, especially for Hahaile and Adi Afherom. As we know that a household to be considered viable needs a pair of oxen, a low proportion of households in Hahaile and Adi Afherom are viable. In Hahaile we see clearly the relationship between female headed households and oxenless households, i.e. here we find the highest proportion of female headed households and the highest proportion of oxenless households.

The low proportion of households with a full yoke of oxen in these weredas means, additionally, that to hire oxen is more precarious as hiring prices will be higher, and the position of the landowner towards the *tewefari* (see below) will be weaker. It is quite possible to state that in Central Tigray land ownership is less crucial for a household's socio-economic status than ownership to traction power. A "clever" farmer with a pair of oxen can quite often get control over a considerable amount of land, whereas a "poor" farmer with a reasonable amount of land can become a "client" of the "ox-patron".

In 6.7 (below) is listed both those households that are self-sufficient in ox-power, those who are semi-sufficient, and the coping mechanisms employed by those households which are lacking this component wholly.

Table 6.11: Distribution of households' main sources of ox-power

WEREDA	MAIN SOURCES OF OX-POWER								
	Self-suff.	Pairing	Hiring	Tewe fari*	Rela tives	Labour excha.	Straw excha.	Other	Total
Adua									
Ad. Ahferom	1 8	57 1	-	-	33.9	-	7 2	-	100
Embas neyti	12 8	51 1	1 1	10 6	24 5	-	-	-	100 1
Endabat sahma	19 1	39 1	2 9	23 8	14 3	0 9	-	-	100 1
Hahaile	9 1	36 4	-	15 6	28 2	8 1	-	7 1	100 5
Average Adua	10.7	45.9	1.0	12.4	25.2	2.3	1.8	1.8	100 1
Tembien									-
Abergelle	26 0	52 1	4 1	5 5	6 9	5 5	-	-	100
Degua Tembien	15 3	44 4	4.2	15 3	8 3	8 3	2 8	1 4	100 1
Keyih Tekli	31 9	46 8	-	14 2	2 8	4 3	-	-	100
Tembien Average	24.4	47.8	2.8	11.7	6.0	6.0	0.9	0.5	100 1
Zone Average	16.6	46.7	1.8	12.1	17.0	3.9	1.4	1.2	100 7

* The *tewefari* is an ox-owner who ploughs a farmer's (landowner's) field(s) on a share cropping basis. In some area, it is most common for the tewefari to be a relative of the landowner, e.g. a nephew. In other areas the landowner will primarily seek a tewefari that will give priority to the ploughing of his/her land. A highly motivated tewefari will give a higher produce than a less motivated one. The components of the share-cropping contract, e.g. the inputs from both the landowner and the plougher (tewefari) will vary, and so will their respective shares of the output. Quite frequently, it is female headed households which enter into tewefari contracts as these households often are poor, i.e. oxen-less, and because it is not culturally accepted for the females to plough.

Notes:

1. There are certain discrepancies in percentages between this table and table 6.6. F.ex., in table 6.6 it is said that in Adi Afherom 55.36% own at least one oxen, while in this table it is indirectly said that altogether 58.9% (1.8% "Self-sufficient" and 57.1% "Pairing") own at least one oxen. These variations relate mainly to the difference between "ownership of oxen" and "main sources of ox-power". A farmer may own an ox that is not used for traction because it is old or sick, or because it is under training. Also some farmers may say that their major source of ox-power is relatives even if they have one ox by themselves. It is also possible to pair an ox that you have borrowed from a relative (for instance your father). We may also have the situation of a female headed household that owns an ox, but apply other sources for ox-cultivation (f.ex. a son ploughing for his widowed mother). As the farmers could only give one answer, they may sometimes have to choose the answer which they feel is closest to reality.

2. Also here we can observe a significant variation between the weredas. Whereas in Adi Afherom less than 2% are self-sufficient in ox-power (meaning that they own a full yoke of oxen), this number is 26% in Abergelle, and almost 32% in Keyih Tekli. From the table we see that pairing (two households with one oxen each teaming them together for ploughing) is the most applied (and preferred) second choice. For those without oxen, borrowing from relatives (usually father, brother or son) is the most employed (and preferred) option, followed by a *tewefari* arrangement. The latter is mostly used by female headed household with no adult sons. Indirectly, we can read from the table that the number in the first column are the households owning one yoke of oxen, the second column consists of households with one oxen, while the rest are, generally, oxen-less.

Table 6.12: Distribution of *tewefari's* share of output

SHARE RATIO	PERCENTAGE
One fifth	1.2
One fourth	7.1
One third	8.2
Half	77.6
Two third	1.2
Three fourth	4.7

As can be seen from table 6.11, it is most common for the tewefari to keep half of the produce from the fields they are ploughing.

6.4.2 Seeds

Lack of seeds are almost as crucial as lack of oxen for a great number of farmers. In table 6.31 we see that almost 25% of the farmers mentioned seed as either priority one, two or three regarding the most important agricultural constraint.

6.4.2.1 Seeding rates for the major crops

The amount of seeds necessary for one gibri of land will vary both according to the size of the *gibri*, types of crops, types of soil and climate. In general terms we might say that an average farmer with an average farm, will use the following rates for the main crops:

Main crops	Amount of seeds[24] per tsimdi Menelik[25]	per hectare Kilogrammes	Kilogrammes/hectare
Hanfets	40-45	26.5 - 30.0	106.0 - 120.0
Taff	10-32	6.6 - 21.3	26.5 - 85.2
Barley	30-96	15.0 - 48.0	60.0 - 192.0
Wheat	20-40	13.0 - 26.5	52.0 - 106.0
Finger millet	8-25	5.3 - 16.5	21.2 - 66.0
Sorghum	16-40	10.5 - 26.5	42.0 - 106.0
Maize	16-40	10.5 - 26.5	42.0 - 106.0

Crop trials performed in some weredas suggest a tripling of yields by the use of imported seeds. This gain, however significant, must be evaluated against increased costs; the communities' taste responses; and their sustainable adaptability to the area. Hence, before a general introduction of exotic seeds, it will be wise to evaluate the merits and the anticipated constraints that might emerge.[26]

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[24]Besides the more peculiar individual differences in seeding rates between the farmers, the seeding rate will, in general, also vary with fertility of the soil. This means that more seeds are used on poor, sandy soils than on rich loamy soils. This is partly due to the low nutrient capacity of the soils in itself, but also due to the fact that the tillering capacity of most cereals decreases substantially in poor, sandy soils. In addition, the huge variation in seeding rate must, most importantly, also be attributed to the fact that the size of a *tsimdi* varies considerably from place to place, most probably with a difference of more than 50%. As a *tsimdi* depicts the area that is cultivated with a pair of oxen for one day, some soils are much easier to plough than others, implying that the ploughed area will be larger there.

[25]A menelik is a common measurement unit in Tigray. A menelik is a cup which actual content may vary somewhat from area to area. In this table we have calculated with an average of 2 menelik of barley to be 1 kilogramme, and 1.5 menelik of all other cereal crops to be 1 kilogramme.

[26]During the questionnaire interview, a farmer was asked the question: "What are the crops which used to be widely spread up to about 20 years ago but have lost their importance since then?" His answer was, in his own words: "You see my brother. I am born in this area and now I am in my fifties. What I observed is that the duration of the rainy season and the intensity of rain has shown a radical change As I remember it, twenty years ago the duration of rains we were receiving was from late May and lasting up to mid-September, and the intensity was better. But presently, we mostly have a rainfall duration not exceeding 45 - 50 days. Moreover, the intensity is considerably lower. During this period of time, we observed that some varieties of crops grew successfully, and others to fall down. For instance, there are two varieties of barley: one which was widespread 20 years ago, and the other variety which is currently becoming popular. The first variety required longer

What we can learn from the on-going trials is that farmers are good experimentators, that they have the necessary practical experiences, and what they actually need is assistance to link their local practices and expertise to improved knowledge and practices. It is also important that local seed strains should be favored before taking measures to introduce exotic seeds.

As seeds are such a crucial element in agricultural production, the importance of table 6.13 (below) is to depict the most important sources for seeds for the farmers in Central Tigray.

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duration and amount of rainfall, whilst the recently introduced one can cope with the current climatic situation." He paused, and was then asked: "From where do you get the latest variety ?" He responded: "It is the descendant of the first, and no one supplied us, but in the field we observed that as the time changed, the crop itself has shown a slow change, and we observed a different variety scarcely dispersed. Then after harvest, we tried to pick up the new strains of seeds, and accumulated them, and finally planted them not mixing with the original seed. We gained a better output and since then this variety has become widely spread all over the area and the previous seed is almost non-existent."

Fig. 4 Percentage Distribution of Respondents by Plot Catagory

in the Sampled Weredas of Central Tigray

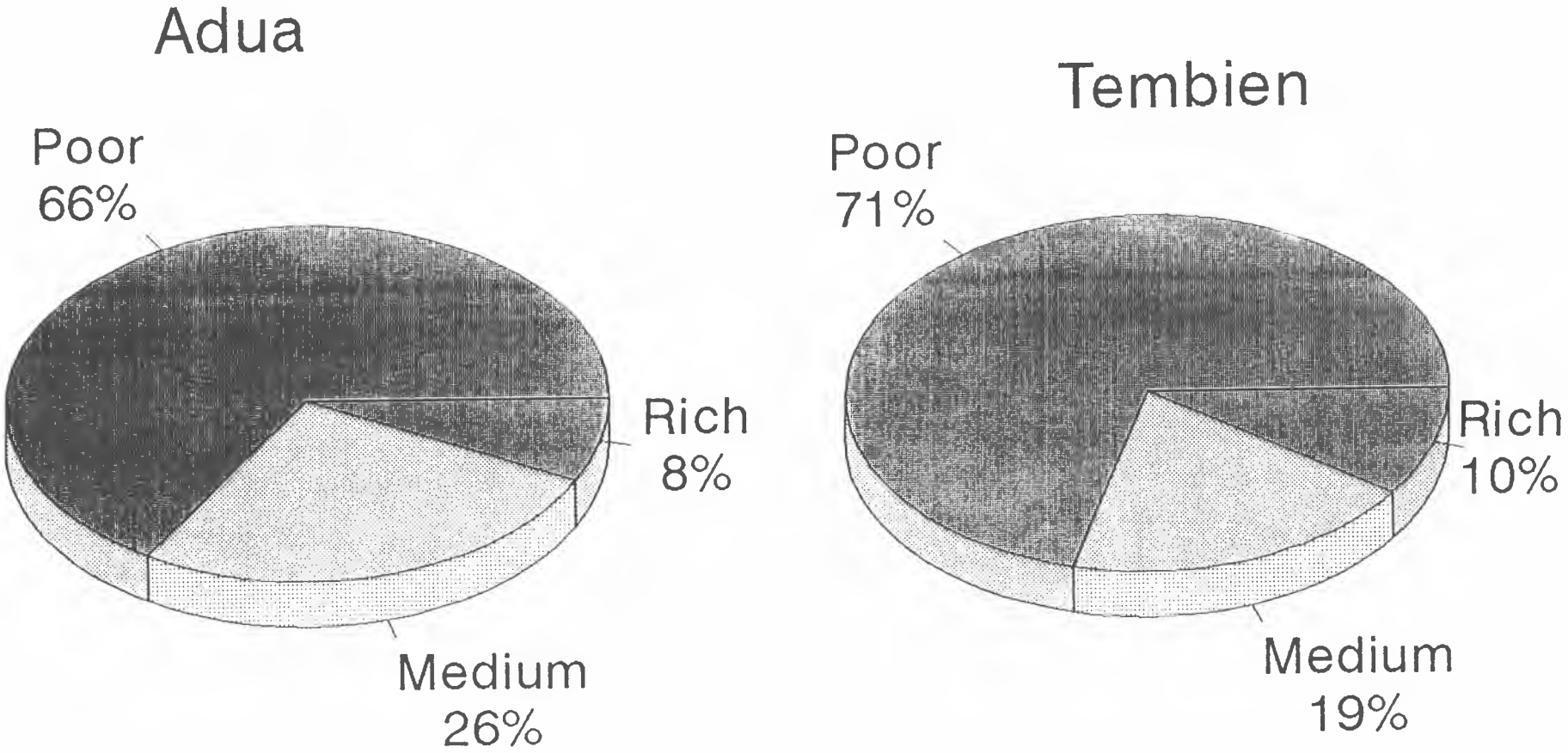

Table 6.13: Percentage distribution of households by major sources of seeds, 1985 Et.C.

WEREDA	MAJOR SOURCE OF SEEDS					
	Own production	Market	Relatives	Seed[27] bank	Aid	Others
Adua						
Adi Ahferom	45.9	36.5	3.8	4 4	0.6	18.2
Embasneyti	56.4	57.5	2.4	6.3	-	19.5
Endabatsahma	42.2	53.9	11.7	1.4	0.4	2.8
Hahaile	48.0	34.9	15.8	1.3	2.0	16.4
Adua Average						
Tembien						
Abergelle	77.3	18.7	3.9	-	-	-
Degua Tembien	65.3	52.2	6.4	2.4	-	0.7
Keyih Tekli	65.3	52.2	6.4	2.4	-	0.7
Tembien Average						
Zone Average						

It should be added that 1985 (Et. Cal) was a well above average year when it comes to agricultural production due to the good rains. Therefore we see that seeds from aid is of minor importance. Even if most household struggle very hard to keep their own seeds, in poor years the amount of seeds from aid increases significantly.

[27]A seed bank is a communal institution where a group of experienced farmers, appointed by the village council, throughout the agricultural season surveys the different fields within the area, particularly the fields of well-known "clever" farmers. The whole intention of this practice is to improve the communal stock of seeds. At harvest, the group selects - after specified criteria - the best seeds of the various crops from the surveyed fields. These seeds are then stored in granaries in a storage house within the compound of a selected and entrusted seed bank manager. Before sowing, households in the area may apply to the council to receive a portion of the seeds from the bank. Poor households are given priority when seeds are distributed. The seeds must be paid for either in cash or kind. Usually, a specified amount of seeds are returned at the next harvest. In most areas the demand for this locally improved seeds is much higher than the supply.

6.5 Cropping system

6.5.1 Major crops

The major food crops harvested in the area are, taff, barley (*segem*), *hanfets* (a mixture of wheat and barley), wheat *(sirnay/sinday/tsendai*), finger millet (*dagusha*), sorghum (*mishela/zengada)* and maize (*mishebahri/efun)*. In addition leguminous crops like chickpeas (*shimbra/ater*), lentils (*baurshin*), horse beans (*alquai*), and *engweya* (grass pea/chicken vetch) are grown. Horse beans are typical for the "humid" highlands. The legumes are generally used for sauce to go with the njerra. Root and tuber crops are generally not grown.

Taff (*Eragrostis abyssinica, E. teff)*. The seeds are extremely small (1-1.5 millimeters in length and 0.75-1 mm in width, firm and heavy, weigh about the same as wheat per hectoliter, 2,500-3,000 grains per gram). Taff is cultivated in all altitudinal zones, though the best climatic conditions are found at about 1,900-2,400 meters. Quite commonly, only brown taff is cultivated above 2,500 meters. As the tiny plants dies off easily in soils which dries out easily, adequate soil humidity is required. This need good soils and careful seedbed preparation. As the small plants have difficulties in competing with tougher plants, careful weeding is necessary. On the other hand, taff is very resistant to most pests and diseases.

Most of the taff is sown in June-July, but the sowing may start in May and extend to August from area to area. The red (or brown) taff ripens in the hawsi degua in about three months and three weeks. The white taff ripens in four months. Yields vary greatly according to altitude, soil and way of cultivation. The estimates range from three to a maximum of eight quintals per hectare. On fertile soils of medium elevation, taff may produce up to 10 quintals per hectare, but, as a rule, yields are lower. White taff has a somewhat lower yield than red. Since taff contains very little gluten, it is not suitable for leavened bread. The straw is an excellent fodder.

Barley, *segem*, (the "dark" season crop) varieties in Tigray are generally early maturing, about 90 days, but varieties down to 80-85 days are found. In general the two-row barleys are earlier than the six-row barleys. Most varieties tiller heavily, and one kernel may produce up to 26 stalks. The barleys have rather, long big kernels (1000 kernels weighing between 31.5 to 64.8 grams, average 45 grams). The population distinguishes two barley types - awned or 'gabs', and awnless barley or 't'amaj'. Barley is a typical highland crop, and its zones of cultivation corresponds with that of wheat. The barley-wheat cultivation is rare under 1,900 meters. In the highest arable plots at 2,900 meters only barley is cultivated. Of the barley varieties: two- row barleys predominate in Tigray and Eritrea. Barley (and wheat) are sown in the middle of the main rainy season, about the end of July or the beginning of August. Harvest is in November and December. Barley generally yields between 4-10 quintals per hectare. Barley is mainly produced for the preparation of breas and the local beverage *sewa*.

In Tigray today barley is mostly used for *sewa* (a local traditional beverage), *enjera* (often mixed with taff), *kollo* (roasted grains), *besso* (roasted and milled barley mixed with some boiled water and butter, or only with cold water. Eaten as small balls), or *tihlo* (almost the same as besso, but mixed with more water and some hot spices).

Most **wheats**, *sirnay/sinday*, are distinguished by their early maturity, but their productivity is not great. Wheat is usually found in zones with a temperate climate, and a moderate to high rainfall pattern, regularly in areas between 1,500 and 2,500 meters. The main cultivation centers are between 1,800 and 2,200 meters. Wheat is sown around July and August; heading is between the end of September and the beginning of October; and harvesting is in November-December (up to January). Yields are most often between 4 and 10 quintals per hectare.

Maize *(mishebahri/efun)* is said to have been introduced by the Portuguese in the sixteenth or the seventeenth century. Late types are prevalent. Maize is mostly grown in areas with a higher rainfall. It is very susceptible to frost, and it does not grow well above 2,400 meters.In many areas it is competing with sorghum which presents less cultivation problems. The sowing time is chosen in a way most likely to ensure a sufficient rainfall during heading. The most suitable time for the highlands is from April to May/early June. Maize is mostly sown broadcast. Ripening period vary from 4-7 months. An average yield under reasonably favorable circumstances is 8-9 quintals per hectare, but most often yields are considerably smaller (4-6 quintals per ha).

Sorghum *(mishela/zengada)* is extensively cultivated. It is very popular because of its hardiness and easy cultivation. In Tigray, mostly moderate to late varieties are grown (4-6 months). Sorghum can be grown up to altitudes of 2,500 meters, but the best areas are found around 1,800 meters. Sorghum is more drought resistant than any of the other cereal crops grown in Central Tigray. Sowing is done in March, April and May, most often before the beginning of the rainy season. Heading starts in the beginning of the dry season. Yields in normal years will average
5-10 quintals per hectare. Sorghum is used both for unleavened bread and for *sewa*.

Finger millet, *dagusha*, is a popular crop, and is considered to be from medium to high yielding. As with sorghum, finger millet is only sown if the rainy season starts early. Dagusha is mainly used for beverage.

Leguminous crops and oil crops are widely cultivated and consumed since religious customs among Christians prohibit the use of animal products for a large part of the year. (FAO 1961: 197)

6.5.2 Cropping Pattern

Even if significant similarities are found, there exist a plurality of cropping patterns in Central Tigray. The variations are generally related to micro-environmental conditions caused by differences in soil type, altitude and climate. As a general rule, it is possible to say that the lower the area, the more important are sorghum (and, secondarily, maize and finger millet); and the higher the area, the more important are wheat (and secondarily, hanfets and barley). Taff is, due to its economic and sociocultural importance, grown in most areas if soil conditions are adequate (requires sandy-clay to clayey soils), but white taff, the most preferred type, is mostly grown in the highlands.

White taff is, as already stated, the most preferred crop, it is followed by red taff, wheat, hanfets/kirkata[28], barley and finger millet. Sorghum and maize are not commonly used as bread grains. Both crops are appreciated for their high yields, but disapproved because they need a long growing period. In addition, these two crops are harder to grind, and hence not that much liked by the women since they are laborious.
Regarding quantity, it is our impression that barley is, over-all, the mostly grown crop. One important reason is that it is the fastest growing crop, and that it does not demand fertile soils. The lowland show some preference for sorghum as it is considered to be drought resistant.

The survey results show that while there is high proportion of sorghum in the lowland areas, wheat is most commonly planted in the high and mid altitude areas. Lack of seeds is one major factor for the variability of cropping pattern in the area. Some farm households are sometimes forced to plant seeds which is available at their hand and which is not so much common in the area (see table 6.xx??).

Fallowing is, typically, not performed in Central Tigray. But there are some exceptions: in areas where land quality is generally poor, i.e. most of the soils are infertile and shallow, the poorest plots are often not cultivated; if there is lack of seeds, some portion of the land is not cultivated; if there is lack of ploughing power, some land is left uncultivated; and if there is lack of labour, some land is regularly not cultivated, especially if the land is poor.

The following table shows the proportion of households plantation of the major cereals during 1985 Et. Cal..

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[28]Both term means a blend or mixture. As agricultural terms they mean a mixture of barley and wheat.

Table 6.14: Percentage distribution of the major types of crops planted during the agricultural season 1985 Et.Cal.

WEREDA	TYPES OF CROPS											
	Barley	Fingmillet	Horsebean	Linseed	Maize	Sorghum	Taff	Wheat	* Hanfets	Red Sorghum	Other	Total
Adua												
Adi Ahferom	8 8	-	7.5	-	7.5	-	18 9	30.2	10 1	-	17 0	100
Embasneyti	10 1	15.3	-	-	14 6	-	8 4	-	18.5	13 2	19 9	100
Endabatsahma	8 9	8 5	-	-	-	14 9	19 5	-	12 4	8.9	27 4	100
Hahaile	-	-	14 4	-	-	12 4	15 8	9 4	20 1	7 0	20 9	100
Adua Average									16.8			
Tembien												
[illegible]	5 4	-	-	7.9	19 7	34 0	26 6	-	-	-	6 4	100
[illegible] Tembien	19 1	-	13 6	-	-	-	19 1	21 8	-	6 4	20 0	100
Kevih Tekli	4 0	11 4	-	-	24 6	14 5	28.3	-	-	11.1	6 1	100

* Other crops include sesame, vetch, fenugreek, etc..

As we see, taff is grown in all seven weredas irrespective of altitude, latitude or longitude. Taff is the "cultural" crop in the sense that it used for the most important rituals and celebrations. In addition, taff, and in particular the white variety, receives the highest price in the market. After taff, barley is most commonly grown (six weredas). If both the white/yellow and the red sorghums[29] are seen together, sorghum is also cultivated in six of the seven weredas, and by an average varying from 6.4% of the farmers in Degua Tembien, to 34% in Abergelle. Sorghum is hence characteristic to Abergelle and other lowland areas of the weredas Endabatsahma and Embasneyti. Horse bean and lentils are most common to highland climate, as for instance found throughout Degua Tembien. Wheat is also most common to Degua Tembien and to the high-altitude areas of Adi Ahferom.

We can correlate the information from table 6.xx above showing the most important seeds sown, with table 6.xx below showing the preferred types of crops used for food.

[29]Red sorghum, *lequa*, is bitter and not very palatable. It is mostly grown because it is drought resistant. This crop is mostly used for brewing beer.

Table 6.15 - Distribution of Households by Major Crops Used for Food

WEREDA	TYPES OF CROPS										
	BARLEY	MILLET	HORSE BEEN	MAIZE	SESEMUM	SORGHUM	*taff*	WHEAT	* *hanfets*	RED SORGHUM	OTHER
Adua											
Adi Ahferom	9.0	-	17.7	-	-	10.5	0.4	20.6	-	-	41
Embaseneyti	12.1	11.5	8.6	-	-	-	8.6	12.6	12.6	-	34.
Endabatsahma	12.2	8.4	-	-	-	13.3	19.3	15.5	14.7	-	16
Hahaile	6.5	-	16.3	-	-	10.3	15.2	19.9	16.8	-	15.
Adua Average											
Tembien											
Abergelle	-	-	6.8	13 1	10.0	12.4	12.3	-	-	-	38.
Degua Tembien	15.3	-	15.5	-	-	-	12.1	14.2	-	-	42.
Keyih Tekli	9.0	13.7	-	21.9	-	13 4	26.4	-	-	7.3	8.
Tembien Average											
Zone Average											

6.5.3 Crop Production

Although the agricultural system includes some pastoral components, crop production is absolutely the most important activity in Central Tigray as a whole. This can be seen when examining the food intake among ordinary farm families. In general, it can be said that their daily diets consists of various types of "bread" made from the different cereals: *enjerra* (soft, flat, pancake-looking bread) primarily (and preferably) made from a fermented taff batter (*bihuk*), but also from taff in combination with other cereals (or even completely without taff, e.g. barley, finger millet, sorghum, maize); *banni* (rolls) made from wheat (mostly found in towns). *hambasha* (big, round, 3-4 cm thick breads) made from wheat; flatbread from barley. Sorghum and maize is most often eaten as porridge, or mixed into the "breads". As relish/sauce people use stews or pastes made from legumes and vegetables hotly spiced with green or red pepper. Meat, although very much enjoyed, is not eaten on a daily basis. Thw locally brewed beer (*sewa)* is an important source of nutrition.

As aforesaid, this survey was launched in the period Yekatit - Megabit 1986 Et. Cal. (February - March 1994 Eu. Cal.), and the issue was about 1986's (1993/94) crop yields of the sample households. Based on this, the following results were obtained:

Table 6.16: Average crop yields per household (farm); plot and hectare in *Quintals* (Qt.),

WEREDA	Aver. crop yield per household	Aver. crop yield per plot	Aver.crop yield per ha
Adua			
Adi Ahferom	2.32	0.76	4.00
Embasneyti	2.85	0.95	4.13
Endabatsahma	2.53	0.96	3.84
Hahaile	1.85	0.85	3.70
Adua Average	2.39	**0.88**	**3.92**
Tembien			
Abergelle	5.08	1.68	2.73
Degua Tembien	5.18	1.96	7.00
Keyih Tekli	3.85	1.58	4.05
Tembien Average	**4.70**	**1.74**	**4.59**
Zone Average	**3.54**	**1.25**	**4.25**

Combining the information from this table with the information from table 6.3 and 6.4, we see that the average crop yield per household is partly a function of the size of the land and partly a function of the fertility status of the land. In the weredas of Adua, and in particular in Endabatsahma and Hahaile, where farms are small and soils infertile, both the yields per household and per hectare are low. The picture is somewhat different in Tembien. In Abergelle, the average yield per hectare is very low, but because farms are 3-4 times bigger than the average in Adua, the yield per household are about double to those of Endabatsahma and Hahaile. In Degua Tembien, the average yield per household is about twice the average of those of Adua, due mostly to the richness of the land.

6.5.4 Cropping Calendar

A basic feature regarding in Tigrayan agricultural production is that rainfall pattern, cropping calendar and the major events within the religious calendar have, over many generations, been partially harmonized. But both variations in rainfall and movable religious holidays may create some disharmony at certain intervals.

The cropping calendars from the different parts of Central Tigray vary mostly according to the altitude variations. The cropping calendar, although having some regular items, is not at all fixed, but will be determined by rainfall. Much rainfall in the period from February to March/April, may lead the farmers to plant maize (as a hunger-gap crop) and the long maturing (but also high yielding) sorghum.

In general, the agricultural seasons are associated with rainfall, and the major seasons are:

(1) *Hagay*, from the first part of February to the first part of June. During this season, some small rains, *belg* or "Asmera" rains, will often fall. If these small rains look promising, some belg-crops may be cultivated, e.g. maize and sorghum.

(2) *Kiremti*, lasting from the end of Hagay (beginning of June) to the first part of October. This is the main rainy season, and also the main agricultural season. The planting of the different crops takes approximately one month, finishing usually early-mid July. Then approximately three-four weeks after plating, weeding will start. Weeding usually continues up to the first part of October (end of Keremti). Some harvesting may take place, e.g. of the early barley, and of the belg-crops (if any).

(3) *Kewie*, lasting from the end of Kiremti up to the start of Hagay (October to February). The most important agricultural activities are harvesting (cutting), threshing and storing. Threshing is generally accomplished by using the oxen to trample the grain at particular threshing sites.

Within the last part of Kiremti and the first part of Kewie, a hunger gap usually occurs as the grains from the last season are often consumed while the new crops are not ripe.

6.5.4.1 Cropping calendar in the different weredas

Table 6.17: The standard cropping calendar covering the major crops in wereda Adi Ahferom (Zone Adua)

MAJOR CROPS	CROPPING CALENDAR		
	PLOUGHING MONTHS	PLANTING MONTHS	HARVESTING/THRESHING MONTHS
Wheat	*Tiri - Ginbot* January - May	*Sene - Hamle* June - July	*Tikumti - Tahsas* October - December
Barley	*Tiri - Ginbot* January - May	*Sene - Hamle* June - July	*Tikumti - Hidar* October - November
Taff	*Tahsas - Miazia* December - April	*Ginbot - Hamle* May - July	*Tikumti - Hidar* October - November

Source: Information collected from baitos at the tabia level.

Table 6.18: The standard cropping calendar covering the major crops in wereda Embasneyti (Zone Adua)

MAJOR CROPS	CROPPING CALENDAR		
	PLOUGHING MONTHS	PLANTING MONTHS	HARVESTING/THRESHING MONTHS
Barley	Sene-Hamle June-July	Hamle July	Tikimti - Tahsas October - December
Maize	Tiri - Megabit January - March	Ginbot - Sene May - June	Nehase/Meskerem - Tikimti August/September - October
Red Sorghum "Lequa"	Tiri - Sene January - June	Sene - Hamle June - July	Hidar - Tahsas November - December

Table 6.19: The standard cropping calendar covering the major crops in wereda Endabatsahma (Zone Adua)

MAJOR CROP	CROPPING CALENDAR		
	PLOUGHING MONTH	PLANTING MONTH	HARVESTING/THRESHING MONTH
Barley	Sene - Hamle June - July	Sene - Hamle June - July	Tikimti - Hidar October - November
Taff	Ginbot - Hamle May - July	Hamle July	Tikimti - Hidar October - November
Wheat	Megabit - Sene March - June	Sene - Hamle June - July	Tikimti - Hidar October - November
Sorghum	Miazia - Ginbot April - May	Ginbot - Sene May - June	Hidar - Tahsas November - December

Table 6.20: The standard cropping calendar covering the major crops in wereda Hahaile (Zone Adua)

MAJOR CROPS	CROPPING CALENDAR		
	PLOUGHING MONTHS	PLANTING MONTHS	HARVESTING/THRESHING MONTHS
Barley	Megabit - Ginbot March - May	Sene - Hamle June - July	Tikimti - Hidar October - November
* Hanfets	Megabit - Ginbot March - May	Sene - Hamle June - July	Tikimti - Hidar October - November
Taff	Miazia - Sene April - June	Sene - Hamle June - July	Tikimti - Hidar October - November
Finger millet	Tiri - Miazia January - April	Ginbot - Sene May - June	Hidar - Tahsas/Tiri November - January/February
Maize	Tiri - Miazia January - April	Ginbot May	Nehase/Meskerem - Tahsas August/September - December
Sorghum	Tiri - Miazia January - April	Ginbot May	Hidar - Tahsas November - December
Wheat	Megabit - Sene March - June	Sene - Hamle June - July	Tikimti - Hidar October - November

* A mixture of barley and wheat

Table 6.21: The standard cropping calendar covering the major crops in wereda Abergelle (Zone Tembien)

MAJOR CROPS	CROPPING CALENDAR		
	PLOUGHING MONTHS	PLANTING MONTHS	HARVESTING/THRESHING MONTHS
Sorghum	Ginbot - Sene May - June	Sene - Hamle June - July	Hidar - Tahsas/Tiri November - December/January
Barley	Sene - Hamle June - July	Sene - Hamle June - July	Tikimti - Hidar October - November
Maize	Sene June	Sene June	Tikimti/Hidar - Tahsas October/November - December
Taff	Sene - Nehase June - August	Sene - Nehase June	Hidar - Tahsas November - December

Table 6.22: The standard cropping calendar covering the major crops in wereda Degua Tembien (Zone Tembien)

MAJOR CROP	CROPPING CALENDAR		
	PLOUGHING MONTH	PLANTING MONTH	HARVESTING/THRESHING MONTH
Wheat	Tiri - Ginbot January - May	Sene - Hamle June - July	Hidar - Tahsas November - December
Taff	Tiri - Sene January - June	Sene - Hamle June - July	Hidar - Tahsas November - December
Barley	Tiri - Ginbot January - May	Sene - Hamle June - July	Tikimti - Hidar October - November
Horse been	Sene June	Sene June	Tikimti - Hidar October - November
Lentil	Hamle July	Hamle July	Tikimti - Hidar October - November

Table 6.23: The standard cropping calendar covering the major crops in wereda Keyih Tekli (Zone Tembien)

MAJOR CROPS	CROPPING CALENDAR		
	PLOUGHING MONTHS	PLANTING MONTHS	HARVESTING/THRESHING MONTHS
Finger millet	Megabit March	Miazia - Ginbot April - May	Tikimti - Tiri October - January
Maize	Megabit - Miazia March - April	Ginbot - Sene May - June	Meskerem - Hidar September - November
Taff	Ginbot - Sene May - June	Hamle - Nehase July - August	Hidar - Tahsas November - December
Barley	Miazia - Sene April - June	Sene - Hamle June - July	Meskerem - Hidar September - November

In Central Tigray, the first crops to be planted are usually, finger millet, maize, sorghum to be followed by barley, hanfets, wheat and taff. The importance of maize and sorghum increases with the earliness of the rains. Sorghum because of its late maturing (but high yielding) capacity, maize because it is then used as hunger-gap crop. Maize and sorghum are also important as they do not require the same amount of soil preparation as wheat and barley, and in particular taff. The above crops are planted during the early part of the rainy season (June-July). Legumes like chickpeas, fenugreek, lentils and chicken vetch are usually planted in the late part of the rainy season. The importance of legumes increases with the failure of the cereals. If, for instance, the cereals dries up in the middle and late part of the rainy season, a crop of legumes is often planted in order to secure some output. Chicken vetch, for instance, do often grow on residual moisture.

With the exception of finger millet and sorghum, which may have growing periods of six months and more, the other cereals mature within from three to four months. Barley is usually the quickest. Of the small cereals, the variation between quick and late varieties is usually not more than two-three weeks.

After the crops are planted, attention is given to weeding, and especially to the weeding of the important cash and food crop taff. The importance of taff is manifested in the number of weedings undertaken. While, for instance, crops like wheat, barley, sorghum and maize are weeded once, taff is, at the least, weeded twice, and sometimes three times.

With the exception of some types of crops, such as for example maize, the harvesting process usually commence during the rainless days of September. Harvesting is undertaken with sickles, and is one of the heaviest agricultural activities.

Once the crop is harvested, the subsequent task is to stack it before threshing. Except for maize, which is hand-shelled, threshing is usually undertaken by oxen. Some oxen-less household thresh by hand. With variations from place to place, and from crop to crop, threshing usually lasts up to January.

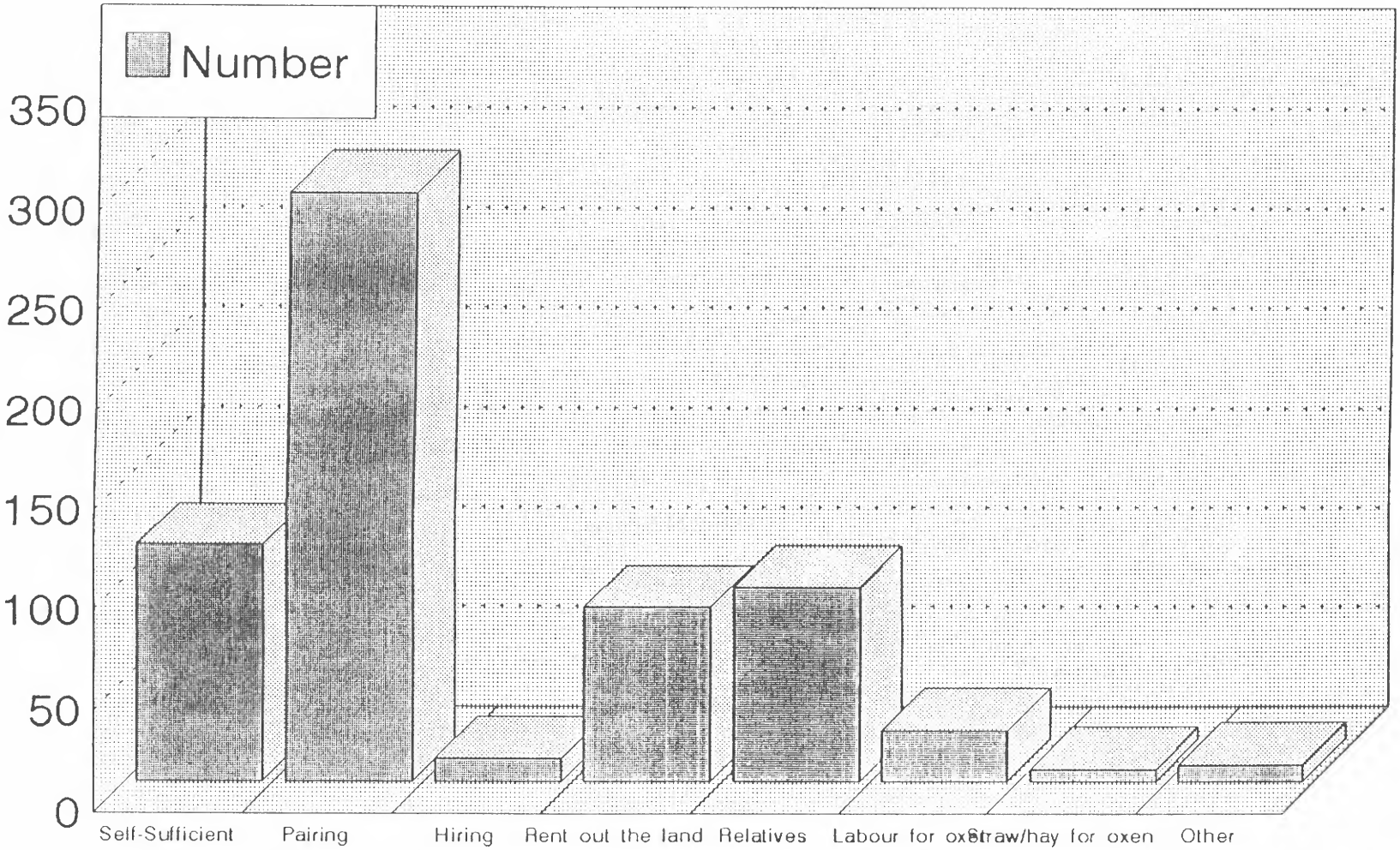
Table 6.24: The three most busy agricultural months of the year and the respective major agricultural activities undertaken

WEREDA	*Ginbot* May	*Sene* June	*Hamle* July	*Nehase* August	*Tikimti* October	*Hidar* November
Adua						
Adi Ahferom	-	ploughing planting	-	fallowing[30] weeding	harvesting threshing	-
Embasneyti	-	ploughing planting	planting weeding	ploughing weeding	-	-
Endabatsahma	-	ploughing planting	planting	-	harvesting threshing	-
Hahaile	-	ploughing planting	-	fallowing weeding	harvesting threshing	-
Tembien						
Abergelle	Ploughing planting	weeding hoeing	planting weeding	-	-	-
Degua Tembien	-	ploughing planting	-	weeding	-	harvesting threshing
Keyih Tekli	-	ploughing planting	planting weeding	-	-	harvesting threshing

[30]Fallowing is here *mitsgae*, a ploughing for a land that next season will be left fallow.

Fig 6 Distribution of Sources of Oxen for Ploughing

in Sampled Weredas of Central Tigray



Number	117	294	11	86	96	25	6	8

From the table we may interpret that the period from June-August is the peak agricultural season, and that the period from December-April is the slack season.

6.6 Livestock Production

As for the rest of the Ethiopian highlands, livestock raising has for millennia been the foundation of the social and economic structure of Tigray. Livestock, and especially cattle do today play an essential part in every agricultural system and community. They are, in the first place, the draft power for the ploughing and cultivation of land is supplied by working oxen. In the second place, they are an investment as wealth is generally measured by land and/or cattle. The return on investment is obtained through the livestock grazing the land, giving off-springs and security and purchasing power. Thirdly, livestock, especially the small stock, are an important source of food. Lastly, they are the major means for transport in an area where most of the marketed produce is carried by pack animals.

While the liveweight of sheep are from 35-40 kilogrammes, the liveweight of mature cattle average 250-350 kilogrammes.

As already stated, the agricultural system of Central Tigray is a mixed system including a small, but still very important livestock segment. The most important constraint on animal production concerns feeding, i.e. it is a lack of produced fodder (straw and hay) and grazing land. Regarding the latter, in addition to the limited area set aside for grazing, the grass production is low due to the poor quality of the range. As first priority is given to oxen, there is not much left for other livestock.

Table 6.25: The total estimated number of livestock in the survey area (based on sample results)

WEREDA	TYPE OF ANIMAL								
	Ox	Cow	Bull	Calves/heifers	Sheep	Goat	Poultry	Equines	Bee-hives
Adua									
Adi Abiyoun	2434	1902	989	2587	1598	4945	10422	1065	685
Emberem	6832	3837	1685	4305	12541	13038	21900	2340	2246
Enda Iyesus	8109	4865	3041	5473	4561	13683	15409	2027	2230
Habte	4398	2501	1294	2329	431	6296	11297	776	1207
Sum Adua	21772	13105	7009	14694	19131	37962	59025	6208	6368
Temben									
Abreelie	9940	8371	5624	4708	1321	29560	37780	1700	785
Dera Temben	9893	5227	4107	5040	3733	10640	29307	3360	933
Kevih Tekl	9984	8307	3113	6381	19220	20932	34784	3424	2179
Sum Temben	29817	21905	12844	16129	24274	61132	101871	8484	3897
Sum zone	51589	35010	19853	30823	43405	99094	160896	14692	10265

Leaving out the poultry and the beehives, we that cattle stands for all most half of the livestock population in central Tigray. It is also interesting to notice that the number of goats is more than twice the number of sheep. As goats are browsers, we observe that in the dry and bushy lowlands of Abergelle, goats are especially predominant.

There are, as earlier stated, significant variations between the weredas regarding the possession and importance of livestock. In table 6.25 (below) this variation is depicted.

Table 6.26: Comparing populations of human beings, cattle, small stock and livestock units (1 head of cattle; 10 goats/sheep is converted into 1 livestock unit (LU)

WEREDA	Human population	Cattle	Small stock	Livestock units	Ratio LUs to humans
Adua					
Adi Ahferom	22,067	7,912	6,543	8,566	0.39
Embasneyti	44,277	16,659	25,579	19,217	0.43
Endabatsahma	50,337	21,487	18,244	23,311	0.46
Hahaile	37,083	10,513	6,727	11,186	0.30
Adua Average	**38,441**	**14,143**	**14,273**	**15,570**	**0.41**
Tembien					
Abergelle	42,393	28,643	30,881	31,731	0.75
Degua Tembien	61,824	24,267	14,373	25,704	0.42
Keyih Tekli	54,366	27,785	40,152	31,800	0.58
Tembien Average	**52,861**	**26,898**	**28,469**	**29.745**	**0.56**
Wereda average for the zone	**44,668**	**19,609**	**20,357**	**21,645**	0.48

As we can see, Abergelle has more than twice as many livestock units as that of Adi Afherom and Endabatsahma, and almost twice the amount found in Embasneyti, Hahaile and Degua Tembien. Together with the yields from arable farming, we see that Abergelle, which may look a bit poor from the ecological side, is a rather well-off wereda in Central Tigray.

6.6.1 Constraints on animal production

The population of Tigray is not satisfied with the prevailing livestock situation as it does not cover what is conceived to be necessary needs, wants and requirements. Most farm families would hence like to possess more animals than they have today. This goes primarily for plough-oxen, but also for other types of cattle and small stock that could be used for food, exchange and security-buffers. In addition to the amount of livestock that decreased substantially during the years of famine, the depletion of natural resources, the recurrence of drought resulting in the shortage of water and the disappearance of grazing areas, and endemic and epidemic animal diseases, are the major contributory factors for the current livestock situation in the region.

A big problem for the livestock sector is lack of pastures and fodder. Crop residues are used during the dry season to feed the cattle. The traction animals, however, get the best both regarding quality and quantity. In addition they are usually fed with some amount of hay cut from the surrounding natural vegetation. Most of the rangeland is depleted, and give very limited yields during the dry season. The rangeland are partly private, i.e. belong to the farm, and partly communal, usually situated at the margins of the village land. The feeding importance of the rangeland increases in the rainy season. Table 6.26 (below) presents a picture of the present division of grazing between private and communal land.

Table 6.27: Average distance travelled (in minutes) to grazing areas in the survey area

WEREDA	PRIVATE		COMMUNAL	
	DRY SEASON	RAINY SEASON	DRY SEASON	RAINY SEASON
Adua				
Adi Ahferom	12	16	30	26
Embasneyti	24	20	41	60
Endabatsahma	0	0	34	39
Hahaile	3	4	13	12
Adua Average	**8**	**8**	**25**	**28**
Tembien				
Abergelle	14	13	98	92
Degua Tembien	7	1	32	60
Keyih Tekli	9	10	30	25
Tembien Average	**10**	**8**	**48**	**51**
Zone Average				

As we can see, it is not the distance to the grazing areas that functions as a constraint on livestock development. Much more serious is their limitedness and their poor quality.

Table 6.28: Source of water for livestock, average distance travelled to the sources, and proportion of users (estimated both for the dry and the rainy season)

SOURCE OF WATER	AVERAGE DISTANCE TRAVELLED (IN MINUTES)		PROPORTION OF USERS	
	Dry season	Rainy season	Dry season	Rainy season
Pond / Dam	120	120	2.32	5.38
Wells	120	-	10.25	-
Streams & River	130	45	50.87	61.50
Spring	124	55	36.56	22.37
Accumulated water (temporarily)	-	30	-	10.75
Total			100	100

Both during the dry and the rainy season, between 80-90 % of the households use streams. rivers and springs as the major sources of water for their livestock. To reach these sources, the users have to travel a bit more than two hours during the dry season, and less than one hour during the rainy season.

6.6.1.1 Animal Health

The scarcity of veterinary clinics (see table 6.30) and the shortage of skilled manpower are important constraints on livestock development. When it comes to animal diseases, Anthrax. Black Leg, C.B.P.D, Fascioliasis and Trypanosomiasis are the most widely spread in Tigray (see table 6.29).

Table 6.29: Estimated death rates among livestock in the survey area

WEREDA	TYPE OF ANIMAL				
	OXEN	OTHER CATTLE	SHEEP	GOAT	EQUINE
Adua					
Adi Ahferom	3.03	5.26	4.55	5.80	6.67
Embas neyti	3.95	7.89	46.83	47.35	7.41
Endabat sahma	12.09	7.69	42.31	56.03	20.00
Hahaile	1.92	7.79	58.33	34.23	(no obs.)
Adua Average	**5.25**	**7.16**	**38.81**	**35.86**	**8.52**
Tembien					
Abergelle	7.32	11.18	78.72	27.80	13.33
Degua Tembien	18.46	18.95	9.09	35 96	18.18
Kevih Tekli	12.93	13.91	4.63	41.14	2.22
Tembien Average	**12.90**	**14.68**	**30.81**	**34.96**	**11.24**
Zone Average	**9.08**	**10.92**	**34.41**	**35.41**	**9.88**

Table 6.30: Percentage distribution of livestock deaths by major diseases

WEREDA	TYPE OF DISEASE								
	ANTHRAX	BLACK LEG	C B P D	FASCIO-LIASIS	PASTEUR-ELLOSIS	RINDER-PEST	TRYPANO-SOMASIS	OTH ERS	UN KNOWN
Adua									
Adi Ahferom	-	7 14	-	14 28	-	-	-	35 72	42 86
Embasneyti	12.36	26 40	7 30	-	-	-	6 74	5.63	41 57
Endabat sahma	0 87	17 39	29.56	-	-	-	1 74	26 53	23 91
Hahaile	-	4 35	73 91	-	-	-	-	-	21 74
Adua Average									
Tembien									
Abergelle	38 43	29 63	6 02	0 46	-	-	8.33	-	17 13
Degua Tembien	-	5 10	3 06	14 29	-	-	-	36 73	40 82
Kevih Tekli	4.35	8.70		4 35	49 41	3.56	5 14	1 17	23 32
Tembien Average									
Zone Average									

Table 6.31: Average distance travelled (in minutes) by households to the nearest veterinary clinic

Wereda	Time Range (min.)		Average (in min.)
	Minimum	Maximum	
Adua			
Adi Ahterum	5	480	89
Embasneyti	30	360	149
Endahatsahma	60	290	143
Hahaile	30	180	159
Adua Average	5	480	141
Temhien			
Abergelle	60	540	258
Degua Temhien	15	300	125
Keyih Tekli	3	360	200
Temhien Average	3	540	196
Zone Average	3	540	169

6.7 Constraints on Agricultural Development

The most basic constraints to agricultural development have already been, the small farms divided into minor plots, low soil fertility, lack of oxen, unreliable rainfall, etc. When asked how they themselves perceived the most important constraints, the households gave the following responses:

Table 6.32: Households' prioritation of the *three* most important agricultural constraints

CONSTRAINT	PERCENTAGE OF PRIORITY ORDER			
	1st	2nd	3rd	% mentioned as 1, 2 or 3 priority
Drought	44.32	18 04	11.82	74 18
Crop Pests	10 58	18 66	15 71	44 95
Weeds	1.56	2 95	3 89	8 4
Cost of inputs	5 44	10 73	11 35	27 52
Shortage of land	9 33	9 80	10.58	29 71
Shortage of labour	1 71	2.02	3.27	7 00
Low soil fertility	5 75	8 55	8 86	23 16
Lack of oxen	12 75	13 06	14 62	40 43
Lack of seed	1.87	7 78	14.93	24 58
Hail	5.91	7 93	7 47	21 31
Crop disease	0 31	0 31	0.47	1 09
Other	0 47	0 16	0 16	0 79
Total	100%	100%	100%	xxxx

6.7.1 Farm implements

Lack of farm implements are also mentioned by most farmers to be a serious constraints on agricultural production. When the different households were asked what type of implements they lacked, the following responses where given:

Table 6.33: Percentage of households lacking basic farm implements

FARM IMPLEMENT	PERCENTAGE
Newit (plough base attached to yoke)	23
Arut (plough yoke)	23
Erfi (plough handle)	23
Dugri (wooden bottom of the plough)	23
Kerfes (metal ring for the plough tip)	23
Mahresha (metal plough tip)	35
Maetsid (scikle)	29
Gezemo (small axe)	50
Misar (axe)	43
Mahtse (scythe)	67
Mendel (metal spike for cutting holes)	30
Metsan (pitchfork)	64
Lokota(sack made of leather)	62

6.7.2 Religious holidays

It is a strong belief among many people working with development activities in Tigray that religious holidays make a major impact in hindering socio-economic development of the region. To find out more about this topic, we have correlated the religious holidays with the busiest months regarding agricultural activities.

Table 6.34: Months with the highest number of absolute work prohibition days in the survey area correlated with the three busiest month in agricultural production

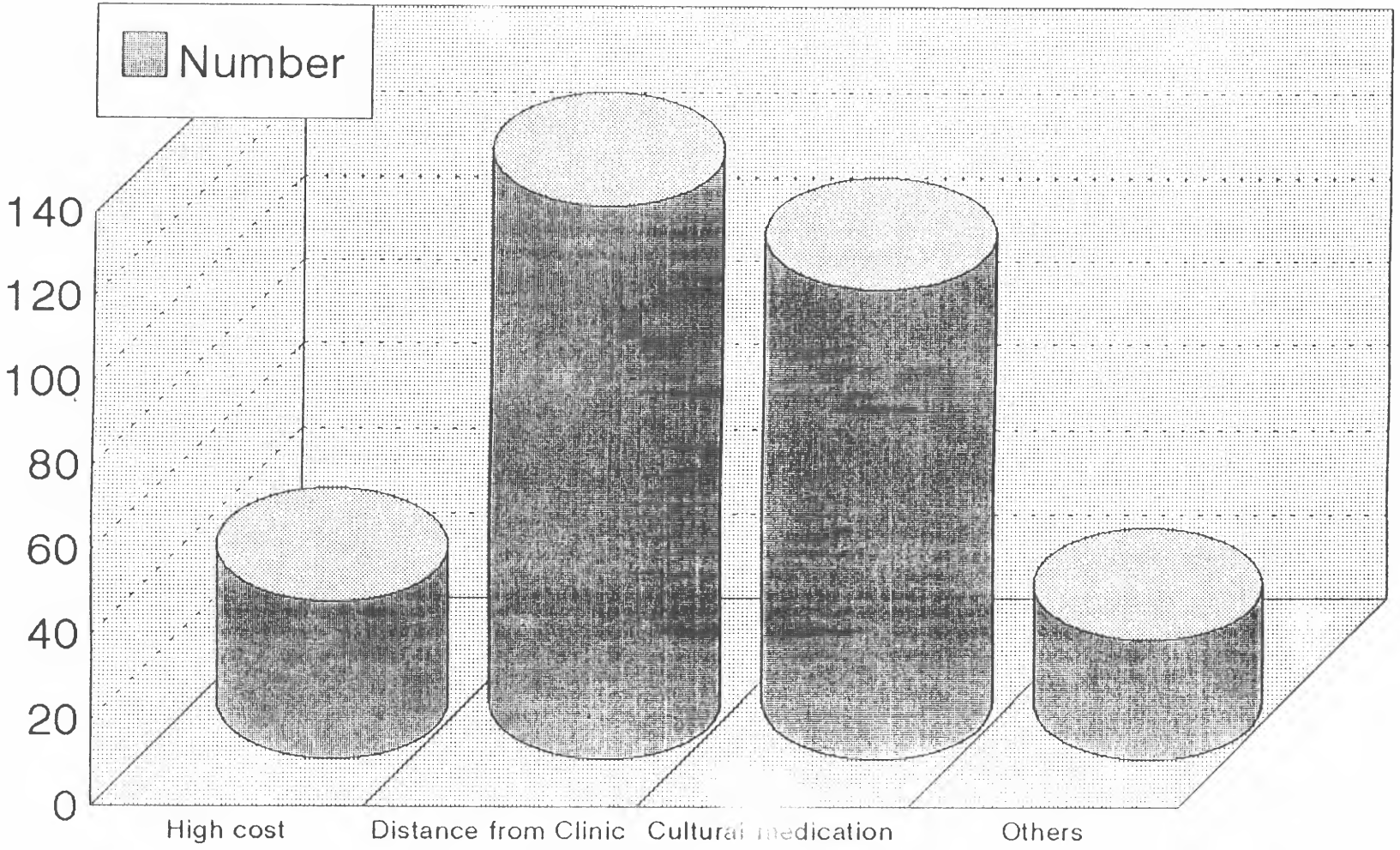
WEREDA	Months with the highest number religious holidays, i e days of work prohibition	The three busiest months in agric production	No of work prohibition days per year
ADUA			
Adi Ahferom	Miazia, Ginbot, Sene April, May, June	Sene, Nehassie, Tikimt June, August, October	122
Emhasneyti	Miazia, Nehassie April, August	Sene, Hamle, Nehassie June, July, August	101
Endahatsahma	Meskerem, Hidar September, November	Sene, Hamele, Tikimt June, July, October	88
Hahaile	Miazia, Nehassie April, August	Sene, Nehassie, Tikimt June, August, October	108
Adua Average			105
TEMBIEN			
Abergelle	Miazia, Ginbot, Nehassie April, May, August	Ginbot, Sene, Hamle May, June, July	105
D Tembien	Miazia, Ginbot April, May	Sene, Nehassie, Hidar June, August, November	120
Keyih Tekli	Miazia, Nehassie April, August	Sene, Hamle, Hidar June, July, November	125
Tembien Average			117
Zone Average			111

Notes: Absolute work prohibition days mean days in which the major agricultural activities (ploughing, planting, weeding, harvesting, threshing etc.) are not allowed to be undertaken by the local church.

The religious holdays do quite often mean a delay in core agricultural activities.

Fig. 5 Distribution of Livestock Health Constraints

in Sampled Weredas of Central Tigray



Number	37	131	111	28

CHAPTER 7: RURAL WOMEN

7.1 Rural Women and their activities

The traditional socio-political system under the rule of Emperor Haile Selassie was oppressive to poor rural people, and rural women in particular suffered from social and economic oppression in a highly conservative and patriarchal setting. Although women theoretically had the right to obtain land under the *risti* land tenure system, in practice they were rarely able to actualize this right. Similarly, although theoretically a woman had a right to half of all common property on divorce, she was rarely able to press her claims, especially if she lacked the backing of strong male relatives to support her.

After 1975, the military government of the ***Derg*** gave theoretical weight to the rights of women in Ethiopia. In practice, however, few tangible advances were achieved, especially for rural women. Instead, povertization in the countryside was exacerbated generally, while in Tigray the government launched major military campaigns against not only the TPLF, but the civilian population as well, including women.

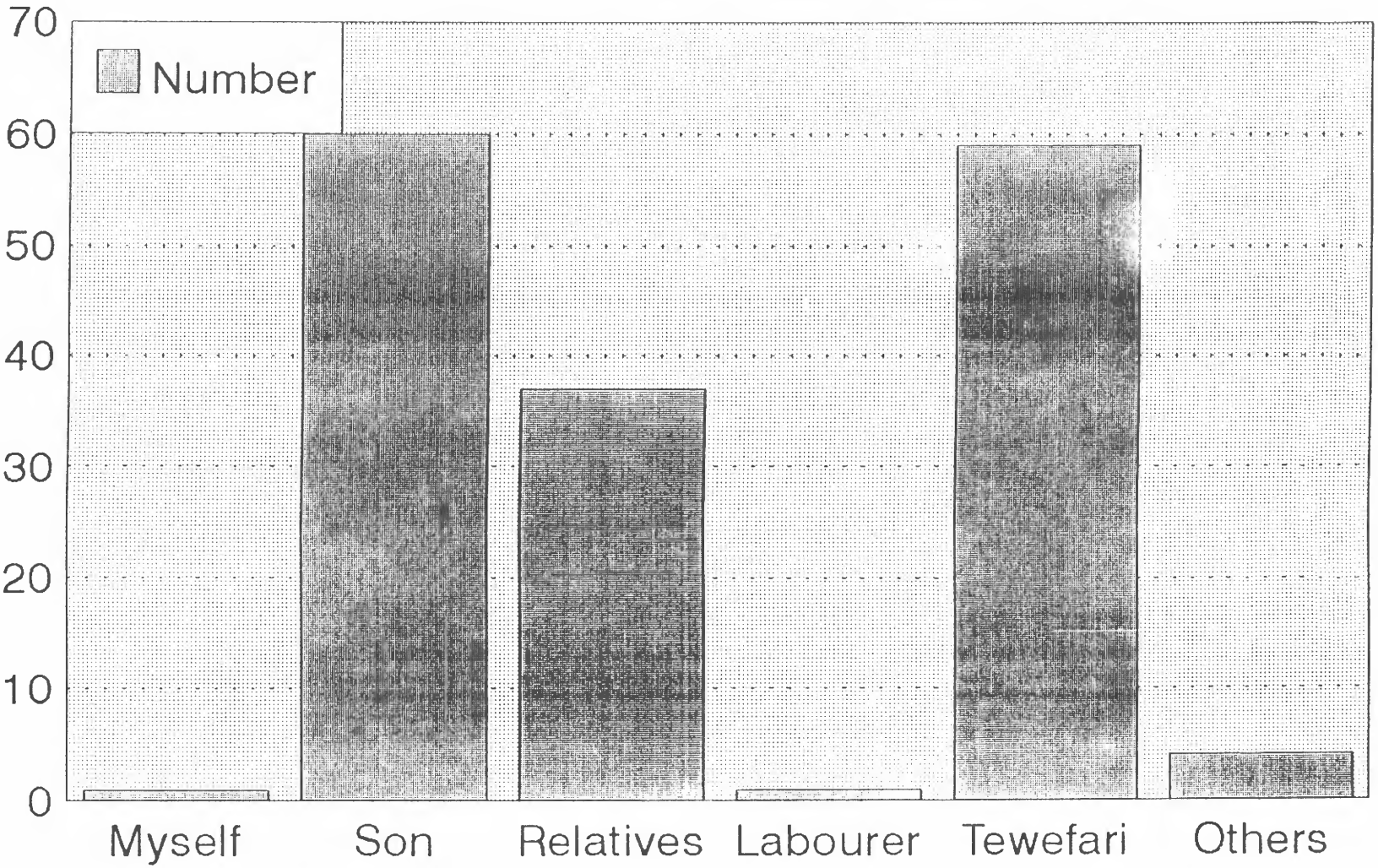
During the war, TPLF introduced a system of land re-distribution in "liberated" areas. As noted previously, this reform gave women rights in land for the first time which could not be alienated upon divorce. This has been especially important in the lives of women-headed households, which findings show constitute 165 out of 643 households surveyed, or 25.66% of households.

In addition, the TPLF lobbied actively for the participation of women in visible positions of authority, and results of this work can be seen today in the number of women on *baitos* at different administrative levels.

Although the situation among rural women in Tigray has improved, however, there is still a long way to go. Today, rural women still carry a huge and unremitting labor burden related to their domestic and agricultural responsibilities. There is a high maternal mortality rate, associated not only with poor health generally but also with harmful traditional practices which many girls are subjected to at a young age, and with unhygienic practices during delivery. The Regional Bureau of Health estimates the number of women assisted by health practitioners and trained Traditional Birth Attendants to be less than 5%.

Fig. 8 Distribution of Source of Labour for Ploughing to the

Female Headed Households in the Sampled Weredas of Central Tigray



Number	1	60	37	1	59	4

Table 20 - *Tabia Baito* Prioritization of Rural Women's Main Problems

wereda	Water	Mill	Health	Market	Educ.	Fire wood	Other
Keyih Tekli	66.7	100	100	100	66.8	16.7	-
Degua Tembien	100	80	100	-	60	25	25
Abergelle	100	100	50	-	-	25	25
Hahaile	100	100	100	25	50	-	-
Adi Ahferom	100	100	100	-	-	-	-
Embaseneyti	100	80	100	-	-	40	-
Endabatsahma	100	100	100	60	-	20	10

Other major problems of rural women include a shortage of labor during agricultural activities. Survey results show that out of the 165 women-headed households, 36.42% hire out their land due to a shortage of labor, while 37.03% use their sons for ploughing. Others, comprising 22.84%, obtain ploughing assistance from male relatives. Only one woman of the surveyed households was found to plough by herself, and one other women hired male labor for payment. The remaining 4% used different sources of labor.

7.2 Rural Women and Their Role in Community Development

During the armed struggle, a considerable number of rural women were trained in soil and water conservation techniques and in different extension works by the TPLF's Department of Agriculture. Women heads of households received training under the Agricultural Extension Program. Access to this sort of assistance was further broadened through the activities of Female Community Development Workers, who operate alongside Agricultural Extension Agents. Today, there are many rural women who have technical conservation skills, and this opportunity has broadened their participation in community development works.

Regarding the physical inputs needed for community development programs, it is up to the community itself to decide, if it chooses to, on a division of labor between men and women. Experience has shown that the participation of women in the labor-intensive Catchment Terracing Program, which has been operating since 1990, is not less than 50%. Concern has been expressed that this program in particular places a considerable additional workload on women. The IADP was developed in order to reduce women's burden by improving social services, including access to clean water, and improved human health services.
Other development intervention activities aimed at women include: their role in the rehabilitation and construction of schools, health centers, wells, dams, rural access roads, and the provision of locally accessible grinding mills.

Women's Physical Activities During Implementation of Development and Rehabilitation Programs:

Program	Women's role
Soil and water conservation	Collecting stones and some digging
Re-afforestation	Seedling transportation, digging of holes, planting and watering of seedlings
Rural farm access road	Collecting and transporting of stones and soil
Hand dug well construction	Collecting and transporting soil and stones
Construction of schools, health centers, mill stations etc.	Collecting and transporting soil and stones, water fetching for the making of mud for painting house interiors.

As noted above, rural women are playing a significant role in public administration, reflected in their presence on *tabia baitos*. However, the percentage of women in local government at *wereda* and regional levels is not as high as at *tabia* level, for reasons including their literacy status as compared with men.

Table 21 - Proportion of Women in *Tabia Baitos*

wereda	Percentage of women *baito* members
Keyih Tekli	10.10
Degua Tembien	15.96
Abergelle	8.68
Hahaile	28.75
Adi Ahferom	8.68
Embaseneyti	15.20
Endabatsahma	14.56
Average	14.56

Table 22 - Decision-Making for Major Household Issues

ISSUE	DECISION MAKER			
	HUSBAND	WIFE	BOTH	OTHER[31]
Planting	12.91	19.75	57.70	9.64
Selling / buying crop	8.71	16.49	69.67	5.13
Selling/buying livestock	11.35	20.68	62.74	5.23
Seed selection	16.49	20.06	52.41	11.04
Social expense	10.58	24.42	60.33	4.67

N.B. Women heads-of-households are included under the heading "Wife"

[31]Other could be adult son or daughter, or the *tewefari* in case of plots hired out.

Table 23 - Percentage of Households responses to the Activities Fully/Partially Accomplished by Rural Women

ACTIVITY WHICH IS FULLY/PARTIALLY ACCOMPLISHED BY WOMEN	PERCENTAGE OF HOUSEHOLDS
Grinding	80.09
Water fetching	55.52
Cooking	84.45
Child care	44.63
Fire wood collection	13.99
Other home activities	41.84
Collection of plant debris	33.44
Hoeing	5.29
Weeding	52.10
Harvesting	13.69
Collecting / transporting of harvested crop	9.18
Preparation of threshing ground	10.42
Threshing	1.09
Other Agricultural activities	13.53

N.B. Other home activities include washing clothes, cleaning the compound, making baskets, spinning cotton, etc. Other agricultural activities include livestock care, milking, etc.

CHAPTER 8: INFRASTRUCTURE AND SOCIAL SERVICES

8.1 Domestic Water Supply

In the villages of Tigray, springs and flowing streams are the most commonly used sources of water. However, years of drought and declining rainfall have made shortage of water more acute in many respects than shortage of food. At present, the water table of many areas has dropped, and many rivers have dried up. Further, traditional sources of water are unsanitary, low yielding, seasonal, and far from village settlements. Cattle are also facing shortages of drinking water, and must be taken long distances, with much energy waste, to drink.

Survey respondents were asked to identify their major source of water supply during the dry and rainy seasons. Results show that springs are a key source, cited by 80% of households. Streams and rivers were cited as a main water source by 25% of households, and 3.73% of households indicated that they use a temporary source of accumulated water, especially during the rainy season.

In most areas surveyed, over half of the main water sources are used by both humans and livestock. Such usage has led to a variety of communicable and non-communicable diseases transmitted by polluted water, among them Amoeba, Giardia, and Bilharziasis.

The problem of water shortage particularly affects women, as they are responsible for fetching the household water supply. In extreme cases, four hours of walking one way, meaning an eight-hour round trip, was cited by households as needed to reach the water source. In addition, time is needed at the source to collect the necessary volume of water. Given this situation, water is a primary issue especially for rural women. Water supply development will reduce the heavy labor burden women face, and will enable them to be involved in other developmental activities.

Duration of main water sources is also a problem. Approximately 77 % of the households in Tembien noted that potable water is available for at least 10 months of the year, while 16% said their water source lasted 7 - 9 months within a year. 4% of households said their water source lasted for only 4 - 6 months, and 2% said their water lasted at most 3 months.

The problem of duration of water supply is more acute in Adua. Only 69% of households had use of their major water source for 10 months; 29% stated they had access for between 7 - 9 months. In the Tables presented below, duration of water sources for all respondents is given.

Table 53 - Percentage Distribution of Household Responses to Availability/Duration of Major Sources of Potable Water

WEREDA	Availability/duration of the major source of potable water			
	10 - 12 months	7 - 9 months	4 - 6 months	1 - 3 months
Adua				
Adi Ahferom	76.78	10.71	5.36	7.15
Embaseneyti	56.84	8.42	32.63	2.11
Endabatsahma	37.14	14.29	34.29	14.28
Hahaile	69.00	29.00	1.00	1.00
Adua Average	58.15	16.29	19.94	5.62
Tembien				
Abergelle	43.84	45.21	5.48	5.48
Degua Tembien	77.78	13.89	8.33	-
Keyih Tekli	94.37	2.11	1.41	2.11
Tembien Average	77.35	16.03	4.18	2.44
Zone Average	66.40	16.17	12.91	4.52

Table 54 - Average Distance Travelled to Nearest Sources of Potable Water (in minutes, one way)

WEREDA	Time Range		Average
	Minimum	Maximum	
Adua			
Adi Ahferom	5	120	26
Embaseneyti	5	120	26
Endabatsahma	5	120	53
Hahaile	5	180	43
Adua Average	**5**	**135**	**39**
Tembien			
Abergelle	5	240	51
Degua Tembien	5	90	27
Keyhi Tekli	5	129	33
Tembien Average	**5**	**153**	**36**
Zone Average	**5**	**144**	**37**

Table 55: Source of water and average distance travelled (in minutes, one way)

SOURCE OF WATER	AVERAGE DISTANCE TRAVELLED (IN MINUTES)		PROPORTION OF USERS	
	DRY SEASON	RAINY SEASON	DRY SEASON	RAINY SEASON
Ponds / Dam	50	35	10.89	2.80
Wells	50	30	9.18	7.78
Streams & River	50	30	22.08	28.30
Spring	55	40	69.67	100%
Accumulated water Temporarily)	-	22	-	3.73

8.2 Health Services

The main health problems of the surveyed area, as indicated by wereda health officers, include:

Dysentery, bronchitis, pneumonia, anthrax, malaria, tuberculoisis, anemia, malnutrition, respiratory diseases, intestinal parasites, and gastro-intestinal diseases.

Most of these diseases are directly related to poverty and poor nutrition, and reflect partly the damage caused by successive years of drought and warfare. Infant mortality rates are very high, which is one of the factors behind the low average life expectancy. At the same time, the few and poorly-supplied health facilities in the region are handling far more than their intended capacity, meaning they cannot adequately cope with the number of people requiring health care, especially as they lack material and skilled personnel. This in turn affects the quality of health care, resulting in high mortality rates.

Among the constraints that hinder alleviation of health problems in the project area are:

- Inadequate health infrastructure
- Shortage of drugs
- Shortage of basic medical equipment
- Poor transportation system

The proportion of people receiving service from health centers is small. Health centers are sparse, located in *wereda* towns, and most households have to travel an average of two hours to reach them; in some areas the walking distance is six hours. For referral to zonal or regional level health facilities, the distance travelled for rural people will be in days.

Except *wereda* Abergelle, which has two clinics, the remaining *weredas* have only one clinic each. According to *wereda* health officers, these clinics are servicing far above their intended capacity, implying that the services are very poor. For instance, the clinic in Endabatsahma serves twice the number of people it was planned to serve. Meanwhile, the expansion of health posts to local areas beyond *wereda* level is proceeding slowly. Presently, there are only three health posts in the surveyed area - two in Endabatsahma and one Embaseneyti. Given the above conditions, there is an urgent need to strengthen health institutions in the region.

The following tables provide more details with regard to the health context of the program area:

Table 55 - Major Communicable and Non-Communicable Diseases of the Survey Area

S/N	*WEREDA*	Communicable Disease	Non-communicable disease	Parasites(transmitted due to drinking polluted water)	Employed staff
1.	Adi Ahferom	Malaria Diarrhea	Pneumonia Bronchitis Goiter	Amoeba	1 Nurse and 9 supportive staff
2.	Keyih Tekli	Malaria Diarrhea	Malnutrition Pneumonia	Amoeba Shigellosis Bilharzia Giardia	1 nurse and 15 assistant
3.	Degua Tembien	Relapsing fever Typhus TB Diarrhea	Bronchitis Malnutrition	Amoeba Bilharzia	1 nurse and 14 supportive staff
4	Abergelle	TB Malaria Diarrhea	Anthrax Respirator infection Malnutrition	Amoeba	2 nurses and 18 supportive staff
5.	Endaba tshama	TB Diarrhea	Bronchitis Malnutrition Anemia	Giardia Amoeba	1 nurse and 7 supportive
6	Hahaile	Malaria TB	Malnutrition Pneumonia	Amoeba	3 health assistants and 6 other staff
7	Embaseneyti	Diarrhea Malaria Respiratory diseases	Malnutrition Anemia Gastritis	Giardia Amoeba Bilharzia	1 nurse and 13 supportive staffs

Table 56 - Average Distance Travelled to the Nearest Health Clinic

WEREDA	Time Range		Average
	Minimum	Maximum	
Adua			
Adi Ahferom	5	240	85
Embaseneyti	30	360	132
Endabatsahma	60	360	143
Hahaile	25	150	122
Adua Average	30	278	
Tembien			
Abergelie	5	360	142
Degua Tembien	15		126
Keyhi Tekli	60	360	186
Tembien Average	27	340	160
Zone Average	29	310	141

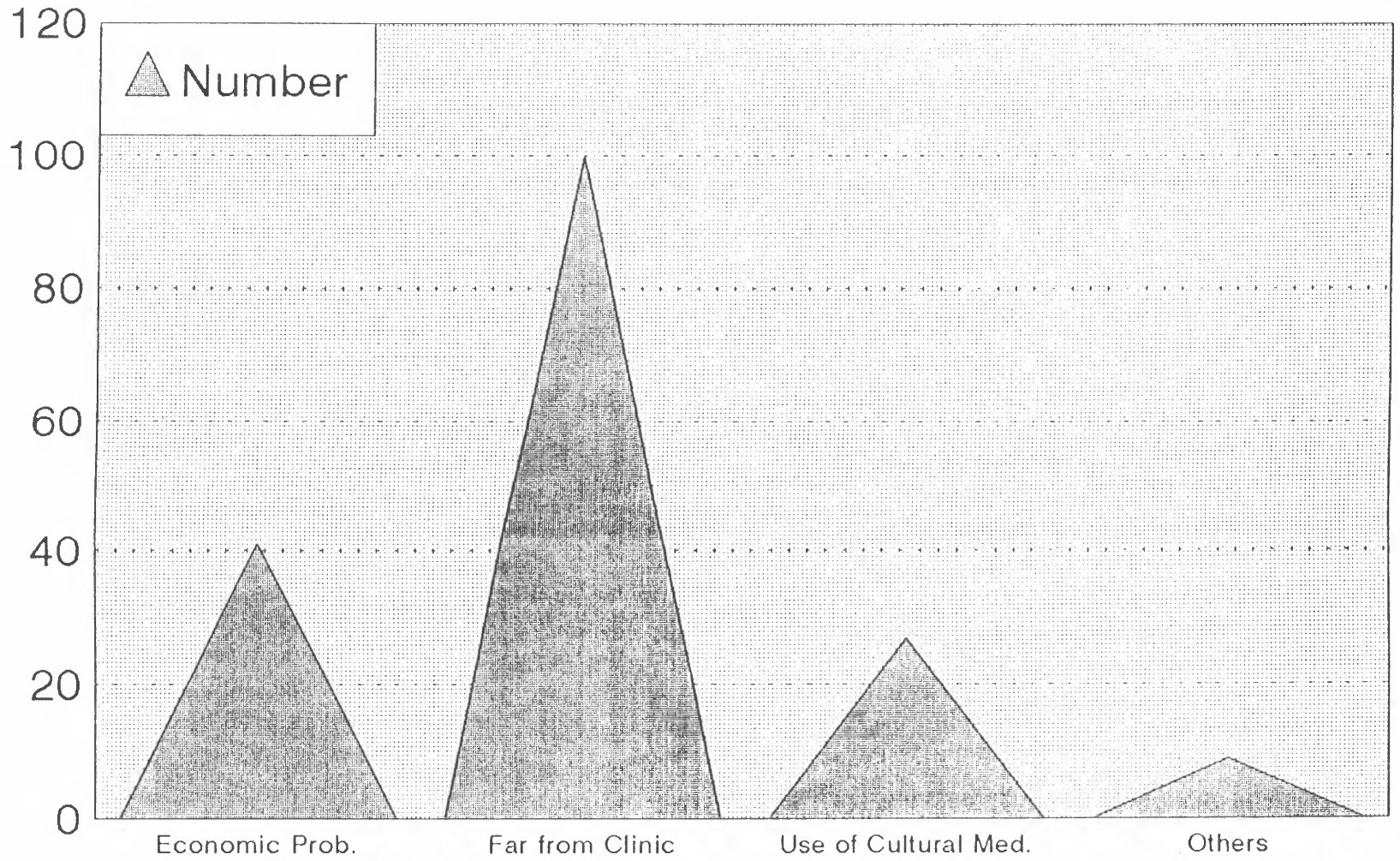
Table 57 - Percentage Distribution of Households with at Least One Member Who Had One of the Following Symptoms/Diseases

SYMPTOM / DISEASE	PERCENTAGE
Skin Disease	11.98
Eye Disease	50.39
Esophagus	24.42
Fever	43.86
Vomiting	24.11
Diarrhea	22.71
Cough	59.56
Stomach ache	47.12
Head ache	60.50
Malaria	14.93
TB	2.64
Heart Disease	1.87
Other	4.70

N.B. These are observations by households according to their own assessments

Fig. 7 Distribution of Human Health Constarints

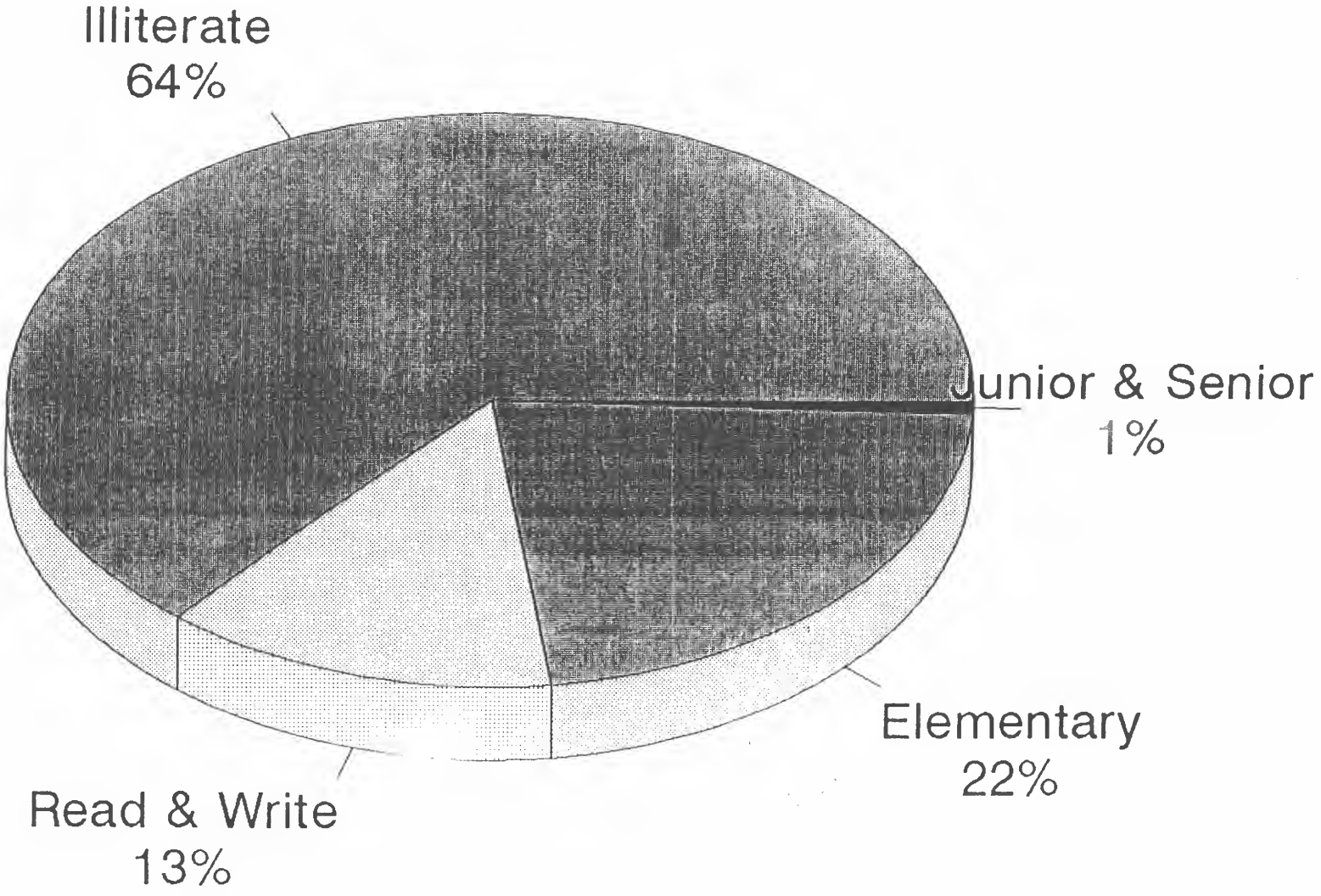
in the Sampled Weredas of Central Tigray



Number	41	100	27	9

Fig. 3A Percentage Distribution of Households by Educational Level

in the Sampled Weredas of Adua



8.3 Education and Education Facilities

At present, Tigray does not have enough institutions necessary to improve the educational and economic level of its population. The Mekelle College of Dryland Agriculture and the Mekelle Bussiness College are the only higher educational institutions found in the region.upted.

Since the end of the war there has been a great effort to rebuild and expand the education infrastructure of the region. Students are highly motivated and have strong community support.

However, schools lack even the most basic equipment. Further, numbers of students are increasing, and this is not being matched by an increase in the number of teachers or adequate facilities. This problem could to some extent be resolved by constructing new schools and maintaining and rebuilding ones that were destroyed in the war.

The following Tables provide further details:

Table 58 - Schooling and School Facilities

WEREDA	No. of students	Total School	School with out class room	School lacking the basic education facility
Adi Ahferom	3,891	5	4	5
Keyih Tekli	1,750	7	4	7
Degua Tembien	2,896	8	3	4
Abergelle	891	4	4	4
Embaseneyti	4,182	7	5	7
Endabatsahma	4,517	10	7	3
Hahaile	5,207	9	5	4

Source: Respective *wereda*'s education bureau offices

Table 59 - Average Distance Travelled to the Nearest School (in minutes, one way)

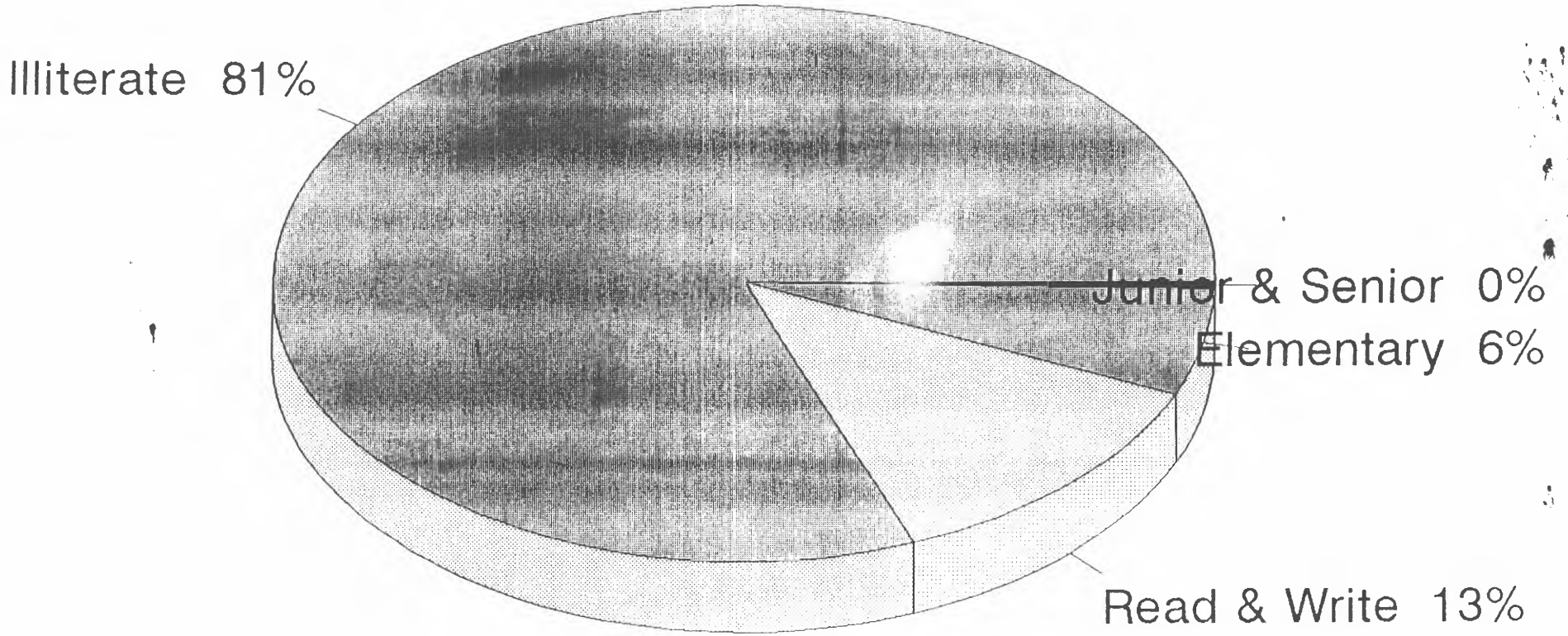
WEREDA	Time Range		Average
	Minimum	Maximum	
Adua			
Adi Ahferom	5	240	24
Embaseneyti	5	300	97
Endabatsahma	5	120	60
Hahaile	5	60	43
Adua Average	5	180	59
Tembien			
Abergelle	5	240	99
Degua Tembien	5	240	66
Keyhi Tekli	5	300	92
Tembien Average	5	260	87
Zone Average	5	220	73

Table 60 - Percentage Distribution of Household Members by Education Level

WEREDA	EDUCATION GROUP					
	ILLITERATE	READ & WRITE	ELEMENTARY	JUNIOR	SENIOR	ABOVE SECONDARY
Adua						
Adi Ahferom	56.25	9.17	34.17	0.41	-	-
Embaseneyti	62.28	18.36	18.11	0.99	0.26	-
Endabatsahma	65.22	15.46	19.08	0.24	-	-
Hahaile	71.75	9.70	17.73	0.82	-	-
Adua Average	**63.87**	**13.17**	**22.27**	**0.62**	**0.07**	-
Tembien						
Abergelle	84.18	11.40	3.68	0.74	-	-
Degua Tembien	78.67	12.87	8.09	0.37	-	-
Keyih Tekli	79.66	13.62	6.55	0.17	-	-
Tembien Average	**80.84**	**12.63**	**6.11**	**0.43**	-	-
Zone Average	**72.36**	**12.90**	**14.19**	**0.53**	**0.04**	-

Fig. 3B Percentage Distribution of Households by Educational Level

in the Sampled Weredas of Tembien



8.4 Rural Access Roads

Most areas of Tigray are difficult to access by means of mechanized transport. Some areas can only be reached during the dry season using four-wheel drive vehicles. This is influencing not only the movement of people from village to village, *wereda* to *wereda,* and town to town, but also the transportation of various agricultural inputs and technologies. It also creates difficulties in implementing rehabilitation and development programs.

The following is a description of the degree of access of each of the surveyed *weredas*:

Adi Ahferom: There is a 20 km. long feeder road from Edaga Arbi (the *wereda* town of Adi Ahferom) to Enticho. This is the only road that links Adi Ahferom with the main tarmac road of Tigray. This road is motorable with some difficulty. There is a possibility of linking Edaga Arbi and Nebelet (the *wereda* town of Embaseneyti), which are 25 km apart. This would be a strategic route, as it is then possible to access the *weredas* Hahaile and Endabatsahma within a short time.

Keyih Tekli: The new road Mekelle-Tembien-Adua road passes through Keyih Tekli at a distance of about 1.5 km on the left side of Werk Amba (the *wereda* town of Keyih Tekli). It has a length of about 37 km within the *wereda*. There are also 7 access roads linking seven *tabias* to Werk Amba.

Degua Tembien: The Mekelle- Tembien-Adua road, not yet completed, has a length of about 50 km within the *wereda*. This links Hagere Selam (*wereda* town of Degua Tembien) with Mekelle and Abi Adi. There are 9 access roads linking the *wereda* center to the different *tabias*.

Abergelle: In terms of accessibility, Abergelle is the most remote *wereda,* accessible only with great difficulty by four-wheel drive vehicles. The distance from the Mekelle-Adua road to Yechila (*wereda* town. Abergelle) is about 25 km., and there is another 25 km long feeder road from Yechila to the border area of the Amhara region. Seven *tabias* have rural access roads that link them with Yechila.

Embaseneyti: Embaseneyti is accessible through the Mekelle-Adua highway via Hahaile. The length from the main road junction at Gendebta to the *wereda* town Nebelet is about 50 km. Eight *tabias* have access to Nebelet.

Hahaile: Feres May (the *wereda* town of Hahaile) is about 15 km. south from the Mekelle-Adua highway. This *wereda* has the highest number of feeder road networks - 13 *tabias* are either linked with the *wereda* town, the main road, or other *weredas*.

Endabatsahma: The Mekelle-Abi Adi-Adua road passes through Endabatsahma, and has a length of about 13 km within the *wereda*. Nine *tabias* are connected with access roads to the main town Edaga Arbi. Moreover, there is a possibility of accessing Endabatsahma through the feeder road linking Hahaile with Embaseneyti and could be a strategic rout.

The following Table further illustrates the question of access in the surveyed areas:

Table 61 - Average Distance Travelled to the Nearest All-Weather Road(by foot)

wereda	Time Range in minutes		Average
	Minimum	Maximum	
Adua			
Adi Ahferom	270	480	360
Embaseneyti	120	480	375
Endabatsahma	60	480	286
Hahaile	60	285	224
Adua Average	128	430	321
Tembien			
Abergelle	180	660	432
Degua Tembien	5	240	125
Keyhi Tekli	15	360	297
Tembien Average	67	420	184
Zone Average	98	425	253

8.5 Marketing and Market Interactions

Selling crops and livestock are the major market interactions of rural communities. Abi Adi and Adua are the largest market centers in Central Tigray. Accessibility considerably affects market prices, although prices are mainly influenced by urban demand.

8.5.1 Crop Marketing

The following is a short description of market features of each of the surveyed *weredas*:

Adi Ahferom: Some weredas of Tembien are the major sources of barley to Adi Ahferom. Some farmers also transport the cash crop *gesho* to the western part of Tigray, and exchange it for barley. However, the greatest proportion of *gesho* is exported to Eritrea via Enticho. *Taff* is mainly supplied from Hahaile. The majority of Adi Ahferom farmers sell their crop produce in Enticho.

Abergelle: Except *taff* and sorghum, most of the major crops (barley, maize, lentils and sesemum) are sold at Abi Adi. The major purchasers at Abi Adi are merchants from Mekelle. Barley and lentils are also purchased and consumed by people in Abi Adi. Horse beans and chick peas are also purchased from a town in the Amhara region called Sekota.

Degua Tembien: Crop marketing is more or less undertaken in Hagere Selam and Mekelle.

Keyih Tekli: Merchants from Adua and Mekelle are the main purchasers of lentils, linseed and sesemum produced in *wereda* Keyih Tekli. Most of the barley is purchased by people from Abi Adi.

Hahaile: *Taff* is the major cash crop of the *wereda,* and this is mainly exported to Asmara in Eritrea. Feres May is the major market town.

Embaseneyti: Barley, sorghum and finger millet - the ingredients for local beer called ***siwa*** - are mostly purchased by the Edaga Arbi *siwa* brewers. Barley is mostly purchased from Tembien. The main market is in the town Nebelet.

Endabatsahma: Most market interactions pertaining to crops are done in Edaga Arbi.

Table 62 - Average Prices of Major Crops (Per Quintal) at Times of Good and Bad Harvest

TYPE OF CROP	AT NORMAL /GOOD HARVEST PERIOD	AT BAD / POOR HARVEST PERIOD	PERCENTAGE A RISE IN PRICE DURING THE POOR HARVEST
Barley	97.50	132.50	35.90
taff	153.00	240.00	56.86
Sorghum	102.50	139.00	35.29
Finger Millet	139.00	182.50	31.29
Wheat	148.00	181.00	22.30
Lentil	165.00	200.00	21.21

N.B. The year 1985, Ethiopian Calendar, was considered a good year in almost all of the surveyed *weredas*. However, 1986 Ethiopian Calendar was found to be one of the worst years. Hence, crop prices during "good" and "bad" harvest years refer to 1985 E.C. and 1986 E.C. respectively.

8.5.2 Livestock Marketing

The following is a short description of livestock marketing in each *wereda*:

Adi Ahferom: Enticho and Bizet are the major cattle selling market places, and the major purchasers in these towns are merchants from Eritrea. Most of the farmers purchase cattle from Nebelet.

Abergelle: In addition to Yechila, the *wereda* town of Abergelle, Sekota and Belesa towns of the Amhara region are also major cattle purchasing areas for the communities of the *wereda*. Farmers from Abergelle also sometimes purchase goats and sheep from wereda Samre.

Degua Tembien: Most of the people in Degua Tembien sell their livestock in Hagere Selam. Purchasing is mostly undertaken in Mekelle.

Keyih Tekli: Abi Adi, Ambera Meteka, and Abergelle towns are the major cattle, goat, and sheep purchasing areas of the *wereda*. Abi Adi is at the same time a major selling market. Most households undertake the purchasing of mules and camels in Enderta.

Hahaile: Hawzien, Embaseneyti, Endabatsahma, and Abergelle are the main cattle purchasing areas for Hahaile. Most farmers in Hahaile purchase mules from Axum and beehives from Adi Ahferom.

Embaseneyti: Nebelet is the major livestock selling center. The majority of the Embaseneyti inhabitants undertake the purchasing of livestock in Hawzien.

Endabatsahama: Edaga Arbi (the main town of Endabatsahma), is the major livestock market center of the *wereda*.

Table 63 - Average Distance Travelled to the Nearest Market Center (in minutes)

wereda	Time Range		Average
	Minimum	Maximum	
Adua			
Adi Ahferom	5	300	78
Embaseneyti	30	480	141
Endabatsahma	60	300	147
Hahaile	5	180	117
Adua Average	25	315	126
Tembien			
Abergelle	10	360	152
Degua Tembien	15	300	126
Keyhi Tekli	90	360	234
Tembien Average	38	340	186
Zone Average	37	328	156

CHAPTER 9: DROUGHT, FOOD DEFICITS, HOUSEHOLD COPING MECHANISMS

9.1 Overview of Drought and Famine History of the Region

The earliest recorded drought and famine event in Tigray was during the period 253-242 B.C. At least 25 severe drought periods are recorded in the period 1060-1900. Since the beginning of the present century, 7 very serious and 7 moderate drought occurrences are recorded. The most significant famine events of recent history include the years 1957/58, 1972, 1982, and 1984/85, with the latter being the most devastating, and considered by many rural people to be the worst region-wide crisis in living memory. It is the chronic recurrence of such events that has greatly contributed to the crippling of Tigray's socio-economic condition. These events have also shaped Tigrayan attitudes toward the present food crisis (International Food Policy Research Institute (IFPRI), 1992, USA.)

Table 64 - Major Drought and Famine Events Since 1900

Period	Contributory factors/severity status
1913 - 14	Severity Undocumented
1953	Severity Undocumented
1957 - 58	Rain failure in 1957, locust and epidemic in 1958
1964 - 66	Cause and Severity Undocumented
1971 - 75	Sequential rain failure
1984 - 85	Sequential rain failure army worm infestation
1993 - 94	Rain failure in 1993

It is mainly due to the recurrence of drought that crop production in most areas of Tigray, and especially the central highlands, has never topped subsistence level, implying that even at times of adequate rainfall, agricultural produce falls short of annual consumption requirements.

9.2 Food deficit in central Tigray

The following calculation is used to determine the extent of production shortfalls:

Assuming:

1. A person's daily calory requirement is 2,000 k. calories.
2. An average household size is 4.73 persons.
3. The calorie value of one quintal of grain is 350,000 k. calories.
4. Cereals and pulses provide 90% of daily calories.
5. A half quintal of seed is needed for planting for the coming season.
6. An additional 10% of grain is "contingency" accounting for wastage, such as losses during storage, sowing, and cooking.

Based on these assumptions, the total average number of quintals required to sustain a household for one year will be:

$$\left| \frac{2000 \times (90/100) \times 365 \text{ days} \times 4.73}{350{,}000} \right| = 8.88 \text{ Qt.}$$

$$\text{Quintals/household/Year} = (8.88 + 0.5) + (0.1 \times (8.88+0.5)) = \underline{10.32}$$

quintals

During the 1986 E.C. harvest (1993/94 European), the average yield obtained by a household was 3.54 quintals. This is compared against the calculated requirement of 10.32 quintals. Thus, households have been running short of food by 60.30% of requirements.

The following Tables provide more detail:

Table 65 - Household Crop Harvests and Calculated Food Deficits during the 1986 Eth. Cal.

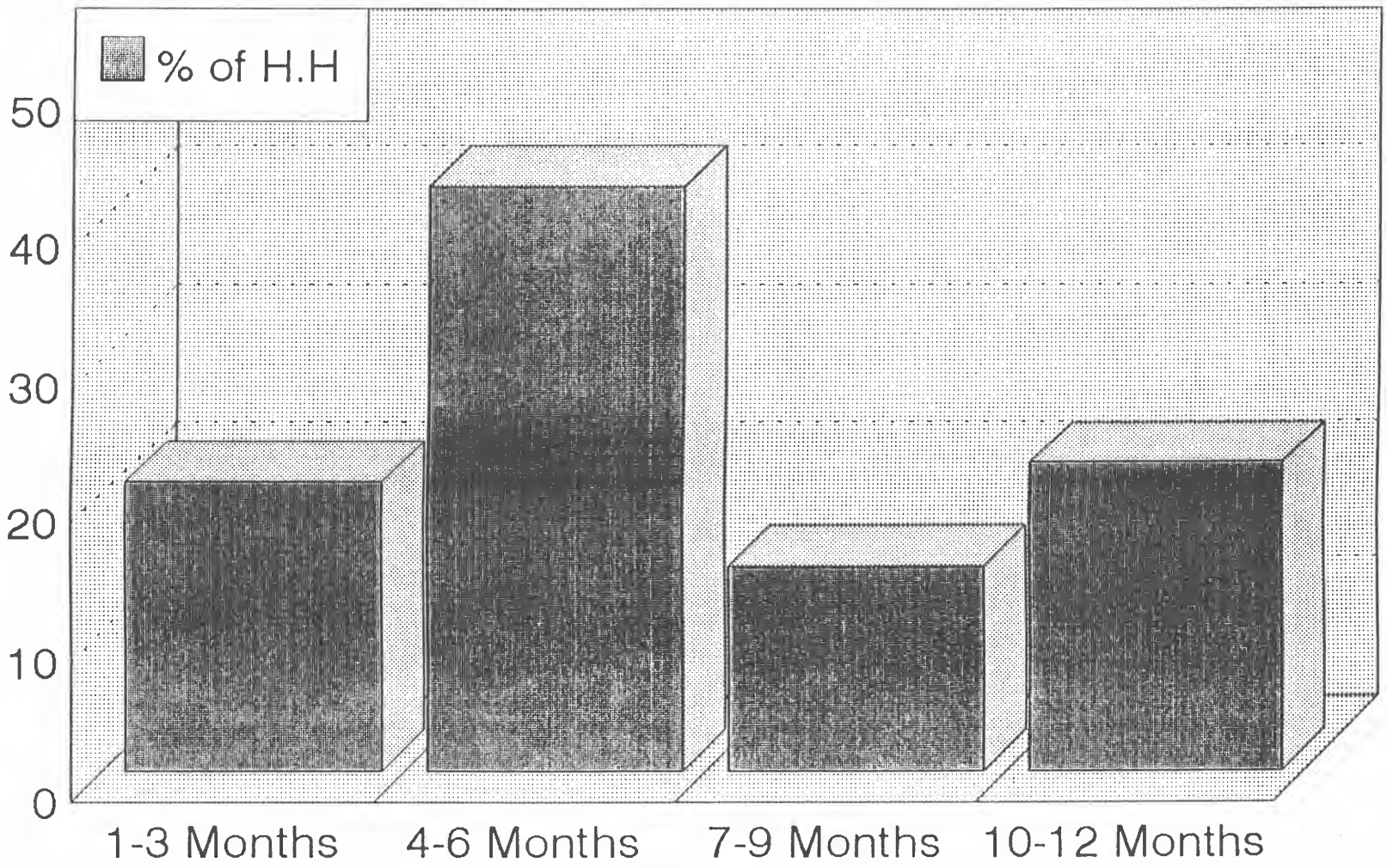
wereda	LAND HOLDING PER H.HOLD (ha.)	OUT PUT/ha (IN Qt.)	NO. OF PLOTS PER H.HOLD (dec. rounded)	SIZE OF A PLOT (in ha.)	AVERAGE CROP YIELD PER H.HOLD (IN 1986 Eth.Cal.)	ACTUAL FOOD GRAIN REQUIREMENT PER H.HOLD (IN Qt.)	FOOD DEFICIT PER H.HOLD (PERCENTAGE)
Adua							
Adi Ahferom	0.58	4.00	3	0.19	2.32	11.24	79.36
Embaseneyti	0.69	4.13	3	0.23	2.85	10.83	73.68
Endaba tsahma	0.66	3.84	3	0.25	2.53	10.32	75.48
Hahaile	0.50	3.70	3	0.13	1.85	9.36	80.24
Adua Average	0.61	3.92	3	0.20	2.39	10.44	77.19
Tembien							
Abergelle	1.86	2.73	3	0.62	5.08	9 71	47.68
Degua Tembien	0.74	7.00	3	0.28	5.18	10.04	48.41
Keyih Tekli	0.95	4.05	2	0.39	3.85	10.71	64.05
Tembien Average	1.18	4.59	3	0.43	4.70	10.15	53.38
Zone Average	0.90	4.25		0.32	3.54	10.30	62.29

Table 66 - Percentage Distribution of Households Responses Regarding the Number of Months of Food Deficits During 1985 Eth. Cal.

NO. OF MONTHS DEFICIT	NO. OF HOUSEHOLDS	PERCENTAGE
1	5	0.9
2.	58	11.0
3.	71	13 4
4.	75	14.2
5.	65	12.3
6.	132	25.0
7.	28	5.3
8.	53	10.0
9.	13	2.5
10.	13	2.5
11.	6	1.1
12.	9	1.7
total with food deficit	528	82.12
total self sufficient	115	17.88
Total	643	100 00

Fig. 2 Percentage Distribution of Households with Food Deficit

in Seven Weredas of Central Tigray (1985 E.C)



% of H.H	20.84	42.3	14.62	22.24

9.3 Household Coping Mechanisms

According to survey results, households responded to food deficits mainly by seeking labor employment in other, relatively surplus-producing areas and in towns, selling their assets, and undertaking petty trading activities.

The Ethiopian year 1984 was relatively good in agriculturall terms, in the sense that there was less pest infestation, and better rainfall intensity and distribution. However, in Ethiopian year 1985, only 17.88% of households were able to manage fully on the 1984 harvest. Totally, 56.92% of households faced food shortages of between 4 - 9 months, while 20.84% were able to live on their own production for 9 - 11 months. Finally, 22.24% of households were able to support themselves for only a maximum of 2 months from the 1984 harvest.

For those households who used seasonal employment as a coping mechanism to address food deficits, 57% worked for between 1 and 3 months. The following table shows the proportion of household members(from the 643 households) who had seasonal employment, and the places where they were employed:

Place of employment	Number of members	Percentage
within *kushet*	9	11
Within *tabia*	8	10
Within *wereda*	16	19
Within Tigray	43	50
Outside Tigray	8	10

Other coping mechanisms included selling assets. Sale of crops, livestock, trees, and poultry products are among the major sources of cash for rural communities. Some households were also involved in trading activities. Of those households who undertook petty trading, 27% were involved in crop trading, 14% in livestock trading, and 24% in the trading of goods such as sugar, soap, coffee, etc.. The remaining 28% traded in various items or carried out different trading activities.

The following Table provides an overview of coping mechanisms employed by the surveyed households:

Table 67 - Household Survival Strategies

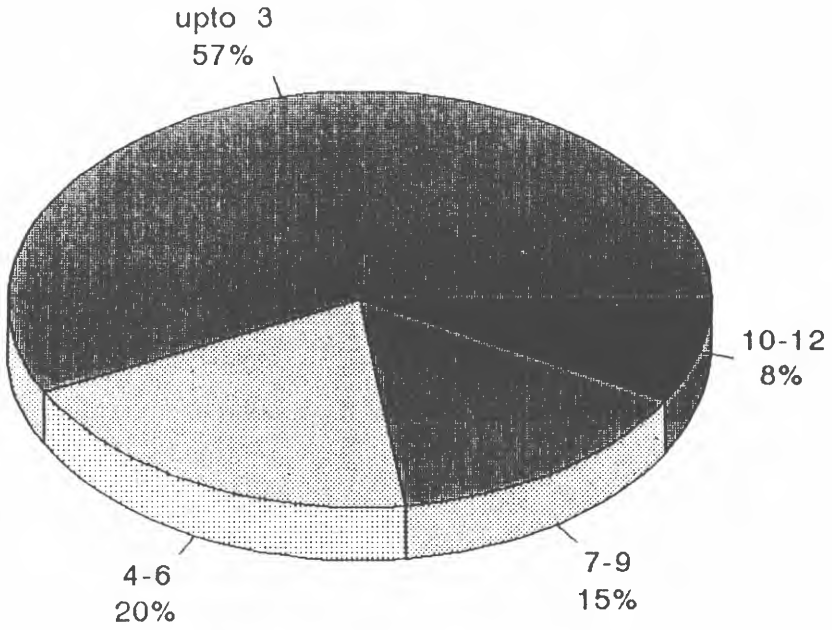
SURVIVAL OPTIONS	PERCENTAGE
Hire out labor	40.5
Borrow grain	38.3
Borrow cash	25.8
Sell livestock	20.6
Sell other property	0.6
Relief aid	24.8
Sales of trees	1.9
Selling local beer	0.9
Petty trade	2.3
Handicraft	1.5
Begging	0.9
Migration	1.5
Assistance from relatives	1.5
Other	11

N.B. Households may employ more than one mechanisms.

Fig 12 Distribution of Households in Months Who Had Off-farm Employment

by Duration of Employment in the Sampled Weredas of Central Tigray

Adua



Tembien

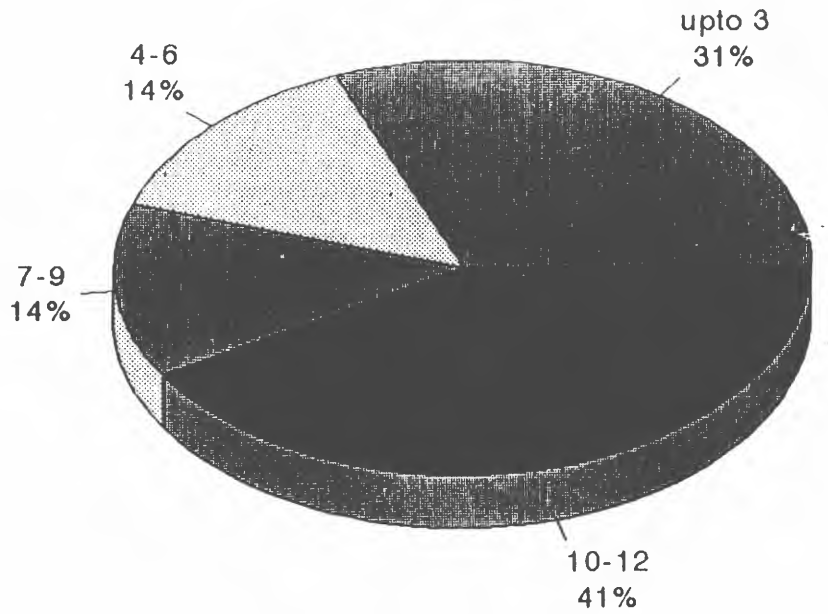
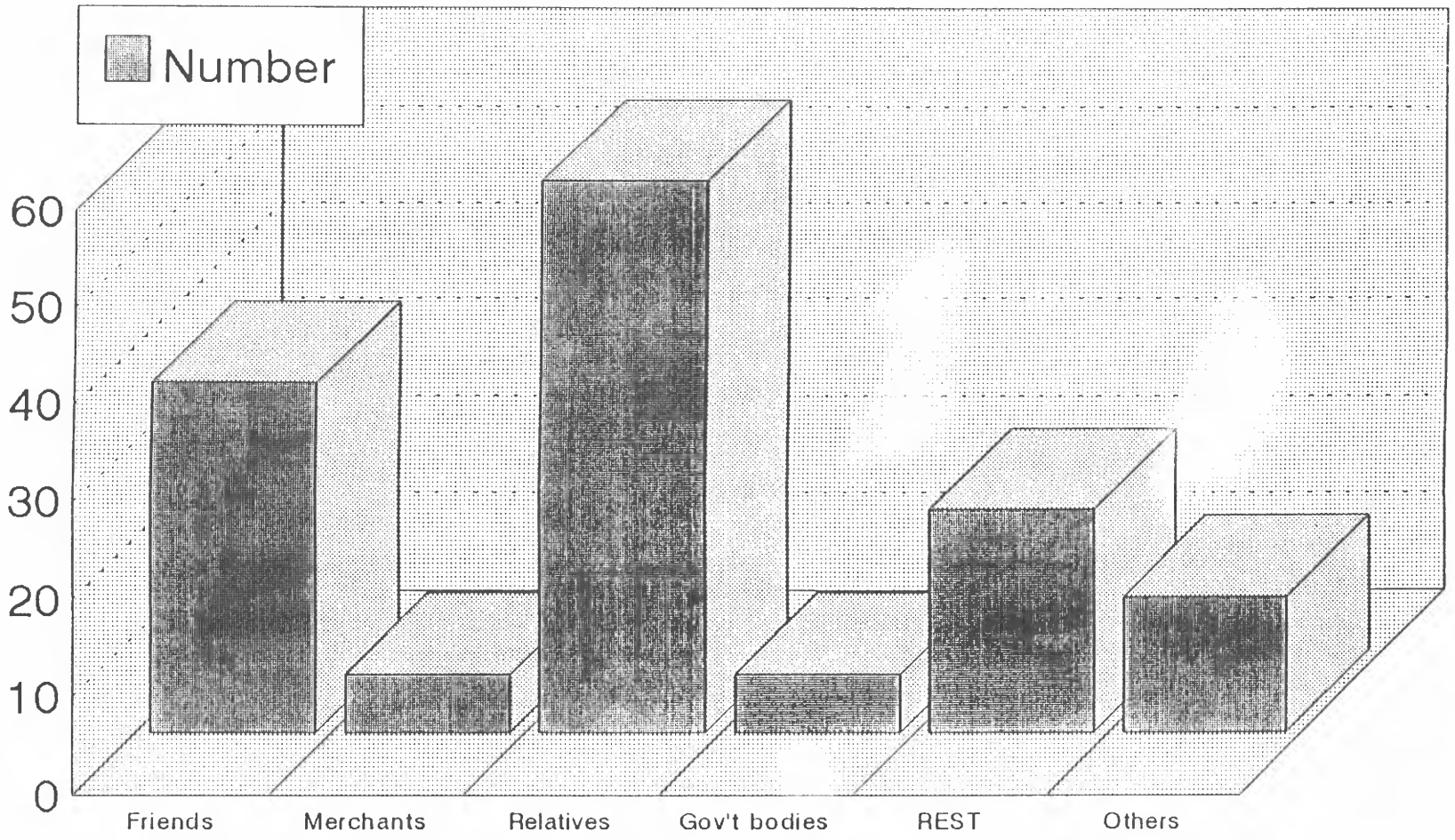


Fig. 9 Distribution of Source of Credit

in the Sampled Weredas of Central Tigray



Number	36	6	57	6	23	14

Fig. 10 Distribution of Households by their Source of Cash Income

in the Sampled Weredas of Central Tigray

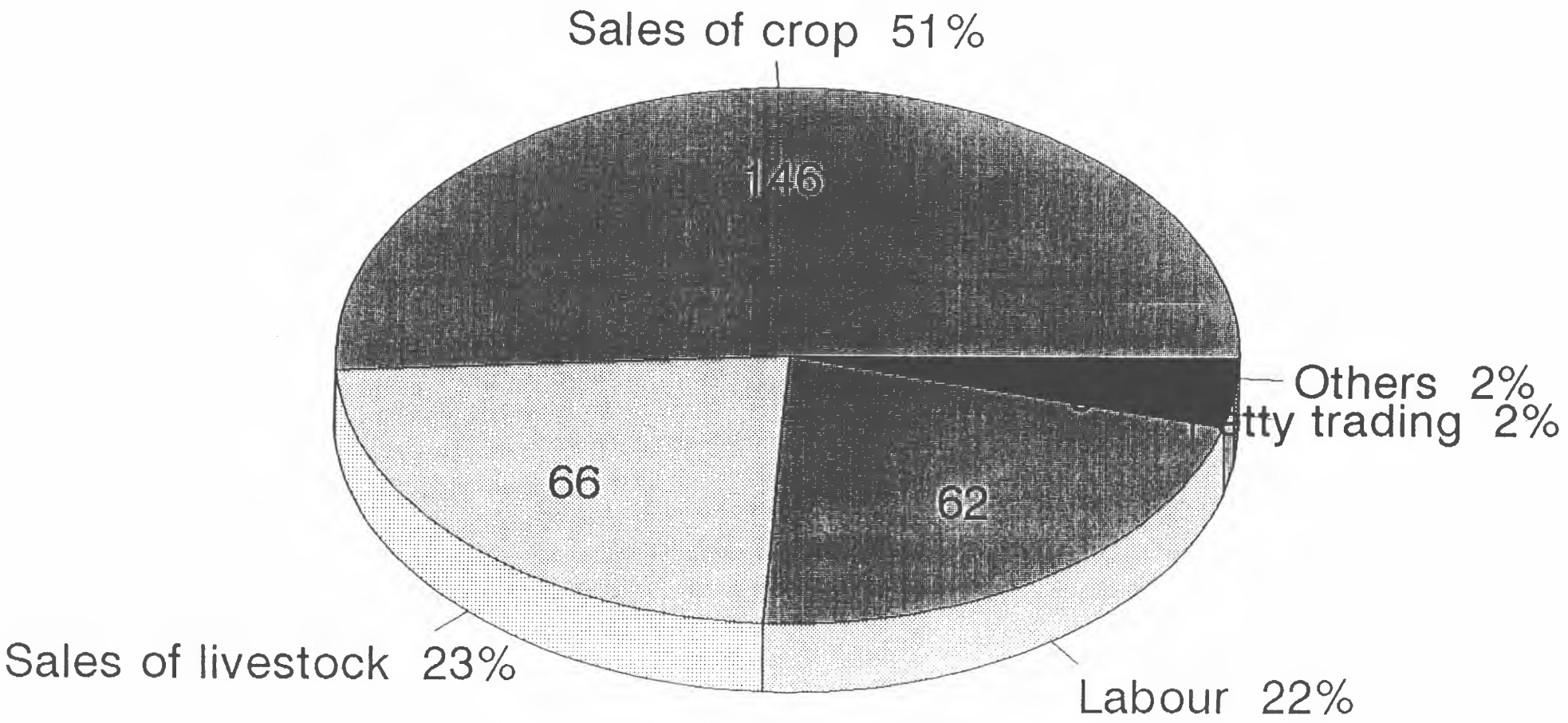


Table 68 - Distribution of Households by Major Crops Used for Food

wereda	TYPES OF CROPS										
	BARLEY	MILLET	HORSE BEEN	MAIZE	SESEMU M	SORGHU M	*taff*	WHEAT	* *hanfets*	RED SORG HUM	OTHE R
Adua											
Adi Ahferom	9.0	-	17.7	-	-	10.5	0 4	20.6	-	-	41.8
Embaseneyti	12.1	11.5	8.6	-	-	-	8.6	12.6	12.6	-	34.0
Endabatsahma	12.2	8.4	-	-	-	13.3	19 3	15.5	14.7	-	16.6
Hahaile	6.5	-	16.3	-	-	10.3	15.2	19.9	16.8	-	15.0
Adua Average											
Tembien											
Abergelle	-	-	6 8	13.1	10.0	12.4	12.3	-	-	-	38.4
Degua Tembien	15.3	-	15.5	-	-	-	12 1	14.2	-	-	42.2
Keyih Tekli	9.0	13.7	-	21.9	-	13 4	26.4	-	-	7.3	8.3
Tembien Average											
Zone Average											

* A mixture of Wheat and Barley

CHAPTER 10: DEVELOPMENT POTENTIALS

For the people of Tigray, the new situation created after the fall of the *dergue* in May 1991 has above all meant that energies can be fully devoted to development of the region. At present, the greatest asset the region possesses is the dedication and commitment of its people for development. With very little external support, people are actively participating in rehabilitation and development programs.

Nowadays, the farmers of Tigray put the conservation of natural resources at the top of their agenda. There is a general mobilization for soil and water conservation, and reforestation. People are also constructing clinics, schools, grinding mill stations, hand dug wells and other service facilities for their communities and locales.

Below, we have listed the various resources of each *weredas* surveyed with regard to its potential for economic growth and development, using information supplied by *wereda baitos* and different regional bureau offices:

Adi Ahferom:

This *wereda* is known for its *gesho* (Rhammus prinoides) production. Currently, *gesho* is exported to Eritrea. *Gesho* can be an important cash crop if the scale and quality of production is improved. Moreover, there are three irrigation potential areas in the *tabias* Semich, Zala, and Waera. These areas should be further studied by technical experts.

With regard to human resources, 37.76% of the population is of working age, representing the lowest figure compared with other surveyed *weredas*. There are also persons with different special skills. For instance, based on sample results, there are more than 900 persons who have basic masonry skills, more than 70 blacksmiths, 600 women with basket-making skills, and 600 people with various other special skills.

Embaseneyti:

Stream diversion for irrigation is possible in the *tabia* Seguh. With the introduction of motor pumps, a considerable part of *tabias* Tseftsef and May Lemin could be cultivated during the dry season. There is also an appropriate site for the construction and utilization of an earth dam. Other development potentials include the expansion of *gesho*, which is used as a main source of cash income. Churches built from rocks in *tabias* Wukro, May Lemin, and Endabamas are potential tourist attractions.

Approximately 52% of the total population is in the working age group. More than 1,300 people are masons, while more than 1,290 women are estimated to have a basic skill in pottery and basket-making.

Endabatsahma:

In this *wereda*, there are three perennial rivers and three irrigable sites in the *tabias* Hibret, Zeamham, and Serie. Although no studies have been conducted regarding mineral deposits, rural communities have collected fragments of gold with traditional methods in the Werie Valley. Stale, with similar design to the Axumite stale, are found in *tabia* Hinzet; these could also be a tourist attraction.

About 52% of the total population is in the working age group. More than 1,200 persons have basic masonry skills; there are around 100 blacksmiths, and 2,100 women with the skill of basket-making.

Hahaile:

In this *wereda*, there is a long history of irrigation practices; five sites have already been studied for the development of micro-dams, and one site for small-scale irrigation. It has also been suggested that the area could be appropriate for coffee plantations.

Half of the *wereda* population is estimated to be in the working group; 690 people have masonry skills, 260 have pottery-making skills, and 260 people have basket-making skills.

Abergelle:

More than 25% of the area is estimated to be bounded by the Tekeze River, and there is a wide plains area appropriate for mechanized cultivation. Further, the area is found to have an appropriate agro-climatic condition for cotton production. The higher livestock potential of the area can also provide for an expansion of small-scale skin and hide production.
The existence of marble on the border sides of the Tekeze River is also a potential for excavation. Finally, the possibility exists of commercial and trade interactions with the Gonder and Wello areas of the Amhara region.

The *wereda* has a relatively high proportion of people of working age, estimated at 56.35%. People with special skills include more than 700 masons, 260 carpenters, 260 potters, and more than 1,300 basket-makers.

Degua Tembien:

Some marble deposits are anticipated in *tabia* Aynalem. The TPLF's command post during the last years of the war is also located in this *wereda*, including man-made caves with meeting rooms and living quarters that have been kept in their original state and are now tourist attractions. The Gedam Endahibey church, made from rock, houses an ancient religious book that can also be of interest to tourists.

Half of the total population is estimated to be within the working age group. There are persons with special skills in masonry, weaving, pottery, and basket making.

Keyih Tekli:

The *wereda* has perennial rivers, and farmers have knowledge of small-scale irrigation practices that could be upgraded. There is also an irrigable area in *tabia* Getski Milesley. The tree Boswellia papyrifera (***meker***), used for the production of gum arabic (***itan***), is found in the lowland areas of the *wereda,* meaning that the potential for wider plantations exists. Local people have also collected gold in some areas. Rock churches in *tabias* Zala, Wukro, and Wetek can be potential tourist attractions.

This *wereda* has the highest number of persons with basic masonry skills - 1,600 - in addition to 80 carpenters, 80 blacksmiths, and more than 4,000 women with basket-making skills.

Table 69 - Development needs as Suggested by Respondents

ISSUE	PERCENTAGE PRIORITY ORDER		
	1ST	2ND	3RD
Seed	42.30	28.31	11.96
Fertilizer	4.98	11.04	14.00
Pesticides	1.24	9.80	14.93
Domestic water	2.96	3.27	3.73
Health	7.00	10.73	16.02
Road	1.87	2.18	3.27
Education	0.78	1.87	2.33
Oxen	29.24	17.11	9.64
Agricultural tools	2.49	9.02	13.37
Grinding mill	0.31	2.18	4.67
Fire wood	0.31		0.62
Other	6.53	4.51	5.44

CHAPTER 11: CONCLUSIONS AND RECOMMENDATIONS

11.1 Recommendations

1. Tigray belongs, both from a climatic and an agro-ecological perspective, to the Sudano-Sahelian region or zone. This zone has among the most fragile, vulnerable and erratic environments in the world, and, partly as a consequence of this, it is also one of the poorest, implying that the need for development is substantial.

2. Support is urgently needed for programmes that prepare and implement strategic planning frameworks for the management of the environment and natural resources of the region. These should be integrated, multi-sectoral, and co-ordinated programmes. This implies a close cooperation between governmental and non-governmental agencies and institution in Tigray. Among other things needed, will be a support for a regional environmental information systems that are linked to networks at national, continental and global levels.

3. Massive infusion of support to village-based land management and pastoral development programmes, including the empowerment of rural organizations with the capacity to manage their resources, and measures to improve traditional production systems.

4. A recognition by the governing authorities in Tigray that higher priority should be given to problems of natural resource management and the need for reforms to ensure this.

5. Support for environmental education in schools at all levels, and environmental awareness campaigns in every subdistrict.

6. The present baseline study is meant to be an efficient means for planning, monitoring and evaluation of the Integrated Agricultural Development Project (IADP) in Central Tigray. The two subsequent components of the baseline study, (1) the field measurements and yield assessments, and (2) the specialist studies are integral components of the whole, and should be completed during the coming agricultural season, i.e. fall 1995 (European Calendar). REST must make sure that both material, monetary and human resources are available to perform this endeavours.

7. An IADP workshop should be arranged at the end of the present agricultural season (fall 1994) with participants from REST, Makalle College of Dryland Agriculture and Natural Resources, Institute of Agricultural Research, the various concerned official bureaux, and field staff and local level officers from the surveyed weredas. The items on the agenda should be:

- Presentation and discussion of survey findings
- From this, evaluate development potentials and constraints for the whole zone and for each individual wereda
- Discuss the most needed and relevant development activities for each wereda
- Develop an action for each wereda and for the whole zone including a calendar of work

8. Similar baseline studies should be undertaken in every administrative zone in Tigray as lack of data is a serious constraint for the development of the region.

9. There should be a review of traditional land use systems and support for alternative or supplementary livelihood systems that are not as dependent on the land. These should include rural economic diversification and the development of light to medium industries. They should aim at eradicating poverty as well as alleviating pressure on and resources.

10. Rural credit can here be a good instrument, but rural credit scheme must be geared towards the establishment and exploitation of new resources, and the development of additional sources for income and employment, as f.ex:

- Establishment of small village saw mills. Within the next decade or two, the afforestation efforts will give some possibilities for an off-take of forest resources if a scheme for continuous tree planting is planned and implemented. Already there are some woodlots with Eucalyptus that could be utilized in this direction. The present local preparation of planks and wooden material for construction and carpentry is both resource wasting and inefficient.

- Fruit production is today limited, both within the villages and at the local markets only small amounts of fruit are avaialble (mostly *beliz*, Prickely pear, and berries from Cora Africana and Zizyphus Spina-Christi). In the future fruit production both for local consumption and for marketing should be developed. Fruits to be considered are papaya, mango, guava, avocado, olive and citrus.

- Sugar cane production with small processong plants in areas with permanent water sources or high soil humidity. Sugar cane could replace Eucalyptus in many places.

- Livestock products. Today, livestock products such as, for instance, hides and leather are almost absent from the local markets. Still, the rather high number of animals in certain weredas must mean that there are some potential for such type of industries. Tanning, sewing, designing, painting and other skin-preparing activities should be developed in order to gain more income from the livestock sector.

- Of particular intererst here could be the introduction of strains of wool sheep. In Tigray there exist a tremendous amount of knowledge and experience in spinning and weaving cotton. If certain types of wool sheep could be introduced, this technology could be applied on another raw material. In the chilly mountain climate found in Tigray, wool products could have a good market potentiality.

- Development of fish resources. In certain areas with a regular supply of water, e.g. Abi Adi and Adi Aha, there could be a possibility for the establishment of ponds for fish farming of carpe, tilapia, cat fish, trout (or any other suitable type). Both economically and nutrionally this could be a valuable resource.

- Conserving and processing industries. Presently, a large amount of prickley pear is harvested and brought to the market during a rather limited harvesting time. In Mexico, for instance, this fruit is important both for wine, juice and jam production. It should be elucidated if this activity could be developed in Tigray.

- Soap production. Shifti/shibti (soap berry) is common in Tigray. Besides its cleaning ability, shifti has a good effect against bilharzia. Production both of soap bars and soap powder based on shifti should be eleucidated.

11. It is important that future approaches and interventions measures for combating drought and desertification and develop new roads to sustainable development, be oriented to take account of new scientific paradigms and of past experiences. Programmes should be designed and implemented in co-operation with the local populations in an integrated and multi-sectoral manner. The programmes must be flexible to allow for changes and reconsiderations during the development process. Since women are heavily involved, the programme designs should pay particular attention to their needs and priorities.

APPENDIX XX: Vernacular and Scientific Names of the Most Important Tree Species of the Area

Seq. No.	Vernacular Name	Scientific Name
1	Kelamitos	Eucalyptus
2	Kliaw	Euclea Schimperi
3	Seraw	Acacia etbacia
4	Awlie	Olea africana
5	Mengi	Rhus glutinosa
6	Tahsos	Dodonaea angustifolia
7	Agam	Carisa edulis
8	Chea	Acacia amythethophyla/seyal
9	Tetaele	Rhus natalensis
10	Nifasya	Albizia malacophilla
11	Awhi	Cordia africana
12	Tambuk	Croton macrostachys
13	Geba	Ziziphus spina-christi
14	Daero	Ficus vasta
15	Momona	Acacia albida
16	Anqua	Commiphora africana
17	Kolqual	Euphorbia abyssinica
18	Lehay	Acacia lahay
19	Erre	Aloe. spp.
20	Beles	Ficus palmata/capraefolia
21	Gesho	Rhammus prinoides
22	Nim	Melia azedarch
23	Meker	Boswellia papyrifera
24	Ankeba	Acacia tortolis
25	Weyba	Comberetum molle
26	Sibkana	Albizia melacophylla
27	Sagla	Ficus sycomorus
28	Shisha	*
29	Tsalwa	*
30	Lusinya	Lusinya leucouphalla
31	Susbaniya	Sesbania sesban
32	Shibaka	Ficus bignonia
33	Malkuza	*
34	Kumel	*
35	Liham	syzyglum guineense
36	Eka	Agave sisal

* Scientific names are not available for the time being.

APPENDIX XX: SURVEY AREAS

COVERAGE OF THE COMMUNITY SURVEY

S.NO	SURVEY AREA	ADMIN. NAME	POP. SIZE	H.HOLD SIZE	H.HOLDS COVERED BY SURVEY
I	Tembien	Zone	-	-	287
1.1	**Abergelle**	Wereda	42393	9548	73
1.1.1	Emba Rufael	Tabia	2900	716	19
1.1.2	Gera	"	3444	774	21
1.1.3	Girawera	"	2450	459	12
1.1.4	Jijike	"	3539	777	21
2.1	**Degua Tembien**	Wereda	61824	13440	72
1.2.1	Aregen	Tabia	2199	549	9
1.2.2	Arena	"	3344	801	12
1.2.3	Endamariam	"	3946	844	13
1.2.4	Mahberesilassie	"	3786	1154	19
1.2.5	May Gua	"	4649	1131	19
1.3	**keyih Tekli**	Wereda	54360	11050	142
1.3.1	Awot Bikalsi	Tabia	3181	653	24
1.3.2	Geski Milesley	"	2424	681	25
1.3.3	Wuhdet	"	3278	661	24
1.3.4	Zala	"	1991	637	24
1.3.5	Wukro	"	2416	531	18
1.3.6	Seken	"	3101	737	27

S.NO	SURVEY AREA	ADMIN. NAME	POP. SIZE	H.HOLD SIZE	H.HOLD COVERED BY SURVEY
II	**Adua**	Zone	-	-	356
2.1	**Embaseneyti**	Wereda	44277	8891	95
2.1.1	Gonek	Tabia	2518	565	21
2.1.2	Kudo	"	1447	312	10
2.1.3	May lemin	"	3271	721	27
2.1.4	Suguh	"	1592	333	11
2.1.5	Tseftsef	"	3418	683	26
2.2	**Endabatsahma**	Wereda	50337	10642	105
2.2.1	Biherawi	Tabia	2500	509	17
2.2.2	Biruh Tesfa	"	2370	571	19
2.2.3	Laelay Endachiwa	"	2605	600	20
2.2.4	Maekelawi	"	4010	807	28
2.2.5	Zeamham	"	3332	643	21
2.3	**Hahaile -**	Wereda	37083	8624	100
2.3.1	Eraro	Tabia	1518	335	13
2.3.2	Genadif	"	3954	772	32
2.3.3	Hadush Adi	"	2703	493	20
2.3.4	Kolla Geble	"	3826	846	35
2.4	**Adi Ahferom**	Wereda	22067	4260	56
2.4.1	Semiech	Tabia	1898	365	12
2.4.2	May Arbea	"	3000	515	17
2.4.3	Hagua	"	1654	342	11
2.4.4	Sefio	"	2328	483	16

APPENDIX XX: The survey team:

Direction, overall co-ordination and technical supervision of the field staff

Gebremedhn Gebru, REST Research Officer

***Wereda* supervisors**

Asefu Hadush
Ayalew Desta
Gebregiorgis Arefayne
Getachew Kiros
Mulu Birhan
Yohanes Meresa

Field team members (data collectors)

Abeba Michael
Aberash Asaminew
Aklil habtesilassie
Alem Gebregziabher
Equar Adisu
Fireweyni Kidanemariam
Genet Seyoum
Hana Abreha
Lemlem Haftu
Rahel Zerabruk
Tiruwork Abay
Yeshi Mekonnen

APPENDIX XX: SUBSEQUENT STEPS OF THE BASELINE SURVEY

This survey is the first of its kind in the program area in terms of coverage and composition. It is hoped that the data gathered in the survey will be a key tool in planning and monitoring programs by both governmental and non-governmental organizations. It is also hoped the survey will form a point of departure for other, related studies.

However, as mentioned in the introductory section of this report, this survey cannot by itself begin to fill in the gaps in knowledge that presently exist. In particular, local community experiences and perceptions need to be described and understood in detail. Hence, there is a need for the professional, specialized studies to follow up the various components of rura life that have been briefly examined in this report.

Subsequent studies to this survey will be in two phases, described below:

PHASE ONE: Establishing Indicator Components

The purpose of indicator components is to establish yardsticks against which development efforts can be measured "objectively", one time per year. These yardsticks consist mainly of field measurements, crop assessments, livestock measurements, and monitoring of socio-economic components ("wealth") among a limited group of farmers selected from the community survey.

The group of farmers to be selected (the "contact" farming households) should consist of a maximum of 10% of the total sample; i.e. maximum 64 farm households. Each family will be thoroughly "measured" against the aforesaid factors each year after the completion of the harvest, to see if there has been any progress from the last year. This will also allow for an evaluation of the extent to which farmers have followed the advice of extension agents and specialists, and in what ways they have adjusted recommendations to suit specific local conditions, or according to their own needs and perceptions.

Field Measurements and Yield Assessments

Concretely, each one of the contact farmer's field will be measured according to size. Thereafter, one to two sample plots from each field will be fenced; each plant/plant station inside the fenced area will then be counted, in order to find the number of plants within each sample plot. The sample plots will be 2.5 square meters in area, since this is approximately 1/1000 of a *tsimdi*.

If there is inter-cropping on the plot, each type of crop within the sample plot will be counted separately; e.g. 65 plants with sorghum and 17 with maize. It should be noted that, since there are often are several tillers (stalks) from each root/plant station, each tiller has to be counted (or an average number of tillers from each root/plant station has to be calculated).

The ratio between the measured field and the sample plot will then be calculated. For example, if the measured field is 1.25 *tsimdi*, and a sample plot is 2.5 square meters, the ratio will be 1:1,250. Knowing the number of plants within the sample plot, and knowing this ratio, enables a good estimate t be made of the total number of plants within the whole field. For example, if 65 sorghum plants were counted within the sample plot, multiplying 65 by 1,250 (the ratio in this example) gives a total of 81,250 plants of sorghum. In addition, if 17 plants of maize were also counted in the same sample plot, 17 multiplied by 1,250 means a total of 21,250 plants of maize in the field.

At harvesting time, 100 heads of each type of crop from each of the measured fields will be harvested, threshed, and weighed. Since the total number of plants from each crop in each field has been counted, and the weight of 100 plants from each crop obtained, it is then simple to measure the total yield of each crop from each field. For instance, 100 heads of sorghum weigh 0.5 kilograms, then 81,250 plants of sorghum will weigh 81,250/100 x 0.5 kilograms, or 406.25 kilograms of sorghum. In addition, if 100 plants of maize weigh .75 kilograms, then 21,250/100 x .75 kilograms totals 161.62 kilograms of maize.

The total yield from that field will then be 406.25 kilograms plus 161.6 kilograms = 567.8 kilograms. Adding the yields from each of the fields, one will know the total yield from that particular farm at that particular harvest.

Livestock Measurements

For livestock, each head of livestock owned by the farming household is counted. In addition, the relative value of the livestock is calculated in market terms, and the importance of livestock compared to other agricultural and non-farm activities is evaluated.

Measurements of Socio-Economic Components

All types of non-farm activities will be described, for example beer-making, petty-trade, handicrafts, wage work, food-for-work, and other activities performed by household members. In addition, an inventory describing the "wealth" of the household will be made, including particular items and their value such as houses, granaries, kitchen utensils, ploughs, and other farming equipment/tools, radios, etc..

In order for this aspect of the survey to be successful, it will be necessary to enter into a very private aspect of a household livelihood. This means there must be a close and trusting relationship established between the interviewer and the household members. Thus, only those households that are willing and motivated to participate should be selected, and all aspects of the survey have to be properly explained.

It is of importance here that the contact households should be stratified by wealth, size, and sex of the household head. This means that the sample should comprise: rich, middle, and poor; big, medium, and small, and male and female-headed households.

PHASE TWO: Specialist Surveys

The specialist surveys will be based on information from the community survey. The aim is to add to community responses the necessary technical information needed for project planning. The aim is also to describe and "evaluate" existing knowledge among rural people, and to make suggestions about how rural people could benefit from additional information and/or training. A proposed list of specialist studies to be conducted is as follows:

a) **Land Resources and Soil Survey**, headed by a soil expert/land use expert and conducted in collaboration with agricultural and natural resources and environmental protection officers at *wereda* and extension levels, and local experienced farmers.

b) **Climate and Water Resources Survey**, headed by a hydrologist and conducted in collaboration with natural resource and environmental protection officers at *wereda* and extension levels, and local experienced farmers.

c) **Vegetation/Ecology Survey**, headed by an ecologist/forester, and conducted in collaboration with natural resource and environmental protection officers at *wereda* and extension levels, and local experienced farmers.

d) **Agronomy/Plant Genetic Resource Survey**, headed by an agronomist, and conducted in collaboration with agricultural officers at *wereda* and extension levels, and local experienced farmers.

e) **Livestock Survey**, headed by livestock expert and conducted in collaboration with agricultural officers at *wereda* and extension levels, and local experienced farmers.

f) **Agricultural Economy Survey**, headed by an agricultural economist, and conducted in collaboration with agricultural officers at *wereda* and extension levels, and local experienced farmers.

g) **Population/Demographic Survey**, headed by a demographer/sociologist, and conducted in collaboration with health, education, and agricultural officers at *wereda* and extension levels, and local experienced farmers.

h) **Gender Survey**, headed by a sociologist, and conducted in collaboration with the Women's Association, and agricultural officers at *wereda* and extension levels, and local women.

i) **Health Survey**, headed by a nurse/health officer, and conducted in collaboration with health, education, and agricultural officers at extension and *wereda* levels, and local people working with health and medical issues, e.g. traditional birth attendants.

j) **Survey on Infrastructure and Services**, including roads (trunk, link, and feeder roads), communications, markets, and marketing. This survey will be conducted by relevant experts in collaboration with the construction and agricultural officers at extension and *wereda* levels, and local people having knowledge of these topics.

POSSIBLE COMPONENTS OF THE SPECIALISTS SURVEYS

5.1 Land Resources

5.1.1 Mapping of the program area land resources based on the following divisions:

- Physiographic units
- Land form units
- Relief units

5.1.2 Soil series, including:

- soil classification (definition) and % of occurrence
- profile description (definition) and % of occurrence
- profile drainage (definition) and % of occurrence
- surface stoniness (definition) and % of occurrence

5.1.3 Land Capability

a) classification by:

- slope
- soil depth
- soil texture
- surface stoniness
- susceptibility to waterlogging

b) by potential use:

- Cultivated area - definition and % of coverage
- Grazing area - definition and % of coverage
- Under-utilized/Non arable - definition and % of coverage
- Forest area - definition and % of coverage
- Wasted area - definition and % of coverage
- Urban area - definition and % of coverage
- Other - definition and % of coverage

5.1.4 Erosion

- Soil and water losses
- Main areas of concern
- Natural water courses
- Cultivation courses

5.1.5 Present land use mapping

a) land use system (including agricultural, forestry, and urban land use systems)
b) potential land use

5.2 Climate and Water Resources

5.2.1 Climate

- Rainfall
- Temperature

5.2.2 Ground water resource

5.2.3 Surface water resource

5.3 Population

5.3.1 Present population of the project area

- Distribution by settlement area
- The rural labor force - the current and the 10/20 year projected rural labor force

- Population projections - for both rural and urban areas population 10/20 years projections

5.3.2 Social aspects

a) characteristics of rural community

- Settlement pattern
- Cultural homogeneity
- Literacy
- Church and the church holidays
- Community labor
- Cultural homogeneity

b) Community organizations

- Formal organizations - such as the farmers, women, youths, etc.
- Internal organizations - such as *sidra bet*, *ekub*, *edir*, etc.
- Religious institutions (the church and the mosque)
- The *baito* system

5.3.3 Land tenure

5.3.4 Communication: Sources and channels of communication to the *wereda* centers and to other economic and social service centers. Major purposes of travel.

5.3.5 Modernization/awareness status of the rural community

- Use of fertilizers
- Knowledge and use of improved seed varieties
- Knowledge and implementation of crop rotation
- Attendance at demonstration days, etc.
- The awareness of the community on the equal rights of women and men

5.4 Womens Issues

5.4.1 Women's time allocation on different domestic work
5.4.2 Value added to a household by the different women's income generating outputs
5.4.3 Women's role in different development programs
5.4.4 Additional burden to women as a result of development programs
5.4.5 Level of health service for women, during pregnancy period and delivery
5.4.6 Participation in decision-making in different household and community issues
5.4.7 Effectiveness of extension projects pertaining to women's development programs 5.4.8 Comparison between male and female-headed households
5.4.9 Main rural women's development recommendations

5.5 Indigenous Knowledge of the Rural Community

5.6 Agriculture

Crop production

5.6.1 Cropping pattern
5.6.2 Cropping calendar
5.6.3 Crop Yields (incorporated in field measurements)
5.6.4 Plant protection - crop pests, diseases, weeds and quarantine
5.6.5 Forage production
5.6.6 Irrigation - practices and available potential areas
5.6.7 Economic analysis of crop production (i.e. offtake and value added to the overall income of the farming community)
5.6.8 Productivity/output projections
5.6.9 Crop genetic resources of the area
5.6.10 Main development recommendations

Livestock

5.6.11 Varieties and distribution
5.6.12 Movement and routes
5.6.13 Oxen - source, work rate, other relevant factors
5.6.14 Livestock feed - production/output from different sources (crop residue, etc.), grazing areas and their carrying capacity
5.6.15 Existing varieties, physical description, growth rate, maturity, purpose, milk yield, average weight at birth, average traction power and other important variables.
5.6.16 Main development recommendations
5.6.17 Communicable and non-communicable diseases, period of occurrence, symptoms, distribution and other variables pertaining to livestock health
5.6.18 Livestock projections
5.6.18 Other professional variables of interest
5.6.19 Main development recommendations

5.7 Food Security and Households Coping Mechanisms

5.7.1 Seasonal migration
5.7.2 Storage and credit
5.7.3 Labor employment
5.7.4 Other household coping mechanisms

5.8 Vegetation/Forest

5.8.1 Varieties and distribution
5.8.2 Major uses by variety
5.8.3 Available plant genetic resources
5.8.4 Other important variables of interest
5.8.5 Main conservation and development recommendations

5.9 Economic Analysis (may be undertaken with follower/contact farmers)

5.9.1 Crop output per household
5.9.2 Food purchase and sales
5.9.3 Other sources of crops
5.9.4 Livestock purchases and sales
5.9.5 Food output and households subsistence requirements
5.9.6 Other sources of incomes of rural households
5.9.7 Rural income and expenditure pattern

5.10 Rural Water Supply

5.10.1 Existing situation - quantity (source, consumption, wastage), quality (ph value, hardness and other quality measures)
5.10.2 Future requirements
5.10.3 Recommendations for improvements

5.11 Rural Health Services

5.11.1 Distribution, periods of occurrence and symptoms of major communicable and non- communicable diseases
5.11.2 Diseases emerging as a result drinking of unsanitary water
5.11.3 Diseases emerging as a result malnutrition
5.11.4 Age-specific common diseases and their characteristic features
5.11.5 Sex-specific common diseases and their characteristic features
5.11.6 Service capacity of existing health infrastructures
5.11.7 Traditional health practices and their problems
5.11.8 Grassroots level animators (CHA and TBA)
5.11.9 Community level of awareness of family planning
5.11.9 Other professional health variables of interest to be incorporated in the study
5.11.10 Recommendations for improvement

5.12 Rural Farm Access Roads

5.12.1 Access to the highways
5.12.2 Availability and access to link roads
5.12.3 Availability of feeder roads
5.12.4 Recommendations for improvement

Table - Proposed Division of Duties for the Specialists Surveys

Seq No	Area of intervention(type of survey)	Responsible/collaborating body	Relevant professionals
1	Land Resources & soil survey	- Bureau of Natural Resources and Environmental Protection(BNREP) - Mekelle Arid Zone Agricultural College	- Soil expert - Land use expert - Expert on the management of natural resources/other relevant experts
2	Climate and water resources survey	- BNREP - REST - PLANNING BUREAU	- Hydrologist/Geologist - Geographer/other relevant experts
3	Vegetation/ecology survey	- BNREP - REST - Mekelle Arid Zone College	- Forester - Biologist/other relevant experts
4	Population survey	- Bureau of labor and social affairs - Bureau of planning - Business College	- Demographer - Sociologist/other relevant experts
5	Survey on rural women	- Tigrayan women's Democratic Association(TWDA) - REST	- Sociologist - Social worker/other relevant experts
6	Agronomy/plant genetic survey	- Bureau of Agriculture - Mekelle Institute of Agricultural Research - REST - Mekelle Arid zone College	- Agronomist - Expert on plant protection - Expert on plant genetics - Livestock
7	Agricultural Economic analysis	- Bureau of Agriculture - Bureau of planning	- Agricultural economists - Livestock, marketing experts etc.
8	Survey on rural water supply	- BNREP - REST	- Hydrologist/Geologist - Health expert/other relevant bodies
9	Survey on Rural health service	- Bureau of health - Bureau of agriculture	- Health expert - Agricultural experts/other relevant experts
10	Survey on infrastructures(roads markets and marketing)	- Bureau of agriculture - BNREP	- Expert in rural technology - Marketing experts/other relevant experts

APPENDIX XX: STATISTICS FROM TIGRAY

POPULATION DISTRIBUTION IN RURAL AND URBAN TIGRAY REGION - 1984

ADM. DIVISION AWRAJA (DISTRICT)	* AREA (KM ^{2})			** POPULATION SIZE			DENSITY per/KM^2	
	TOTAL SIZE	SALT PLAIN	AGR. USABLE (KM^2)	URBAN	RURAL POP	TOTAL POP	CRUDE DEN.	RURAL DEN.
TIGRAY AWRAJA	67,790		66,890	198,034	2,211,666	2,409,700	35.5	31.1
ADWA	3,890		3,890	20,062	479,738	499,800	128.5	123.3
AGAME	3,780	100	3,680	20,688	324,112	344,800	91.2	88.1
AXUM	3,790		3,790	17,753	288,447	306,200	80.8	76.1
ENDERTA	21,020	230	20,790	75,474	277,826	353,300	16.8	13.4
KELETE AWLAELO	14,180	430	13,750	15,648	200,352	216,000	15.2	14.6
RAYA & AZOBO	8,710	140	8,570	22,893	107,907	130,800	15.0	12.6
SHIRE	8,600		8,600	14,921	265,579	280,500	32.6	30.9
TEMBIEN	3,820		3,820	10,595	267,705	278,300	72.9	70.9

* FAO. Assistance to Land-use planning, Ethiopia. Land-use, production Regions and Farming Systems Inventory. Rome, 1984.
** CSO. Ethiopian Statistical Abstract, 1984.

ESTIMATES OF CULTIVABLE AREA AND CROPPING PATTERNS

CEREALS			PULSES			OIL - SEEDS		
KINDS	CULTIVABLE AREA		KINDS OF CROPS			KINDS OF CROPS		
	HECTARE	%		HECTARE	%		HECTARE	%
TEFF	52,444	21.1	CHICK PEA	16,338	6 6	SESANE	4.771	1 9
SORGHUM	49,907	20.1	HORSE BEAN	7,049	2 8	LINSEED	3,259	1.3
BARELY	35,236	14.2	FIELD PEA	3,559	1.4	NUG	2,267	0 9
WHEAT	30,709	12.4	GRASS PEA	2,396	1 0	TOTAL	10,297	4 1
F MILLET	29,274	11.8	LENTIL	1,029	0.4	OTHERS		
MAIZE	6,769	2.7	HARICOT BEAN	270	0.1	ANNUALS	3,325	1.3
TOTAL	204,339	82.3		30,641	12 3	GRAND TOTAL	238,602	

SOURCE : Data Book on land use and Agriculture in Ethiopia. UNDP/FAO and LUPRD. Vol 1, 1982

1. Excluding Dalo Wereda of Agame Awraja and Enda - Selassie Wereda of Adwa Awraja.

DISTRIBUTION OF LAND UNDER VARIOUS USES IN TIGRAY BY AWRAJA IN THE LATE SEVENTIES (per cent)

REGION/AWRAJA	AREA (HA)	CROPPED LAND		GRAZING & BROWSING	FOREST, WOODLAND, BUSHLAND, SHRUB LAND		CURRENTLY UNPORDUCTIVE LAND	CURRENTLY UTILIZABLE LAND
		ANNUALS	PERSENNIALS		FOREST	OTHERS		
TIGRAY	6,779,000	23.4	1.7	39.0	0.3	3.1	0.7	31.8
Kilte Awelaelo	1,418,000	7.1	-	39.1	-	1.7	0.2	52.0
Enderta	2,102,000	18.7	0.9	37.2	0.3	2.6	0.1	40.3
Raya and Azebo	871,000	14.4	2.7	45.0	1.6	2.0	0.5	33.8
Agame	378,000	18.5	0.3	41.8	-	10.2	0.7	28.6
Adwa	389,000	35.2	2.5	46.4	-	3.3	3.4	9.3
Axum	379,000	50.6	5.2	34.7	-	-	1.3	8.2
Shire	860,000	37.1	4.5	39.9	-	7.2	1.8	9.4
Tembein	382,000	66.5	1.2	26.5	-	-	0.2	5.7

SOURCE : FAO/UNDP. 1994. Ethiopia. Technical Report 3.

DISTRIBUTION OF PRODUCTIVE LAND POTENTIAL UNDER VARIOUS USES IN TIGRAY BY AWRAJA (ESTIMATED DURING THE PERIOD 1797 - 82) (per cent)

REGION/AWRAJA	AREA (HA)	CROPPED LAND		GRAZING & BROWSING	FOREST, WOODLAND, BUSHLAND, SHRUB LAND		CURRENTLY UNPORDUCTIVE LAND
		ANNUALS	PERSENNIALS		FOREST	OTHERS	
TIGRAY	4,623,278	34.3	2.5	57.2	0.4	4.6	1.0
Kilte Awelaclo	680,640	14.7	-	81.4	-	3.5	0.4
Enderta	1,254,894	31.3	1.5	62.2	0.5	4.3	0.2
Raya and Azebo	576,602	21.7	4.1	68.0	2.4	3.0	0.8
Agame	269,892	25.9	0.4	58.5	-	14.2	1.0
Adwa	352,823	38.8	2.7	51.2	-	3.6	3.7
Axum	347,922	55.1	5.7	37.8	-	-	1.4
Shire	779,160	41.0	5.0	44.0	-	8.0	2.0
Tembcin	360,226	70.5	1.3	28.1	-	-	0.2

SOURCE : Computed from data presented in the table describing the distribution of productive land potential under various uses in Tigray by awraja (estimated during the period 1797 - 82) (per cent) table 8.4.

ESTIMATES OF LIVESTOCK POPULATION BY AWRAJA IN TIGRAY REGION

TIGRAY	GOATS		SHEEP		CATTLE	
	BEFORE 1970	1978	BEFORE 1970	1978	BEFORE 1970	1978
Adwa	350,000	500,001 and above	190,000	200,001-300,000	100,000	300,001-400,000
Agame	150,000	200,001-300,000	310,000	Below 100,000	150,000	100,001-200,000
Axum	130,000	100,001-200,000	50,000	Below 100,000	50,000	Below 100,000
Enderta	360,000	400,001-500,000	200,000	200,001-300,000	250,000	200,001-300,000
Kelete Awlaelo	150,000	200,001-300,000	250,000	200,001-300,000	130,000	100,001-200,000
Raya & Azobo	300,000	400,001-500,000	190,000	600,001-700,000	200,000	400,001-500,000
Shire	300,000	300,001-400,000	150,000	Below 100,000	150,000	100,001-200,000
Tembien	250,000	100,001-200,000	150,000	100,001-200,000	150,000	Below 100,000
Total	1,990,000	2,750,000	1,490,000	1,635,000	1,180,000	1,690,000
Pack Animals	Asses	Camels	Horses	Mules	Total	Total Dom. Animals Density
In Tigray	275,000	59,000	9,000	17,000	360,000	6,435,000 96.2

Source : - Ministry of Agriculture and Settlement 1970 and 1978
Pack Animals : 1978 estimate
* 1965 Data

DENSITY OF LIVESTOCK POPULATION (ACCORDING TO 1978 ESTIMATE)

AWRAJA	AGRI USED AREA KM²	GOATS		SHEEP		CATTLE		TOTAL	
		NO.	DENSITY	NO.	DENSITY	NO.	DENSITY	LIVESTOCK	DENSITY
ADWA	3,890	500,000	128.5	250,000	64.3	350000	90	1100000	282.8
AGAME	3,680	450,000	122.3	95,000	25.8	15000	40.8	695000	188.9
AXUM	3,790	150,000	39.6	95,000	25.1	95000	25.1	340000	89.7
ENDERTA	20,790	450.000	21.6	250,000	12	250000	12.0	950000	45.7
K/AWLAELO	13,750	250,000	18.7	250,000	18 2	150000	10.9	650000	47 3
RAYA & AZOBO	8.570	450,000	52.5	450,000	52.5	450000	52.5	1350000	157.5
SHIRE	8,600	350,000	40.7	95,000	11 1	150000	17.1	595000	69.2
TEMBIEN	3,820	150,000	39.3	150,000	39.3	95000	24.9	395000	103.4

MEAN DAILY DURATION OF MAXIMUM POSSIBLE SUNSHINE HOURS FOR DIFFERENT MONTHS & LATITUDES IN NORTHERN ETHIOPIA

	JAN	FEB	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT	OCT	NOV	DEC
20°	11.0	11.5	12.0	12.6	13.1	13.3	13.2	12.8	12.3	11.7	11.2	10.9
15°	11.3	11.6	12.0	12.5	12.8	13.0	12.9	12.6	12.2	11.8	11.4	11.2
10°	11.6	11.8	12.0	12.3	12.6	12.6	12.6	12.8	12.1	11.8	11.6	11.5

SOURCE : - FAO, 1984. Irrigation and drainage paper 24. Rome.

TOTAL NUMBER OF HOUSEHOLDS BY SIZE OF HOLDINGS IN TIGRAY DURING 1968 TO 1971

	SIZE OF HOLDINGS IN HECTARE										
WITH OUT LAND	upto 0.05	0 051 0.10	0 101 0.20	0 201 0.30	0.301 0.50	0.501 0.70	0.701 1.00	1 001 1.50	1 501 2.00	2 001 3 00	3 001 4 00
NUMBER 63031	2800	5100	20733	30573	49540	32994	32977	32294	14494	12010	4277
PERCENT 20.4	0.9	1 0	6.7	9.9	16.0	10.7	10.7	10.4	4.7	3.8	1 4

SOURCE : ETHIOPIA. Data Book on Land use and Agriculture in Ethiopia. Vol. II. A field document based on the work of UNDP/FAO Assistance Project (ETH/78/003) and Land Use Planning and Regulatory Department of Ethiopia. Addis Ababa, 1982.

EMPERATURE, RAINFALL AND POTENTIAL EVAPOTRANSPIRATION IN SOME AREAS OF TIGRAY

STATION	LOCATION	ELEMENTS	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
ADIGRAT (1937-84)	LAT 14° 16'N LONG 38° 57'E G ALT 1907 MASL	Temp C° RF (mm) PE T(mm)	12 9 5 2 123	13 9 15 0 132	14 4 30 8 163	15 4 58 2 176	15 1 49 7 170	16 3 71 9 137	14 9 191 9 121	14 7 172 5 109	14 5 17 9 121	14 2 29 146	12 7 29 2 128	12 9 8 5 111	14 3 679 1 1635
MYCHEW (1937-83)	LAT 12° 48'N LONG 39° 32'E G ALT 2380 MASL	Temp C° RF (mm) PE T(mm)	14 3 6 6 138	14 9 26 2 150 0	16 1 38 8 170	16 8 85 3 178	17 9 85 9 180	18 4 58 2 144	17 8 204 2 122	17 7 248 2 115	16 5 206 4 128	14 7 62 1 149	14 6 12 6 136	13 9 10 8 127	16 1 1045 1 1719
HAGERE SELAM (TEMBIEN)	LAT 13° 38'N LONG 39° 10'E G ALT 2300 MASL	Temp C° RF (mm) PE T(mm)	13 1 3 8	14 1 5 7	13 9 33 9	14 4 38 2	14 6 40 7	14 3 75 7	12 6 214 6	12 5 213 8	13 3 93 3	13 5 13 8	12 6 4 1	13.2 5 7	13 5 743 3
ADWA	LAT 14° 09'N LONG 38° 54'E G ALT.1907 MASL	Temp C° RF (mm) PE T(mm)	17 5 2 4 135	19 0 5 9 145	20 8 8 7 185	22 4 31 7 200	22 5 31 9 175	21 7 81 1 141	20 2 215 9 124	18 7 296 7 116	19 3 163 9 124	19 36 3 161	18 5 10 2 144	17 2 1 4 122	19 7 886 1 1773
MEKELLE	LAT 13° 30'N LONG 39° 24'E G ALT 2040 MASL	Temp C° RF (mm) PE T(mm)	16 3 1 6 134	17.5 6 2 144	13 7 18 2 173	19 6 24 181	20 5 12 1 179	20 2 34 7 147	18 3 219 5 124	17 7 259 7 114	18 2 81 4 129	18 4 1 1 149	15 9 5 9 132	14 3 0 9 119	17 6 685 2 1724
RAMA	LAT 14° 18'N LONG 38° 50'E G ALT 1800 MASL	Temp C° RF (mm) PE T(mm)	20 3 12 7	21 6 3 3	24 4 5 8	24 7 10 3	24 9 34 9	23 2 58 3	19 8 291 8	19 1 125 8	21 3 40 6	21 17	20 3 12 5	18 4 0 0	21 6 613
ABI ADI	LAT 13° 37'N LONG.39° 00'E G ALT 1870 MASL	Temp C° RF (mm) PE T(mm)	21 9 3 7 144	19 5 0 4 154	23 8 21 5 195	24 4 8 8 201	24 1 39 8 188	23 4 94 6 149	21 1 247 8 131	20.2 240 3 120	21 4 67 9 133	22 3 9 8 156	21 4 2 3 138	21 1 5 6 129	22 9 742 5 1837

SOURCE : - FAO, 1984. Irrigation and drainage paper 24. Rome.

TABLE: PERCENTAGE AGE - SEX DISTRIBUTION OF SAMPLE HOUSE HOLDS FROM SEVEN WEREDAS OF CENTRAL TIGRAY

AGE	ADI AHFEROM		IN %		EMBASNEYTI		IN%		ENDABATSAHMA		IN %		HAHAILE		IN %		ABERGELLE		IN%		DEQUA TEMBIEN		IN %		KEYIH TEKLI		IN %	
	MALE	FEMALE	M	F	MALE	FEMALE	M	F	MALE	FEMALE	M	F	MALE	FEMALE	M	F	MALE	FEMALE	M	F	MALE	FEMALE	M	F	MALE	FEMALE	M	F
0 - 4	26	25	8.97%	8.62%	33	38	8.99%	7.63%	39	43	7.86%	8.67%	30	39	6.98%	9.07%	25	26	7.74%	8.05%	35	23	10.61%	6.97%	80	59	8.58%	8.44%
5 - 9	25	27	8.62%	9.31%	41	31	8.69%	6.57%	39	35	7.86%	7.06%	32	31	7.44%	7.21%	23	14	7.12%	4.33%	23	33	6.97%	10.00%	65	47	8.58%	6.72%
10 - 14	21	15	7.24%	5.17%	29	37	6.14%	7.84%	39	25	7.86%	5.04%	22	33	5.12%	7.67%	25	20	7.74%	6.19%	20	17	6.06%	5.15%	55	49	7.87%	7.01%
15 - 19	11	21	3.79%	7.24%	34	35	7.20%	7.42%	27	35	5.44%	7.06%	30	22	6.98%	5.12%	21	24	6.50%	7.43%	17	19	5.15%	5.76%	38	44	5.44%	6.29%
20 - 24	10	8	3.45%	2.76%	19	15	4.03%	3.18%	20	25	4.03%	5.04%	16	25	3.72%	5.81%	15	19	4.64%	5.88%	11	9	3.33%	2.73%	22	25	3.15%	3.58%
25 - 29	7	9	2.41%	3.10%	10	13	2.12%	2.75%	17	12	3.43%	2.42%	14	14	3.26%	3.26%	13	8	4.02%	2.48%	7	8	2.12%	2.42%	20	17	2.86%	2.43%
30 - 34	2	7	0.69%	2.41%	4	10	0.85%	2.12%	9	13	1.81%	2.62%	5	9	1.16%	2.09%	8	6	2.48%	1.86%	4	15	1.21%	4.55%	11	18	1.57%	2.58%
35 - 39	2	9	0.69%	3.10%	3	19	0.64%	4.03%	2	13	0.40%	2.62%	4	14	0.93%	3.26%	6	11	1.86%	3.41%	11	11	3.33%	3.33%	8	21	1.14%	3.00%
40 - 44	7	6	2.41%	2.07%	7	9	1.48%	1.91%	6	6	1.21%	1.21%	6	7	1.40%	1.63%	7	3	2.17%	0.93%	4	6	1.21%	1.82%	12	21	1.72%	3.00%
45 - 49	11	2	3.79%	0.69%	14	4	2.97%	0.85%	12	10	2.42%	2.02%	8	11	1.86%	2.56%	7	5	2.17%	1.55%	8	7	2.42%	2.12%	23	10	3.29%	1.43%
50 - 54	3	5	1.03%	1.72%	9	6	1.91%	1.27%	8	10	1.61%	2.02%	12	3	2.79%	0.70%	6	6	1.86%	1.86%	6	2	1.82%	0.61%	15	12	2.15%	1.72%
55 - 59	7	4	2.41%	1.38%	12	14	2.54%	2.97%	9	8	1.81%	1.81%	4	4	0.93%	0.93%	5	5	1.55%	1.55%	8	3	2.42%	0.91%	11	6	1.57%	0.86%
60 - 64	3	4	1.03%	1.38%	3	7	0.64%	1.48%	5	11	1.01%	2.22%	2	13	0.47%	3.02%	3	4	0.93%	1.24%	4	5	1.21%	1.52%	9	7	1.29%	1.00%
65 & above	7	6	2.41%	2.07%	12	6	2.54%	1.27%	10	8	2.02%	1.61%	11	9	2.56%	2.09%	5	3	1.55%	0.93%	7	7	2.12%	2.12%	13	6	1.86%	0.86%
TOTAL	142	148	48.97%	51.03%	230	242	48.73%	51.27%	242	254	48.79%	51.21%	196	234	45.58%	54.42%	169	154	52.32%	47.68%	165	165	50.00%	50.00%	357	342	51.07%	48.93%
TOTAL M+F		290		100.00%		472		100.00%		496		100.00%		430		100.00%		323		100.00%		330		100.00%		699		100.00%

ANIMAL DISEASES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Endabatsahma	Wekie			
	Himam shambu			
	Megerem			
	Silmi			
	Efil			
	Echilam			
	Tsigietegna			
	Gulhay			
	Micha			
	Tselewta			
Embaseneyti	Tafiya			
	Megerem			
	Wekie			
	Mieta			
	Silik			
	Himam Shambu			
	Tsigietegna			
	Efil			
	Gulhay			
	Halafien			
	Eliel			

ANIMAL DISEASES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Abergelle	Megerem			
	Wekie			
	Gulhay			
	Himam Shambu			
	Tsigietegna			
	silmi			
	Efil			
	Micha			
Degua Tembien	Halafito			
	Tsigietegna			
	Gulhay			
	Wekie			
	Efil			
	Himam Shambu			
	Megerem			
	Selmi			
	Micha			

ANIMAL DISEASES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Keyih Tekli	Silmi			
	Enfirir			
	Wekie			
	Megerem			
	Tsigietegna			
	Micha			
	Gulhay			
	Himam Shambu			
	Efil			

ANIMAL DISEASES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Hahaile	Silik			
	Zigag			
	Wekie			
	Himam Shambu			
	Tsigietegna			
	Efil			
	Gulhay			
	Michea			
	Halafen			
	Abek			
Adi Ahferom	Megerem			
	Wekie			
	Himam Shambu			
	Efil			
	Gulhay			
	Silik			
	Halafen			
	Tafa/Tafiya			
	Zigab			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Abergelle	Zagra			
	Mantile			
	Bukuariya			
	Zibie			
	Sesah			
	Gebel			
	Kokuwah			
	Mefles			
Embaseneyti	Midaque			
	Sesah			
	Kokuwah			
	Zagra			
	Zibie			
	Bukuariya			
	Hibey			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Abergelle	Zagra			
	Mantile			
	Bukuariya			
	Zibie			
	Sesah			
	Gebel			
	Kokuwah			
	Mefles			
Embaseneyti	Midaque			
	Sesah			
	Kokuwah			
	Zagra			
	Zibie			
	Bukuariya			
	Hibey			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Degua Tembien	Gebel			
	Ariar Nebri			
	Buquariya			
	Zibie			
	Zagra			
	Sesah			
	Mantile			
	Dukula			
	Gihe			
	Choke Anbesa			
	Hibey			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			
	Tigrigna Name	Amharic Name	English/Scientific Name	Remark
Endabatsahma	Weag			
	Zibie			
	Buquariya			
	Mantile			
	Hibey			
	Kinfiz			
	Ariar Nebri			
	Choke Anbesa			
	Zibad			
	Hargets			
	Tsihirya			
	Midaque			
	Gihe			
	Sesah			
	Kokuwah			
	Zagra			
	Simih			
	Abagunbah			
	Rigibit			
	Euf			
	Gebel			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			
	Tigrigna Name	Amharic Name	English/Scientific Name	Remark
Degua Tembien	Gebel			
	Ariar Nebri			
	Buquariya			
	Zibie			
	Zagra			
	Sesah			
	Mantile			
	Dukula			
	Gihe			
	Choke Anbesa			
	Hibey			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			
	Tigrigna Name	Amharic Name	English/Scientific Name	Remark
Endabatsahma	Weag			
	Zibie			
	Buquariya			
	Mantile			
	Hibey			
	Kinfiz			
	Ariar Nebri			
	Choke Anbesa			
	Zibad			
	Hargets			
	Tsihirya			
	Midaque			
	Gihe			
	Sesah			
	Kokuwah			
	Zagra			
	Simih			
	Abagunbah			
	Rigibit			
	Euf			
	Gebel			

TYPES OF WILDLIFE ANIMALS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Adi Ahferom	Midaque			
	Hibey			
	Mantile			
	Kokuwah			
	Zagra			
	Gebel			
Hahaile	Mantile			
	Zibie			
	Buquariya			
	Kokuwah			
	Midaque			
	Zagra			
	Gebel			
	Weag			
	Kinfiz			
	Tsihirya			
	Chechera			
	Barito			
	Anchiwa			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Adi Ahferom	Shewa			
	Higo			
	Muguya			
	Tingta			
	Mesi			
	Teneg			
	Mezerbae			
	Kuenti			
	Selate			
	Gontse			
	Birnahiyc			
	Michiqua			
	Fie			
	Degie			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Degua Tembien	Ashebir			
	Muguya			
	Mesi			
	Tingta			
	Gulae May			
	Gonche			
?	Zibay			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Endabatsahma	Kewie Genen			
	Goncho			
	Kirdad			
	Teneg			
	Muguya			
	Tsahyay Shewa			
	Wezwazo			
	Tingta			
	Muchiqua			
	Adegese			
	Kuaquito			
	Mesi			
	Buarequa			
	Chew Amrakut			
	Dagusha Kelbi			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Embaseneyti	Shewa			
	Murkuz Seytan			
	Teneg			
	Keyih Hareg			
	Muguya			
	Chew Amrakut			
	Kuaquito			
	Hindukduk			
	Silyan			
	Muchiqua			
	Adgele			
	Wezwazo			
	Tingta			
	Saeri			
	Mesi			
	Feag			
	Higo			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Abergelle	Metselem			
	Mekemecha Hibey			
	Aquakumo			
	Guza			
	Saeri			
	Kotsli Amharay			
	Saeri Shewa			
	Wezwazo			
	Dahnekay			
	Segertsa			
	Saen Dagusha			
	Chew Amrakut			
	Gelgele Meskel			
	Tahag			
	Baldo			
	Mira			
	Guara			
	Dagusha Kelbi			
	Choba			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Keyih Tekli	Digeie			
	Mugiya			
	Aquakumo			
	Wezwazo			
	Muchiqua			
	Birikrik			
	Ashebir			
	Mekemecha Meamin			
	Metselem			
	Marerot			
	Shahshahta			
	Eshok Mergem			
	Gonche Bereka			
	Quakuito			
	Tingita			
	Mesi			
	Asgedom			

TYPES OF WEEDS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Hahaile	Muguya			
	Shewa			
	Wezwazo			
	Nigta			
	Selata			
	Teneg			
	Gud Yibelu			
	Gelgele Meskel			
	Kewie Genen			
	Dandier			
	Tingta			
	Sibhi Tiel			
	Muchiqua			
	Eshok Mergem			
	Quakurto			
	Higo			
	Gonche			
	Mezerbae			
	Birnahiyo			

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Adi-Ahferom	Kiliaw			
	Tsihdi			
	Awlie			
	Bahrthaf			
	Lihay			
	Hitsawits			
	Seraw			
	Agam			
	Niebi			
	Tambuk			
	Awhi			
	Tebeb			
	Hahot			
	Kumel			
	Shibaka			
	Tahisos			
	Kinchib			
	Kerets			
	Koranyet			
	Tish Alalito			

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Adi-Ahferom	Gesho			
	Chekente			
	Daero			
	Liham			
	Hambihambo			
	Beles			
	Kode			
	Awhi			
	Chea			
	Argudi			
	Mengi			
	Eka			
	Ere			
	Kolqual			
	Konteftefe			
	Gonek			
	Surbetri			
	Malita			
	Kaga			
	Andiel			

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Endabatsahma	Awhi			
	Daero			
	Awlie			
	Tambuk			
	Chekemte			
	Agam			
	Liham			
	Tahsos			
	Andiel			
	Kot			
	Kolqual			
	Sagla			
	Seraw			
	Lihay			
	Momona			
	Gava			
	Mekie			
	Atkaro			
	Nifasiya			
	Ankeba			

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Endabatsahma	Weyba			
	Karawih			
	Chea			
	Aye			
	Humer			
	Reway			
	Kumel			
	Kermed			
	Korom			
	Anqua			
	Kiliaw			
	Metere			
	Shibaka			
	Lusinya			
	Tselim Berbere			
	Albizya			
	Ashuak Accasia			
	Lemlem Accasia			
	Nim			
	Diredawa Zaf			

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Degua Tembien	Kelamitos			By Reafforestation
	Accasia Saglina			"
	Tikur Berbere			"
	Beles			"
	Shewshawe			"
Embaseneyti	Seraw			
	Chea			
	Daero			
	Momona			
	Awhi			
	Awlie			
	Bahrthaf			
	Tahisos			
	Kiliaw			
	Gesho			
	Mengi			
	Kolqual			
	Beles			
	Tambuk			
	Gava			

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Abergelle	Kelamitos			By Reafforestation
	Guaza			"
	Humer			"
	Limo			"
	Tetaele			"
	Albizia			"
Degua Tembien	Awlie			Grown Naturally
	Chea			"
	Tetaele			"
	Seraw			"
	Tshdi			"
	Daero			"
	Sagla			"
	Awhi			"
	Shafa			"
	Tahisos			"
	kolqual			"

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tignga Name	Amharic Name	English/Scientific Name	
Abergelle	Chea			Grown Naturally
	Seraw			"
	Mekie			"
	Gava			"
	Weyba			"
	Sibkana			"
	Tsalwa			"
	Fachuka			"
	Shisha			"
	Aye			"
	Sagla			"
	Awhi			"
	Argizana			"
	Walwa			"
	Anqua			"
	Malkuza			"
	Lusinea			By Reafforestation
	Diredawa Zaf			"
	Momona			"
	Nim			"

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Hahaile	Hahot			"
	Tibshi Alalito			"
	Lihay			"
	Hambiahambo			"
	Nifasiya			By Reafforestation
	Lemlem Accasia			"
	Eshok Accasia			"
	Shewshawe			"
	Gava			"
	Lusinea			"
	Susbania			"
	Gravilla			"
	Diredawa Zaf			"
	Aye			"
	Bus			"

TREE SPECIES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Hahaile	Kiliaw			Grown Naturally
	Chea			"
	Momona			"
	Tahisos			"
	Seraw			"
	Awlie			"
	Tambuk			"
	Awhi			"
	Mengi			"
	Kelamitos			"
	Shibaka			"
	Sagla			"
	Hitsawits			"
	Atiat			"
	Beles			"
	Agam			"
	Liham			"
	Thihdi			"
	Eka			"
	Argudi			"

TYPES OF PESTS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Abergelle	Fenta			
	Tsatse			
	Kurfatya			
	Tselim Haseka			
	Shimtat			
	Lihiqua			
	Mantile			
	Kinfiz			
	Anatsu			
	Bukuariya			
	Aewaf			
	Hinziz			
	Chiwara			
	Barnos			
	Filho			
	Nekez			
	Mefles			

TYPES OF PESTS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

	Names of Tree Species			
Wereda	Tigrigna Name	Amharic Name	English/Scientific Name	Remark
Degua Tembien	Anatsu			
	Nekez			
	Kancha Sersir			
	Aewaf			
	Hibey			
	Kinfiz			
	Tsatse			
	Fenta			
	Filho			
Endabatsahma	Mokta			
	Fenta			
	Anatsu			
	Lihiqua			
	Filho			
	Agora			
Disease/Pest ?	Tekusi			
?	Kedewle			
?	Kaekaeta			

TYPES OF PESTS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Keyih Tekli	Anatsu			
	Fenta			
	Hasaku			
	Mokta			
	Filho			
	Kancha Fehan			
	Kaketa			
	Hibey			
Embaseneyti	Anatsu			
	Fenta			
	Chechera			
	Kaketa			
Disease/Pest ?	Tekusi			
	Anbeta			
	Aewaf			
	Mantile			
	Weag			
	Kinfiz			
	Bukuariya			

TYPES OF PESTS FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Adi Ahferom	Anatsu			
	Barnos			
	Kinfiz			
	Bukuariya			
	Aewaf			
	Weag			
	Tsatse			
	Chechera			
	Hasaku			
Hahaile	Mokta			
	Anatsu			
	Barnos			
	Kinfiz			
Disease/Pest ?	Kubi			
	Weag			
	Fenta			
Weed/Pest ?	Zibeay			
	Hinziz			
	Aewaf			
	Kancha Fehari			
	Cheguara			
	Hasaku			

CROP DISEASES FOUND IN SEVEN OF THE IADP WEREDAS
WHERE THE SOCIO-ECONOMIC SURVEY WAS LAUNCHED

Wereda	Names of Tree Species			Remark
	Tigrigna Name	Amharic Name	English/Scientific Name	
Hahaile	Qualiya			
	Himodiya			
	Wag			
Pest/disease ?	Tekus			
Embaseneyti	Himodiya			
Pest/disease ?	Kubi			
Endabatsahma	Qualiya			
Abergelle	Himodiya			
	Michi			
	Bacha			
	Mear			
	Tikusha			
	Akmid			
Keyih Tekli	Himodiya			
Degua Tembien	Himodiya			
Pest/disease ?	Kubi			
Adi Ahferom	Himodiya			
Pest/disease ?	Kubi			
	Lemtsi			

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