

POPULATION PRESSURE, LAND USE CHANGE AND  
PATTERNS OF AGRICULTURAL PRODUCTIVITY  
IN EZANA WOLLENE AND CHEHA 'WEREDAS'  
SABAT BET GURAGELAND

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Population Pressure, Land use change and Patterns of  
Agricultural Productivity in Ezana Wollene and Cheha  
'Weredas', Sabat Bet Gurage Land.

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This Work is Dedicated to **the Gurage Elders** and  
Others who Contributed to and / or  
Initiated, Organized and Coordinated the  
**Construction of Roads** in the  
**Gurageland**

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## ACRONYMS AND SOME AMHARIC /GURAGIGNA/ NAMES

|       |   |                                             |
|-------|---|---------------------------------------------|
| AAU   | = | Addis Ababa University                      |
| CCI   | = | Crop Concentration Index                    |
| CSA   | = | Central Statistical Authority               |
| CSO   | = | Central Statistical Office                  |
| EMA   | = | Ethiopian Mapping Authority                 |
| ENI   | = | Ethiopian Nutrition Institute               |
| FAO   | = | Food and Agricultural Organization          |
| IAR   | = | Institute of Agricultural Research          |
| IDR   | = | Institute of Development Research           |
| LUPRD | = | Land Use Planning and Regulatory Department |
| MoA   | = | Ministry of Agriculture                     |
| NGO   | = | Non - Governmental Organisation             |
| NMSA  | = | National Meteorological Service Authority   |
| OCPZ  | = | Office for Central Zone Planning            |
| PA    | = | Peasant Association                         |
| RTPD  | = | Rural Technology Promotion Department       |
| UNDP  | = | United Nations Development Programme        |
| UN    | = | United Nations                              |

|              |                                                                          |
|--------------|--------------------------------------------------------------------------|
| -----        | -----                                                                    |
| Wereda       | = Lowest administrative unit which may correspond to sub -district       |
| Awraja       | = May correspond to a district                                           |
| Kiflehager   | = Corresponds to a province                                              |
| Keremt (zar) | = Summer                                                                 |
| Bega (abar)  | = Winter and / or dry season                                             |
| Enset (asat) | = Ensete Ventricosum                                                     |
| Zeng (Zeer)  | = Land measurement unit equal to about three meters                      |
| Wedere       | = Land measurement unit which equals to about twenty four zeng<br>(zeer) |

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## ABSTRACT

The major objective of the study is to assess the agricultural resources, patterns of rural land use and land covers and their changes, farming system (with particular reference to enset, its economic uses and production problems) in conjunction with some socio-economic and physical factors which are likely to affect agricultural productivity and to identify the factors to which land and labour productivity are most responsive. Emphasis is, however, given to the impact of population pressure on the land use, the farming system and the agricultural productivity in the study area.

Data needed in the study were acquired from field survey using questionnaires and interviews, field measurements (with the help of aerial photographs and base maps) and some raw data from government offices and other sources. Central tendency measures (mean and median), percentages, standard deviations, coefficient of variations, student-t test, analysis of variance (ANOVA), crop combination indices, crop concentration measures, simple and multiple correlations, stepwise multiple regression techniques were used to analyse the data.

The findings revealed that the mean annual precipitation and hence the basin yield (surface run-off) tend to decrease; the drop in the latter being more faster than that of the former. This may be attributable to changes in climate, land use/land cover, soil resource depletions, etc. Population pressure in the region is one of the highest in the country as it varies from 50 to 728 persons per square kilometer at PA level. One result of the consequences of the high population pressure in the region has been large a volume of seasonal rural-out migration which in the region was recorded as 12.1% in 1992/93. The second major response has been land use/land cover change in the last 21/36 years. Woodland (mainly eucalyptus tree lots), cultivated area, and the growth of settlements, at

the expense of grazing area, recorded an expansion of 196%, 26%, and 5%, respectively. Farm size was generally found to be small (68% of the respondents reported to possess less than a hectare). Family labour is the basis of all farm operations and it was found to be 3 (weighted average) per house hold. Only 19% of the respondents reported to use oxen to prepare land. Manuring is extensively used to replenish soil fertility. Enset is widely cultivated and accounts for 61% of the cultivated land and it is followed by chat(15%), barley(11%) and coffee(5.1%). Enset is grown not only for food but also has many other economic values. It has a calorie yield of about nine million cal. per hectare which is about 217% of most of the cereals, and is expected to support about nine persons per hectare while most cereals may support about 4.5 persons per hectare of land.

There is a significant variation in the patterns of land and labour productivity at zonal, PA and individual farm levels. The regression analysis revealed that eight variables (out of thirteen) emerged as significant predictors which together explained about 25.5% of the variance in land productivity, of which about 70% was accounted for by agricultural labour force, rural literacy, manure input, land value, and distance between homesteads and farm plots. In case of labour productivity, only five variables (manure input, stocking density, agricultural labour force and land value) appeared as significant predictors which together explained about 17% of the variance.

It is worth mentioning that the thirteen variables taken into consideration have contributed only 25.5% and 17% to the variances of land and labour productivities respectively, which leave 74.5% and 83% of the variance to be explained by the variables which have not been considered in the study. Therefore further research to identify the more significant variables from amongst those which have not been considered is advisable.

On the basis of the findings so far noted the following recommendations have been made. These are the need to restructure the farming system, in general, and that of onset in particular; to optimally plan the land use in such a way that the demand for various uses would be balanced on priority basis ; to improve traditional and archaic tools used in cultivation and processing of onset; to set up at least one onset research station in the Gurage area; to integrate agriculture with other income generating occupational activities; to improve infrastructural facilities; to attract capital investment into the area to develop agro-industries, irrigation schemes, and small and medium size modern ranching; and strictly observe the 1993 National Population Policy (family planning aspect in particular) so as to realize balance between population and resources of the area.

# CHAPTER ONE

## INTRODUCTION

### 1.1. GENERAL STATEMENT OF THE PROBLEM

The fact that the economy of Ethiopia is predominantly agricultural, the expansion of the economy and improving the standard of living of the great majority of Ethiopians depend largely on how efficiently the agricultural land is utilized. It is evident that agriculture in Ethiopia is still subsistence type and traditional, uses simple and archaic tools, and controlled by climatic vagaries and meagre resources of farmers. As a result, agricultural productivity is reported to be low to the extent that the nation could not produce ample food which can sufficiently feed the existing population which is growing at a rate of about 3% per annum. Hence, there is the need to tackle the problem of low agricultural productivity which, in turn, will depend on understanding the varying characteristics of Ethiopian agriculture at large and assessing the situation at regional level in specific.

One of the attributable factors to the problems of agriculture in Ethiopia at large and that of Sabat-Bet Gurageland, in specific, is high population pressure. Simple man-land ratio at national level was about 41 persons per square kilometer in 1990 while rural density was estimated at about 250 persons per square kilometer cultivated land. In the Sabat Bet Gurageland and the study area in specific, however, rural density approaches to 400 persons per square kilometer cultivated land. This approximates to the densest pockets such as Damot Gale and Aleta Wendo in Sidamo, and Kedida Gamela and Kacha Bira weredas in Kembatana Hadiya.



Such high population densities reported to have accelerated deforestation and brought about shortage of fuel wood which is increasingly replaced by animal dung and crop residue, which in turn, has led to progressive deterioration in soil quality (Daniel, 1990; Hurni, 1988). This probably has reduced the nation's crop production capacity by about 10 to 20% below the potential (Wood, 1990). Furthermore, growing land scarcity, one of the most challenging problems of the Gurages, shortening of fallow period and the relative stagnation of land use technology, etc. have aggravated agricultural problems in Ethiopia and in enset culture areas in specific.

As a consequence of all these and other problems, food production at national level has failed to keep pace with population growth rate. At national level, in the peasant sector, production fell from 69.4 million quintals in 1979/80 to 53.8 million quintals in 1987/88 (CSO/CSA, 1987, 1988), suggesting a decline of 22.5%. Furthermore, yield of all crops, cereals and tef declined from 12.5, 12.8 and 9.5 quintals per hectare in 1979/80 to 8.9, 9.3 and 7.5 quintals per hectare, respectively, in 1985/86 (CSA, 1987). In the Sabat Bet Gurageland and other enset growing regions too, agricultural performance showed similar reflections and enset yield dropped by about two quintals per hectare in the period between 1960 and 1982 (UNDP/FAO, 1982; MoA, 1984).

Some writers including people (some) in the study area attributed the decline partly to the bacterial wilt of enset ("enset disease") and damages caused by wild animals, land use changes characterized by diminishing land holding size and "contracting" grazing land which resulted in reduction in livestock number and hence, decreased manure supply. This, in turn, made the enset - based traditional farming system incapable to compensate the depleting soil quality. There is also a growing devotion of land (both grazing and enset lands) to very recently adopted cash crops such as chat, orange and eucalyptus trees consequently, a shift in attention and care, labour as well as manure input from enset to

cash crops.

What may be added to these is an increasing off-farm engagements and seasonal labour emigration to urban centers of other regions , which drains away agricultural labour force, and lack of structural adjustment. Moreover, as reported by Amare Getahun (1977), Ethiopia as a whole lacks institutions and infrastructures which are capable of fastening and supporting a modern agricultural economy because of high illiteracy; inadequate communication, transportation, agricultural credit, agricultural services and new input facilities; and lack of marketing facilities, poorly developed extension services as well as absence of soil and water conservation practices.

All the factors noted so far and others could have aggravated rural poverty or are manifestations of agricultural problems in the study area. But which of the problems are more important and considerable in resolving agricultural problems or setting strategies to improve living conditions of the people in the area.

In the light of the noted agricultural problems, low nutritional value of enset (which is the staple food crop in the area), and given the existing high population density, land scarcity and low technological inputs, some people suggest (as a solution) the need for a shift from enset preponderance to grain dominance with enset as the secondary cultivation. Would it be desirable?

Needless to say, restructuring of the farming systems and developing infrastructures and extra- agricultural activities which can complement supports that come from enset in the Sabat Bet Gurageland deem necessary. But, what then should be changed and / or what is the way out?

Thus, the need to appraise the land use system, its change and dynamics, assess agricultural resources, characterize the farming system and point out those production factors to which farmers are most responsive. Consequently, to suggest means and



alternatives which enable to counter the adverse effects of some of the factors and come up with ideas which can improve the carrying capacity of land which supports the Gurages in the study area and the Sabat Bet Gurageland at large.

Following this introductory remark, included in the first chapter are summary of related literature on the subject, objectives of the study, hypotheses, data sources and acquisition methods and techniques used in the analyses and limitations of the study. Chapter two is devoted to imparting basic information of both the natural and cultural environment or the resource base of the study area . Then, two major responses of high population pressure i.e. labour migration and land use change are discussed in chapter three and four respectively. Chapter five is broad and devoted to disclose characteristics of the agricultural system of the two weredas including the enset culture. This is followed by discussions of pattern of agricultural productivity, factors of production and analyses of statistical results in which partial agricultural productivity variables are separately regressed on the production factors. The discussion finally winds up with concluding remarks.

## **1.2. JUSTIFICATION OF THE STUDY AND STUDY AREA**

The major problems of Ethiopian agriculture and that of the Sabat-Bet Gurage areas in particular are structural, policy and institutional induced ones which include very high population pressure, overstocking, land scarcity, land degradation, technological stagnation, lack of proper land-use planning poor farm management etc. In the Ezana Wollene and Cheha weredas of the Sabat-Bet Gurage land, population pressure is very high and arable land is scarce to allow any further expansion of cultivation. Food production falls short of the demand. Therefore, rural poverty is increasing and the standard of living

is deteriorating. Hence, the region loses much of its productive forces in the form of rural-out migration, a typical manifestation of rural development problems. Thus, there is the need to evaluate the agricultural situation and resource-base of the two weredas.

Moreover, in the study area in particular, and Sabat-Bet Guragelands at large, there is very high concentration of enset crop of which the Gurages largely depend upon it. Hence, there is the need to see the association of enset culture and high population pressure, and appreciate its supporting capacity and numerous economic uses. Since the study adopts zonal approach by way of regional analysis, all the three agro climatic zones - dega, woina dega and Kolla-occur only in the two weredas which are most accessible, they are considered in the study as sample weredas in the Sabat Bet Gurageland.

Inspite of its spatial limitations, this study is designed to make an assessment of available agricultural resources, the spatial and organizational structure of agriculture with the intention to identify the farming system including farm structures, production functions and processing. It is also desired to identify patterns of agricultural productivity and factors which generate them. As such, the study provide some basic information (data) needed to appraise the uses and misuses of available agricultural resources and hence, formulate and pursue sound land use policies to improve agricultural production by overcoming the constraints which adversely affect agricultural productivity in the study area.

Moreover, by correlating patterns of population density with agricultural productivity, which according to Mandal (1981), helps to understand the inherent fertility and capability of land resources, the study gives a clue whether vertical (zonal) or inter-zonal migration of population is possible or not by way of relieving high population pressure in certain zones.

### 1.3. SUMMARY OF RELATED LITERATURE

#### 1.3.1. HIGH POPULATION DENSITY AND ITS CONSEQUENCES

The population of Ethiopia was estimated at 42 million in 1984 (CSO, 1984) while in 1990 it increased to 50.9 million (about 89% rural and 11% urban). It was also estimated that the population is growing at the rate of 2.9% per annum since May 1984. This rate is expected to increase by 0.01% every year (CSO, 1984). Accordingly, if this rate of growth continues until the end of this century, about 25 million people would be added to the rural population (CSO, 1985). There is however, regional variation in population distribution and the rate of growth of population; the central and western regions recorded higher growth rates than those of northern and eastern regions (Kloos and Aynalem, 1987)

The Gurage population is estimated to be 1.9 million in 1984 (Belete, 1993). In the past Antonio Cecchi (1886) estimated the Gurage population to number only 40,000. Trucker and Brayan (1956) furnished a figure 350,000 while the Gurage Exhibition Committee (1955) suggested a figure of 500,000. Based on a 77% area sample and a 6 person per house hold assumption, the population of Cheha and Eza was estimated at 131,000 (Ipcar, 1970). But CSA (1990) reported a figure 305,852 for the two weredas in 1989, along with addition of some more sub-weredas.

Population density in Ethiopia changed from about 22 persons/km<sup>2</sup> in 1975/76 to 33.6 in 1984 and 40.7 in 1989 (CSO/CSA, 1977, 1984, 1990). This may imply that population density in Ethiopia is increasing at a rate of about 1.4 persons/km<sup>2</sup> per annum since 1984. However, population densities vary significantly between administrative regions (6.3 persons/km<sup>2</sup> in Aseb to 172.3 in south Shewa region) notably between

peripheral and central (highland) awrajas (less than 10 person/km<sup>2</sup> for Aseb, Gambela, Borena, Kelafo, Gode, etc. to more than 200 persons/km<sup>2</sup> for Kembatana Hadya, Sidama, Welayta, etc.) (CSO, 1984), and between "enset culture" and plough-seed grain culture areas (Kloos and Aynalem, 1987; Westphal, 1975; Mesfin, 1972; Stanley, 1966; Shack, 1966; Smeds, 1955). The administrative regions of Arsi, Shewa, Wello, Tigray and Gojam showed consistently higher population densities between 1965 to 1984 in contrast to Bale, Hararge and Illubabor which recorded the lowest (Amare, 1987).

It may also be noted that most of the awrajas with high population densities are well known for their enset cultivation due to the fact that enset can support more persons per unit area than what can be supported by plough and pastoral farming (Smeds, 1955; Stanley, 1966; Shack, 1966; Mesfin, 1972; Westphal, 1975). In most of the weredas where enset is a staple crop, population densities exceed 150 persons/km<sup>2</sup>. In the weredas of Sabat Bet Gurageland (typical enset growing area) population densities ranged from 150 to 364 persons/km<sup>2</sup> in 1988 (CSA, 1980). The pressure on cultivated land, however, was about 400 persons/km<sup>2</sup> which certainly is one of the highest densities ever recorded in some African regions of plantation culture or in whole of Africa (Ipcar, 1970, Smeds, 1955).

#### 1.3.1.1. CONSEQUENCES OF HIGH POPULATION DENSITY

The impact of population density on rural development has been a controversial issue. Boserup (1965, 1981) argued that population density is the main condition in agrarian change whereas Brookfield (1984) said that population density alone can not explain agrarian change. Despite their controversies, many authors agree that doubling of population has an obvious adverse effect on the natural and agricultural environment

(Markos, 1990; Wood, 1990; Daniel, 1990; Repetto and Thomas, 1983).

Gleave and White (1969) argued that there is a connection between population density and agricultural practice. Rapid population growth results in more intensive land use and change in land use pattern (Boserup, 1965; De Wilde, et.al., 1967; Clarke, 1968; Gleave and White, 1969; Ipcar, 1970; Morgan and Munton, 1971; Benneh, 1972). High population density also leads to expansion of cultivated land and reduction in land holdings (Grigg, 1966; Gleave and White, 1969; Mesfin, 1972; Repetto and Thomas, 1983; OCZP, 1987/88), and eventually results in land parcelation and reduced length of fallow period (Boserup, 1965; Shack, 1966; Gleave and White, 1969; Mesfin, 1972; Fassil, 1980; Repetto and Thomas, 1983; Dessalegn, 1984; Getachew and Mekonen, 1984; Dejene, 1986).

Furthermore, population pressure influences the spread of cash cropping, change in methods of cultivation (including the technology) such as adopting reduced fallow period, using compost, manure, fertilizers and irrigation, terracing, introduction of new crops, etc. (Boserup, 1965; Gleave and White, 1969). Some crops give higher yields than others and can support more population. Accordingly, many writers agree that no other crop except enset could sustain the existing high population density in the Gurage areas and Sidamo regions including Kembata and Hadiya area (Smeds, 1955; Shack, 1966; Stanley, 1966, Ipcar, 1970; Mesfin, 1972; Westphal, 1975; Bekure, 1983). Hence, population density influences the specific type of crop(s) cultivated in an area (Bekure, 1983).

In many areas, as population density increases grazing lands have been converted to agricultural lands resulting in shortage of grazing land, overcrowding of animals and a consequent deterioration in livestock enterprise (Boserup, 1965; Smeds, 1955;



OCZP, 1987/88); decline in agricultural yield and agricultural income (Boserup, 1965; Morgan and Munton, 1971); increased engagements in off-farm activities (Dejene, 1986; Shack, 1966; Mesfin, 1972); and increase in the number of times enset is harvested per year (Eyasu Waro, 1991).

The other major effect of population pressure is seasonal rural out-migration. Studies made in Ethiopia, Africa and elsewhere indicate that population pressure has led to permanent and seasonal out-migration (Morgan, 1955; Gleave and White, 1969; Wood, 1986, 1977). Owing to high population density and environmental degradation, many highland areas of Ethiopia have become areas of out-migration (Kloos and Aynalem, 1989; Wood 1986; 1977; Mesfin, 1985). Many writers also argued that the Gurages' seasonal labour migration in large number is in response to high population pressure in the Gurage land (Shack, 1966; Wood, 1986/1977; Ipcar, 1970; Assefa, 1980; Mesfin, 1972).

#### 1.3.1.2. FACTORS DETERMINING THE TYPE/STAGE OF EXPECTED RESPONSES TO POPULATION GROWTH

The "type and stages of responses" to population growth during any particular time period, undoubtedly, depend upon the stage of agricultural development of the society (Bilsborrow, 1987: 183). The factors determining the response may include: (1) the existing level of living (whether societies are at subsistence or above subsistence level); (2) the availability of untapped, potentially available land; (3) the availability of off-farm rural employment opportunities; (4) the availability of urban employment opportunities which may be sufficient enough to induce migration; (5) the potential for labour-intensive, land saving technological change; (6) the existing crop structure and its capacity for change; 7) the existing ratio of the rural population to the urban population, (larger the

ratio of rural to urban population, the greater will be the potential number of people desiring to leave and the smaller the absorptive capacity of the receiving areas, hence a serious limitation to the "safety valve" of out-migration); 8) the prevailing level of rural fertility and the strength of factors maintaining its high level; (9) the existing size of land holdings and their distribution, and; (10) the institutional structure (Nicholas, 1969; Shaw, 1974; Weiss - Altane, 1977; Bilsborrow, 1987).

The information about these and other factors in any country help to predict the most likely type(s) of response(s). Bilsborrow (1987, 1985) asserted that the greater is the potential for increasing the land area or increasing non-agricultural employment (factors (2),(4)) the less will be the likelihood of intensification (5). The greater also is the potential for out-migration because of (4) and (7) and less likely will be the decline in a rural fertility. However, a concentrated and unchangeable land distribution (factor 9) might stimulate either out-migration or fertility decline, as land intensification possibilities become exhausted (Bilsborrow, 1987). Nevertheless, out-migration and fertility decline are to some extent substitutable responses to increased population pressure (Bilsborrow and Winegarden, 1985).

### **1.3.2. POPULATION BASED AGRARIAN CHANGE: BOSERUP'S THEORETICAL CONSTRUCT, DEBATE AND SOME EMPIRICAL TESTS**

Boserup (1965) together with Allan (1965) and Clarke and Haswell (1967) was one of the pioneer of population-based theory of "agrarian change". Whereas, Malthus thought that food supply limits the population size, Boserup (1965/1981) suggested that in a pre-industrial society an increase in population stimulates a change in agricultural techniques

so that more food could be produced. This may remind the old saying 'necessity is the mother of invention'. Boserup (1965) argued that population pressure determine agricultural intensity and it is the major cause of changes in agricultural technology, land use, land tenure system and settlement forms. which consequently enabled agricultural development to occur.

In her early work on tropical subsistence agricultures, Boserup maintains the idea that an increase in population pressure is the key factor that forces a shift from extensive to intensive system of cultivation associated with developing land use technology in which progressive reduction of fallow period, replacement of digging sticks by the hoe, which in turn is ousted by the plough. In her latter work, Boserup showed a close positive association between rural population density and the extent of multiple cropping and also observed a positive relationship between population density and the amount of fertilizers used per hectare of arable land (Boserup, 1981).

Nonetheless, Boserup's thesis had been criticized for incompleteness, disregarding other factors and considering population density as the sole condition responsible for agrarian change. In her analysis, Boserup (1965) disregarded the possibility of extension of cultivation, the use of higher-yielding crops and other non-agricultural responses, to population pressure such as out-migration and decline in population fertility (Grigg, 1979). Brookfield (1972) in his theory of "Intensification and Disintensification in the Pacific Agriculture" considered two other factors - the bio-physical potential of land and the existence of surplus production for social and trade purposes - which were disregarded or held constant in Boserup's analysis. And yet, Brookfield (1972) used to argue that the ideas Boserup and those of Geertz and of Malthus could be reconciled if one took account of the variables which each ignored, or disregarded. In effect Brookfield (1972) observed significant influences of environmental and social factors in the relationship between

population density and intensity of cultivation.

By examining several social theories of agrarian change, Brookfield (1984), in his work 'Intensification Revisited' argued that most of the innovations can only be realized when there is surplus production available for investment rather than with mere presence of population pressure. Nevertheless, none of the innovation selected from Java, Borneo, and Mexico suggest that there is association between agro-technical innovation and the emergence of either population pressure on resource or of social control. But, he got a stronger evidence in Mexico and hence concluded that no final answer is yet possible as far as the question of innovation and agricultural intensification is concerned (Brookfield, 1984).

On the other hand, Jonathan Rigg (1986) in his study of innovation and intensification in Thailand, observed that population pressure had forced farmers to consider new ways of increasing production and also found evidence to support Brookfield's (1972) contention that marginal environment can seriously limit the scope of innovation.

Regardless of these, however, there are a number of empirical studies which have reinforced and supported the findings of Easter Boserup (e.g. Turner, et.al., 1977; Chaudry, 1981; Dayal, 1984; Mosely, 1982; Gleave and White, 1969; Morgan, 1955; Montimore, 1967). The findings of Dayal (1984), in his analysis of the pattern of agricultural productivity in India, are notable in connection with the proposition of Boserup (1965) as well as Brookfield (1972). Dayal (1984) observed a negative relationship between population density and land (aggregate) productivity in contrary to Boserups idea, and between labour productivity and the density of agricultural workers; his inclusion rainfall as an environmental factor in and his analysis reinforced Brookfield's postulation to modify Boserup's model.



### 1.3.3. RURAL LAND-USE : SURVEY, PATTERNS AND CHANGE

#### 1.3.3.1. LAND USE SURVEY

Different authors seem to have a common understanding about land-use but they express it differently such as a "biogeographical entity" (Moss, 1963), an end product and expression of the interaction between man and land resources (FAO, 1986; Found, 1971); the surface utilization of all developed and vacant rural land at a given time and space (Freeman, 1968); and a deliberate human act, a kind of permanent and cyclic intervention on the ecosystem to satisfy the needs of man (Vink, 1975).

As land use manifests the nature and degree of interaction between man and his environment (Jackson, 1963; Found, 1971; FAO, 1986), its understanding by way of land use survey together with land resources assessment (Young, 1968) becomes a necessary pre condition in rural development planning (Mandal, 1981). Depending on scale, purpose and nature of a region, land use survey primarily registers the occurrence of crops in their regular geographic distribution, nature of farm settlement, and field patterns including different aspects (modes) of land use, size and shape of the fields (Vink, 1975; Mandal, 1981), etc.

Young (1968) and Collins (1966) contended that conducting current rural land use survey and making land use maps with the help of aerial photographs is an essential tool in the hands of rural development workers. Rural land-use survey should also be the first task before patterns of land resources are thought, trends identified and planning for the future is designed (Stamp, 1960). Needless to say, however, that the initial task of land use mapping should be to develop a classification system (Mitchell, 1979). Hence, based



on the works of Odeya and Mengistu, the Ethiopian Land Use Planning and Regulatory Department (LUPRD) in collaboration with FAO adopted twelve land-use categories in different colours, and compiled a land-use and land cover map of Ethiopia in eleven sheets at the scale one to a million (UNDP/FAO/LUPRO, 1989). Land use map of the Sabat-Bet Gurageland is available at the same scale from Addis Ababa sheet NC-37. But the scale is too small to provide details of land-use information (data) for rural development planning. Thus there exists the need for larger scale rural land use maps of the study area.

#### 1.3.3.2. PATTERNS OF LAND-USE

Throughout the historic parts, as Arnon (1987) stated, certain traditional patterns of land uses that characterize subsistence agriculture have evolved in many parts of the world. In Ethiopia, though land-use data are not much dependable, what may be striking in the land-use is that grazing and browsing lands account for more than half of the total area at the national level, followed by land under crops (15%), land under various kinds of woody vegetation (12%), natural and man-made forests (3%), and nearly 19% of land not utilized for agricultural purposes including land which is currently not productive (FAO, 1986). The patterns, however, show regional variations. Land under crop including fallow land in the late 1970's varied from 32.1% (Shewa), 25.9% (Arsi) and 19.2% (Gojam), 8.9% (Sidamo), 5.9% (Hararge) to 3.5% (Bale). Likewise, the proportion of pasture land stood at 81% (Sidamo), 70% (Hararge), 35.7% (Keffa), 32.8% (Eritrea) and 11.6% (Illubabor) (FAO, n.d). Different pictures do appear on micro-regional levels as can be seen for Ezana Wollene and Cheha of the Sabat Bet Gurageland where grazing land accounted for only 26.1% while cultivated lands were as much as 50.1% and 41% respectively in 1989/90.

### 1.3.3.3. VON THUNEN'S MODEL AND LAND USE ZONES

Since J.H. von Thunen first published his theory of land-use in 1826, the issue of the relationship of distance between a farmer's house and his fields and the intensity of utilization of rural land had been of interest to many writers (Chisholm, 1962). Given a cash economy, von Thunen (1826) also propounded that the patterns of land-use were a function of price variation among agricultural products in which cropping intensity diminishes as the distance between the farm and a given consumption center (a farm or town) increased. Von Thunen's work was thought to be applicable at two levels, i.e. local (farm) level in which the farm house (on farm village) is the center of both inputs and consumption or disposal of produce, and at regional (or macro) level where an urban center is the regional market center in the so called isolated state. In effect, a tendency of patterns of land use to be arranged in rings ('Von Thunen's rings') appeared around the rural settlements or the central market in which products requiring high efforts or wages and capital per acre were found near the farm-house (town) while lower market value (effort) products were pushed to distant fields. Hence, land use intensity declined not only away from a farm-house but also as distance from the urban market increased (Grigg, 1979; Found, 1971; Chisholm, 1972).

Many writers tested von Thunen's model in different agricultural environments and have found it to be applicable to many instances (e.g. Morgan (1969) in Northern Nigeria; Horvath (1969) and Jackson (1970) in Ethiopia; Blaikies (1971) in India; Chisholm (1962); Found (1971) etc.

In Ethiopia, Horvath (1969) discovered that the land use pattern around Addis Ababa confirmed the prophesy of von Thunen although all his assumptions were not met.

However, Jackson's (1970) observation in the South-western part of Ethiopian highlands could not confirm the existence of 'von Thunen's rings' because small farmers tended to intensively use all their holdings regardless of their distance from the farm house. Nonetheless, he noted that big farmers land use tended more in line with von Thunen's model.

Observations made in enset growing regions including the Gurage areas also showed zonation around individual homesteads which is in line with the idea of von Thunen (e.g. Amare (1976) in horticultural regions; Alemayehu (1979) in Kembatana Hadiya; Shack (1966), Ipcar (1970) and Adamu (1979) in the Gurage areas). It is also asserted that the Gurage homesteads and fields comprise spatially linked and inseparable units (Shack, 1966, Admau, 1979).

#### 1.3.3.4. LAND-USE CHANGES

Vink (1975) reports that land use is the outcome of techniques inherited and customs acquired by people and reflects previous systems of settlement and the land use of many thousands of years. Shack (1966) argued that the land use system practised by the Gurages at present was taken over from the 'Sidamos'. The Gurages adopted the use of digging stick to the horticulture of enset which was the indigenous staple crop of the region (the 'Sidamos') before the Gurages settled in the area during or even before the 14th century.

Land-use is under continuous field of tension between human needs and available resources (Vink, 1975). Hence, existing methods of cultivations and the land use systems are not permanent features; rather, they are phases in a process of economic development

which can be more plausibly explained as result of differences in population density (Boserup, 1965). FAO (1984) experts also reported that the Ethiopian population in its size, distribution, cultural orientation and practices has had tremendously influenced the land cover type of the country.

The available data, though they are inconsistent, show that there are considerable changes in the land use patterns of Ethiopia. Crop lands expanded from 12044 thousands hectare (average of 1961-65) to about 13730 thousands hectare in 1979 (UNDP/MOA, 1982), a gain of nearly 14%. Recent data from CSA (1987) on actual croplands, however, show a decline of 1.2% and 3.2% for all sectors and private sectors, respectively during 1979/80 - 1985/86. Arsi, Gonder, Sidamo and Wellega yet showed an expansion by above 10%. However, Shewa and Wello showed moderate expansion of 7.4% and 2.9% respectively (CSA, 1987).

Data on perennial crops (enset and chat) (UNDP MOA, 1982; MOA, 1984) revealed that areas under enset crop, at country level, decreased from 166871 hectares in 1969-71 to about 114,249 hectares in 1983/84 (a decline of nearly 32%). Whereas, chat, an emergent highly competitive cash crop, expanded in area from about 15,857 in 1969-71 to 42806 hectares in 1983/84. Hence, chat showed a 170% expansion in about one and a half decade period. Hararge and Shewa accounted for about 95.1% of the total chat area in the country in 1983/84, and showed area expansion of 84.4% and 106% respectively, between 1969-71 and 1983/84 (UNDP/MOA, 1982; MoA, 1984). 40% of the area under chat in Shewa region was accounted for Chebona Gurage awraja, especially the Sabat Bet Gurage weredas. This may suggest that there is land use change resulting from competition in cash crops. Moreover, Shack (1966) and Ipcar (1970) witnessed the on going land use change due to cash cropping in the Gurage areas.

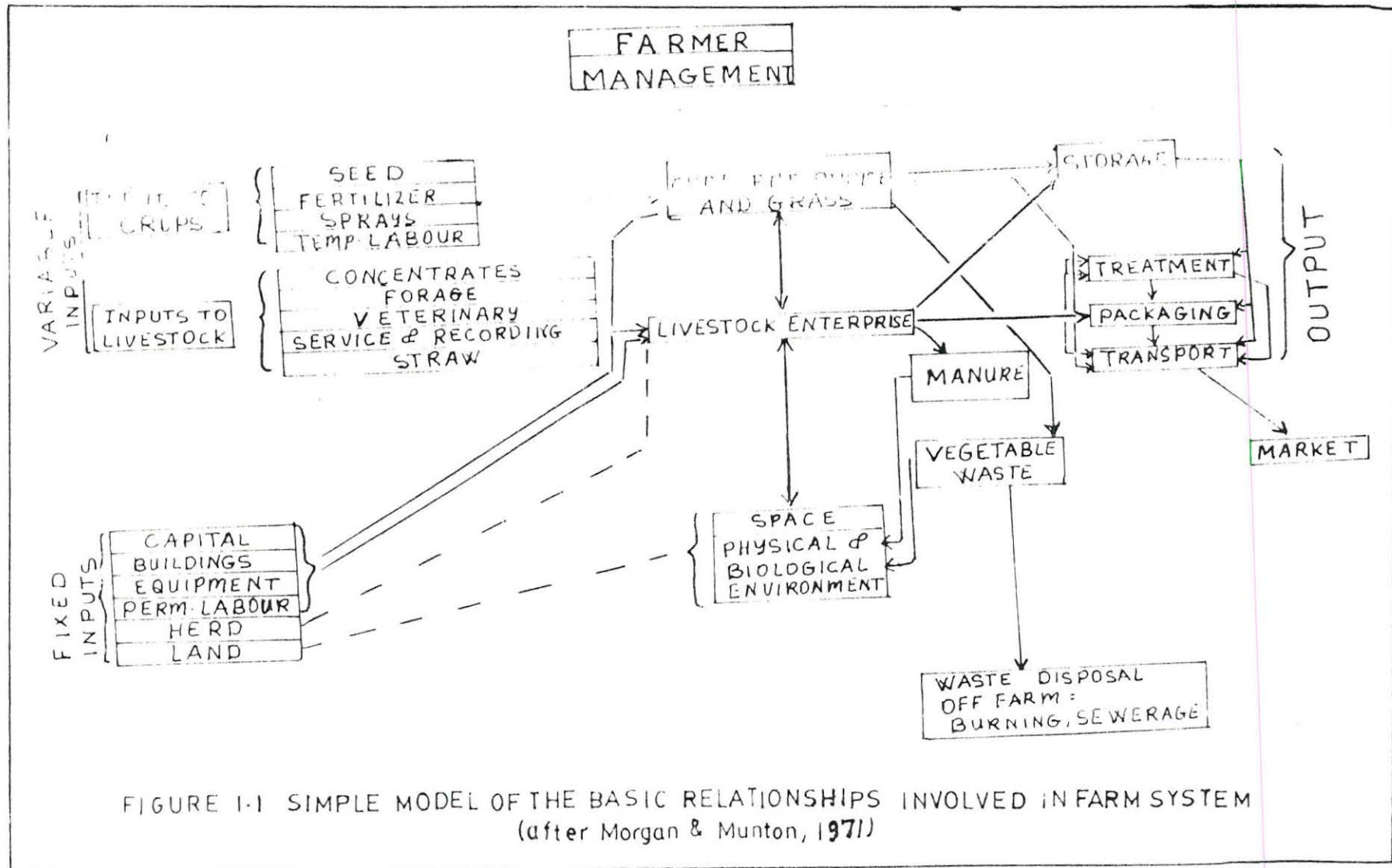
#### 1.3.4. FARMING SYSTEM IN ETHIOPIA

Land use system, which is elaborated in terms of cropping and livestock pattern, identifies itself closely with the farming system (UNDP/FAO, 1986). Farming system is a collection of distinct functional units of a farm such as crop, livestock, and operational activities, and assembles farm resources by means of technology for the production of primary agricultural products (Hardwood, 1979). In a farm system its components and activities are closely related by the common use of the farm's labour, land and capital, and by the joint use of the farm's management capacity (Walter, 1973). The graphical model by Morgan and Munton (1971) shows farm components and the relationship existing amongst the components (see Figure 1.1.).

Ruthenberg (1980) asserted that different farming systems emerge in the process of adopting cropping and livestock raising patterns and farming techniques of each location and aims of farmers. However, writers vary in opinion regarding the basis of identification of farming systems. Benneh (1972) argued that identification should be based on how the constituent elements of a farm system function while Ruthenberg (1980) considered the transformation of input to output as the basis; Gee's (1970) basis of identification was hand, animal and engine power utilized, whereas Amare (1977) related it to the agroclimatic and cultural patterns. Westphal (1975) however, considered land use intensity for crop production and tools used. Accordingly, he identified four agricultural systems in Ethiopia - the enset complex, the seed farming complex, shifting cultivation and pastoral complex.

Still others argued that the systems of classifications so far cited in connection with





Ethiopia are incomplete because they have neglected the most dominant land use type (livestock production), and hence, do not reflect the true status of the rural economic activities and the total resource pattern (UNDP/FAO/LUPRD, 1986). A system which incorporates patterns of crop and livestock is recommended. Accordingly six farming systems were identified in Ethiopia (UNDP/FAO/LUPRD, 1986). However, the Gurage enset regions were wrongly placed with predominately plough-culture regions.

### **1.3.5. LAND OWNERSHIP, FARM SIZE AND LAND FRAGMENTATION**

The size of farm and type of land tenure are elements of agricultural system and they well influence the nature of other elements in the system (Benneh, 1972; Grigg, 1979).

#### **1.3.5.1. LAND TENURE SYSTEM**

Morgan and Munton (1971) asserted that land tenure system can have far-reaching effects on the land use patterns. Many writers claim that land tenure system in Ethiopia had been much diversified and varied from region to region (Mesfin, 1972, 1991; Dessalegn, 1981). Before the Land Reform of 1975, the tenure system in Ethiopia comprised of people who were not allowed to own land, landless peasants (tenants), owner-cultivators of small holdings, the land lords, commercial farmers who owned land by leasing from the government (Mesfin, 1991); and to these may be added land owned communally in the northern parts, and lands owned by the Ethiopian Orthodox Church and by the government (Dessalegn, 1984). The 1974/75 agricultural survey revealed that the communal tenure system accounted for 11% of total holdings and 6% of total cropland

area, own-operated 38% and 37%, tenants operated 36% and 33%, and owned and rented 15% and 24% respectively (Dessalegn, 1984). Needless to say, since February 1975 land is has become property of the Ethiopian government.

#### **1.3.5.2. FARM SIZE**

The question of farm size is crucial almost every where because it decides the degree of risk taking, affects the possibility of specialization, the quantity and size of equipment and power use (Morgan and Murton, 1971), and has an important bearing on the types of farm inputs, consumer goods marketed, the possibility of realizing economics of scale and on the design and development of rural infrastructure (Dessalegn, 1984).

Rural Ethiopia, before and after 1975 land reform, has remained land of peasants with small holdings and the pattern of land holdings emerging after the reform is almost the replica of the old pattern (Desalegn, 1984). The 1974/75 and the 1977/78 agricultural sample surveys (MoA, 1975, 1978) revealed that about 50% and 51.1% of all holdings in the country were less than one hectare and accounted for about 19.4% and 18.5% of the total croplands; 43.9% and 47.5% of the holdings were between one and five hectare and covered about 52.3% and 73.1% of the cultivated land; and holdings of five hectare and above accounted for 5.8% and 1.4% of the total holdings and covered 29.3% and 8.4% of the area in the pre-and post-1975 reform, respectively.

#### **1.3.5.3. LAND FRAGMENTATION**

Land fragmentation is a serious problem of Ethiopian agriculture. The 1974/75 agricultural sample survey (MOA, 1975) brought out that only 40% of land holdings in

Ethiopia were made up of one compact plot while 36% consisted of 3 and more parcels. Land fragmentation in Ethiopia or else where is attributed to inheritance law (Allan, 1965; Fassil, 1980; Messfin, 1972; Dessalegn, 1984), population pressure (Allan, 1965), soil heterogeneity and variation in land quality (Fassil, 1980). Fassil (1980), Dessalegn (1984) and Mesfin (1986) also reported that the land redistribution policy practised after 1975 in Ethiopia aggravated the problem of land fragmentation in many parts of the country.

### 1.3.6. CROP AND LIVESTOCK PRODUCTION

#### 1.3.6.1. CROPPING SYSTEM

Ethiopia is a country of physiographic and cultural complexities. The wide range of agro-ecological varieties existing in Ethiopia enable the country to grow a large number of crops. Moreover, the subsistence need of the farmers and inadequacy of quick and cheap transportation facilities which restricted exchange of commodities urged peasants to produce almost all crops included in the consumption basket of the family (UNDP/FAO/LUPRD, 1984; Amare, 1976; Bekure, 1983). Cereals dominate the pattern, accounting for 80% of the land under annual crops followed by pulses (12%) and oil seeds (2%). Teff occupies the largest area, nearly a third under this group while coffee and enset are the major perennial crops (UNDP/FAO/LUPRD, 1984). However, in very densely populated areas of Sidamo, Kambatana Hadiya and Gurage areas enset is the major staple food crop while among the Welaytas and Janjeros, and in Keffa and Gamo Gofa it is cultivated as a co-staple along with cereals and tubers (Stanley, 1966 Mesfin, 1972, Westphal, 1975). In the Sabat Bet Gurage weredas cropping pattern is dominated by enset though there is zonal (vertical) variation in the pattern (Shack, 1966; Ipcar, 1970, OCZP,



1987/88).

### 1.3.6.2. LIVESTOCK RAISING

Ethiopia has the largest livestock population in Africa numbering a little over 74 million heads of ruminants (= to 30 million TLU), 5.3 million chickens and 18,000 pigs (MOA, 1978). Livestock in Ethiopia is the principal wealth of the farmers. It is the source of support energy for the farm, transport of commodities, domestic fuel (cattle dung) and pen manure used as fertilizer in many parts of the country (UNDP/FAO/LUPRO, 1984; Amare, 1977). As in the case of crops, peasants keep a mix of species to meet the above specified needs. On the highlands about 19 livestock combinations which are grossly generalized into two combinations -cattle-sheep -horse, and cattle - goat - ass are identified (UNDP/FAO/LUPRD, 1984). The 1978 agricultural sample survey of MOA revealed that cattle account for 81.3%, sheep and goats (4.9%), horse, mule and ass (9.2%) and camel (4.7%) of their numbered strength (UNDP/FAO/LUPRD, 1984). In Chebona Gurage awraja, still cattle predominate the pattern of livestock; and livestock raising in enset growing areas is highly integrated with crop (enset) production and the two are complementary operations (Amare, 1975; Shack, 1966; Smeds, 1955; Stanely, 1966; Adamu Retta, 1979; MOA, 1984).

### 1.4. OBJECTIVES OF THE STUDY

The major objective of this study is to assess the agricultural land resources, patterns of rural land-use and their changes, farming system and socio-economic factors which affect agricultural production and the impact of population pressure on the



availability of agricultural labour, land use, farming system and agricultural productivity in Ezana Wollene and Cheha weredas. More specifically it is intended:

1. to assess the land resource base which includes topography, soil, natural vegetation, climate and water resources:
2. to assess the land use pattern and the land use system and change:
  - 2.1. by way of surveying the current land use and land cover of the area based on sample peasant associations in the three traditional climatic (elevation) zones of dega, woina dega and kolla, and compiling land use map at the scale of 1:25,000 or larger using aerial photographs and field works, and
  - 2.2. appraise the land use pattern and change, proportion of land utilized for various uses including land used for growing crops, livestock grazing and feed resources, and pattern of settlement, etc.;
3. to assess and provide data on farming system on which government's agricultural decisions shall be based. This will include:
  - 3.1. land ownership (or tenure system), farm size, available household labour and its use, techniques of restoring soil fertility, off-farm engagements, farm implements, etc.,
  - 3.2. types of crops grown, crop combination, specialization and concentration, crop yield & cropping calendar including cycle of onset cultivation,
  - 3.3. types and number of livestock raised including livestock pattern,
  - 3.4. degree of integration of onset cultivation and livestock-pastoral industry;

4. to assess crop production factors which largely are from the socio-economic environment and determine those to which peasants (or agricultural productivity) are most responsive;
5. to assess the interrelationship between population density and agricultural productivity;
6. to characterize patterns of land and labour productivities in the three traditional agro-climatic zones;
7. to assess some of the responses of peasants concerning change in cropping patterns farm size magnitude of migration and increasing rural population density in the last 10 to 18;
8. to assess whether of a shift from enset predominance to grain dominance with enset as the secondary cultivation is desirable or not.

#### 1.5. WORKING HYPOTHESES

1. There is a considerable change in land use patterns over the last 21 to 36 years (objective 6,7)
  - 1.1. Cropland has increased;
  - 1.2. Pasture land and meadows have decreased in area,
  - 1.3. Livestock number per house hold has decreased but livestock densities increased.
2. Land productivity show altitudinal (vertical) variation (obj. 6).
3. Labour productivity patterns show vertical variation (obj. 6).
4. Land and labour productivity show uniform patterns in altitudinal zones (obj. 6).
5. Population density (a surrogate measure of population pressure) is positively correlated with land productivity and explains variation in land productivity much

more strongly than other factors taken individually (obj. 4,5).

6. Labour productivity is negatively correlated with population density (Obj. 4,5).
7. Household livestock size, which may be indexed by stocking density which indicates available amount of manure supply, is positively correlated with land productivity (Obj. 3,4).
8. Both population density and livestock density together with farm-size and environmental factors (rainfall(altitude) and land value(quality)) account for the highest proportion of the variation in land and labour productivity hence,are most considerable in the restructuring of enset culture of the study area and formulation of development policy (Obj. 4,5).
9. Calory yield and population supporting capacity of enset per unit area is greater than that of most grains (obj. 8).

## **1.6. DATA SOURCES, ACQUISITION AND METHODS OF ANALYSIS**

### **1.6.1. DATA SOURCES**

The study involved data acquired from secondary as well as primary sources. The secondary sources include existing base maps: 1:50,000 topographic maps, 1:1,000,000 geomorphology and soil maps, and land use and land cover maps as well as land resources map of the area including 1:250,000 and 1:1000,000 topographic maps; aerial photographs which enlarged to 1:25,000 or larger scale; reports, statistical abstracts; and documents from government and non-government organizations. Primary data on socio-economic and demographic factors were generated by using questionnaires and interviews from sample house holds, and community leaders and elders respectively. Land use data, however, were partly collected based on actual field survey and then mapped using aerial

photographs.

### 1.6.2. DATA ACQUISITION PROCEDURES

1) Secondary and primary data. From the physical environment were acquired both from map analysis and interpretation, and field observations. Data needed to describe relief, slope, hydrography, soil, geomorphology, vegetation etc. were acquired from large and small scale topographic maps including thematic maps related to agroclimatic conditions.

Data required to compile current land use/land cover map of three sample peasant associations (PA)<sup>1</sup> were collected based on field observations (survey) just before the onset of harvest season with the help of recently taken aerial photographs of the areas on a scale of 1:25,000 or larger (enlarged from 1:50,000). Aerial photographs of 1972 for Noreha PA (dega) and that of 1957 for Agenna (woina dega) and Dubissana Karssa (kolla) were used to evaluate the probable changes in land use land cover by comparing with current land uses and cover maps compiled in the field.

Data on the quality of land which is expected to be the aggregate effect of soil fertility, soil and topographic problems were collected in terms of a surrogate measure i.e., land value. Despite it is illegal to sell land (because land in Ethiopia was claimed to be government's property since 1975), some peasants have been "selling" lands with an "understanding" of local governors and or in the name of transferring permanent crops which are found on a land from one proprietor to another. Current land values were collected at village level by interviewing community elders and PA leaders as well as

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<sup>1</sup> One sample PA from each agroclimatic zone - Noreha in dega, Agenna in Woina dega and Dubissana Karssa in Kolla (see map I) were selected based on accessibility but randomly, and current land use/land cover surveyed in field. It is presumed that the three PAs would represent their respective zone.

individual peasants. Data on climatic conditions (rainfall in particular) were measured in terms of another surrogate measure that is average elevation<sup>2</sup> of each village from 1:50,000 topographic maps and checked by using well-calibrated altimeter.

2) Socio-economic data. Data on socio-economic and demographic factors were obtained from sample PAs, households and household farms using questionnaires and interviews.

3<sub>a</sub>) Sampling Procedure and Sample Frame. All peasant associations, both in Cheha (53) and Ezana Wollene (65) weredas, and 44,335 peasant households and their farms (1991/92) were used as sample frames. Out of the total 118 PAs only 10 PAs (7 from Ezana Wollene and 3 from Cheha weredas) were selected in such a way that one PA appeared from Kolla zone while five and four appeared respectively from woina dega and dega parts in proportion to the area of each zone. The selection was, however, based on accessibility. The consideration of PAs was based on the fact that they have relatively comprehensive and up-to-date information pertaining to the number of peasants, house hold heads and well defined administrative boundaries that can be used for spatial analysis.

3<sub>b</sub>) Sampling Design. In the two weredas, there were about 44,335 (1991) households and a total population of 347,790 (1993). About 243 house holds which account for about 0.55% of all house holds in the two weredas and 6% of the house holds of the 10 selected sample PAs were surveyed. The number of sample households selected were made proportional to the household numbers in each PA. Distribution, therefore, was based on proportion and stratification followed by a systematic random selection of target sampling units from household with different farm sizes. Each household is,

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<sup>2</sup> There is a 0.4 positive association between rainfall distribution and altitude in the Gurage zone including adjoining places. Hence, I supposed that altitude of a place would partly and crudely index the amount of rainfall each village receives and soil moisture condition in the study area (Roy, 1982: 467-8).



therefore, used both as the primary and target sampling unit.

Moreover, the sampling distribution involves a four-stage stratification. The initial stage is at wereda level, the second at zonal level, then at PA level in which distribution is based on proportion of house-hold numbers and finally, the number of households in each PA with equitable distribution among two groups of farm sizes viz., those with less than 0.5 hectare of farm land and the other larger than 0.5 hectare (see Table 1.1.).

**Table 1.1. SAMPLING PROCEDURE\***

| Sample PAs      | 'Wereda' | Agro-Climatic Zone |           |         | Area (km <sup>2</sup> ) | Pop. (1993) | Total H.H.S. | Sample H.H.S. |
|-----------------|----------|--------------------|-----------|---------|-------------------------|-------------|--------------|---------------|
|                 |          | 'Dega'             | 'W. dega' | 'Kolla' |                         |             |              |               |
| Norcha          | Ezana W. | x                  |           |         | 10.0                    | 3243        | 400(1990)    | 23            |
| Kokera          | "        | x                  |           |         | 14.4                    | 2686        | 406 "        | 24            |
| Ketane          | "        | x                  |           |         | 9.2                     | 3500        | 459 "        | 27            |
| Cheza Sefer     | "        | x                  |           |         | 22.0                    | 5215        | 677 "        | 39            |
| Agenna          | "        |                    | x         |         | 7.1                     | 5143        | 558 "        | 32            |
| Muttana Wera    | "        |                    | x         |         | 7.7                     | 2530        | 354 "        | 20            |
| Darcha          | "        |                    | x         |         | 8.2                     | 2062        | 249 "        | 15            |
| Endeber         | Cheha    |                    | x         |         | 11.0                    | 5706        | 469(1991)    | 27            |
| Sissena Denab   | "        |                    | x         |         | 9.05                    | 2412        | 350 "        | 20            |
| Dubissana Karsa | "        |                    |           | x       | 9.1                     | 1804        | 280 "        | 16            |
| Total           | -        | -                  | -         | -       | 107.73                  | 34301       | 4152         | 243           |

\* For location see map II

### 1.6.3. METHODS OF DATA ANALYSIS

To achieve the stated objectives and test the hypotheses, various methods of data analyses were used in connection with determining land use dynamics and patterns, controls of agricultural productivity, spatial characteristics of crops, relationships among crops, i.e. crop complements, crop specialization and crop-concentration including changes in the land use pattern.

1) Change in Land Use/Land Cover Pattern. Sequential aerial photographs were employed as a tool to study the land use /land cover changes in Norcha(1972), Agenna and Dubissana Karsa PAs(1957). These are respectively found in upper dega ,woina dega and kolla, and expected to represent the three agro-climatic zonesand the region at large. Current land use/land cover pattern is surveyed and mapped for the three PAs using most recently taken aerial photographs at a scale of 1:25,000 or larger (enlarged). On the other hand, using aerial photos of 1957 and 1972, in case of Agenna and Dubissana Karssa, and Norcha respectively, old landuse/land cover pattern of the three areas were evaluated and mapped. Accordingly, six land use/land cover maps, two for each PA were compiled. From the six maps, area of each land use/land cover units for the three PAs in two different periods were measured using 'Digital Planimeter' and changes in the pattern were evaluated.

Moreover, similar evaluations were made in case of changes in cropping patterns in the 10 PAs based on peasants' responses. Comparison was also made between the two. The time gap and the specific periods were however, different (with this hypotheses 1.1. and 1.2 are tested).

2) Assessment of Spatial Characteristics of Crops. To evaluate crop association, crop specialization and areal concentration, various models were employed. Weaver's (1954) model is employed to determine crop combination, - coefficient of determination used to show relationship among crops and to determine which crops farmers are likely to produce simultaneously, i.e. crop complement (Humphery, 1974); and to reveal the degree of crop concentration, coefficient of specialization (CS) or diversification model (Isard, 1960; Bekure, 1983; Shryock, et.al; 1976) are used.

3) Pattern of Agricultural Productivity. Simple correlation and regressions used analyses were used to see the strength and direction of associations which exist between

land /labour productivity and the selected thirteen variables( $X_{1-13}$ ) as well as with other a few other independent variables. A stepwise multiple regression model is also employed to show the relative influence of the independent variables (each and in groups), and isolate, in particular, those which do have critical influence and should be retained in regression equation either to describe or predict other values of the dependent variables (Jonson, 1980).

Moreover, partial correlation is ran to disclose the relative strength of the association between the dependent and independent variables. Multiple correlation and multiple coefficient of determination is used to discern the overall degree of association and what proportion of the total variance in the patterns of agricultural productivity can be accounted for by all or part of the predictors.

Analysis of Variance (ANOVA) is used to test whether agricultural land and labour productivity, landuse, etc. patterns differ with one to another at zonal and PA levels. ANOVA is also used to test level of significance of the contribution of population density, farm size, physical factors, etc. in explaining variation in the pattern of agricultural land productivity as well as labour productivity. (With these hypotheses 2,3,5,6,8,9, and 10 are tested.).

4) Maps, Tables, Graphs and other Drawings. They are extensively used to portray patterns of land use/land cover, agricultural productivity, rainfall distribution, surface run off, age-sex structure, migration rates, etc., and as tools of interpretation (with these hypotheses 1,2,3 and 4 are tested).

In general, in most cases of assessments of spatial patterns and structures, the analyses strictly followed zonal approach at agro-climatic level as well as at PA level, when it deemed necessary.

### 1.7. LIMITATIONS OF THE STUDY

This study, though expected to show the agricultural environment and its problems as well as attributable factors in connection with high population pressure, suffers from limitations which include:-

The findings of the study are inferable to Ezana Wollene and Cheha weredas and then probably to Sabat-Bet Gurageland. However, due to time and financial constraints as well as the very nature of the study, the author is forced to select only 10 PAs in two weredas and only 243 sample house holds, which would have some limitations in making inference to the general population.

While evaluating the agricultural performance which is a function of both socio-economic and physical factors, again due to time and financial limitations, only a few prominent socio-economic and demographic factors were considered together with two surrogate natural factors (elevation and land value which is assumed to crudely index land quality which, in turn is a function of soil fertility, slope, ruggedness, etc). Natural factors to a large extent are not considered.

Respondents were very suspicious and highly reluctant to give the actual figures in connection with questions related to income (e.g. amount of agricultural products / number of enses harvested or marketed, livestock owned, and size of land holding, number of migrants, etc.). Moreover, because the peasants were so eager to get aids from governmental and non-government agencies, they might have magnified or underestimated some of their socio-economic problems, and hence the objective reality might be disguised to some extent. This is one limitation of income/ yield data collected using questionnaire /interview. Hence, the thirteen predictors selected succeeded to explain only about 15% to 26% of the variance in labour and land productivity respectively. The failure ,as such,

may be partly attributed to this. But there had been no other options feasible to collect yield /income data because of financial and time constraints.

Problems were also encountered with regard to recalling the amount produced, land use and cropping pattern, etc in the past. On the other hand, the bulkish nature of enset crop and its product could not enable to determine its production in kilograms. Therefore, conditions did compell the author to collect enset production data in terms of enset numbers harvested and then multiplied by local unit selling price.



## CHAPTER TWO

### THE PEOPLE AND THEIR ENVIRONMENT

#### 2.1. THE GURAGELAND AND THE PEOPLE: AN OVERVIEW

##### 2.1.1. THE GURAGELAND

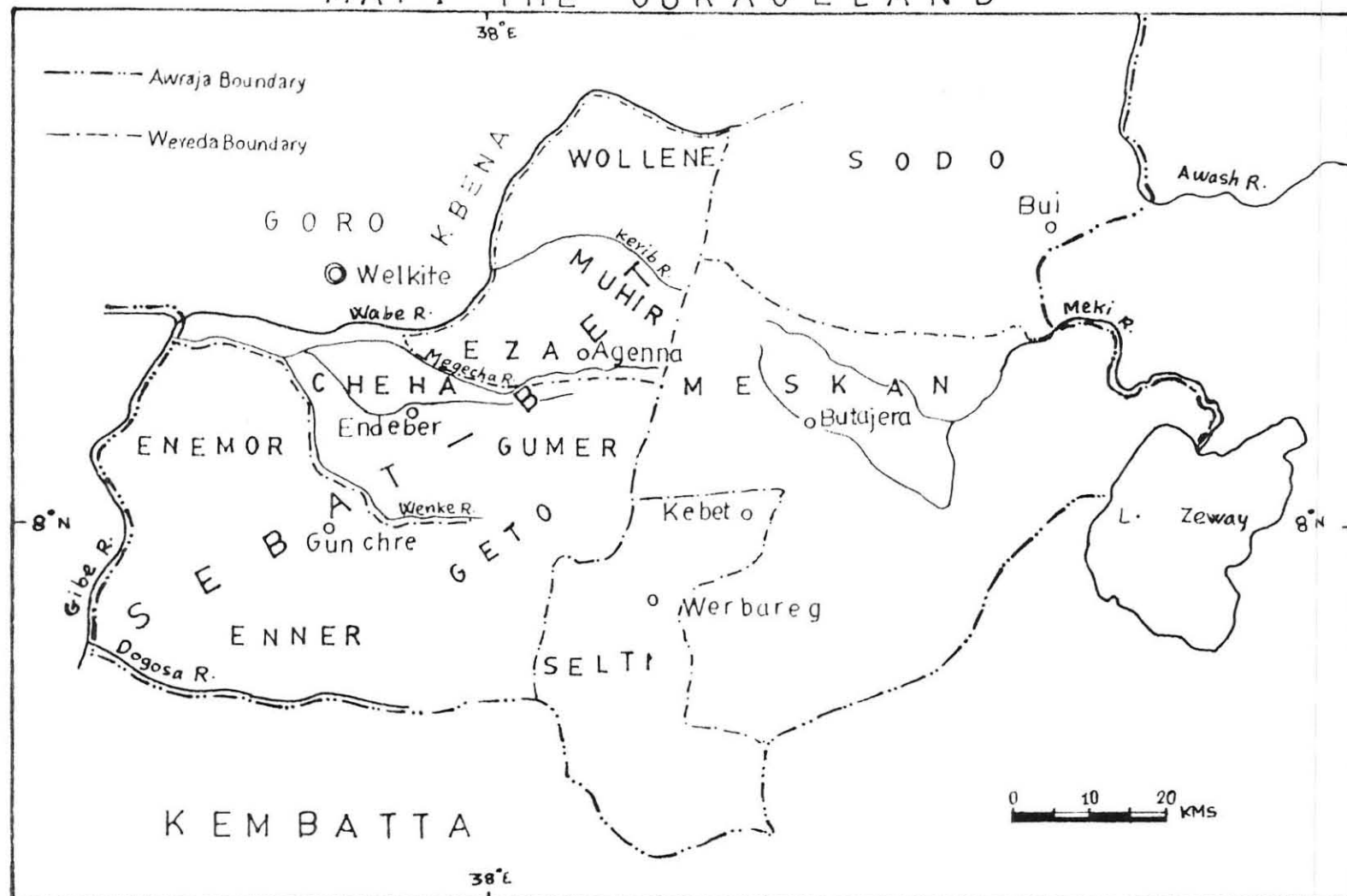
The area under study includes two subdistricts of Ezana Wolene and Cheha weredas and comprises the western part of the Gurage cultural region which hereafter referred to as the "Gurage land" for it is settled by the Gurage people. It may not be easy to define boundaries of the land settled by Gurages because, through its long history, it has slowly grown wider and in some directions Gurage settlements have already blended with settlements of neighbouring tribes (the Oromos in the east, north and west) (Seifu, 1974: 35).

The Gurages occupy a portion of the most south-western range of the central Ethiopian plateau. Their land, the Gurageland, is situated to the south and south-east of Addis Ababa between about 37° 30' and 38° 50' E, and 7° 46' and 8° 45' N. (See map I). The region is circumscribed by prominent topographical features; in the east it is bounded by the rift valley and reaches as far as the islands in Lake Ziway<sup>3</sup>, in the north it is conventionally bounded by the Awash River, in the west by Wabe, (Rebu) and Gibe Rivers, and in the south by Kembatta mountains (Shack, 1966; Ipcar, 1970; Seifu, 1974). Culturally, the Gurage people are bordered on the north, west and east by three Oromo sub-groups - the Mecha, the Tulama and the Arsi, respectively. Immediately across the

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<sup>3</sup> Inhabitants of islands of Galila, Debre Sina, Gete-Semane, Debre Tsiyon and Tedecha in Lake Ziway were migrants who escaped invasion of Gran Ahmed, (Seifu, 1974) practise Christianity and speak a language which belong to Oriental 'Gurage language group (Shack, 1966).

# MAPI THE GURAGELAND



Omo trough and to the south are two sub-groups of the Sidamo people -the Janjero and the Kembatta respectively (Shack, 1966; Ipcar, 1970; Seifu, 1974).

Within the Gurage Cultural land there are a number of sub-regions as Sodo wereda in the north and north-east, Meskan in the east and Silte in the south and south-east (Shack, 1966; the Gurage Exhibition Committee, 1955). Others such as Cheha, Ennemor, Eza, Geto and Muhir, the initial "five houses", properly belong to the loose "political federation" referred to as the "Sabat Bet Gurage", the seven houses. To these W.A. Shack added Aklil and Wollene-Weriro while (Worku, 1984) included Maqorqor and Endagagne. Getnet Bekele however, disagreed that Endegagne form part of the "Seven Houses" and rather he considers Maqorqor (Wollene) and Meger (South of Ennamour) as members of the "federation" (Getnet, 1992: 32).

Sabat Bet Gurageland is found in the western part of the Gurage land and currently includes five weredas of which Ezana Wollene and Cheha wereda are included in this study. These two weredas constitute the south western and western part of the Sabat Bet Gurageland and the Gurageland at large i.e. between  $37^{\circ} 48' 13''$  and  $38^{\circ} 9' 38''$  E.,  $8^{\circ} 12''$  and  $8^{\circ} 24' 25''$  N. The two weredas have a total area of  $1539.3 \text{ km}^2$  (Ezana Wollene, =  $987.4 \text{ km}^2$  and Cheha wereda =  $551 \text{ km}^2$ ). The area lies about 180 to 200 kilometres south-west of Addis Ababa and can be reached by following the Jimma road until the town of Welkite (about 150 km) and then branching off to the south-east (see map II).

### 2.1.2. THE GURAGE PEOPLE

The Gurage, people who have inhabited the Gurageland, are the fourth major linguistic groups in Ethiopia. They speak basically a semitic language and are clustered in numerous small, densely settled, kin-group villages. Based on the work of W.A. Shack

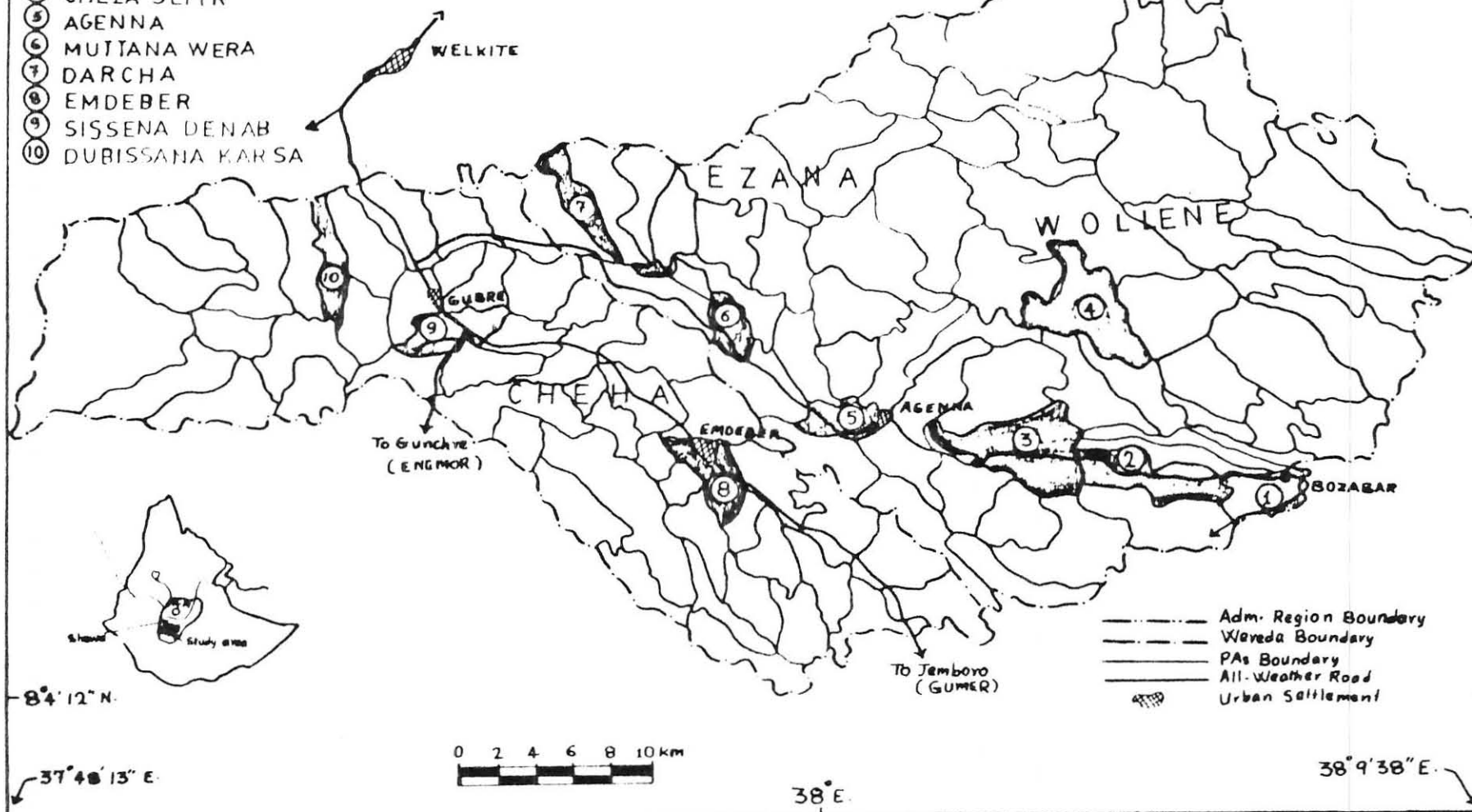
# SAMPLE PAs

- ① NORCHA
- ② KOKERA
- ③ KETANE
- ④ CHEZA SEFIR
- ⑤ AGENNA
- ⑥ MUTTANA WERA
- ⑦ DARCHA
- ⑧ EMDEBER
- ⑨ SISENA DENAB
- ⑩ DUBISSANA KARSA

## MAP II

### LOCATION MAP OF EZANA WOLLENE AND CHEHA WEREDAS

8°24'25"N



(1966) and the languages they speak, the Gurages may be grouped as 'Oriental' (Eastern) Gurages which include dialect groups of Selti, Wollene, Ulbareg, Innekor and Ziway, who are followers of Islam (except Gurages inhabiting some of the islands in Lake Ziway, who are christians) and the 'Western' group which include the Gurages of Aklil, Cheha, Enamour, Endegagne, Eza, Geto, Gogot, (Maskan) and Muhir, of which most are followers of christianity though there are good number of moslems amongst. The 'Northern' group includes the Sodo Gurages who have been referred to as 'Kistane' which means christians and inhabit the northern region known as Sodo wereda ( Shack,1966; Getnet,1992). "Sodo" may mean the fusion of Gurages and Oromos (Getnet, 1992 = 28).

The Gurages of the seven house (Sebat Bet), grouped on the basis of a common culture and language, have been parts of the 'Western' group. Ezana Wollene and Cheha weredas have been settled by members of the Sabat Bet Gurage, Cheha wereda by Cheha Gurages and Ezana Wollene werda by Wollenes, Gurages of Eza, Aklil and Muhir. Only the Wollenes belong to the 'Oriental' language group.

### 2.1.3. HISTORICAL ROOT OF THE GURAGES

What may be amazing about the Gurageland and its people is that different languages with their numerous dialects are clustered in a relatively small geographical space. This elicits the need to understand the ethnogenesis of the Gurages and trace their origin. Most of Ethiopian and foreign writers agree that Gurage tribesmen basically belong to the semitic group (Seifu, 1974). Yet, explanations given as to the origin of the Gurage people and even to their composition, have been controversial so that the matter today appears to have grown to political controversy. Some political groups strongly argue



that the land formally known as the "Gurageland" includes the "Eastern", "Western" and "Northern" parts, and the inhabitants are indiscriminately Gurages. Others however, claim that the seltis in specific, and probably all those inhabiting the "Eastern Gurageland" are not Gurages. They assert that "Seltis are Seltis and can not be identified with other tribes" and hence, seltis are not Gurages.

In connection with the ethnogenesis of the Gurages, there are two apparent outlooks, one sets up a fixed ancestral home for the Gurage and the other one looks for diverse historical roots (Getnet, 1992: 17). The former view appears to be dominated by works which attach the term 'Gurage' to a province known as 'Gura', a place in Akale Guzay (a province in Eriterea) and/or with the Amharic word 'Gira', to mean 'left'. In his work of "Ya Ethiopia Hizb Tarik", Aleka Taye said that the Gurages came to Aymelet, a place in "Northern Gurageland", as a contingent of Amde Siyon (r.1314-44) led by Azmach Sebhat and 'Guragae' meant the people of 'Gura'; and they are called 'Gurage' because they settled to the left of the king's court (Aleka Taye, 1965/66). This report might have dominated the thinking of many laymen and some scholars alike (Getnet, 1992).

However, as noted in the chronicle of "Gedle Zena Markos" quoted by Seifu (1974), the Gurage people have settled in the said Gurageland during and/or even before the reign of Yekuno Amlak (r.1270-1285), grand father of Amde Siyon. In the light of the same chronicle, Seifu Debabe asserts even that the Gurage people might have come to South Ethiopia probably during the time of the Zagwes and/or Yodit or even during the time of the Axumites (Seifu, 1974).

On the otherhand, in support of the second view, Seifu Debabe strongly argues that the present Gurage people who settled in the Gurageland belong not only to the outcome of one movement (migration) in one direction and one origin (Seifu, 1974:9). Rather they

are the result of continued contacts and flow of streams of people from different directions having different origins, (such as from Tigre, Gonder, Gojam, Shewa, etc. in the north, from Harar (Adere) in the east, etc.) as well as military colonies established by the medieval kingdoms of Ethiopia and the forces of Ahmed Gragne (Getnet, 1992:21). William Shack, on the other hand, asserted that the Gurages are basically of Sidamo stock and their territory was once inhabited by Sidamo tribesmen (Shack, 1966).

As noted by Getnet (1992:19), diversity in language, subgrouped as 'Northern', 'Western' and 'Eastern' and even dialect clusters within certain languages with an identified common and largely exclusive morphological features including unique and great number of common roots but lacking agreed common ancestor(s) (Lesla, 1965:20), together with diversity in religion amongst the 'Eastern', 'Northern' and 'Western' Gurages may show the deeper and different roots of the people of Gurageland (Getnet, 1992: 19,20).

Hence, Seifu (1974: 11) contended that the people who now inhabits the Gurageland are from many parts of Ethiopia: Tigre, (Harar), Gonder, Gojam and Shewa. In other words, they are from Amhara, Tigre, Gaft, Hadiya, Oromo, (Adere) and Sidamo tribes.

The Gurage people today, apart from their semitic language, can not be readily distinguished in other social and cultural features from the Sidamo and have developed a series of common traits that are characteristic to the enset culture (Shack, 1966:37). Their culture is reported to be essentially uniform. Amongst them exists a common set of artifacts, a common technology and mode of production, a common architectural design in building houses, similar pattern of settlement, and a common form of economic and social organization (Shack, 1966: 35).

All these common cultural attributes of the Gurages together with their cultural landscape, values and beliefs have interrelatedly developed a typical and complex culture

because of enset cultivation (Savard, 1970:10). Thus, what may be more important to the people in improving their socio-economic life is to adopt development strategies which can take into account the common cultural factors that the people developed in their long history by way of living closer together and inter mixing with each other rather than dividing the people in line of language, religion and an immediate origin. The latter in particular may, however, adversely affect (harm) the peoples' socio-economic and cultural basis to societal progress.

## 2.2. PHYSICAL SETTING OF EZANA WOLLENE AND CHEHA 'WEREDAS'

### 2.2.1. GEOLOGY

The area under consideration is a part of the Shewan plateau and is piled-up with Trappean lava following the uplift of the great Ethiopian swell and the Somalian plateau during the Tertiary period. The region shares the general geologic structures common to the Shewan plateau. It is unlikely that basement rocks of the precambrian and mesozoic period outcrop in any parts of Ezana Wollene and Cheha weredas.

G. Marela, et.al., (1973) on their Geological map covering Ethiopia and Somalia reported that surface rocks of the lower, middle and upper plateaus of woina dega and dega portion of Cheha and Ezana Wollene weredas are predominantly of volcanic origin of pleistocene. Trachyte, rhyolite, andesite and ferobasalts of pleistocene period outcrop in various parts of the lower, middle and upper plateaus, i.e. in the dega and woina dega parts of the two weredas.

In upper Kolla and lower Wabe River gorge, basalts of Wollega volcanic group

with intercalations of acidic tuffs and loose clastics of miocene to pliocene period outcrop.

Similarly, abundant rhyolite and trachy basalts of Jimma volcanic group of oligocene to miocene period outcrop in the Gibe trough in Cheha (Marela, et. al., 1973). Sandstones are also reported outcropping in parts of Cheha and Eza areas (Ipcar, 1970).

## 2.2.2. PHYSIOGRAPHY AND DRAINAGE

### 2.2.2.1. RELIEF AND LANDFORM

The two weredas considered in this study, being part of the Central Ethiopian Plateau, comprise some structurally horizontal table-land in lower woina dega parts. A group of mountains forms chains of the Trappean Lava running from Achebir in the north-east of the region through Wollene, Muhir, Eza (Wadye) and Cheha (Dakuna) and joins Mt. Aster in Enamour and Enner, which, in turn finally joins the Kembatta mountain group. Some of the mountains in the two weredas, which form parts of the chain include groups of mountains in the most north-east of Muhir and Wollene-Mt. Mur, K'echa and Asta dega which all rise more than 3400 meters above mean sea level (m.a.s.l.) and are known as Zebidar Mountains in group. Others such as Wadye (2500 meter) and Dakuno (2400 meter) are found in Eza and Cheha close to Agenna and Emdeber towns respectively. These and other mountains occurring in the two weredas impart the region, in general, a mountainous character.

Despite the overall dominance of tectonics in the physiography of the two weredas, at micro level, landform is produced by denudational processes. Since the region is drained by numerous streams descending the plateau, with their enormous energy, the region as a whole, and the middle and upper parts in particular are deeply incised and

hence, many erosional scars are observed.

The tectonics, associated with mountain building, together with the agents of degradation have made the topography of the area to be too rough, resulting in high relief. The altitude of the region ranges from 1040 meter a.m.s.l. in the Gibe trough (the Kolla of Cheha wereda) to about 3500 meter a.m.s.l. in the furthest north-east of the region (Zebidar mountains). Hence, the over all relief in the region is 2360 meter, while the mean elevation is about 2315 meter a.m.s.l. (Table 2.1.) and the median elevation as shown by the hypsometric diagram (Map III) is about 2300 meter a.m.s.l. The average slope is 9.2 degree while the range is from 0 to 13 degrees.

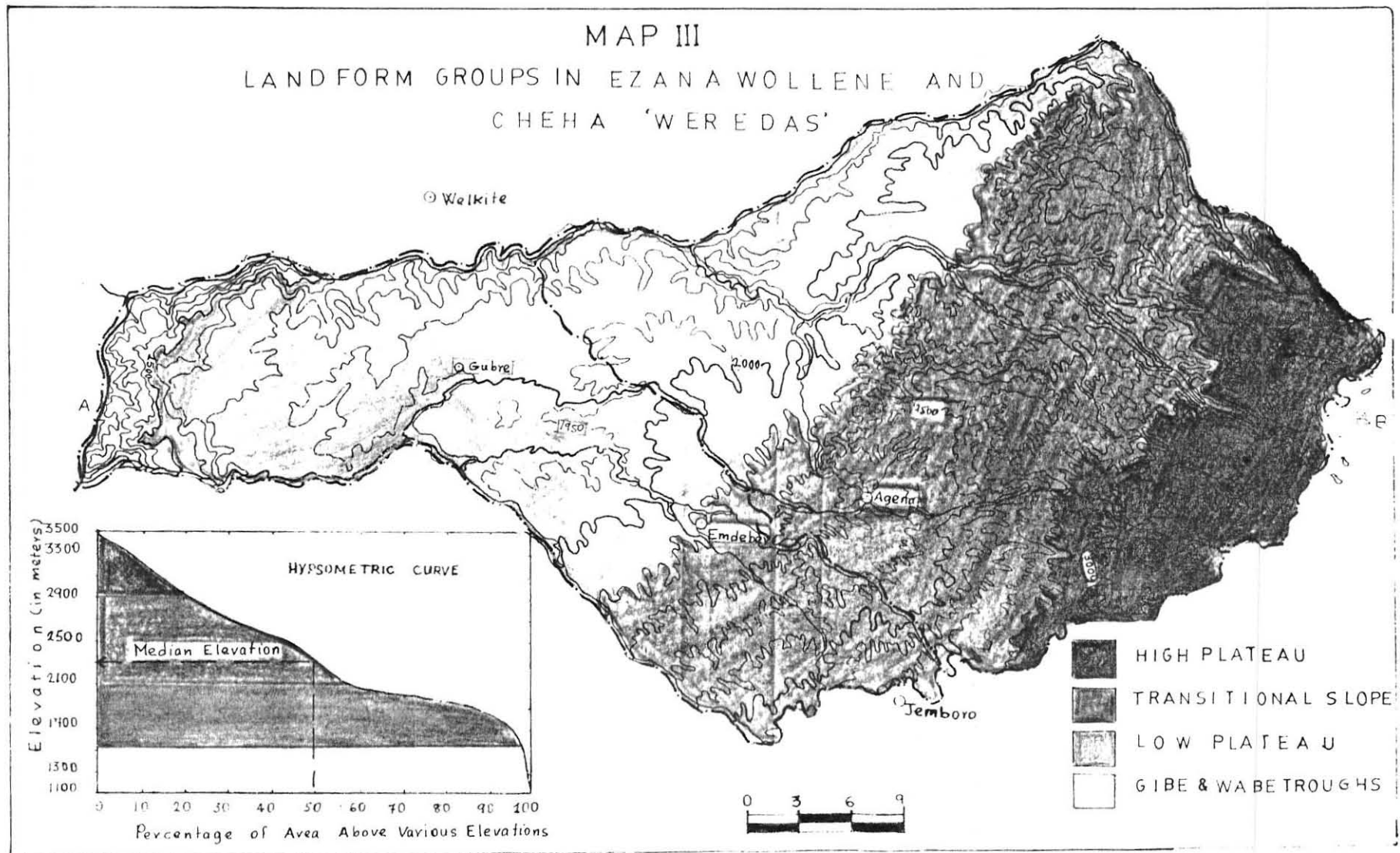
Elevation-relief ratio (ER) ranges from 0.38, the lowest for upper dega where the terrain is very rough, to 0.95 in the lower plateau where the surface is very level and uniform. The general surface, on the average, shows a value of 0.526 which is moderate because the very rough surface in the upper dega is counter balanced by the leveled surface of the lower plateau. Besides the chain of mountains identified earlier, four principal land form units may be identified in the two weredas (Map III). The first is the High Plateau which is over 2900 meter a.m.s.l. It occupies the upper dega zone covering 21.5% of the total area. It is characterized by gently slopping flat land and moderately dissected and undulating side slopes and pedimonts. The slope ranges from 5.3 to 10.7 degrees (Table 2.1.). The division has a grain<sup>4</sup> (or topographic texture) of onemile and it is "fine" because of frequent occurrence of ridges, valleys and streams in short distances for the region consists of highest elevation and receive maximum rainfall. It covers the eastern most part of the study area.

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<sup>4</sup> Land surface grain is determined by the spacing of major ridges and valleys. Grain size is an indication of topographic texture. It can be considered as "coarse" or "fine". "coarse-grained" topography is associated with widely-spaced major drainage ways and interflows while "fine grained" or "textured" areas have closer spacing of ridges and valleys.

### MAP III

#### LAND FORM GROUPS IN EZANA WOLLENE AND CHEHA 'WEREDAS'



Source: Base map adapted from 1:250,000 topographic sheet by FMA, 1979.



In the middle and lower woina dega and upper kolla zones ranging between 1500 and 2100 meter a.m.s.l, occurs the other physiographic division which may be referred to as Low Plateau; and largely consists of undulating flat lands with an average slope ranging from 0 to 1.7 degrees and slightly dissected side slopes and low pediments. The topographic "texture" is relatively very "coarse" and grain size ranges from 2 to 3 mile. It covers about 38 percent of the whole area of the region. There are about sixteen extensive and very gently sloping and undulating plains which include Degage and Kaffa plains found in upper Kolla zone of Cheha wereda; Gafat, Buchach, Aduma, Yegonche Bete, Weredene, Adoshe, Yamara and Yekerat Eche in Woina daga zone of Cheha wereda; and Adiawana, Ambuse, Yemahetewe, Yagemese, Afuye and Yeshebraden plains in the lower and middle woina dega parts lying in Ezana Wollene wereda.

In between the Lower and Upper Plateaus lies the transitional slope zone which covers about 39.5 percent of the region and includes parts of the lower dega and upper woina dega. This slope zone consists of the most severely to moderately dissected and cut up slopes and pedimonts. Inter-spur depressions are highly gullied in this part because it has the steepest slope ranging from 8 to 13 degrees (Table 2.1). The topographic "texture" has a grain size of about two-miles, very steep slope and characterized by higher degree of human interference which is attributable to high population density which also has resulted in acute degradation of environmental conditions exemplified by frequent occurrences of badlands, deep and steep gullies and other eroded surfaces.

**Table 2.1. NUMERICALLY EXPRESSED TERRAIN FACTORS (Mean elevation, Mean slope, relief, elevation-relief ratio (ER) and grain size) of EZANA WOLLENE & CHEHA 'WEREDAS'**

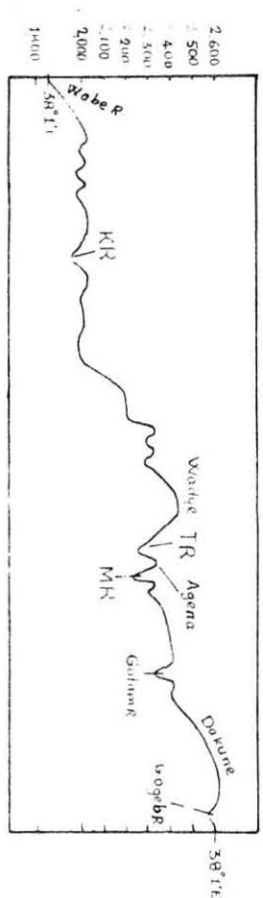
| Region/zone                           | Altitude range (m a.s.l.) | Slope <sup>1</sup> (in Degree) |         | Elevation (meter m a.s.l.) |            |            | Relief (h-c) (d) | Elevation in Relief Ratio (ER) <sup>2</sup> = (a-c)/d | Grain size (in mile) |
|---------------------------------------|---------------------------|--------------------------------|---------|----------------------------|------------|------------|------------------|-------------------------------------------------------|----------------------|
|                                       |                           | Range                          | Average | Mean(a)                    | Highest(b) | Lowest (c) |                  |                                                       |                      |
| 'Dega' Total                          | 2400-3500                 | 5.3-13                         | 9.3     | 2819.3                     | 3500.0     | 2400       | 1100             | 0.38                                                  | 1                    |
| Upper Plateau/Upper 'dega'            | 2900-3400                 | 5.3-10.7                       | 8.1     | 3133.0                     | 3500.0     | 2900       | 600              | 0.39                                                  |                      |
| Lower 'dega' (1)                      | 2400-2900                 | 10.8-13                        | 11.9    | 2608.2                     | 2900.0     | 2400       | 500              | 0.42                                                  |                      |
| Transitional zone (1+2)               | 2100-2900                 | 8-13                           | 10.0    | 2451.0                     | 2900.0     | 2100       | 800              | 0.44                                                  | 2                    |
| Upper 'Woina dega' (2)                | 2100-2400                 | 5.3-10                         | 8.0     | 2252.4                     | 2400.0     | 2100       | 300              | 0.51                                                  |                      |
| Middle 'woina dega' (3)               | 1900-2100                 | 1.9-4.5                        | 3.2     | 2000.0                     | 2100.0     | 1900       | 200              | 0.50                                                  |                      |
| Lower 'Woina dega' (4)                | 1700-1900                 | -                              | 4.5     | 1800.0                     | 1900.0     | 1700       | 200              | 0.50                                                  |                      |
| 'Woina dega' Total                    | 1700-2400                 | 1.9-10                         | 5.8     | 2013.6                     | 2400.0     | 1700       | 700              | 0.49                                                  | 2.3                  |
| Lower plateau (3+4)                   | 1500-2100                 | 0-1.7                          | 1.7     | 2069.1                     | 2100.0     | 1500       | 600              | 0.95                                                  |                      |
| 'Kolla' Total                         | 1040-1700                 | -                              | 9.93    | 1419.3                     | 1700.0     | 1040       | 660              | 0.57                                                  |                      |
| Upper 'Kolla'                         | 1500-1700                 | 1.7-2.9                        | -       | 1600.0                     | 1700.0     | 1500       | 200              | 0.50                                                  |                      |
| Lower 'Kolla'/Gibe & Lower Wabe Gorge | 1040-1500                 | 8-11                           | 10      | 1301.2                     | 1500.0     | 1040       | 460              | 0.567                                                 |                      |
| All the Region                        | 1040-3500                 | 0-13                           | 9.2     | 2315.5                     | 3500.0     | 1040       | 2460             | 0.52                                                  |                      |

- 1  $S(\tan) = Ixm/3361$ , where S is the slope tangent; I is the contour interval in feet; and m is the number of contours crossed per mile of random traverse.
- 2 Elevation-relief ratio (ER) proportion of upland and lowland within an area, is derived from the equation:  $ER = (E-L)/R$ , where E is the average elevation of the area, L is the lowest elevation; and R is the relief of the area. Calculated ER may approach the relief (R) in value but never reach it, the elevation-relief ratio must always be greater than 0 and less than 1.

The fourth physiographic region is part of the lower Wabe and Gibe troughs. It is found in kolla zone with in 1100 to 1500 meter a.m.s.l. and covers about 3 percent of the total area. It has the steepest average slope (above 10 degree) in the region and is characterized by various terraces - terraces of morphoselection, terraced pedimonts, terraces of fault-steps, etc. - landslides, scraps, colluvial deposits with debris of pebbles, boulders, and alluvial fans of effluent streams.

The cross-section from Gibe trough (A) in the south-west to Zebidar mountains (B) in the most north-east (Figure 2.1b) and Map III) shows that altitude decreases in the south-west direction, and hence, the land generally slopes accordingly. The slope gradient ranges from 20 meters in up-lands to 0 in the plains for every 100 meter horizontal distance. The other cross-section (Figure 2.1a) drawn in the north-south direction along 38°1' east longitude passing through Wadye, Agenna town and Dakuna, against the general slope direction of the region shows that the terrain is characterized by more rugged surface, convex spurs and deeper and steeper gorges. The altitude also increases from north to south until Dakune.

From the point of view of erosion cycle, as portrayed by the hypsometric curve (Map III inset), the region as a whole approximates to a "mature stage" of erosion and it is in "equilibrium". However, the curve further suggests that the Upper Plateau and the transitional slope zone including the Gibe and Wabe troughs in the kolla zone are remenantal (still) erosion surfaces, though erosion would continue to be appreciably high. This is attributable to "finer topographic texture" and , high altitude in the former environments and to the steep slopes in all the three cases. While the Lower Plateau-lower and middle woina dega, and upper kolla zones - is in "Monadnock" phase, old phase of erosion cycle to mean erosion is at the lowest rate, because the sub-region is predominantly plain.



(b)

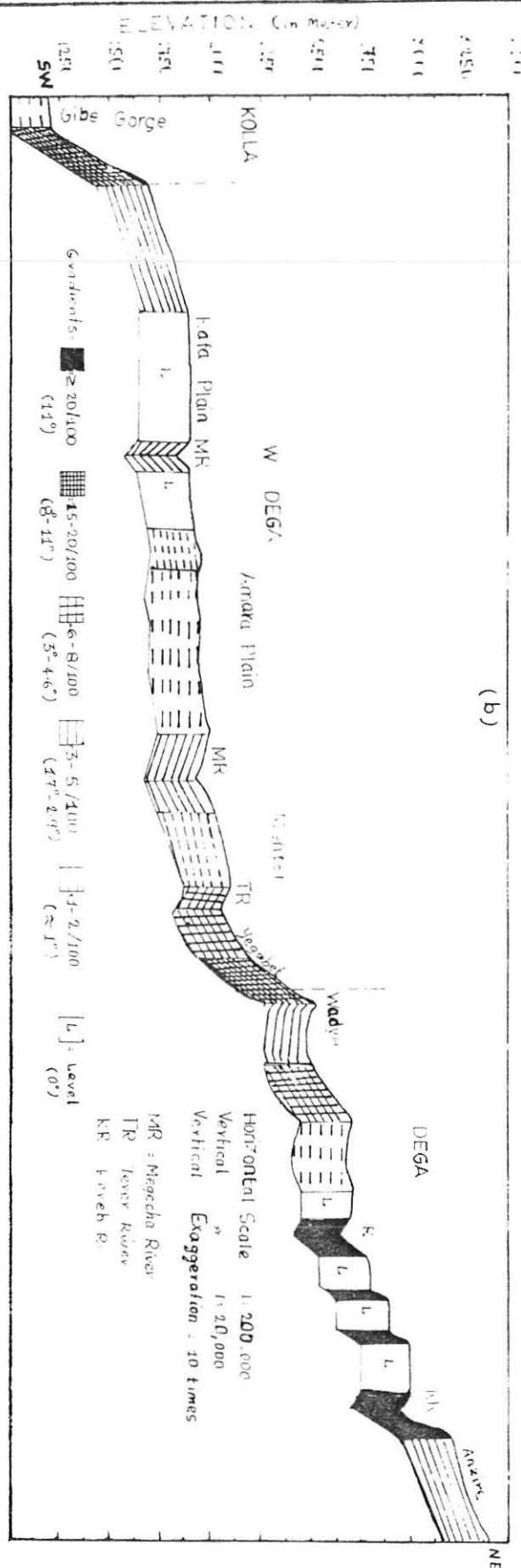


Figure 2.1 Cross-sectional View Through the Terrain following the Direction of Flow of Rivers (NE to SW) (b) and North-south Direction Along 38°1'E Perpendicular to the General Slope (a)

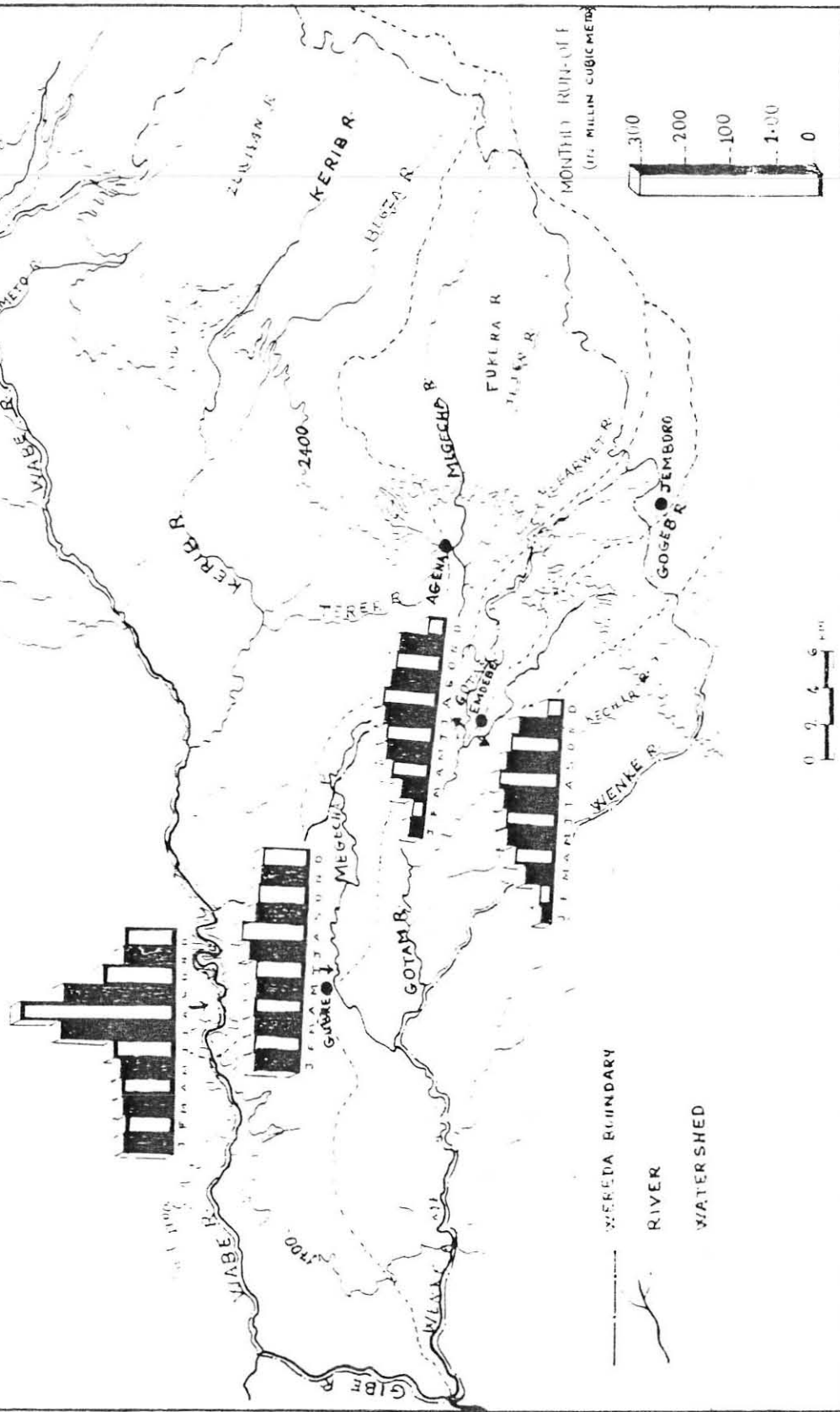
Generally, surface roughness, slope, altitude and relief increase north-east ward while topographic "texture" becomes "finer" and elevation-relief ratio becomes lesser which is an indication of more surface irregularity. All these attributes of the terrain in the region together with its geology (including moisture condition) would be important factors to understand the drainage system, pattern, direction, and drainage density and texture as well as run off rate in the region.

#### 2.2.2.2. DRAINAGE PATTERN, DENSITY AND TEXTURE

Areas of the two weredas are part and parcel of the Gibe River drainage basin. With the exception of minor deviations at local level, the streams in the region have a dendritic drainage pattern. The direction of flow of the streams may vary depending upon orientation of local relief at micro level. However, all the major streams ultimately drain west and south-west ward following the general inclination of the region. All the major streams, some with the exception rise from the upper dega zone of Wollene, Muhir, Eza, Gummer and Geto.

There are six principal rivers which drain the two weredas. These are River Wabe, Kerib, Megecha, Gotam, Wenke and Gibe. On sub regional level, the area is drained by two major tributaries of Gibe, namely, Wabe and Wenke, draining the northern and southern parts of the area under study respectively (Map IV). The Wabe system comprises the basin of Kerib (formed by affluents like Terer, Begaz, Zewiyan, etc.), Ameto and others, while Wenke system formed of Megecha (formed by Fokera, Jejer, Yebarawet, et), Gotam (includes Gogeb, Kechir and others), etc. Cheha wereda is primarily drained by the Wenke system through Gotam and Megecha. Only a small part in the north west is drained by Gibe and Wabe

# FIG. 3. P. IV DRAINAGE SYSTEM AND RIVER DISCHARGE IN EZANA WOLLENE AND CHEHA 'WEREDAS'





Rivers. Ezana Wollene wereda is largely drained by Wabe system through Kerib River and its tributaries. A small part in the south and east is drained by Megecha (Map IV).

**Table 2.2. BASIN AREA OF MAIN STREAMS**

| River        | Catchment Area     |       | Remark                 |
|--------------|--------------------|-------|------------------------|
|              | in km <sup>2</sup> | %     |                        |
| Wabe         | 882                | 56.9  |                        |
| Kerib        | 500                |       | It is part of Wabe K.  |
| Wenke        | 630                | 40.6  |                        |
| Megecha      | 328                |       | It is part of Wenke R. |
| Gotam        | 289                |       | It is part of Wenke R. |
| Gogeb        | 63.5               |       | It is part of Gotam R. |
| Gibe         | 38.0               | 2.5   |                        |
| Total (Gibe) | 1550               | 100.0 |                        |

Source: measured from 1:250,000 map by EMA.

Table 2.2 shows that out of the total area of the two weredas, Wabe R. system drains about 57% of which about 32.3% is shared by Kerib (its tributary). In the southern part, R. wenke together with Megecha and Gotam (including Gogeb) have catchment areas of 328 and 289 km<sup>2</sup> respectively.

Drainage density determined from small scale maps (smaller than 1:50,000) may not be dependable for application because of higher degree of cartographic generalization involved in the construction of the map. Nonetheless, computations made from a drainage map of 1:250,000 provide a general density of 313 meters channel length per square kilometre area. In the dega, woina dega and kolla parts it is about 300, 280 and 800 meters per square kilometre respectively. Zonal values are lower than the average for the regions except in

Kolla section. In kolla zone, the drainage density is relatively higher because its area is small and is surrounded by almost all the principal streams and some tributaries, notably, Gibe, Wabe, Wenke and Megecha. Moreover, it is also traversed by many other effluent streams.

Sample observations made in different agro-climatic zones using a 1:50,000 topographic maps reveal that drainage texture, spacing of streams (valleys) in the terrain or average inter-stream distances become "finer" or decrease with increasing altitude. In the kolla parts streams are expected to occur at about 870 meter distance interval while in the lower to middle and upper woina dega they are expected to occur at 740 and 530 meter respectively; in the transitional slope zone, however, it is about 490 meters. In the lower and upper dega streams are expected to be spaced at the lowest interval of 450 meters and 400 meters respectively.

Generally, drainage texture becomes "finer" towards higher altitude zones. Like wise, drainage density in the dega parts is greater than that in the middle zone. But drainage density is the highest in the kolla section while the texture is most "coarse" which principle wise, appears contradictory. This and the fact that the general pattern of drainage density and drainage texture calculated appear inconsistent may be attributed to differences in the scale of the maps from which drainage density and texture calculated, and to the unique environmental position of the kolla section.

### **2.2.3. CLIMATE, WATER BUDGET AND RUNOFF**

#### **2.2.3.1. CLIMATE**

Teh climate in most part of the two weredas may be classified as temperate or subtropical, a modification introduced by altitude. In the west and south-west parts of the

lowlands of Wabe River and Gibe trough it is tropical (kolla) type. The wet highlands are either in woina dega (subtropical) or dega (temperate).

Generally, the two weredas encompass three distinct traditional altitude zones comprising three major agro-climatic zones, i.e. kolla (defined as lying between about 1040 meters and 1700 meters a.m.s.l., woina dega (1700 - 2400 meters a.m.s.l.), and dega (2400 - 3400 meter a.m.s.l.). About 57.8% of the total area lies in woina dega zone which accounts for 48% of Ezana Wollene and 75.3% of Cheha wereda. The dega zone accounts for 37.3% of the total area. It shares 52% of Ezana Wollene and 10.5% of Cheha wereda, and about 5.1% is kolla occurring in Cheha wereda (see map V).

Although data concerning temperature is not available for all the three zones, based on records obtained from the National Meteorological Service Agency (N.M.S.A) for Emdebir and Welkite (both occur in woina dega), showed mean annual temperatures of 17.9°C and 18°C (Map VI) respectively. Moreover, Charles Ipcar reported that in "highland regions of the tropical latitudes, the annual day time temperature range is fairly small (between 12 and 22oc). However, the diurnal variation is quite large and it occasionally drops to freezing during the dry season in the valley bottoms" (Ipcar, 1970).

While the annual ranges of temperature in the two towns does not exceed 2.75°C, the warmest and coldest months at Emdeber and Welkite occur in May (18.5°C) and August (16.3°C), and March (19.8°C) and July (17.2°C) respectively.

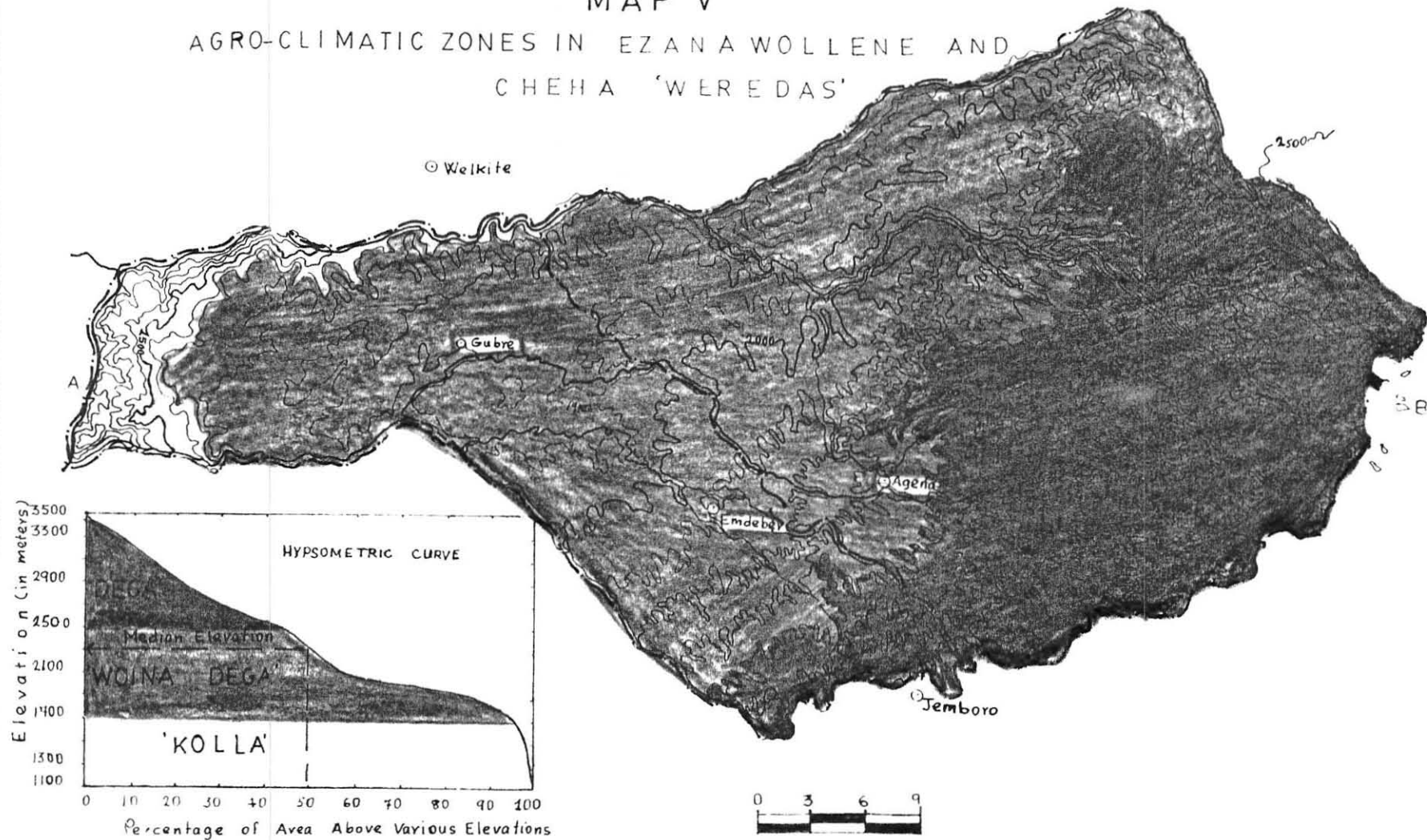
In the region, as many as 5 to 6, thermal zones<sup>5</sup> were identified. In the south-western extreme of the region (1040-1700 meters a.m.s.l.) in which mean annual temperature and length of growing period ranges from 20° to 22.5°C and from 211 to 240 days respectively. Thermal zones 5 and 6 occur in woina dega (1700-2600 meters a.m.s.l.) where the mean annual temperature is between 15°C and 20°C., and the growing period ranges from 211 to 270 days. The dega zone is constituted by zones 7 and 8 (2600-3400 meter a.m.s.l) where the

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<sup>5</sup> Thermal zones simply are areas defined interms of daily temperature (heat in oc) during the growing season by taking into account of altitude. Accordingly in Land Resources map of Ethiopia FAO/UNDP-Eth (1984) 10 different thermal zones are identified.

# MAP V

AGRO-CLIMATIC ZONES IN EZANA WOLLENE AND  
CHEHA 'WEREDAS'



mean annual temperature ranges from 10° to 15°C, and has a length of growing season ranging from 210 to 270 days (FAO/UNDP Eth, 1984).

The mean annual rainfall of the Gurage region was variously estimated to ranged from 1000mm to 1524mm (Kebede Tato, 1964; Ministry of Commerce and Industry cited in Shack, 1966; OCZP, 1987/88). However available rainfall amount records at Welkite, Emdeber, Agenna and Jemboro (Gummer) suggest that the mean annual rainfall ranges from 1226.8mm at Emdeber to 1425.6mm at Jemboro. The average for the region is about 1307.6mm (Table 2.3 and Map VI). Rainy days in the region, however, range from 160 to 180 days (Kebede Tato, 1964).

As in most part of Central Ethiopian Highlands, two very common seasons may be distinguished mainly based on the concentration of the amount of rainfall. As such, the main rainy season follows the small rainy period of spring and extends from early June to mid-September, (which is known as zar), while the major hot and dry season (abar) dominates the rest of the year. But some amount of moisture is available in the seasons which follows and precedes the dry season.

Accordingly, over half of the total rainfall in the region and in all the climatic stations occurs during zar (summer). This also ranges from about 47% at Jemboro to 56% at Emdebir (Table 2.3) and from about 20% to 34% and 11% to about 19% during autumn and spring, respectively. However, in the season which extends from about April to end of August, rainfall occurrence is as much as 78.4% while in winter it is only about 6.5% of the total amount for the region (Table 2.4).

Table 2.3. MONTHLY DISTRIBUTION OF RAINFALL AMOUNT (MM)

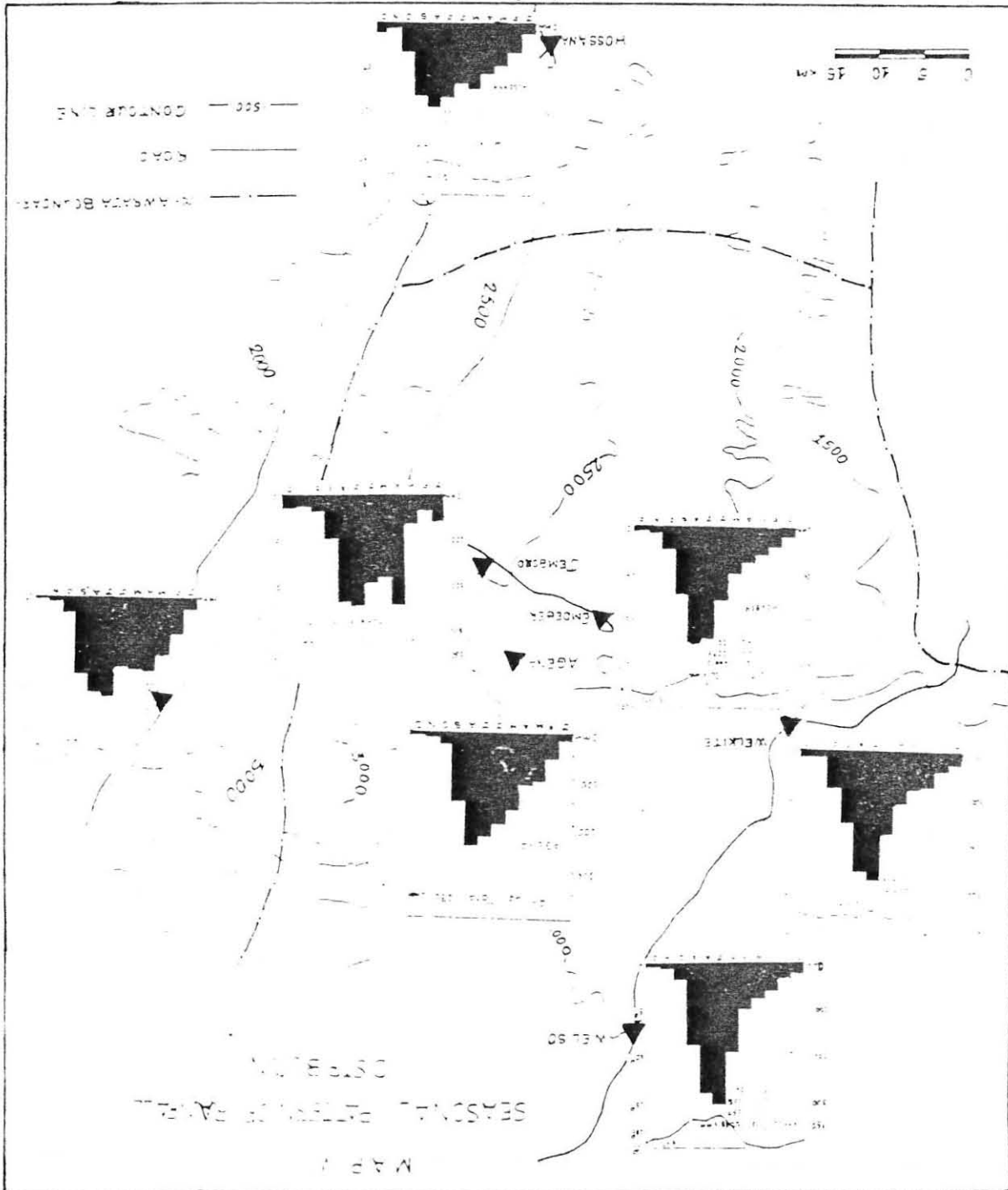
| Station                       | Jan.  | Feb  | Mar.  | Apr.  | May   | June  | July  | Aug.  | Sept. | Oct. | Nov. | Dec. | Total  |
|-------------------------------|-------|------|-------|-------|-------|-------|-------|-------|-------|------|------|------|--------|
| Welkite (Lower woina dega)    | 21.2  | 38.6 | 73.1  | 76.5  | 108.6 | 173.9 | 274.0 | 258.1 | 150.4 | 76.7 | 12.3 | 12.3 | 1275.7 |
| Emdeber (middle W.dega)       | 19.4  | 37.8 | 80.4  | 73.6  | 11.5  | 161.9 | 254.0 | 261.7 | 151.6 | 45.2 | 11.8 | 10.1 | 1226.8 |
| Agenna (Upper Woina dega)     | 17.0  | 54.6 | 102.0 | 111.4 | 164.0 | 198.0 | 223.0 | 243.0 | 146.7 | 25.0 | 9.6  | 7.54 | 1302.4 |
| Jemboro (dega) <sup>6</sup>   | 58.5  | 33.2 | 64.7  | 240.9 | 180.2 | 189.0 | 241.2 | 237.4 | 93.7  | 34.0 | 25.5 | 27.3 | 1425.6 |
| Regional Average <sup>7</sup> | 29.02 | 41.1 | 81.0  | 125.6 | 141.1 | 180.7 | 248.2 | 250.0 | 135.6 | 45.2 | 14.7 | 14.3 | 1307.6 |
| % of the total                | 2.2   | 3.1  | 6.2   | 9.6   | 10.8  | 13.8  | 19.0  | 19.1  | 10.4  | 3.5  | 1.1  | 1.1  | 100    |

Source: National Meteorological Service Agency (NMSA), 1993.

<sup>6</sup> At Jemboro rainfall distribution appears of two-maxima, one in April and the other in July and August. The spring maxima may be only due to abnormal rainfall amount recorded (672mm) in the month of April in 1956 and data paucity.

<sup>7</sup> Averages are calculated based on 31 and 21 years of rainfall records for Welkite and Emdebir, respectively, while that of Jemboro and Agenna from less than 3 to 5 years with some missing figures.





The percentage distribution of rainfall amount at different stations in the region (Table 2.4) reveals that middle and lower woina dega exemplified by Emdeber and Welkite, respectively, receive the highest proportion of rainfall in summer (Zar). This proportion of occurrence decreases north and north east wards i.e. toward the dega zone. This would probably be due to the fact that Emdeber and Welkite intercept moisture bearing Equatorial Westerly winds before Agenna, Jemboro and other stations located in the uplands. The contrary is true during spring because the direction of moisture carrying winds is from the south-east and east.

**Table 2.4. PERCENTAGE DISTRIBUTION OF RAINFALL AMONG THE FOUR SEASONS**

| Station          | Winter | Spring | Summer | Autumn |
|------------------|--------|--------|--------|--------|
| Welkite          | 5.7    | 20.2   | 55.3   | 18.8   |
| Emdeber          | 5.8    | 20.5   | 56.2   | 17.5   |
| Agenna           | 6.1    | 29.0   | 51.1   | 13.9   |
| Jemboro          | 8.3    | 34.1   | 46.8   | 10.8   |
| Regional Average | 6.5    | 26.3   | 52.1   | 15.0   |

Source: NMSA, Ethiopia, 1993.

On the other hand, rainfall reliability is expected to be uniform and high, and to increase in amount and with altitude while annual rainfall variability is fairly low.

However, there is small variation amongst rainfall recording stations. At Emdeber, Welkite, Butajera and Wolliso, annual rainfall variability is about 20, 27.4, 20.8, 18.7 and 12.3 percent respectively (Map VI). Rainfall Variability at Welkite appears a bit higher than others probably due to abnormally high amount which occurred in 1979 (Figure 2.3).

The mean annual precipitation and the standard deviation of rainfall amount observed in a number of years as well as the chance of occurrence at Emdeber and Welkite, or in the region at large (based on the records of the two stations) may be read from Figure 2.2. Accordingly, there are only 12.7% and 20% chances that rainfall at Welkite and Emdeber, respectively, would be less than 1000mm. Conversely, there is a probability of 87.3 and 80% that rainfall will exceed 1000mm in the region or at the two stations respectively. While the likelihood that the region would receive less than 1500mm ranges from 81 to 84%. The probability that rainfall amount will exceed 1500mm is 16 to 19% in the region (Figure 2.2.).

Furthermore, temporal patterns of rainfall observed from 1969 to 1991 at both Emdeber and Welkite as shown in Figure 2.3., reveal the cyclical pattern of annual rainfall amount. Time series portrayal of rainfall, based on five-year moving averages (Figure 2.4) also show that there is a trend of decline in rainfall amount over the last 22 and 35 years at Emdeber and Welkite respectively, or in the region at large. Moreover, there are certain strange observations in the distributional patterns at the two stations (see Figure 2.3.).

Both Welkite and Emdeber lie in the woina dega zone, only 30 kilometer apart and have altitudinal difference of only 140 meter. Nevertheless, the two places show some divergent patterns of rainfall records. During 1969 to 1973 patterns show that rainfall amounts were above and below the general mean at Emdeber and Welkite respectively. In 1979, Welkite received about 2900mm (this could be a wrong record) while Emdeber

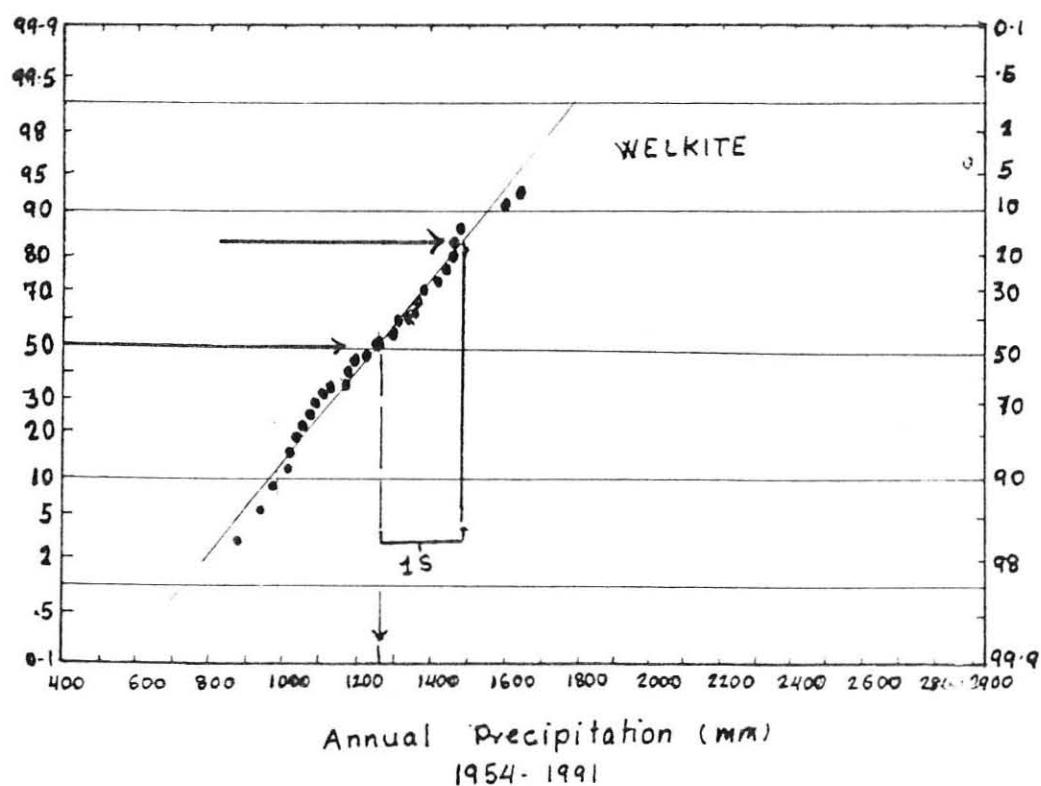
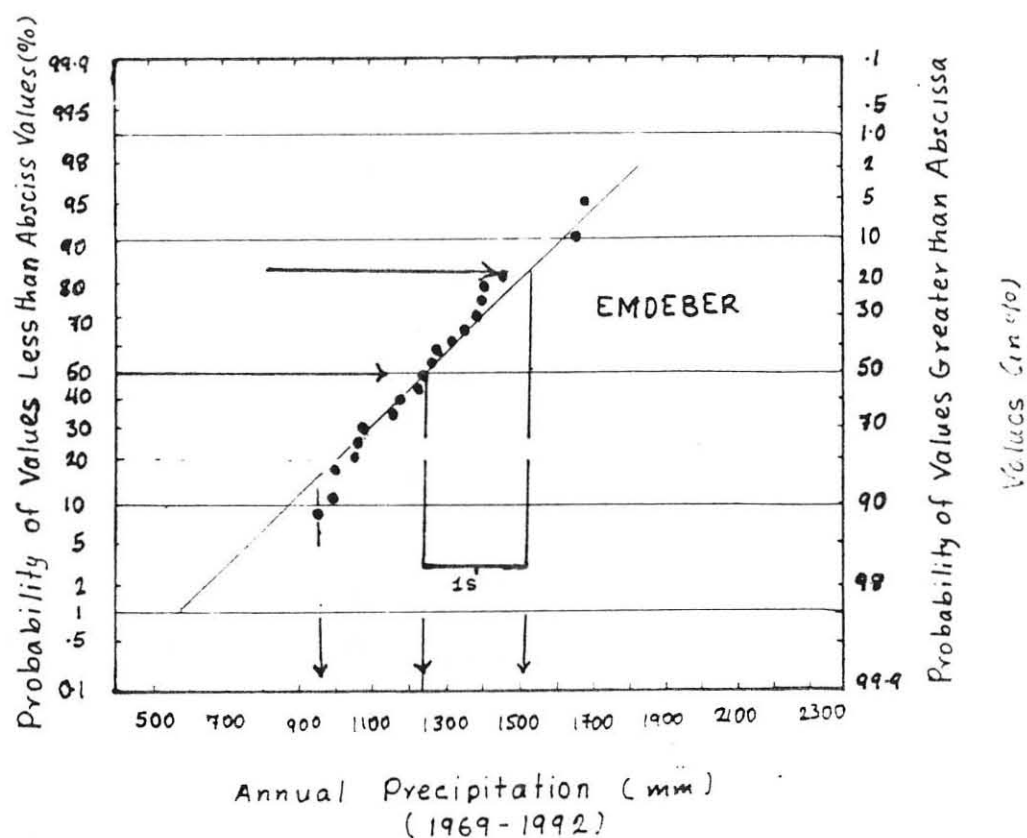


Figure 2.2 Cumulative Percent Frequency or Probability of Annual Precipitation at Emdeber and Welkite, Plotted on Arithmetic Probability Paper.

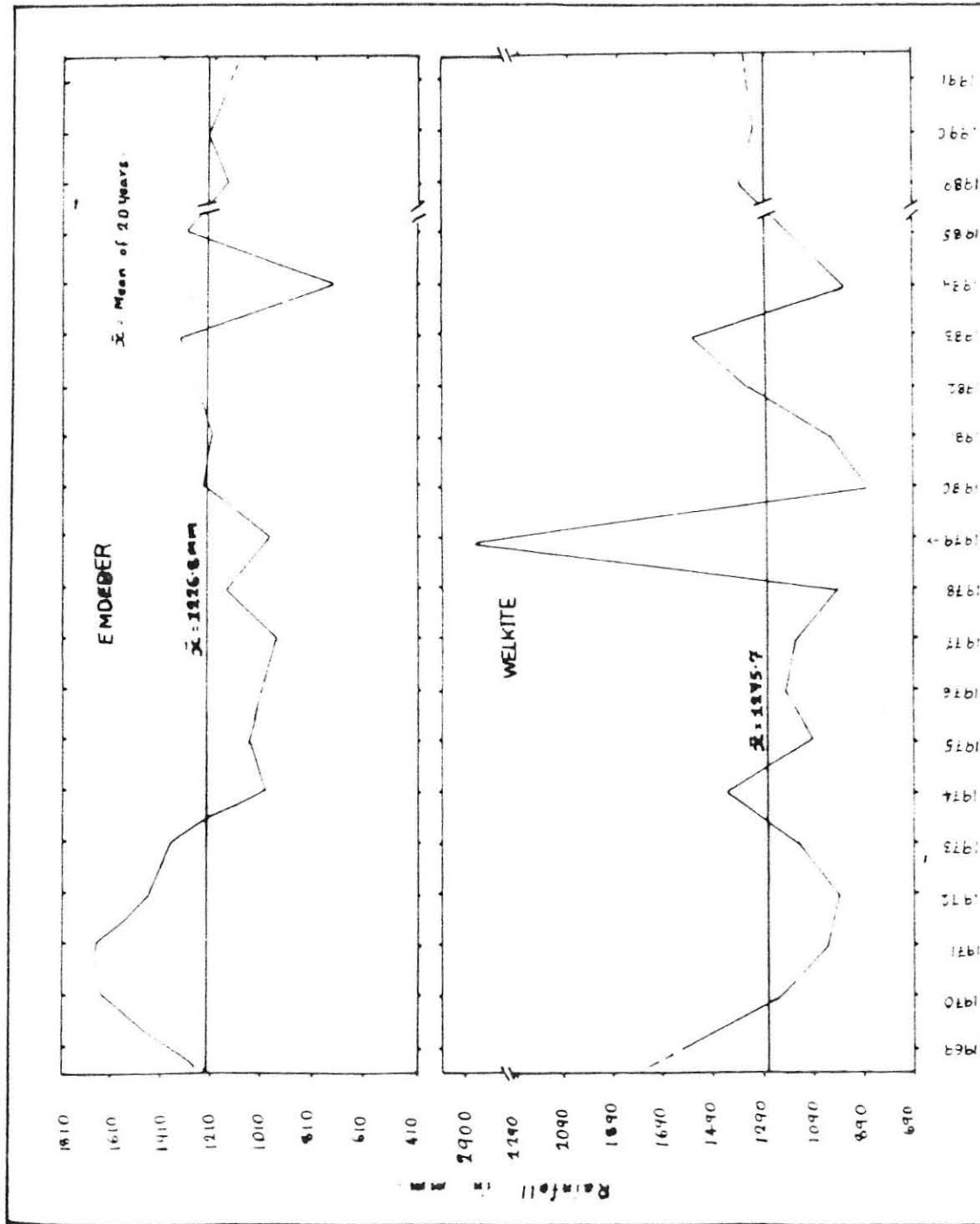


Figure 2.3 Temporal Pattern of Rainfall Distribution in Twenty Years at Emdeder & Welkite

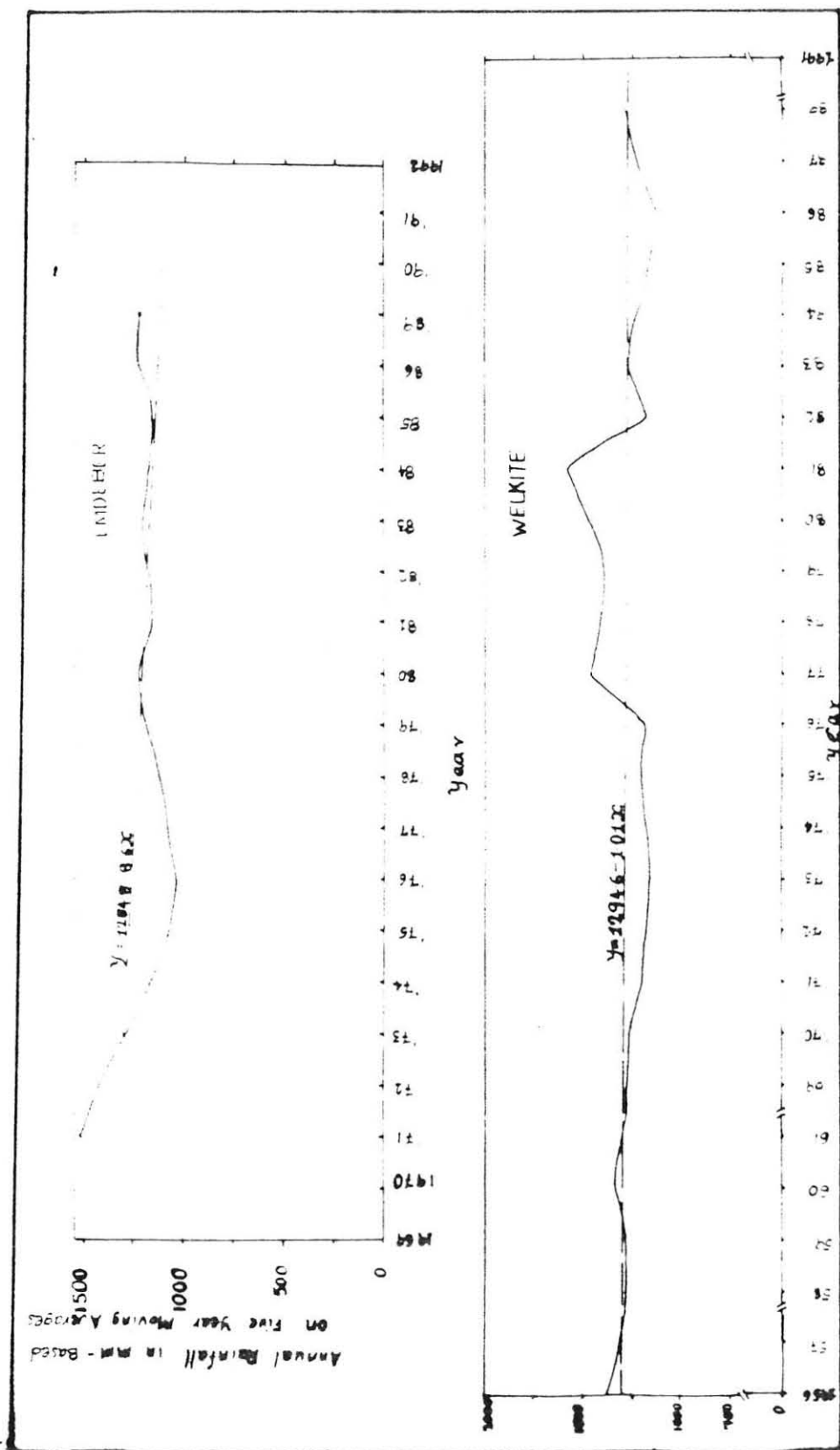


Figure 2.4 Long-Range Trend in the Pattern of Annual Rainfall Distribution at Emdeber and Welkite  
(Rainfall Values are 5-years moving averages)



recorded only 1010mm. Both stations, however, recorded one of the lowest amount of rainfall which probably signify a drought year in 1984.

The pattern of rainfall observed in the region in connection with the amount received, occurrence and distribution in the different seasons would be basic to understand the regional hydrological conditions and water budget of the region at large and of the climatic stations in specific.

#### **2.2.3.2. WATER BUDGET**

Water budget calculations for the two stations - Emdeber and Welkite, are summarized in Table 2.5. and Figure 2.5. For others, namely, Agenna and Jemboro, calculations could not be made because of paucity of rainfall data and in availability of temperature records. Needless to say, however, the water budget calculations for Emdeber which is situated on the watershed of Gotam and Gogeb Rivers is expected to show continuity of water flow in the southern part of the region and/or Cheha wereda. On the otherhand, the water budget of Welkite which is located in the lower Wabe River catchment is presumed to have continuity and represent the Wabe R. drainage basin in all, which includes most parts of Ezana Wollepe wereda. Hence, the two stations are expected to represent the study regions.

Figure 2.5 and Table 2.5 show the principal hydrological characteristics of Emdeber and Welketie. Both portray seasonal patterns of precipitation, actual and potential evapotranspiration, soil moisture deficit and utilization including soil moisture replenishment and water surplus. The procedures followed to determine the parameters of water budget is discussed in Appendix A.

**Table 2.5. LONG-TERM AVERAGE WATER BUDGET/WATER BALANCE OF EMDEBER AND WELKITE**

| EMDEBER     |      |        |         |       |       |       |       |        |        |       |       |        |         |              |
|-------------|------|--------|---------|-------|-------|-------|-------|--------|--------|-------|-------|--------|---------|--------------|
|             | Unit | Jan.   | Feb.    | Mar.  | Apr.  | May   | Jun   | July   | Aug.   | Sept. | Oct.  | Nov.   | Dec.    | Annual Total |
| 1. T        | oc   | 17.8   | 18.2    | 18.3  | 18.15 | 18.5  | 18.55 | 17.05  | 16.3   | 17.1  | 17.5  | 18.5   | 18.3    | 17.9         |
| 2. j        | -    | 6.84   | 7.07    | 7.13  | 7.04  | 7.25  | 7.28  | 6.41   | 5.98   | 6.43  | 6.66  | 7.25   | 7.13    | 82.47        |
| 3. P        | mm   | 19.4   | 37.8    | 84.2  | 73.5  | 111.5 | 161.9 | 254.0  | 261.7  | 151.6 | 45.2  | 11.8   | 10.10   | 1226.7       |
| 4. GPET     | mm   | 65.12  | 67.8    | 68.5  | 67.48 | 69.87 | 70.22 | 60.2   | 55.46  | 60.53 | 63.13 | 69.87  | 68.50   | 786.7        |
| 5. LCF 10°N | -    | 0.97   | 0.98    | 1.0   | 1.03  | 1.05  | 1.06  | 1.05   | 1.04   | 1.02  | 0.99  | 0.97   | 0.96    | -            |
| 6. CPET     | mm   | 63.17  | 66.46   | 68.5  | 69.5  | 73.36 | 74.43 | 63.21  | 57.68  | 61.74 | 62.50 | 67.77  | 65.76   | 794.08       |
| 7. P-CPET   | mm   | -43.77 | -28.66  | 15.70 | 4.0   | 38.14 | 87.47 | 190.79 | 204.02 | 89.86 | -17.3 | -55.97 | -55.66  | 432.62       |
| 8. APWL     | mm   | -172.7 | -201.36 | -     | -     | -     | -     | -      | -      | -     | -17.3 | -73.27 | -128.93 | -221.46      |
| 9. SM       | mm   | 75.0   | 72.0    | 87.7  | 91.7  | 129.8 | 200   | 200.0  | 200.0  | 200   | 185.7 | 142.9  | 114.3   | -            |
| 10. SMC     | mm   | -39.3  | -3.0    | 15.7  | 4.0   | 38.1  | -70.2 | -      | -      | -     | -15   | -42.8  | -28.6   | -            |
| 11. AET     | mm   | 48.7   | 42.8    | 68.5  | 69.5  | 73.36 | 74.43 | 63.21  | 57.68  | 61.74 | 60.2  | 54.6   | 38.7    | 713.32       |
| 12. D       | mm   | 14.47  | 23.66   | 0     | 0     | 0     | 0     | 0      | 0      | 0     | 2.3   | 13.17  | 27.06   | 80.66        |
| 13. S       | mm   | 0      | -       | 15.70 | 4.0   | 38.14 | 87.47 | 190.79 | 204.02 | 89.86 | 0     | 0      | 0       | 629.98       |

| WELKITE     |    |        |         |        |      |       |       |       |       |       |       |       |        |        |
|-------------|----|--------|---------|--------|------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| 1. T        | oc | 17.8   | 18.3    | 19.8   | 17.9 | 18.25 | 17.9  | 17.15 | 18.0  | 17.65 | 17.7  | 18.1  | 17.55  | 18.01  |
| 2. j        | -  | 6.84   | 7.13    | 8.03   | 6.9  | 7.1   | 6.9   | 6.46  | 6.95  | 6.75  | 6.78  | 7.01  | 6.69   | 83.54  |
| 3. P        | mm | 21.2   | 38.6    | 73.1   | 76.5 | 108.6 | 173.9 | 274.0 | 258.1 | 150.4 | 76.7  | 12.3  | 12.3   | 1275.7 |
| 4. GPET     | mm | 64.6   | 68.0    | 78.6   | 65.3 | 67.5  | 65.3  | 60.6  | 65.9  | 63.6  | 63.9  | 66.6  | 62.9   | 792.8  |
| 5. LCF 10°N | mm | 0.97   | 0.98    | 1.0    | 1.03 | 1.05  | 1.06  | 1.05  | 1.04  | 1.02  | 0.99  | 0.97  | 0.96   | -      |
| 6. CPET     | mm | 62.7   | 66.6    | 78.6   | 67.3 | 70.9  | 69.2  | 63.6  | 68.5  | 64.9  | 63.26 | 64.6  | 60.4   | 795.1  |
| 7. P-CPET   | mm | -41.5  | -28.0   | -5.5   | 9.2  | 37.7  | 104.7 | 210.4 | 189.6 | 85.5  | -13.4 | -52.3 | -48.1  | 460.   |
| 8. APWL     | mm | -155.3 | -183.33 | -188.8 | -    | -     | -     | -     | -     | -     | -13.4 | -65.7 | -113.8 | -      |
| 9. SM       | mm | 95.0   | 90.0    | 82.5   | 91.7 | 129.4 | 200.0 | 200.0 | 200.0 | 200.0 | 192.9 | 157.1 | 117.8  | -      |
| 10. SMC     | mm | -22.8  | -5.0    | 7.5    | 9.2  | 37.7  | 70.6  | 0     | 0     | 0     | -7.1  | -35.8 | -39.3  | -      |
| 11. AET     | mm | 44.0   | 43.6    | 78.6   | 67.3 | 70.9  | 69.2  | 63.6  | 68.5  | 64.9  | 63.26 | 48.1  | 51.6   | 733.56 |
| 12. D       | mm | 18.7   | 23.0    | 0      | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 16.5  | 8.8    | 67.0   |
| 13. S       | mm | 0      | 0       | 5.5    | 9.2  | 37.7  | 104.7 | 210.4 | 189.6 | 85.5  | 0     | 0     | 0      | 642.6  |

Source: Calculated by the Author

Where, P = Mean monthly precipitation; j = Monthly heat index ( $j = T^0c/5)^{1.514}$ ). PET = Gross potential evapotranspiration (not corrected); LCF = Latitude correction factor of GPET at 10°N; CPET = Corrected PET; APWL = Accumulated potential water loss; SM = soil moisture; SMC = Change in soil moisture; AET = Actual evapotranspiration; D = soil moisture deficit; S = soil moisture surplus; and T = mean monthly temperature (in°c).

The difference in precipitation and corrected potential evapotranspiration defines two seasons: a wet season lasting for seven and six months from March to September and April to September at Emdebir and Welketie respectively, when rainfall exceeds evapotranspiration. The dry season includes the rest of months when potential evapotranspiration not met by precipitation.

The severity of the dry season increases with the sequence of months with excessive potential evapotranspiration starting from October at both the stations. Accumulated potential water loss (APWL) is about 201.36 cm at Emdebir which is higher than that at Welketie (188.8cm).

Soil moisture deficit is about 80.66cm and 67.0cm at Emdebir and Welketie respectively. Plants remain under stress in the dry season and the stress increases with increasing accumulated potential loss or decreasing the available soil moisture starting from the onset of the dry season (October). Moisture deficit together with other water balance parameters would indicate not only the time and magnitude of moisture stress on plants but also the timing and magnitude of irrigation requirement which is required to remove the stress.

In Figure 2.5 also shows the time of soil moisture utilization which corresponds to the dry season and soil moisture replenishment from about the last week of March to late June at both Climatic stations. Moreover, it is shown that 629.98cm (51.4%) and 642.6cm (50.4%) water surplus is available at Emdeber and Welketie respectively for percolation and surface run off during the wet seasons. However, the annual average potential evapotranspiration is 794.08 cm. and 795.1cm and accounts for about 64.7% and and 62.3% of total moisture inflow (p) at Emdebir and Welketie, respectively. Hence, generally evapotranspiration would play the major role in the loss of surface and subsurface water in the two weredas.

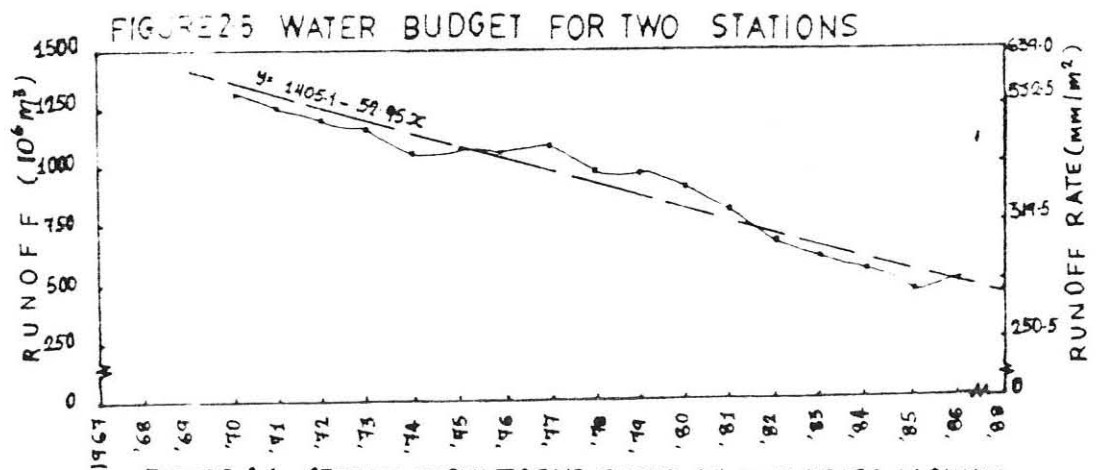
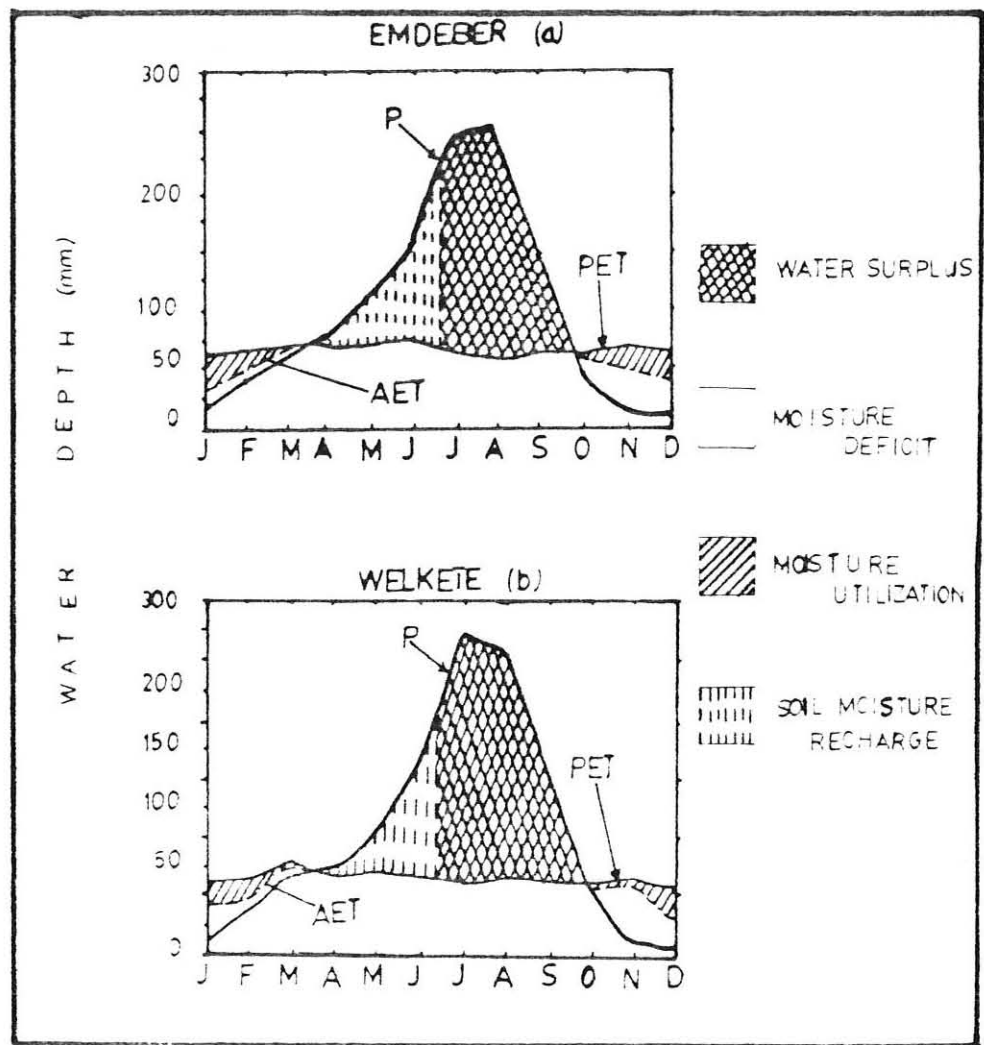


FIGURE 26 STREAM FLOW TREND BASED ON FIVE YEARS MOVING AVERAGES IN THE CATCHMENTS R. WABE, MEGECHA, GOTAM & GODEB.

### 2.2.3.3. BASIN YIELD: RUNOFF

Runoff which is the total amount of water that leaves a basin flowing down through a drainage system constituted by hydrologic net may be equated with what is known as "basin yield", which refers to the quantity of water available from a stream at a given point over a specified duration of the time (Davar, et.al., 1973).

Runoff occurs when the rate of precipitation exceeds the demand of infiltration of the soil. Water yield or run off rate from an area depends not only upon hydrological factors such as rainfall amount, intensity and distribution; but is also considerably influenced by the geology, geomorphology, size and shape of the area drained.

The two weredas under consideration, are in the catchment of Gibe River. Moreover, they are drained by Wabe River and Megecha, Gotam, and Gogeb Rivers which are tributaries of Wnke River (see 2.2.2.2.).

Though water discharge and hence, run off records are not available for Wenke River, the Wabe and Megecha Rivers are guaged close to the towns of Welketie and Gubre respectively. The Gotam and Gogeb Rivers which both largely drain the Cheha wereda area gouged close to the town of Emdeber, probably represent to some extent the hydrological condition in the uncovered part of Wenke River catchment. The result of 21 years average gauging records (from 1968 to 1988) is shown in Table 2.6. and the Seasonal patten is also graphically portrayed in Map IV.

**Table 2.6. MEAN ANNUAL RUNOFF, RAINFALL DEPTH AND RUNOFF COEFFICIENT**

| River                  | Mean Annual Runoff ( $10^6 \text{ m}^3$ ) | Basin mean Rainfall Depth (mm) <sup>a</sup> | Basin Area (km <sup>2</sup> ) | Runoff per unit Area (mm) | Runoff Coeff. |
|------------------------|-------------------------------------------|---------------------------------------------|-------------------------------|---------------------------|---------------|
| Wabe R.                | 712.945/337.453 <sup>b</sup>              | 1288.9                                      | 1863.4                        | 382.6                     | 0.297         |
| Megecha                | 107.3                                     | 1264.0                                      | 327.5                         | 327.6                     | 0.259         |
| Gotam R.               | 57.811                                    | 1318.0                                      | 93.1                          | 621.0                     | 0.471         |
| Gogeb R.               | 55.832                                    | 1318                                        | 63.2                          | 883.4                     | 0.67          |
| The two <u>weredas</u> | 558.396                                   | 1307.6                                      | 1563                          | 397.6                     | 0.304         |
| All basins             | 933.888 <sup>c</sup>                      | 1307.6                                      | 2347.3                        | 397.6                     | 0.304         |

Source: Derived from data collected from NMSA and Ethiopian River Valleys Development Authority, 1993.

a) Basin mean annual rainfall is calculated by considering all the available rainfall records of the climatic stations found in the respective drainage basins and other which are found close to the catchment.

b) Wabi R. basin includes more than 52% of the area outside the the two weredas.

c) This is the sum of area of Wabe R. basin (total), basins of Megecha, Gotam and Gogeb River above and below the gauging sites and small area of Wabe R. basin which is not included in any of the four rivers.



As shown on Map IV, the seasonal pattern of basin yield (runoff) is characterized by the highest discharge and hence run off during the rainy season (July, August and September); the maximum in all cases being recorded in the rainiest month of August. But it is the lowest in winter months of (December, January and February). The two correspond with the seasons of highest and lowest rainfalls but lower and higher temperature respectively because of greater evapotranspiration (Cf. Map IV with Map V).

As shown in Table 2.6, the average total runoff for the total basin area and the two weredas are 933.888 and 558.396 million cubic meter respectively. The runoff per unit area (397.6mm) and rainfall coefficients (0.304) are the same. Thus, it can be concluded that about 30.4% of the rain water is lost as runoff.

It may be interesting to note the pattern of runoff coefficient. It appears that the runoff coefficient is higher in the streams with smaller catchments (e.g. Gogeb and Gotam Rivers). This is explained in terms of run off factors such as basin size, shape, slope, elevation, perimeter, rainfall depth, etc.

Furthermore, based on Table 2.5. and 2.6., the amount of rain water to recharge underground water in the two weredas may be assessed with the water balance equation.

$$I = P - (AET + RO)$$

where, I = rate of infiltration; surface runoff (RO) = 397.6mm; precipitation (P) = 1307.6mm; actual evapotranspiration (AET) = ((713.3 + 733.56)/2) (see Table 2.5).

$$\begin{aligned}\text{Therefore, } I &= 1307\text{mm} - (397.6 + 723.45\text{mm}) \\ &= 1307.6\text{mm} - 1121.05\text{mm} \\ &= 186.55\text{mm}\end{aligned}$$

The volume of water (V) in cubic meter for the two weredas may be calculated:

$$\begin{aligned}V_{(I)} &= I \times A_w, \text{ where } A_w = \text{area of the two weredas.} \\ &= (186.55/1000\text{M}) \times 1563 \times 10^6 \text{ M}^2 \\ &= 291.57765 \times 10^6 \text{ cubic meter (14.27\%)} \\ V_{(AET)} &= AET \times A_w \\ &= (723.45/1000\text{M}) \times 1563 \times 10^6 \text{ m}^2 \\ &= 1130.7523 \times 10^6 \text{ cubic meter (55.32\%)} \\ V_{(RO)} &= RO \times A_w \\ &= 397.449 \times 1563 \times 10^6 \times \text{cubic meter} \\ &= 621.449 \times 10^6 \text{ cubic meter (30.41\%)} \\ V_{(P)} &= P \times A_w \\ &= 1307.6/1000\text{M} \times 1563 \times 10^6 \text{ m}^2 \\ &= 2043.779 \times 10^6 \text{ cubic meter (100.0\%)}\end{aligned}$$

Thus, from this one would say that water loss due to evapotranspiration accounts for about 55% of the total precipitation while only 14% of the rain water (i.e. about 291.578 million cubic meter) is available for replenishment of underground water supposing that surface water evaporation and river channel evaporation and other minor losses such as seepage along river beds are negligible.

It is apparent from Figure 2.6. that long-term runoff pattern shows a declines in the quantity of runoff drained out from the four catchments. Run off per unit area in the four catchments was about 555.85mm (or 1304.74 million M<sup>3</sup>) in 1968 while it decreased to about 292.76mm (or 687.19 million m<sup>3</sup>) in 1988.

Time series analysis of run off records based on a five-year moving average shows that stream flow in the region is expected to decrease at a rate of about 52.95 million cubic meter every year and the pattern is characterized by cyclical fluctuations (Figure 2.6). The calculation however, appears very alarming This may be attributed to change in the land use (see section 4.3) and local climatic condition as well as soil degradation in the region. Nonetheless, change in rainfall depth appears not well marked to result in this much change of runoff amount (C.f Figure 2.4. and 2.6.). If the present rate of decline continues, the stream flows are expected to touch zero mark by the later half of this decade and would be desasterous to the region. Hence, the need to regulate and optimize the land use system.

#### **2.2.4. SOILS**

There is little technical information available on Soil types represented in the study area. But some writers communicated some very general information based on a few qualitative observations. For instance, Westphal (1975) reported that soils in enset growing regions are mainly alfisols. Murphy (1959) asserted that "enset flourishes better

on clay loam soil with fine texture". William Ipcar (1970) agrees with Murphy and reported similar soil texture in Eza and Cheha area.

In a study compiled on enset cultivation by the Office of Central Zone Planning (OCZP) it was reported that soil colours in enset regions of Shewa, of which Sabat Bet enset areas are parts, range from brown, black to red; and in the light of the results of soil study in Hosanna, soils of enset growing areas in Shewa are expected to be deep enough except on slopes, have a PH of 5 to 6 and low content of C.B.C and phosphorous (OCZP, 1987/88).

Table 2.7. **DISTRIBUTION OF DIFFERENT SOIL GROUPS IN EZANA WOLLENE AND CHEHA WEREDAS\***

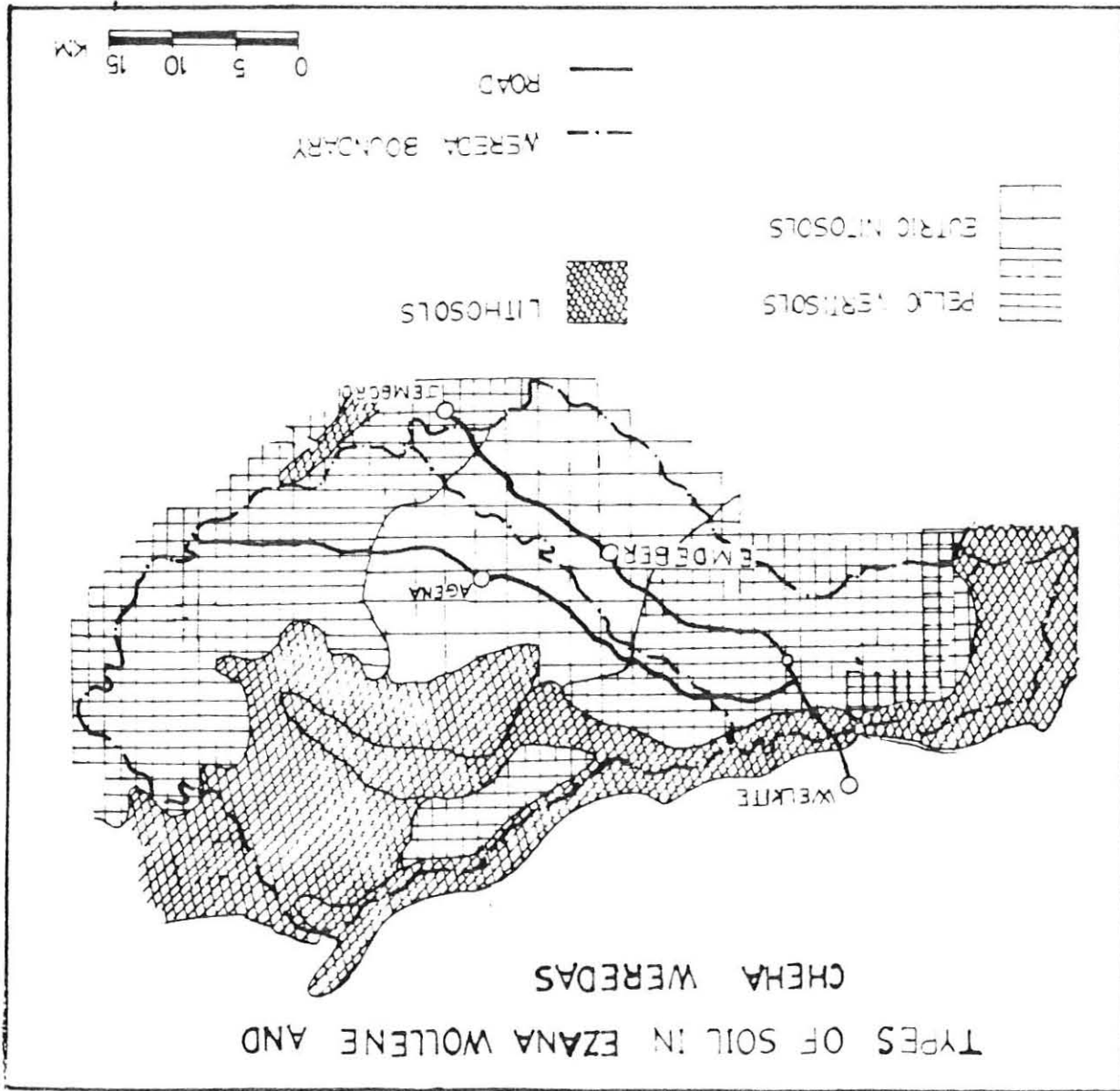
| Soil Group       | Soil colour         | Ezana Wollene 'Wereda'           |      | Cheha W.                        |      | Both 'Wereda's.                 |      |
|------------------|---------------------|----------------------------------|------|---------------------------------|------|---------------------------------|------|
|                  |                     | Area covered (km <sup>2</sup> .) | %    | Area covered (km <sup>2</sup> ) | %    | Area covered (km <sup>2</sup> ) | %    |
| Pellic Vertisols | Black-dark grey     | 475                              | 42.3 | 301.25                          | 48.7 | 776.25                          | 44.6 |
| Eutric Nitosols  | Redish brown to red | 210                              | 18.7 | 207.5                           | 33.5 | 417.5                           | 24.0 |
| Lithosols        | -                   | 437                              | 39.0 | 110.0                           | 17.7 | 547.7                           | 31.4 |
| Total            | -                   | 1122.5                           | 100  | 618.75                          | 100  | 1741.215                        | 100  |

\*Based from Map VII which is adapted and further edited from Geomorphology and Soil map (FOUNDED 1980, 1984)

Note that since the map is adapted from 1:100,000 base map and due to boundary problem, the total area is a bit exaggerated

MAP VII

TYPES OF SOIL IN EZANA WOLLENE AND  
CHEHA WEREDAS



Source: Adapted from Geomorphology and Soil Map of Ethiopia 1:1,000,000 by FAO/UNDP/MOA 1983

According to the Geomorphology and Soil map (1:1,000,000), (UNDP/FAO, 1984) three principal soil groups cover the area. The one which most extensively cover the area is the pellic vertisols-soil group which covers about 45% of total area of the two weredas (see map VII and Table 2.7.).

Vertisols in general and Pellic Vertisols in particular develops on basic parent materials, level to gentle slope and impeded drainage, and in areas of naturally dry and dry season of the High and Low Plateaus and on colluvial slopes. They are either black or very dark grey, heavy textured and hence, have low permeability, expand and contract with changes in moisture content and which consequently, show wide vertical cracks when dry. Pellic Vertisols in the region are found in association with urtic Nitosols.

Depending on population pressure on the land and local farming system, Vertisols are intensively cultivated and mostly devoted to the production of grains in dega parts of the Upper Plateau in Ezana Wollene wereda, and left predominantly for grazing in the lower to middle parts of the Lower Plateau of both Cheha and Ezana Wollene weredas (Map VII). Because they are heavy textured, they create hardship in tillage, and problems in drainage and damage the roots of plants while cracking during dry season. Moreover, they are highly erodible and hence, are much susceptible to severe erosion hazard because of high runoff rate.

The other group of soil is Eurtic Nitosols which occurs in association with Pellic Vertisols and cover about 24% of the total study area (18.7% and 33.5% of the areas of Ezana Wollene and Cheha weredas respectively). They have developed on parent materials of volcanic origin and occur on the gently slopping to steep parts of the Transitional Slope Zone in Eza and Cheha areas (Map VII).

Nitosols in general and Eutric Nitosols in particular are clayey. They range in colour from redish brown to red. They have good depth, stable structure, and are very porous. They have a high moisture storage capacity, deep rooting volume, and are well drained and easily workable. Hence, in areas with a moderate to high population density, Nitosols are intensively cultivated for perennial crops such as enset, chat, coffee and orange.

Lithosols account for 31.4% of the total area. These are poorly developed soil groups because of either too steep slopes and/or the geologically too young parent materials that have permitted no significant degree of soil development. The former factor probably appear more important than the latter.

Lithosols occur in the gorges of River Gibe, Wabe and Kerib and on severely dissected side slopes and pediments of the Transitional slope zone of the region. They are more wide spread in Ezana Wollene weredas. They have variable chemical and physical characteristics. They are very shallow, young, newly weathered and still in the process of evolution and thus, tend to be coarse textured. However, they have comparatively good nutrient status.

Except in the upper Wollene, outside Kerib and Wabe River valleys, Lithosols in most part of the two weredas are under natural vegetaion - covered with scrubs and byshes. Because they have a limited root depth, they are too shallow for agricultural uses. In the Gibe and Wabe River gorges Lithosols occur in association with stony surfaces while utric Fluvisols may be found in the bottom of the two river gorges. On the severely dissected side slopes and pediments of Wollene and western Muhir areas outside river gorges, Lithosols occur associated with eutric Nitosols and/or chromic Luvisols with small patches of chromic Vertiosls.



Based on the generalization which can be made from the available Geomorphology and Soil map of the region, nearly 45% of the region's soil has black to dark grey colour while 24% is covered with red (redish brown). However, peasants responses from sampled households show that red soil appeared most common. In woina dega part 99% of the peasant holdings are reported to have red soil while in the kolla zone 100% of the farms possess black soils. In the dega zone however, 43% of the farms have black soils.

Furthermore, Peasants' responses further expose that in 43% of the sample farms, soils are moderately fertile<sup>8</sup>, while 22% of the farms are very fertile and 33% have low fertility status. Regardless of the differences in the two (peasant responses and generalization made from the soil map), perennial crops and ensets in particular, grow better and most of the settlements are situated on red soils.

#### 2.2.5. NATURAL VEGETATION COVER AND WILD LIFE RESOURCES

As already mentioned, the high population pressure since long past and its unprecedented increase has resulted in ever increasing quest for agricultural land, and need for wood for farm house construction, fuel and others. Consequently, the natural vegetation including forests and woodlands has been cleared from most part of the area, except in a few scattered patches on the plateaus and along the river valleys.

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<sup>8</sup> Fertility status was identified qualitatively based on peasants openions by considering local variations in land qualities.

The original covers of forests and shrubs in most parts are denuded and replaced either by coarse grasslands which predominate the region and or brought under enset and other perennial and annual crops. Grass cover, today, be it original or modified extends over 66% of the kolla zone, 31% of the woina dega zone, and only 4% of the Upper Plateau of dega parts (Table 4.1). Shrubs, which largely occur on the slopes of the Transitional slope zone and in some river gorges account for as much as 12% of the kolla region and less than 0.5% in the other regions (see Table 4.1.).<sup>9</sup>

Although it is difficult to reconstruct the exact original vegetation pattern of the area, which might have existed before the expansion of settlements, there are some indications which would show that the region originally was probably under forest and associated grasslands (Ipcar, 1970; Chaffey, 1979; Getnet, 1992).

A part from this, there are some other local elements and residuals in support of the assertion stated in the preceding paragraph. There are a few existing patches of forests which are supposed to be residuals of the original montane temperate forests. They are found in woina dega and dega parts, and predominantly constitute of *Podocarpus gracillor* (Zigba), *Juniperus procera* (Tid) and others.

The existing residual montane temperate forests include Geche, the largest in the region which covers one square Kilometeres area, Koter-Gedera (<0.77 km<sup>2</sup> area), Geme (0.7km<sup>2</sup>), Abangiya (0.6km<sup>2</sup>), Genema (0.3km<sup>2</sup>) and Yaseray (0.16km<sup>2</sup>) lying in Eza; Achimweke forest in Wollene, and Yetenaka, Girar Debir (0.26km<sup>2</sup>) and yeforehena (0.25km<sup>2</sup>) in Cheha wereda. There are also scattered extensive wood lands following the

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<sup>9</sup> The figures are taken from actual land-use survey of three peasant associations, one each in Kolla, Woina dega and dega zones.

upper course of Kerib River in Megeran and Tekle Haimanot areas in Muhir. Moreover, some *Erica arborea* (Astha) woodlands are found in upper dega zone of Bozabar area. Altogether, forests account for not more than 0.25% coverage of the region.

Furthermore, individual trees such as *Acacia etbaica* (Girar), *Podocarpus gracillor* (Zigba), *Junperous procera* (Tid), *Commophora African* (Warka) and others exist very sparsely. Their survival, at least one in each village owes to the social and cultural reasons which once again undoubtedly indicate that they are residuals of the original forest cover. Each village preserves at least one Zigba or Tid /and or Sholla tree in woina dega, dega and kolla zones respectively, and in Jefuer which serves as a meeting ground for village assembly and a resting place for the passers by amidst the village.

Thirdly, some place names may indicate once the existed natural vegetaion, forests in particular, and trees that composed forests. For instance, Em-debir, an emergent market place and wereda town of Cheha, which meant mother (big) forest. "Im" means mother, and "debir" means forest. Around Emdeber place names - Girar Debir (which meant 'accacia forest'), Yawre Debir ('forests of wild life') are found (Getnet, 1992). In Eza area too, place names such as "Debir" (means forest/woodland), "Yeterek Deed" which means dry "Tjd" and "Yegefe" (local tree name) would signify the existence of forests in the past.

As deforestation grew serious, the Gurages introduced eucalyptus trees to their region in the last decade of the 19th century shortly after it was planted around Addis Ababa (Horvath, 1968: 13-19). Planting eucalyptus has grown wider and occurs almost in all agroclimatic zones including the most upper dega parts. Hence, today it covers about 6-21% of the region's area. It is the only source of fire wood, greatly used for construction and has

emerged as one of the major source of cash by exporting to urban centres outside the region, particularly to Addis Ababa.

Some writers reported that in the past, before natural covers of the region was disturbed, various wildlives such as lions, elephants, buffalos were roaming all over the region (L.Traverse as quoted by Getnet, 1992; Gurage Exhibition Committee, 1955). However, since the natural habitat is disturbed, most of these big wild animals have disappeared. What are commonly found today in the region include leopards, civet cats, variety of monkeys, guereza, porcupines, foxes, haynas, antelops, pigs, apes, variety of birds, etc.

## 2.3. CULTURAL SETTING OF THE AREA

### 2.3.1. POPULATION SIZE AND DISTRIBUTION

One of the factors which has influenced not only the natural vegetation patterns but also the land-use system at large in the Gurage history is population pressure (Getnet, 1992). High population density in the Gurageland was reported as early as 1840's (Haris, 1844: 318).

Even nowadays, the Gurageland and / or the Sabat Bet Gurageland at large and Ezana Wollene and Cheha weredas, in specific, are amongst the most densely populated areas in Ethiopia. In terms of population density, the two weredas are comparable to the most densely populated weredas in enset growing regions such as Kedida Gamela, Kacha Bira (both found in Kembata and Hadiya) and Damot Gale in Wolayta where population density already exceeded 400 persons per square kilometre (CSA, 1990).

It was noted earlier that the population of Gurage was estimated at more than 1.9 million (Belete, 1993), of which about 50% is accounted by the Sabat Bet Gurages which live in four weredas, i.e. Ezana Wollene, Gummer, Cheha and Enamour and Enner. Based on an estimated 0.01% rate of increase per annum over the 2.9% yearly growth rate<sup>10</sup> of the Ethiopian population, the population (1984) of Ezana Wollene and Cheha weredas together was projected to reach about 347,790 (Ezana Wollene about 212,630 and Cheha 133,153) in 1993. The respective figures for 1984 were 266,082, 163,738 and 102,544 (CSO, 1985).

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<sup>10</sup> Growth rate of Ethiopian population was estimated of 2.9% since May 1984 and this is expected to increase by 0.01% per annum (CSO, 1983).

Based on the first population and housing census report of 1984, the urban population of the study area accounted for only 1.1% (2.4% in Cheha and 0.3% in Ezana Wollene). Thus, the population of the two weredas is practically rural.

Despite the region is said to be one of the densest in enset growing regions, population distribution and/or pressure as indexed by crude population density measure shows both horizontal and vertical variation. The crude population densities were 171 and 224.5 persons per square kilometre in Cheha and Ezana Wollene in 1984 respectively. The average for the two was 189 persons per square kilometre and this was about 4.8 times the national average.

While population grows at about 2.9 to 3.0% per annum (1984-1994), the number of inhabitants is expected to reach as much as 241.3 and 215.6 persons per square kilometre by 1993 in Cheha and Ezana Wollene respectively. The average for the two, however, has reached to about 224.6 persons per square kilometre (1993).

On the otherhand, the rural density for the two weredas was estimated at 417 and 387 persons per square kilometre of cultivated land in Ezana Wollene and Cheha respectively. This is about twice the national average (CSA, 1990).

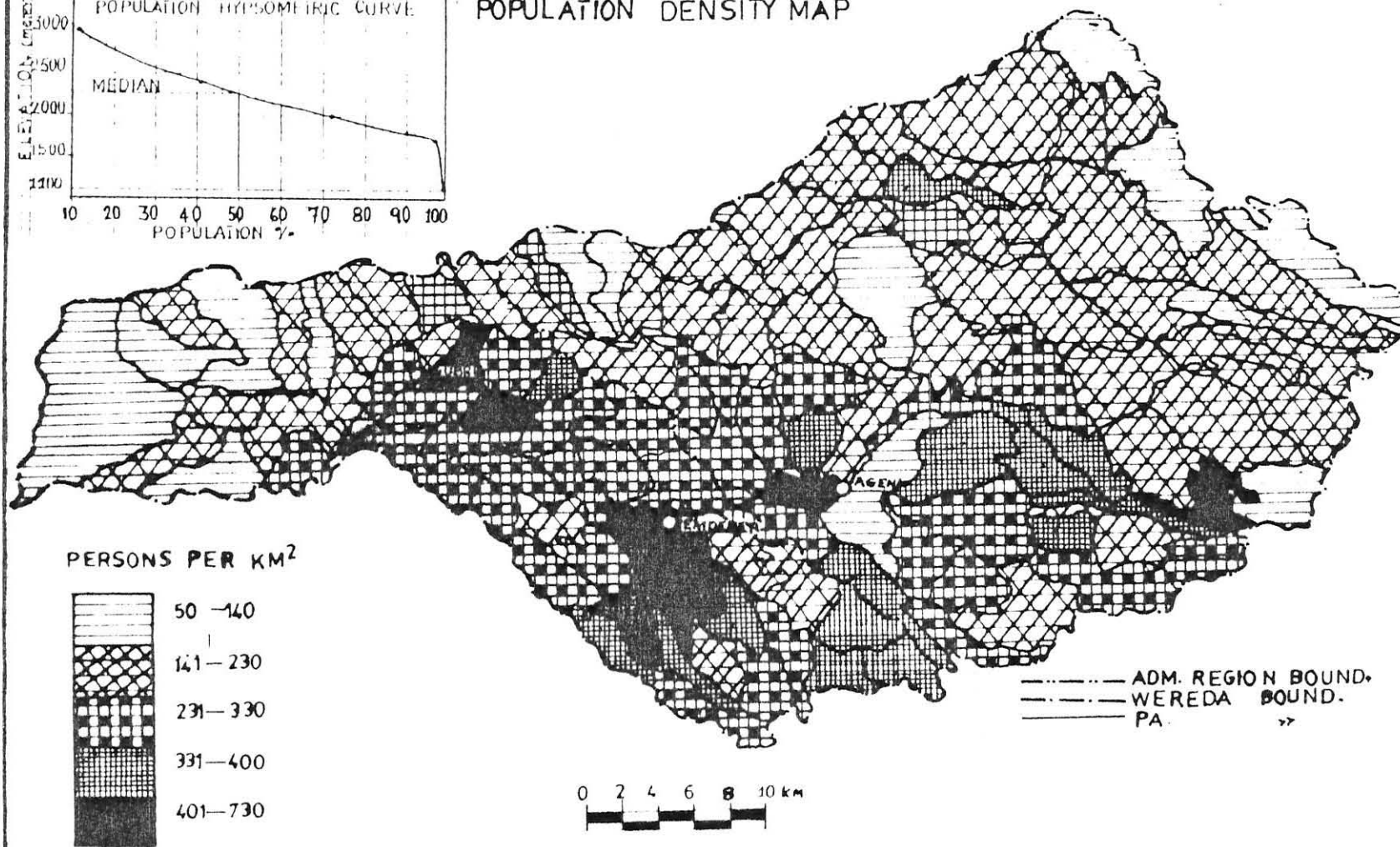
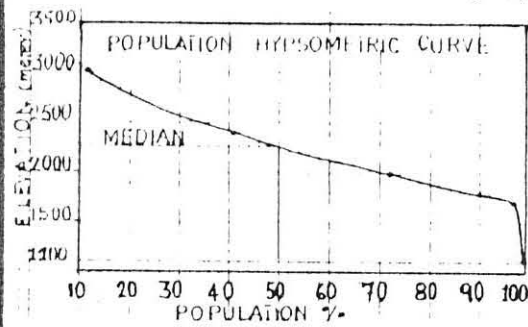
In contrast to densities at wereda level (or higher), measures at agro-climatic zones, peasant association (PA) and even at individual peasant holding level better show the extent of population pressure on the available resources in general and land resources in particular. At peasant association level, the number of inhabitants per square kilometre varies from about 50 in Lukena Aba, in the extreme south west kolla, to as much as 728 in Agenna PA (upper woina dega).

As portrayed on Map VIII, the central and southern parts of the region appear to be



# M A P VIII

## POPULATION DENSITY MAP



more densely populated than the northern and western sections. Areas around the urban centres are also appear most densely populated.

Needless to say, however, Cheha wereda appears to be more densely populated than Ezana Wollene, probably, due partly to the urban influence and the relatively smaller sizes of land holdings by the peasant associations (compare Map VIII and Map II).

At the other extreme, spatial organization of the population at individual farm holding level appear more impressive and still shows a better picture of population pressure. Based on the sampled peasant households distributed in all agro-climatic zones, densities range from 37 to as much as six to about 9000 persons /km<sup>2</sup>. However, the average density in the zones is found to be about 414.3 in 'woina dega', 427 in 'kolla' and 817 persons per square kilometre in 'dega'. The over all average is about 527.8 persons per square kilometre (Table 2.8).

**Table 2.8 CRUDE POPULATION DENSITY AT PEASANT HOLDINGS LEVEL**

| PA/Zone                  | Density Range (p/km <sup>2</sup> ) |         | Average |
|--------------------------|------------------------------------|---------|---------|
|                          | Lowest                             | Highest |         |
| Norcha                   | 97                                 | 1515    | 1423.0  |
| Kokera                   | 153                                | 2601    | 1331.5  |
| Ketane                   | 166                                | 2767    | 495.0   |
| Cheza Sefer              | 205                                | 9231    | 1005.0  |
| 'Dega' total             | -                                  | -       | 817.0   |
| Muttana Wera             | 171                                | 705     | 353.2   |
| Darcha                   | 94                                 | 740     | 468.2   |
| Agenna                   | 148                                | 2400    | 617.0   |
| Sissena Denab            | 201                                | 914     | 414.0   |
| Emdeber                  | 131                                | 2468    | 515.3   |
| 'woina dega' total       | -                                  | -       | 414.3   |
| Dubissana Karssa/'kolla' | 37                                 | 1006.4  | 427.0   |
| Both <u>weredas</u>      | -                                  | -       | 528.0   |

Source: Field work, 1993.

## VERTICAL DISTRIBUTION OF POPULATION

In his analytical work on altitudinal distribution of world population, Staszewski (1957), as quoted by Clarke (1965), showed that population numbers and densities diminish with altitude. This is a reflection of the increasing difficulties entailed in the exploitation of existing geographic environments and adaptation to them. Such is a case in regions of higher latitudes, where environmental hostility grows worse with increasing elevation.

However, in low latitudes, the tropics in particular, higher altitudes would be advantageous to human occupation because of climatic amelioration. Highlands in Ethiopia are healthier, more hospitable and have greater potential for agricultural production because they receive ample rainfall and have more productive soils. Hence, settlements are more attracted towards higher lands. As a matter of fact altitude is a surrogate factor which can be a representative of most of the physical factors by way of explaining population distribution in Ethiopia in general, and in Ezana Wollene and Cheha weredas in particular. This is quite contrary to the generalization of Staszewski. Of course, there exists a limit to the altitude from where the trend changes. In the area under study that limit might be marked at 3000 meter. Apparently, as shown in Table 2.9, 72.2% of the population in the two weredas (85.4% in Ezana Wollene and 50.7% in Cheha) live on the zone above 2000 meters a.m.s.l. which includes 63.3% (82% in Ezana Wollene and 37.2% in Cheha weredas) of the total land area. Moreover, in so much as 96.6% of the region's population, or 100% of the Ezana Wollene and 91.3% of Cheha weredas people have settled in areas above 1700 meters a.m.s.l.

Table 2.9. VERTICAL DISTRIBUTION OF POPULATION IN 1993

| Altitude<br>Zone (meter<br>a.m.s.l.) | Population (%) |          |       | Area (%) |       |       | Density (P/km <sup>2</sup> ) |       |       |
|--------------------------------------|----------------|----------|-------|----------|-------|-------|------------------------------|-------|-------|
|                                      | Cheha          | Ezana W. | Total | Cheha    | Ez.W. | Total | Cheha                        | Ez.W. | Total |
| 1100-1700                            | 8.7            | -        | 3.4   | 21.6     | -     | 7.6   | 96.8                         | -     | 96.8  |
| 1700-2000                            | 40.6           | 14.6     | 24.6  | 41.2     | 18.0  | 26.1  | 236.1                        | 168.6 | 206.0 |
| 2000-2400                            | 33.5           | 28.9     | 30.7  | 23.2     | 26.03 | 25.0  | 346.1                        | 231.1 | 268.8 |
| 2400-3000                            | 17.2           | 38.3     | 30.2  | 14.03    | 34.0  | 27.0  | 294.0                        | 234.6 | 245.4 |
| 3000-2500                            | -              | 18.2     | 11.2  | -        | 22.0  | 14.3  | -                            | 171.7 | 171.7 |

Source: Compiled by the Author based on CSO's 1984 population data.

As shown on the hypsometric curve of the population of the two wereadas (see Map VIII inset), the median level of vertical population distribution is found to be about 2250 meters a.m.s.l. In contrast to this the mean level of the vertical distribution of population, as reported by Clarke (1965), quoting Statewski (1957), was 590 meters for Africa, Asia (319), Australia (95), Europe (168), North America (430), south America 644 and the world (320 meter). Table 2.9 also reveals that the elevation zone between 1700 and 3000 meters appears to be the most hospitable as most settlements have precipitated. Density is the highest (268.8 p/km<sup>2</sup>) in the upper woina dega zone which lies between 2000-2400 meters a.m.s.l. of the region as a whole.

Nonetheless, density as well as population numbers tend to increase until about 3000 meters. Thus, based on the available numerical data and author's personal field observations, particularly in the kolla zone (below 1500m) and in the upper dega (above 3000 meters) critical limits to permanent occupation may be placed.

### **2.3.2. AGE - AND SEX-STRUCTURE OF THE POPULATION**

The age-and sex-structures of a population are the two significant demographic characteristics which are considered in the present study. By way of influencing population growth rate, the age-structure partly affects production capacity and hence determines the status of man power supply, and the requirement of services. On the other hand, sex composition partly influences the incidence of births and deaths, marriages, migration occupational status and virtually all population characteristics (U.N. 1953).

Table 2.10. POPULATION BASED AGE AND SEX COMPOSITION OF SAMPLE HOUSE HOLDS

| Zone     |     | 0-5 |     | 6-10 |     | 11-15 |     | 16-20 |     | 21-25 |     | 26-30 |     | 31-35 |     | 36-40 |     | 41-45 |
|----------|-----|-----|-----|------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|
|          |     | M   | F   | M    | F   | M     | F   | M     | F   | M     | F   | M     | F   | M     | F   | M     | F   | M     |
| 'Dega'   | No. | 36  | 37  | 44   | 53  | 59    | 35  | 44    | 39  | 18    | 6   | 13    | 17  | 6     | 17  | 15    | 21  | 14    |
|          | %   | 6.6 | 6.8 | 8.1  | 9.8 | 10.7  | 6.4 | 8.1   | 7.1 | 3.9   | 1.2 | 2.4   | 3.1 | 1.1   | 3.1 | 2.7   | 3.9 | 2.6   |
| 'W.Dega' | No. | 36  | 42  | 58   | 58  | 51    | 45  | 55    | 52  | 26    | 22  | 25    | 27  | 19    | 25  | 13    | 17  | 11    |
|          | %   | 3   | 5.9 | 8.1  | 8.1 | 7.1   | 6.3 | 7.7   | 7.3 | 3.6   | 3.1 | 3.5   | 3.8 | 2.7   | 3.5 | 1.8   | 2.4 | 1.5   |
| 'Kolla'  | No. | 8   | 2   | 12   | 11  | 13    | 9   | 6     | 10  | 6     | 5   | 4     | 7   | 4     | 4   | 1     | 2   | 4     |
|          | %   | 6.3 | 1.2 | 9.4  | 8.7 | 10.2  | 7   | 4.7   | 7.8 | 4.7   | 3.9 | 3.1   | 5.5 | 3.1   | 3.1 | .8    | 1.6 | 3.1   |
| Total    | No. | 80  | 81  | 144  | 122 | 123   | 89  | 105   | 101 | 50    | 33  | 42    | 51  | 29    | 46  | 29    | 40  | 29    |
|          | %   | 5.8 | 5.8 | 8.2  | 8.8 | 8.9   | 6.4 | 7.6   | 7.3 | 3.6   | 2.4 | 3     | 1.5 | 2.1   | 3.3 | 2.1   | 2.9 | 2.1   |

| 46-50 |     | 51-55 |     | 56-60 |     | 61-65 |     | 65+ |     | Total |      | Overall<br>Total |
|-------|-----|-------|-----|-------|-----|-------|-----|-----|-----|-------|------|------------------|
| M     | F   | M     | F   | M     | F   | M     | F   | M   | F   | M     | F    |                  |
| 11    | 5   | 6     | 1   | 14    | 5   | 2     | 2   | 6   | 4   | 288   | 255  | 543              |
| 2.0   | 0.9 | 1.1   | .2  | 2.6   | 0.9 | 0.4   | 0.4 | 1.1 | 0.7 | 53    | 47   | 100              |
| 20    | 21  | 9     | 6   | 14    | 8   | 12    | 6   | 18  | 8   | 367   | 348  | 715              |
| 2.8   | 2.9 | 1.3   | 0.8 | 2     | 1.1 | 1.7   | 0.8 | 2.5 | 1.1 | 51.3  | 48.7 | 100              |
| 1     | 1   | 3     | 3   | 1     | -   | 3     | -   | 1   | 1   | 67    | 59   | 126              |
| 0.8   | 0.8 | 2.4   | 2.4 | 0.8   | -   | 2.4   | -   | 0.8 | 0.8 | 53.5  | 46.5 | 100              |
| 32    | 27  | 18    | 10  | 29    | 13  | 17    | 8   | 25  | 13  | 722   | 662  | 1384             |
| 1.6   | 2.0 | 1.3   | 0.7 | 2.1   | 0.9 | 1.2   | 0.6 | 1.8 | 0.9 | 52.2  | 47.8 | 100              |

Source: Field work, 1993

It was reported that the working age population of the two weredas constitutes 45% (MoA, 1984). However, based on population counts of sample households it is apparent that the working force (population between age 15 and 60) accounts for about 51.4% of the total. While 44.0% and 4.6% are accounted for by segments of the population which are "too young" and "too old" to participate in the labour force respectively (Table 2.10). Hence, the total dependency burden is about 94.4% while youth and old-age dependency is about 85.5% and 8.8% respectively.

There is slight zonal variation observed in the age structure and hence in the total proportion of dependency burden. It is apparent from Table 2.11 that dega population appears to be more "young" because the youth population accounts for about 48.6% as compared to 41% of the total, and the aging proportion is the highest in the woina dega. Hence the total dependency burden is highest in dega (104.9%) in contrast to 87.7% in woina dega.

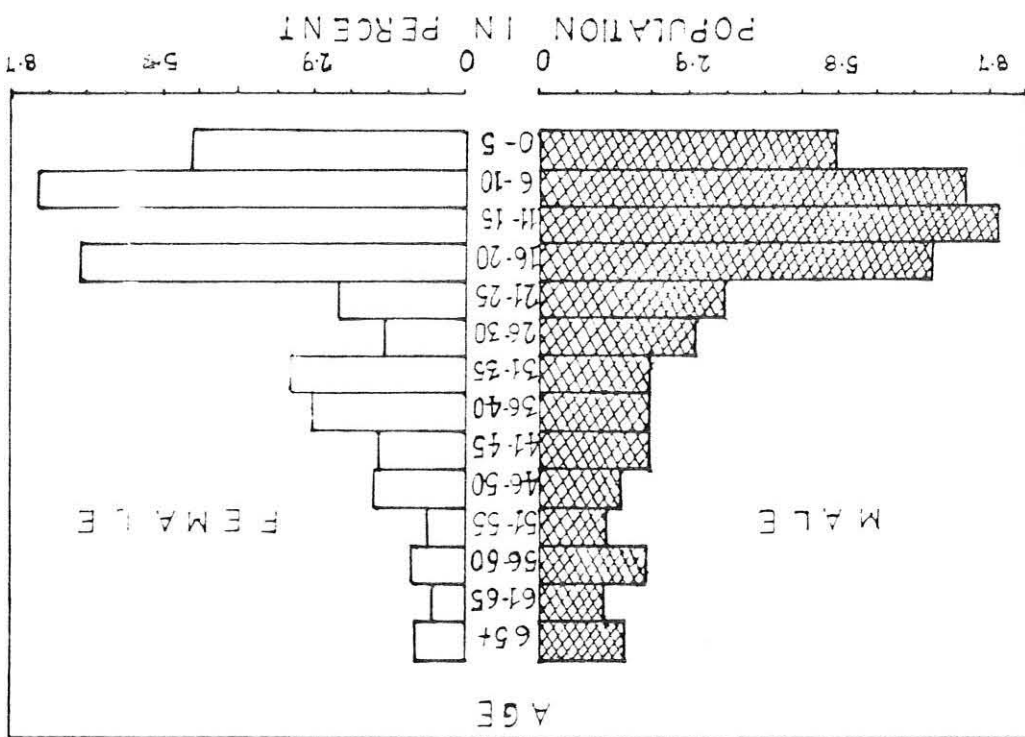
**Table 2.11. THE THREE SEGMENTS OF THE POPULATION AND DEPENDENCY BURDEN (%).**

| Zone     | "young"<br>pop. (0-<br>15 yrs) | Working<br>force<br>16-60 | Aging<br>pop.60<br>+ | Total<br>Depende<br>ncy<br>Burden | Pre-<br>school<br>age<br>population<br>(0-5) | School-<br>age pop.<br>(5-17) |
|----------|--------------------------------|---------------------------|----------------------|-----------------------------------|----------------------------------------------|-------------------------------|
| 'Dega'   | 48.6                           | 48.8                      | 2.6                  | 104.9                             | 13.4                                         | 43.1                          |
| 'W.Dega' | 40.6                           | 53.3                      | 6.2                  | 87.7                              | 10.9                                         | 37.3                          |
| 'Kolla'  | 43.6                           | 52.4                      | 4.0                  | 90.9                              | 8.7                                          | 40.5                          |
| Total    | 44.0                           | 51.4                      | 4.6                  | 94.4                              | 11.6                                         | 39.9                          |

Source: Computed by the author



FIGURE 2.7 POPULATION PYRAMID OF  
SAMPLE HOUSEHOLDS IN 1993



### 2.3.3. HOUSE HOLD SIZE AND MARITAL AND LITERACY STATUS

The average house hold size at a national level for rural Ethiopia was 4.5 while for the two weredas it was reported as 4.3 (CSO, 1985). However, the sample survey of 214 households in the two weredas shows that household size range from 5.72 in Agenna to 7.9 in Ketane and Cheza sefer PAs with an over all average size of 6.8 (Table 2.12). For the dega woina dega and kolla zones the average figures are 7.4, 6.5, and 6.1 respectively. The discrepancy may be attributed to the fact that migrants were not considered in the census while the sample household survey regarded all members of a house hold irrespective of their presence or absence. Nevertheless, house hold size tends to increase with altitude (Table 2.12).

Table 2.12. AVERAGE HOUSE HOLD SIZE\* (A.W.H.S)

| PA/ZONE      | A.H.H.S | PA ZONE            | A H H S | PA ZONE     | A.H.H.S |
|--------------|---------|--------------------|---------|-------------|---------|
| Norcha       | 6.9     | Agenna             | 5.7     | Dibissana k |         |
| Kokera       | 6.4     | Dmdeber            | 6.6     | (Kolla')    | 6.1     |
| Ketane       | 7.9     | Muttana Wera       | 6.4     | Grand Total | 6.8     |
| Cheza S.     | 7.9     | Darcha             | 6.0     |             |         |
| 'Dega' Total | 7.4     | Sissera Denab      | 7.6     |             |         |
|              |         | 'Woina Dega' total | 6.5     |             |         |

Source: Field Work, 1993.

\* A.H.H.S. = Total population divided by number of households.

Similarly, the proportion of school-going children is more in dega zone (43.1%) in contrast to 37.7% in woina dega parts. There is also more pre-school children concentration in dega parts (Table 2.11). This may imply that more schooling provisions and budget would be needed in dega parts.

The other aspect that can be observed from the age and sex-structure (Table 2.10 and Figure 2.7) is that the proportion of women in age group 15 to 49 years which largely determines the reproductive potential of societies, is calculated to be about 49.2%. This is much higher than the national average which is 41% (CSA; 1990). Moreover, the proportion of women in the age group 20 to 29 years which are presumed to be the most "fertile" and accounts for about 25.8% of women in age group 15 to 49.

As per CSO report of 1984 sex or masculinity ratio of the general population was about 95.5 males for every 100 females. In Cheha wereda it was 98.1% as compared to 94% in Ezana Wollene. The result of the sample counts, however, shows a pattern contrary to the reported one. It is found to be 109 males per 100 females for the area (Table 2.10). The discrepancy may be attributed to migration. During the sample house hold surveys, all the house hold members who were away from home were also counted. The 1984 census counts however, considered only those house hold members who were actually around. What so ever the case may be, the discrepancy in the proportion of males and females, and differences in the two count would be attributed to migrations since there are more male migrants than females (See 3.3.).

## MARITAL STATUS

The distribution of population aged 10 years and above by marital status (Table 2.13) shows that the percentage of married, single, widowed, separated as well as polygamists is 56.3, 36.8, 36.8, 4.9, 0.12, and 1.7 respectively. It appears that divorce and separation are rare cases in the area. There are more married people in dega and kolla zones than woina dega parts, while the proportion of singulates are relatively more in the woina dega zone (Table 2.13).

Table 2.13. MARITAL STATUS OF SAMPLE POPULATION

| PA/Zone               | Married<br>(in%) | Single<br>% | Widowed<br>(%) | Separated<br>(%) | Polygamist |
|-----------------------|------------------|-------------|----------------|------------------|------------|
| Norcha                | 61.1             | 30.6        | 5.6            | -                | 2.8        |
| Kokera                | 77.6             | 17.9        | 4.5            | -                | -          |
| Ketane                | 54.5             | 36.5        | 7.1            | -                | 1.2        |
| Cheza Sefer           | 56.57            | 34.3        | 5.6            | -                | 4.0        |
| 'dega' tota           | 61.3             | 30.7        | 5.1            | -                | 2.2        |
| Agenna                | 70.7             | 20.7        | 3.7            | -                | 4.9        |
| Emdebir               | 47.6             | 46.8        | 5.6            | -                | -          |
| Muttan Wera           | 55.0             | 41.3        | 1.3            | -                | 2.5        |
| Darch                 | 46.2             | 46.2        | 4.6            | 1.5              | 1.5        |
| Sessena Denab         | 43.3             | 48.3        | 7.2            | -                | 1.0        |
| 'Woina dega' total    | 52.0             | 41.3        | 4.7            | 0.2              | 1.6        |
| Dubissana Karsa/kolla | 60.9             | 36.2        | 2.9            | -                | -          |
| Grand total           | 56.3             | 36.8        | 4.9            | 0.1              | 1.7        |

Source: Field survey by the author, 1993.

### LITERACY STATUS

Based on UN recommendation for national censuses in 1970, data on illiteracy and/or literacy are collected for population aged 10 years and over. This is because reading and writing ability is not ordinarily achieved until one has had some schooling or has at least had time to develop skills (Shryock, et.al., 1976 = 182). Hence, in the study it is only of the population 10 years and over which is considered to determine the literacy and illiteracy status.

In the past that is at least during the post revolution period the literacy level in Ethiopia had been reported to have reached 77.2% (CSA, 1990). However, the situation in the two weredas, has been worse as the literates accounted only for about 41% of the total population. This rate varies from 33.3% in kolla zone to about 43.5% in woina dega parts (Table 2.13).

**Table 2.14. CRUDE ILLITERACY RATE (C.I.R\*) AND LITERACY LEVELS OF THE POPULATION**

| PA/ZONE          | C.I.R.* |         |          | Literacy Level (%) |              |             |             |             |
|------------------|---------|---------|----------|--------------------|--------------|-------------|-------------|-------------|
|                  | Males   | Females | Both Sex | Read only          | Read & write | Grade 3 - 6 | Grade 7 - 8 | Grade 9-12+ |
| Norcha           | 68.3    | 92.7    | 73.3     | 3.3                | -            | 16.7        | 4.4         | 2.2         |
| Kolkera          | 40.6    | 96.9    | 65.7     | 4.5                | -            | 20.9        | 6.0         | 3.0         |
| Ketane           | 31.1    | 54.2    | 39.1     | 10.1               | 7.3          | 30.9        | 5.8         | 5.8         |
| Cheza S.         | 54.5    | 70.5    | 60.9     | 2.7                | 0.9          | 19.1        | 8.8         | 8.2         |
| 'Dega' total     | 47.4    | 78.5    | 60.7     | 6.0                | 1.8          | 21.4        | 6.3         | 5.1         |
| Agenna           | 47.1    | 77.5    | 60.4     | -                  | 2.2          | 19.8        | 8.8         | 8.8         |
| Emdibir          | 44.6    | 71.6    | 57.5     | -                  | 1.4          | 7.8         | 9.2         | 24.1        |
| Muttana W.       | 51.5    | 65.7    | 58.8     | 1.5                | 1.5          | 14.7        | 8.8         | 14.7        |
| Darcha           | 40.0    | 85.7    | 60.0     | 1.3                | 6.3          | 12.5        | 12.5        | 7.5         |
| Sissena D.       | 41.7    | 55.2    | 48.8     | 0.8                | 5.5          | 18.1        | 7.9         | 18.9        |
| 'Woina D.' total | 44.5    | 69.3    | 56.4     | 0.6                | 3.4          | 14.2        | 9.3         | 16.2        |
| Dubissa 'Kolla'  | 47.0    | 77.3    | 67.7     | 4.3                | 3.2          | 17.2        | 6.5         | 2.2         |
| Grand total      | 47.0    | 73.0    | 59.1     | 2.5                | 2.8          | 17.1        | 7.8         | 10.8        |

Source: Field Work, 1993.

\*C.I.R. =  $I/p \times 100$ , where I = number of illiterates, P = total population

The average crude illiteracy rate (C.I.R.) for the region is 59%. Zonal variation, however, range from 56.4% in 'woina dega' to as much as 67.7% in 'kolla' zone! Ketane and Sissena Denab recorded the lowest rates, while in Norcha and Dubissana Karsa illiteracy is found to be most prevalent (see Table 2.14).

Illiteracy rate is higher among females (73%) than among males (47%). It is also very astonishing that crude illiteracy rate for female is as high as 97% in Kokera and Norcha PAs which lie in upper dega zone. This would be a reflection of lack of access to schools and hence, future effort of allocating additional schooling provisions by government or non-government organizations should be geared to the extreme upper 'dega' and 'kolla' zones in the two weredas. Educators and other concerned groups should also find means to increase the participation of females/women/ in schooling.

#### 2.3.4. SETTLEMENT PATTERN

The way that population is grouped into occupance units together with the activities in the form of houses (farm houses), paths, etc., which serve the inhabitants or simply settlement, is the most important element of cultural landscapes. A knowledge of the pattern of rural settlement as asserted by G.C. Last (1977), is basic to understand problems of economic and social development because it will determine the case with which population can be mobilized in growth centres, recognized for economic purposes and provided with basic social services.

One of the most attractive quality and peculiarity of the Gurage cultural environment is the magnificent pattern of the settlement. Settlements in the two weredas and the Sabat Bet

Gurageland at large, are predominately rural, sedentary and are in group forming villages. Homesteads are very closely situated to enset farms.

As in areas where "hoe culture " is prevalent, the landscape has an appearance of villages in group and takes linear pattern which has made the Gurage rural settlement impressive and distinct from other rural and grouped settlements within and outside the enset culture regions. The linearity is characterized by village-like groupings with definite patterns of nucleation focused on a main path (Jefuer).

Homesteads are closely spaced at an interval of 11 to 55 meters with an average spacing of about 28 meters. Spacing appears more closer in woina dega zone where population density is highest and the average land holding size is smaller. Homesteads are located virtually next to each other. The number of farm houses in each village would range from about 25 to 60 and the average would be about 35.

Farm houses which the Gurages use, "Yegurage Bet", are circular in style with round wall and conical roof. The top gets support from a pillar which stands at the very center and the roof is thatched with dried straw. The walls are built with very thick splinters of big eucalyptus and other locally available wood, and fastened with splinted bamboos or young eucalyptus trees using dried enset rope and/or hareg (tree climber). The walls (in all zones) and roofs (only in upper dega) are earthned from inside so as to keep temperature inside the houses warmer. All materials used for construction are locally available except nails (if used).

Three types of "Yegurage Bet" can be identified. They are Guye Bet, the largest Gurage house which has a radius equal or more than 16 feet. It is often used as the main living unit and sleeping room for most of members of the household including couples as well as for livestock. Zeger, the smallest unit in size, is often used as kitchen and has a radius



less than 10 feet. The other "Ygurage Bet" type is Harar which has an intermediate size ranging from 10 to 16 feet radius. It is used as service-room in which guests are served and entertained.

Some well-to-do farmers own all the three houses in one farm yard, while others possess either one or two of the three units. A total of 363 houses were reported to have been owned by 236 sampled house hold heads. Of the 236 household heads, about 35% reported that they own one Guye Bet while about 22% and 8% own only Harar, and Guye Bet and Zeger respectively. Those who own Guye Bet, Harar and Zeger in one farm yard account for only about 4%, and those who have only Zeger are 2.5% of the total. The rest did not specify the unit they own though reported to possess a farm house.

Most of the settlements are situated on the crests of elongated gently sloping convex spurs, and have linear pattern. Most of the villages are oriented from east or north east to west or south-west following the general slope direction of the region. Hence, linearity of the pattern in village settlements is considerably attributable to the land forms of the region.

The other fascinating morphology of the Gurage settlement is that they are "symmetrical and have basically a broad avenue with farm houses symmetrically disposed on either side" (Ipcar, 1970). The central avenue, what the Gurages call it Jefuer divides each village settlement into two segments and also serves as an intra-village, inter-homesteads and inter-village foot path-communication line. Hence, one can see an evident net work of paths. The major one runs following the avenue in either direction and eventually connects one village with neighbouring village unit or even central market places. Feeders connect adjacent homesteads and still there are other paths which lead from each homestead to streams and or to wood lots. In consequence, each village is almost accessible to neighbouring villages and

others at closer distances.

Regardless of zonal and landform variations, patterns of village settlement including the morphology is almost uniform in all traditional altitude-temperature zones in the region. Linearity of the pattern may be attributed to the frequently occurring convex spurs that characterize the region. While close spacing of homesteads and their continuity is due to high population density and the farming system which prevail in the region, respectively. There is a strong link between the Gurage settlement (homesteads), 'enset cultivation and livestock raising (see 5.4).

Needless to say, aside from the indigenous rural Gurage village settlements, there are a few newly emerged "Amhara military colonies" at Wadye, Sham, Dakune, Doro Gebya, Sefer, etc. which have already adopted to the Gurage patterns in most respects. There are indigenous market places some of which have grown into "urban settlements". These include Emdeber, Agenna, Gubre, Bozabar, Sefer and Abret. However, they are few, far apart and a good number of their inhabitants still engage in rural-based economy.

### 2.3.5. TRANSPORT AND COMMUNICATION

As far as rural physical infrastructural development is concerned, like most other rural parts of Ethiopia, the Gurageland in general, and Sabat Bet Gurage areas and the two weredas in specific, lack in most parts even basic infrastructures. Nonetheless, the region is awake and is absorbed in the establishment and construction of infrastructures such as schools, health centres, post office, motorable roads and others which are basic to restructuring agricultural organization by way of agrarian transformation.

followed the despaired old Italian road (Ipcar, 1970-73). Since its formation, the Gurage Road Committee which is now renamed as "Gurage People Self-Help Development Organization", constructed motorable all-weather roads which connect most parts of Sabat Bet region and sub-regions.

The principal connections of the motorable Gurage roads are the town of Welkite in the west to Hosanna in the south and perspective to Butajera in the near future. Hence the orientation of road networks in the region is east-west direction following the general slope direction of the region. Roads in most cases are constructed following central avenues along the crest of convex spurs on which most of the settlements are situated (Map IX).

For sure, every wereda, sub-weredas and even villages, in some cases, in the Sabat Bet Gurageland are connected with motorable roads. All weather roads in the region, measure more than 320 kilometre out of which about 250 kilometres are found in the two werdas (175km. in Ezana Wollene and 87km. in Cheha wereda). Therefore, road density in the Sabat bet Gurage area is about 93 meter per square kilometre of area while for the two weredas it is 171 meters (about 150 and 175 meters for Cheha and Ezana Wollene weredas respectively). This is about 10 to 11.7 times higher than that of the national average which is only 15 meters/km<sup>2</sup>.

It is also evident from Map IX that all the regions and villages except parts of northern Wollene are with in a range of less than 10 kilometres access from all weather motorable roads. Moreover, the region is almost open (accessible) to all regions - to southern Ethiopia via Hosanna, south-west and western Ethiopia via Welkite and then to Jimma, north and north west via Addis Ababa, and in the near future to eastern Ethiopia via Butajera and then to Zewai and Nazareth.



Such services are few in number and have spatial limitations to cater to the needs of all parts of the two weredas. Telephone and postal services were introduced into the region in the wake of the construction of motorable road which connected the region with the outside regions beyond the Sabat Bet Gurage areas. Postal service is available only at Emdeber while telephone based interaction is possible both from Emdeber and Agenna.

Until late 1960's the Sabat Bet Gurageland was geographically isolated. Inter-and intra-village and regional movement of people and goods were possible largely on foot and using mule, horse, and donkey back. These comprised the indigenous transportation network. The modern transportation network evolved in the last few decades consisting of a number of motorable all-weather and dry-season roads which all converge at or just before the town of Welkite which is situated on the Addis Ababa-Jimma road.

The modern road transport network development is partly in the process of superimposing itself over a well developed indigenous one. Charles Ipcar (1970) reported that the history of the modern transportation network began with the construction of several motor roads by the Italians during 1936-1941 period. Italian roads were constructed largely on the basis of "forced" human labour and took advantage of existing central avenues ("Jefuēr") of settlements. After World War II however, as is the case in other parts of Ethiopia, the Italian motorable roads in the region fell into despair and eventually became of marginal uses only in the dry season. This was because of lack of repair caused by the cut off of its locus, of external innovation and energy (Ipcar, 1970).

The modern and existing motorable road network began in 1966 with the formation of Pan Gurage Road Committee. The new road networks in some areas, more or less,

Thus, the development of good road networks which connected the region internally as well as externally has not only facilitated the movement of people and exportable surplus products from one sub region to another but also to areas outside the region. As a result, of course together with a growing population pressure it has induced and facilitated the land use change by way of growing more and new cash crops and population migration to urban centres outside the region. The land-use change, in turn, is expected to bring about a change in the cropping pattern and ultimately a change in the agricultural organization (system).

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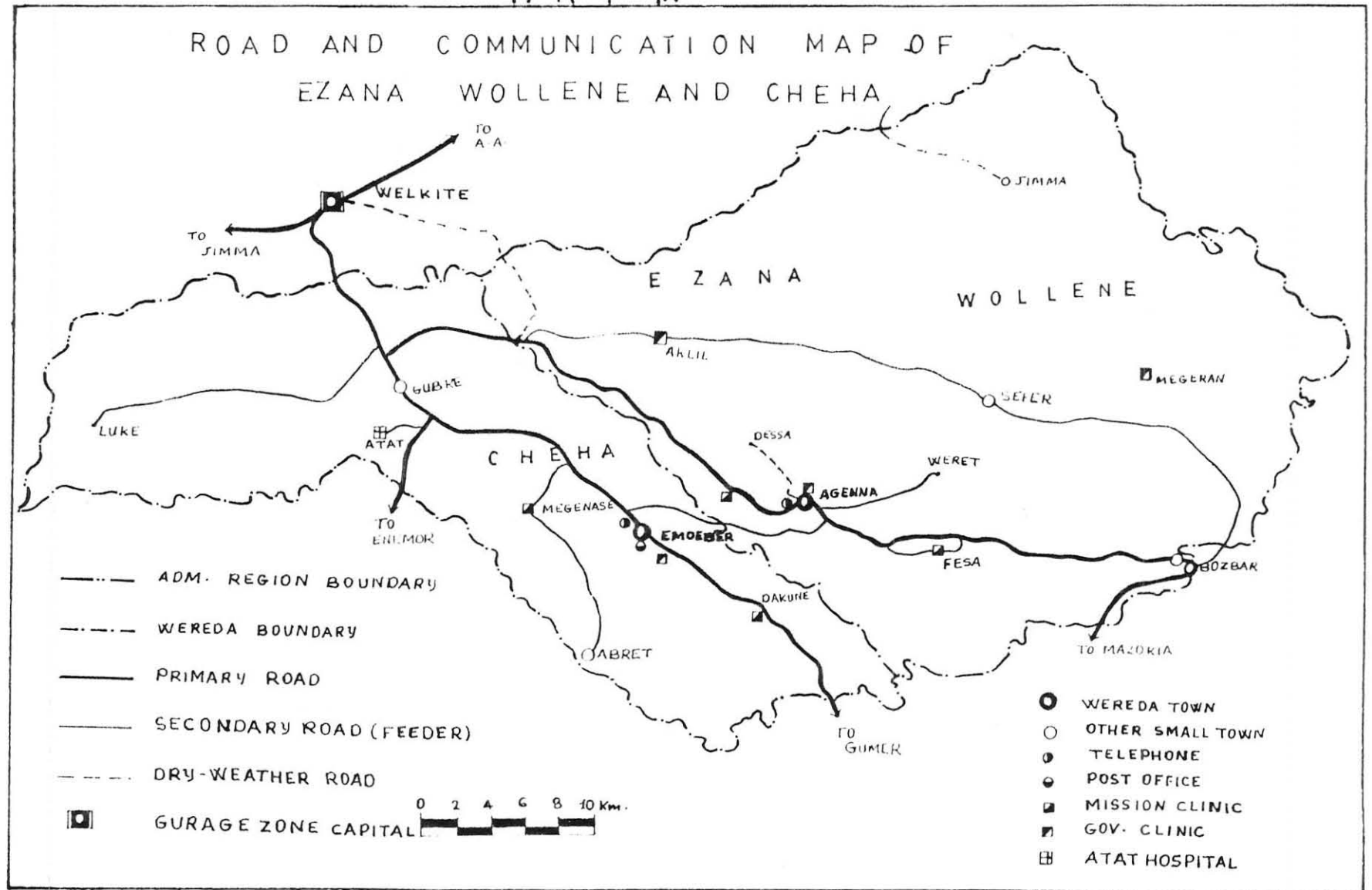
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The modern and existing motorable road network began in 1966 with the formation of Pan Gurage Road Committee. The new road networks in some areas, more or less,

# MAP IX

## ROAD AND COMMUNICATION MAP OF EZANA WOLLENE AND CHEHA





## **CHAPTER THREE**

### **POPULATION MOVEMENT/MIGRATION AS AN EFFECT OF POPULATION PRESSURE**

Population "mobility" as used in demography refers to spatial, physical, or geographic movement of people, while migration is simply one form of geographic or spatial mobility which involves a permanent change of usual residence between clearly defined geographic units (Shryock, 1976; Clarke, 1970).

Migration is one of the three attributes of population dynamism. Together with deaths and births it influences change of population both in areas of origin and destination of migrants. Hence, knowledge of the number and characteristics of people leaving (in case of this study) or entering is vital to understand changes in the structure of the population labour force and some other socio-economic and political consequences of an area.

The mobility of man including population migration is one of the phenomena which started in long past. Although the types and causes of human mobility or population migration vary, man's mobility increased with technical and socio-economic development particularly with the advent of modern means of transport. Movements were induced by spatial variations in opportunities, climatic changes, marriages, natural "hazards", war, etc. The technological developments and modern means of transports resulted in the expanding human knowledge of space around them. This broke the confined subsistence living of the groups of people in small packets. Complementarity emerged. Thus the exchange of produces, ideas, etc. also developed. All these and other factors together accelerated the pattern of movement of people

on earth permanently or temporarily. People in the Gurageland could not escape this phenomena. However there are different views of observers as to movement of the Gurages.

Although some assert that emigration of the Gurages in large number, specifically for wage labour, is relatively of recent origin and comes as a consequence of the Land Act of 1929 (Shack, 1966:77). Others say that the Gurages were probably the first people in Ethiopia to migrate in quest for money which was meant to pay taxes imposed by Amhara rulers after 1889 (Pankhurst, 1968). Still some others reported that the Gurage men began to leave their home in search of work and money in much older times. Quoted by William Shack (1966) Inselberg and Krap wrote in 1843 that "the Gurage merchants go to Sentishiro" (a district in Walayta) and James Bruce in his writing noted that he observed Gurages in Gonder even during the 18th century. What ever the case may be, it is certain that migration was accelerated in late 1960's after the evolution of new road network and development of motor transport in the region.

These days, very large number of Gurages continuously flow out to areas outside the Gurageland in search of permanent and seasonal employment including trade (Shack, 1966). Based on the 1984 Population and Housing Census Analytical Reports, more than half a million Gurages which account for more than 27% of all Gurages live outside their home region. Those who live in Addis Ababa expected to be as much as quarter of a million and accounts for about 18-20% of the population of Addis Ababa. Seasonal labour out migration in general is thought helpful in partly alleviating the problem of high population concentration and contributes to the general prosperity of the region. Therefore, William shack (1966) reported that at least one man from each household is away during agricultural off seasons. Thus, it may be safe to say that the Gurages are one of the most "migration-prone people"

and probably one of a few ethnic groups in the country whose population, using the word of Mesfin Woldemariam, has already "exploded" due to very high population concentration and land scarcity.

### 3.1. RATES AND FREQUENCY OF SEASONAL OUT MIGRANTS IN THE AREA

As far as this study is concerned different attributes of out-migrants from about 214 sample house holds with about 1449 persons are considered. Accordingly, it is found that out migration rate for the 214 sample house-holds in which about 1449 were members was 12.1% in 1992/93; i.e. 175 of the 1449 persons out migrated during the year (Table 3.1)

**Table 3.1. RATE\* AND FREQUENCY OF OUT-MIGRANTS**

| Zone     | All Emigrants Rate (1993) %    |                                    |                                             | Frequency of out-migration (in%) |                       |                        |                   |                    |        |
|----------|--------------------------------|------------------------------------|---------------------------------------------|----------------------------------|-----------------------|------------------------|-------------------|--------------------|--------|
|          | All emigrants<br>(in %)<br>(a) | Household<br>heads migrated<br>(b) | % house holds<br>only 1 per son<br>migrated | Once in<br>a year                | Twice<br>in a<br>year | Thrice<br>in a<br>year | Once in<br>2 year | Once in<br>3 years | Rarely |
| 'Dega'   | 9.5                            | 20.5                               | 46.2                                        | 62                               | 15                    | -                      | 8                 | 8                  | 8      |
| 'W.Dega' | 13.4                           | 16.5                               | 45.2                                        | 63                               | 13                    | 22                     | -                 | -                  | 3      |
| 'Kolla'  | 15.7                           | 23.8                               | 52.4                                        | 38                               | 25                    | 12                     | 12                | 12                 | -      |
| Total    | 12.1                           | 18.7                               | 46.3                                        | 60                               | 15                    | 12                     | 5                 | 5                  | 3      |

Source: Field survey, 1993.

\* Note that the rate of migrants is calculated of all persons in the considered sample households (a) and of all household heads in the sample (b).

Amongst the sample household heads as many as 40 which account for about 19% of the total household head migrants involved in out migration. Ninety nine house holds (46%

of the total) responded that at least one member in a house hold, though not necessarily the house hold head, has out-migrated (Table 3.1.).

However, out-migration rate for all age-groups shows zonal variation, which ranges from 9.5% in dega to as much as 16% in kolla zone. But woina dega zone experienced the lowest rate of out migration of both household heads (16.5%) and any one member of the household (45.2%). It appears that there are more house hold head migrants in dega and kolla zones. Most of these migrants (more than 60% in dega and woina dega but only 38% in kolla) reported that they migrate once in a year and or return home while about 15, 13 and 5% of them reported returning twice in a year, three times in a year and once in two years respectively (Table 3.1.).

### 3.2. CHANGE IN SEASONAL RURAL-OUT MIGRATION RATE

Responses obtained with regard to the rate of out-migrants from about 214 sample house holds in the year 1974/75, 1982/83 and 1992/93 are shown in Table 3.2. The rates for 1974/75 and 1981/82 were calculated in reference to the number of out migrants in 1992/93 while that of 1992/93 computed interms of total sampled population in the 214 house holds.

From Table 3.2. it is evident that migration rate increased in the last 19 years. The rate of out migration of both sex and for all sample house holds in all zones was only about 34% of current rate in 1974/75. After 8 years, in 1982/83 the rate increased to about 63.4% of the 1992/93 rate. In the three agro-climatic zones change in the rate varied from 20% in kolla to about 38% in woina dega of their respective current migration rates in 1974/75 to about 45% in kolla and to about 66% in dega in 1982/83.

Table 3.2. CHANGES IN SEASONAL RURAL-OUT MIGRATION RATES<sup>11</sup>

| Zone       | 1974/75 |        |       | 1982/83 |        |       | 1992/93 (Current) |       |         |       |         |       |
|------------|---------|--------|-------|---------|--------|-------|-------------------|-------|---------|-------|---------|-------|
|            | Male    | Female | Total | Male    | Female | Total | Male              |       | Female  |       | Total   |       |
|            |         |        |       |         |        |       | No. (1)           | % (2) | No. (1) | % (2) | No. (1) | % (3) |
| 'Dega'     | 37.8    | 0      | 30.9  | 71.1    | 30.0   | 65.5  | 45                | 81.2  | 10      | 18.2  | 55      | 9.5   |
| 'W.Dega'   | 44      | 20     | 38.0  | 68      | 60.0   | 66.0  | 75                | 75.0  | 25      | 25.0  | 100     | 13.4  |
| 'Kolla'    | 25      | 0      | 20    | 43.8    | 50.0   | 45.0  | 16                | 80.0  | 4       | 20.0  | 20      | 15.7  |
| All Region | 39.7    | 12.8   | 33.7  | 66.2    | 53.8   | 63.4  | 136               | 77.7  | 39      | 22.3  | 175     | 12.1  |

Source: Field Work, 1993.

- 1) Number of out-migrated; 2) Percentages calculated in reference to total out migrants (according to sex) (3) Percentages of all persons in the sample households of the respective zone.

On the other hand, participation of women in rural out-migration was only 12.8% in 1974/75 which increased to about 54.0% of the current in 1982/83. However, the proportion of female migrants to the total was about 22.3% in 1992/93 (Table 3.2). Nevertheless, women's participation in migration was almost nil in dega and kolla in 1974/75 but it grew to about 40% of the current (1992/93) and these days they account for about 18% of the total migrants. In kolla too, the account was nil in 1974/75 but now it is about 20% of the total in the zone.

<sup>11</sup> Since data on the number of persons in the sample households are missing for 1974/75 and 1982/83, migration rates for the years calculated in reference to the number of out migrants in 1992/93

### 3.3. DURATION, DESTINATION AND SEASONAL PATTERN OF OUT-MIGRANTS

Many migrants remain away from their permanent homes for some periods and return periodically. On the average, migrants stay away for about ten months in one year. However, most house hold heads are away for about only 6.5 months in a year as compared to 11 months for other house hold members (Table 3.3.). From the table it is apparent that there is no significant variation in the duration that common household members stay away in the three altitude zones. But for household heads duration of migration varies from about 5.6 months in woina dega, 7.3 dega to about 7.5 months in kolla zone. Hence, as noted earlier (section 3.1.) and now it becomes apparent that the rate of household heads' rural-out migration and the duration they stay away from home is the lowest in woina dega zone (cf. Tables 3.1 and 3.3).

Table 3.3. DURATION OF RURAL OUT MIGRATION

| Zone     | H.H.Heads     | Other H.H. members | All members   |
|----------|---------------|--------------------|---------------|
|          | No. of months | No. of months      | No. of months |
| 'Dega'   | 7.3           | 10.7               | 9.7           |
| 'W.Dega' | 5.6           | 11.1               | 10.1          |
| 'Kolla'  | 7.5           | 10.4               | 9.7           |
| Average  | 6.5           | 10.9               | 9.9           |

Source: Field work, 1993.

Although the average duration of stay away from home is said to be 10 months in a year, most of the out-migrants stay away from home place from October to about end of August (Figure 3.1.). It is interesting to note from Figure 3.1. that most of the out-migrants



return home in the month of Yidar (September) to celebrate Meskal and Azamene (wedding). Yidar, like summer months in the western countries, is a month of holidays related to meskal including Azemene. Meskal is holiday celebrated by followers of the Ethiopian Orthodox (Coptic) Church as the date (September 27) of the finding of the CROSS on which Christ was crucified by Queen Elleni in the fourth century A.D. by exhumation.

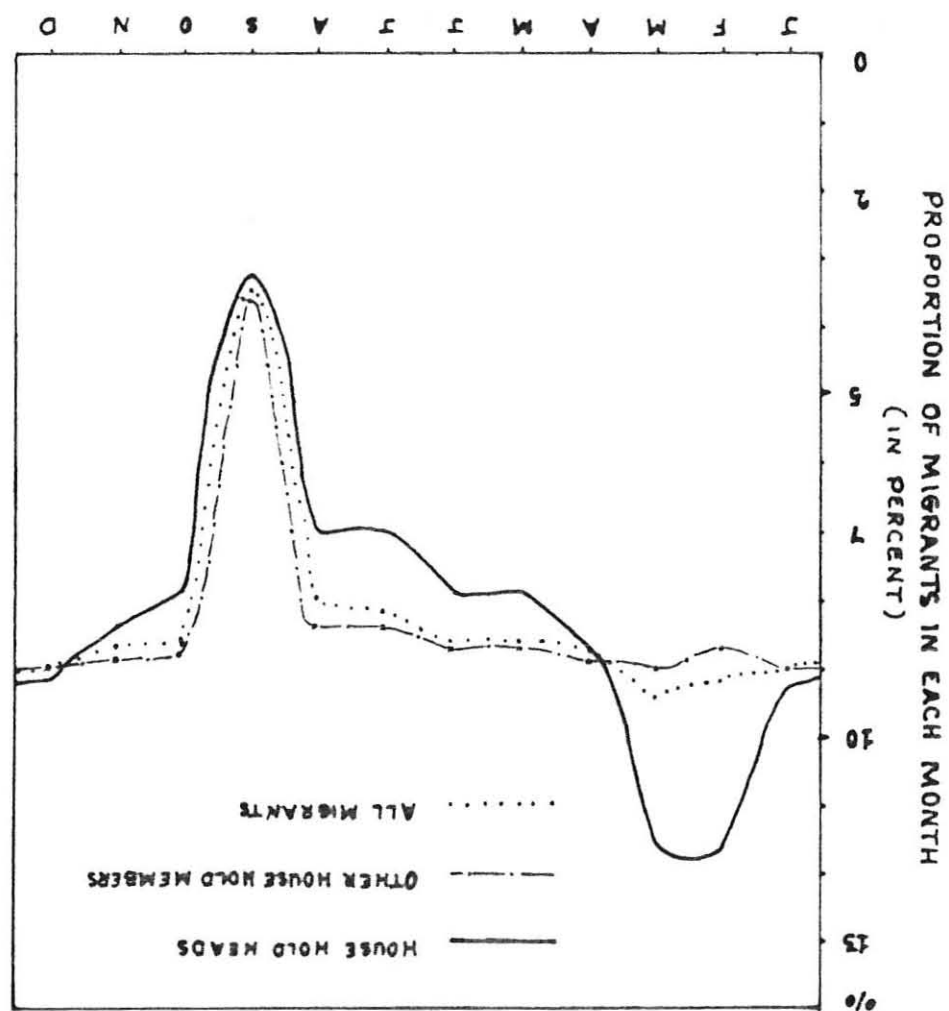
Moreover, Yidar is the first month of a new year, the time flowers blossom and fields to appear like carpets. Yedar is, thus, a month of new hope, a hope to meet parents, brothers, sons, sisters, daughters, relatives and friends, who were away for at least 10 months. And it is a month during which almost all people in the region aspire for new and better life in the year.

Migrants stay in their home-place for at least one month and start out migrating again from October, which reaches its zenith after in February/March. February and March are specially significant for the migration of house hold heads probably because of off-farm (slack) season. Farmers become relieved from an intensive harvest which is immediately followed by planing, transplanting and hoeing of enset farms and other perennial crops.

Contrary to periodic out-migration pattern of the house hold heads, migration periodicity pattern of other common household members show more regularity except the drastic drop observed in September because of meskal holiday (Figure 3.1.).

As to the direction of migration and destination which presumabaly indicate distances covered by migrants, the report on population and housing census of 1984 disclosed that about 51% of Gurage out-migrants live in Addis Ababa. But the present sample survey shows that about 74% of the out-migrants from the area are destined to Addis Ababa. The second largest group which accounts for about 13% migrated eastward to Dire Dawa, Harar and Jijiga

FIGURE 31 SEASONAL PATTERN OF MIGRATION



towns; 4% are destined to Nazareth; 6% to South Ethiopia including Sidamo, Goba and Shashemene; and 3% to south-west (Jimma, Agaro, Metu, etc.) (Table 3.4). The reasons why nearly three-quarters of rural out migrants from the study area (and the Gurageland) destined to Addis Ababa may be attributed to the fact that Addis Ababa is close to the region and it has better urban infrastructures, better job opportunities and social provisions. Moreover, migrants have a better chance of getting relatives, friends and villagers in Addis Ababa than elsewhere. Contrary to the south and western parts, northern Ethiopia which appears deficient of cash crops (e.g. coffee) did not attract migrants from the study area, and probably form the Gurageland at large.

Table 3.4. DESTINATIONS OF MIGRANTS (%)

| Zone         | Addis<br>Ababa | D.Dawa,<br>Harar, Jijiga,<br>etc. | Nazareth | Jima,<br>Agaro,<br>Metu<br>etc. | Sidamo | Shashem<br>ene,<br>Goba,<br>etc. | Gojam<br>etc. |
|--------------|----------------|-----------------------------------|----------|---------------------------------|--------|----------------------------------|---------------|
| 'Dega'       | 76             | 19                                | -        | 1.3                             | 4      | -                                | -             |
| 'Woina dega' | 73             | 11                                | 5        | 4                               | 2      | 4                                | 1             |
| 'Kolla'      | 72             | -                                 | 11.1     | -                               | 6      | 11.1                             | -             |
| Average      | 74             | 13.3                              | 4        | 3                               | 3      | 3                                | 0.5           |

Source: Field work, 1993.

At destinations the migrants engage in various sectors of the economy. About 46% of them are engaged in the informal sector of pedlars of various kinds; 18.1% become daily wage labourers; 14% each as formal and informal shoppers and in public services; and others (Table 3.5.).

**Table 3.5. TYPE OF ENGAGEMENTS (%)**

|                     | 'Dega' | 'Woina dega' | 'Kolla' | Total |
|---------------------|--------|--------------|---------|-------|
| Shopper             | 18.2   | 11.1         | -       | 14.0  |
| Pedlar              | 36.3   | 55.6         | 50      | 46.0  |
| Daily wage labourer | 18.2   | 11.1         | 50      | 18.0  |
| Public Service      | 9.1    | 22.2         | -       | 14.0  |
| Domestic Service    | 18.2   | -            | -       | 9.0   |

Source: Field work 1993.

Zonal variations do exist in the employment characteristics of the migrants. As one clearly see from the table, nearly 56% of migrants from woina dega are pedlars while for kolla and dega the respective proportions are 50% and 36.3%. Getnet Bekele (1992) has reported specific fields of engagements of subclass of Gurages in Addis Ababa. Accordingly the association are of construction work with Endegne, butchery with Enner, shope based trade with Cheha, green groceries and horticulture with Eza, textile with Soddo, coffee (and grain) trade with Selti, etc. These broad specializations are probably mainly due to earlier attachments rather than home related knowledge and activities. This same issue further manifests the importance of earlier-migrated relatives as a pull factor.

### 3.3. OUT-MIGRANTS AGE-SEX DIFFERENTIAL

Migration is age and sex selective. There is the tendency of certain segments of population to be more migratory than others. Late adolescents and young adults (16 to 30 years old) are preponderant and accounts for about 60% of all out-migrants. They often migrate for their first job and, fortunately, they can easily adjust themselves to their new environment than people for other age groups. The early teen ages (from 8 to 15 years), middle (31-40 years) and late adulthood ages (41-60 years) account for 16, 12.2 and 12.2% respectively (Table 3.6).

Hence, it appears that age-specific crude out migration rate steadily increase upto age 30 and then starts dropping. From Table 3.6 it is apparent that the region loses good number of most energetic people who at the same time have very good talent and enthusiasm to work.

As for the sex, the table also reveals the preponderance of male. In the past, men used to migrate more freely than females. This is more true of the economically advanced western societies (clarke, 1970: 74). Although empirical data is not available but information from people reveal that the number of female migrants has increased considerably, since late 1960's when the two weredas and the Sabat Bet Gurageland got a better road facilities; even then females constitute only 20% of the migrants. On the basis of zones, the account of female migrants is the highest (25%) in woina dega part and as low as 14% in dega zone. As a result, the demographic imbalance in which the masculinity proportion is lower than the femineity proportion in the two weredas as disclosed during the 1984 Population and Housing Census would be partly attributable to predominance of men out-migrants from the region.

Table 3.6. AGE-AND SEX-COMPOSITION OF OUT-MIGRANTS(%)

| Zone      | 8-15 years |      |      | 16-20 |     |      | 21-30 |     |      | 31-40 |     |      | 41-60 |     |      | Total |      |
|-----------|------------|------|------|-------|-----|------|-------|-----|------|-------|-----|------|-------|-----|------|-------|------|
|           | M          | F    | T    | M     | F   | T    | M     | F   | T    | M     | F   | T    | M     | F   | T    | M     | F    |
| 'Dega'    | 6.3        | 11.1 | 17.4 | 25.4  | 3.2 | 28.6 | 31.7  | -   | 31.7 | 12.7  | -   | 12.7 | 9.5   | -   | 9.5  | 85.7  | 14.3 |
| 'W. Dega' | 9.3        | 4.7  | 14.0 | 18.7  | 5.6 | 24.3 | 26.2  | 9.3 | 35.5 | 11.2  | 0.9 | 12.1 | 11.2  | 1.9 | 14.0 | 76.6  | 25.4 |
| 'Kolla'   | 5.6        | 16.7 | 22.3 | 27.8  | -   | 27.8 | 27.8  | -   | 27.8 | 11.1  | -   | 11.1 | 11.1  | -   | 11.1 | 83.3  | 16.7 |
| Total     | 8.0        | 8.0  | 16.0 | 21.8  | 4.3 | 26.1 | 28.2  | 5.3 | 33.5 | 11.7  | 0.5 | 12.2 | 10.6  | 1.6 | 12.2 | 80.3  | 19.7 |

Source: Field work, 1993.

### 3.4. CAUSES AND CONSEQUENCES OF OUT-MIGRATION

#### 3.4.1. CAUSES OF MIGRATION IN THE AREA

As noted by J.C Caldwell cited in Gunilla Bejeren (1985) and quoted by Getnet (1992), it is the physico-socio-economic and cultural characteristics of environment of "region of origin", i.e., "ethnic origin", which decide who will migrate and will not. This is the most important factor in the migration process.

The Gurageland in general and Sebat Bet Gurage areas in particular are areas where historical and ecological conditions, in other words physical, demographic and economic factors, had left the areas capital deficient. Moreover, since Gurages are predominantly "subsistence enset cultivators" and surplus production is unlikely, trade is minimal and unfavourable and lacked continuity. Market demand for kocho (fermented enset) and enset fiber as well as productivity is lower. Further intensification and diversification of agriculture got less chance due to ecological, demographic and land in availability constraints. Hence, purchasing power of the people, their capacity to meet domestic demands for food and government requirements in the growing cash economy seriously degenerated. Thus, in order to achieve success in the new economic order and maintain sustenance of the society, restructuring of labour in the form of labour migration was adopted as profitable alternative.

Many authors have reported that economic, demographic, socio-cultural and political factors have together promoted labour migration from the region specially since the establishment of Addis Ababa and its immediate predecessor Entoto (Pankhurst, 1968; Assefa, 1979; Shack, 1966; Getnet, 1992). Some of the factors which tend to drive the



Gurages out of their village are known as "push" factors which are active at the region of origin while those which tend to attract them are "pull" factors exerted by the destinations. One of the strongest "push" factors which included very large out-flux of migrants from the Gurage land and the two weredas in particular is its fast population growth and the consequent population pressure (Wood, 1977, 1986; Shack, 1966; Ipcar, 1970).

This was supported by 31% of the respondents of the sample house holds from the two weredas. Out of these respondents about 25% reported that population pressure as the most important condition of out-migration in the region at large and in Agenna and Emdeber PAs in particular.

Land scarcity, although is manifestation of population pressure, appears to be even stronger "push" factor. This was supported by about 33% of all the responses, about 60% of which graded it as the first and strongest "push" factor. Assefa (1979) also argued on the same line.

Inspite of enset's protracted years of maturity, it involves several transplanting and extensive manuring, it needs short man-hour in a year. Hence, in enset predominant areas not less than six months in a year are labour-slack seasons. Accordingly, about 27% of the sample respondents corroborate the above argument for seasonal migration.

Lack of part-time employment opportunity in the region during labour-slack seasons is identified as another out-migration stimulating factor by 9% of the respondents.

Besides what are noted so far, some respondents considered the unavailability of secondary high schools in the dega and kolla parts as migration stimulating factor amongst students. Deficiency in the traditional means of subsistence, prevalence of poverty with income stagnation at near subsistence level or even falling are also reported as providing a

powerful "push" out of the country side (Assefa, 1979; Hedung and Lundhal, 1983; Getnet, 1992).

Regional, rural-urban migrations are also induced by nation wide regional imbalance in growth and development and gaps in rural and urban development and existence of amenities in urban areas while they are missing in rural parts. This is corroborated by Mesfin Woldemariam (n.d.).

To the above general demographic and economic factors, William Shack (1966), Assefa (1979) and Getnet (1992) have added some socio-cultural factors as extra vagaza during wedding, the hard working character of rural Gurage women and their patience and tolerance in waiting for their husbands while the husbands are away from home for protracted period of time; the assistance, security and protection afforded at place of migration destination by relatives, friends and village fellows to new arrivals feel at home and provide them the possibility of getting economic and social assistance to start an independent business from the Gurage social organization such as Ikub. Moreover, the absence of any sort of seclusion in Ethiopian towns, unlike the case in many developing countries, might have created a safe ground for this migration.

### **3.4.2. CONSEQUENCES OF MIGRATION**

Labour migration is thought to have tremendous positive and adverse effects on demographic, economic as well as socio-cultural structure of the Gurage people. It has also adversely influenced urban-rural relations (Getnet, 1992, Shack, 1966).

In the study area as well as in the Sabat Bet Gurageland rural out migration has

drained away mostly the able-bodied men and women working age group which accounts for 84% of the migrants (Table 3.6). It is rightly argued that migration is a "safety-valve" for high population pressure, which partly relieves the stress and or tension due to high population concentration in a region.

Furthermore, rural-out migration has resulted in unbalanced sex and age structure of the population of the area because of preponderance of males (80%) and people in late adolescent and/or early adulthood age group amongst the migrants (Table 3.6). The result is the preponderance of population in early teen-ager on the one hand and out numbering of males by female folks (95.5 male/1000 females) in the area (CSO, 1985).

The one positive consequence of labour migration from the two weredas and the Gurageland is their contribution to the general prosperity of the area by way of investing the remitted money in buying cattle and land, and meeting wedding and other social obligations as well as to pay government taxes and other requirements of the government. Out of the total responses from the sample households about 35%, 28%, 27% and 11% reported investments in buying land<sup>12</sup> cattle, repair and construction of houses as well as fences, and to meet socio-cultural obligations respectively. William Shack (1966) also observed similar trends.

The other effect of migration from the region is reflected in the transfer and inter -- mixing of largely urban based mode of thinking and culture into the Gurageland. The influence is perceived to the extent that some indigenous Gurage cultures, such as weeding, mourning, cultural songs, music and dance, etc. are dominated by imported new cultural elements.

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<sup>12</sup> Although it is not legal to sell and buy land but people illegally practise it with an informal understanding of local governors (PA leaders).

However, the impact of migration at the urban destination contributes to the high rate of population growth and hence results in urban socio-economic problems such as increased demand for food, basic social provisions, increased pressure on existing infrastructural settings, etc. It is also expected to aggravate housing problems and results in growth of slums and shanty towns as in 'Addis Ketema', part of Addis Ababa city, which is predominantly settled by Gurages.

Based on the foregoing discussions, it may be concluded that Gurages in the two weredas and most likely in all Sabat Bet Gurage weredas are indiscriminately involved in seasonal migration, regardless of zonal variation and differing agricultural systems. Getnet (1992) however, argued that the Gurages involved in seasonal migration exclusively from all parts where enset is extensively cropped while in parts like upper dega where grain production is predominant seasonal labour migration is rare.

Money earned by such seasonal labour migrants is used to support basic agricultural production, to buy cattle, hire labour, pay government tributes in the form of taxes and others. But greater part is spent in procuring consumer goods like clothing and in festivities, wedding, etc. William shack (1966) and Getnet (1972) argued that capital investment is quite negligible.

Nonetheless, the construction of all-weather roads connecting most of the sub-regions in the Sabat Bet Gurageland, which opened the region to most parts of Ethiopia, and is pivotal in the restructuring of rural Sabat-Bet economy may be attributed as capital investment from remittance.

## CHAPTER FOUR

### LAND-USE SYSTEM AND ITS DYNAMICS

Land is the principal resources of human beings in general and agrarian society in particular. Its utilization shows a reciprocal relationship between the prevailing ecological conditions of a particular region and man. And it is noted in chapter one that land use is the end product and manifestation of the degree of interaction between the two and a kind of permanent and cyclic intervention of man in his environment (Freeman, 1968; Vink, 1975). Hence, the distribution, type and pattern of land use is thought to be an important indicator of the state of the resource base...consequently, of the problems and or possibilities of sustainable development (Solomon, 1992: 23).

Many writers argue that the nature and intensity of land use of a given area is evolved and conditioned by the economic and social environment which has been in existence since historic past. Given the potentials of land resources, i.e. the permutation and combinations of physical characteristics of the natural environment, the kind and extent of uses are primarily determined by the basic needs of individual inhabitants from time to time. It is conditioned by the social norms accepted by the community in which they live, and in turn, is facilitated by the prevailing social and economic institutions and physical infrastructures. Thus, there are physical factors on the one hand, and economic and institutional factors on the otherhand, which altogether ultimately shape the land-use system of an area (Mandal, 1981; FAO/UNDP, 1986).

Enset cultivation, the Gurages and their environment are inseparable. Enset cultivation is the most distinguishing feature of the Gurage land-use. As noted by Shack (1966) Gurage

elders often say that enset is older than the first Gurage; and assert that God created the Gurageland and then provided enset as a blessing to prevent starvation. William Shack (1966) reported that enset-based land use system which have been practised by the Gurages was adopted from the Sidamos. They started using marasha (forked digging tool) to the horticulture of enset which was the indigenous staple crop of the Sidamos before the Gurages settled in the area they occupy today.

#### **4.1. LAND-USE SYSTEM: DISTRIBUTION OF MAIN LAND-USE/LAND COVER TYPES**

The land-use system in an area may be characterized by the kinds of uses and non-uses to which the land is put to (UNDP/FAO, 1986). The most distinguishing kinds of uses of productive land are grazing, cropping and woody vegetation divided between natural forests and other woody vegetation which may include eucalyptus wood lands and shrub/bush lands. Moreover, currently unutilizable lands such as marshy and swampy areas, and like water surfaces, deserts, built-up and urban areas may be added to the land use/cover components.

In the light of what is noted in the preceding paragraphs, in the study area or at least in the three sample peasant associations surveyed (Norcha, Agenna & Dubissana K.) most of the above land-use/land cover components are identified except desert from the unutilizable group. Pastures are further subdivided into meadows (Gm), open grasslands (OG) and shrubed grasslands (SG) (Appendix C). When aggregated, the agricultural land which is supposed to comprise cultivated lands, grazing and browsing lands accounts for about 95.7% of the total geographic area of the three PAs. Productive land potential which, on the other hand, is the aggregate of agricultural land and currently unproductive land is about 96.2% (Table 4.1, Figure 4.1 (d); Map X,XII,XIV). Badlands are considered here as currently unproductive land because it is thought that they are potentially rehabilitable by afforestation.

#### 4.1.1. CURRENT LAND-USE /LAND COVER PATTERNS

The land-use system in a given area can be identified through the land-use pattern. The proportion of area under major kinds of land-use to the total geographic area expressed in percent are characterized as land-use pattern (FAO/UNDP, 1986:22) in this study. Land-use pattern is also said to be a good measure to assess the current status of land-use.

Distribution of areas under different categories of land uses in three PAs-Norcha, Agenna and Dubissana Karssa supposed to be representative of dega, woina dega and kolla zones respectively-were ascertained on the basis of actual field survey (1993) and recent aerial photographs (Table 4.1., Figure 4.1.). The aggregated patterns show that cultivated land together with fallow land is the dominant land-use type and accounts for about 42% of the total geographic area of the three PAs. Fallowing is practised only in the dega zone (Norcha) and the fallow period is only of one year during which peasants use them for grazing.

**Table 4.1. CURRENT LAND-USE/LAND COVER PATTERN, 1993 (in % of total area\*)**

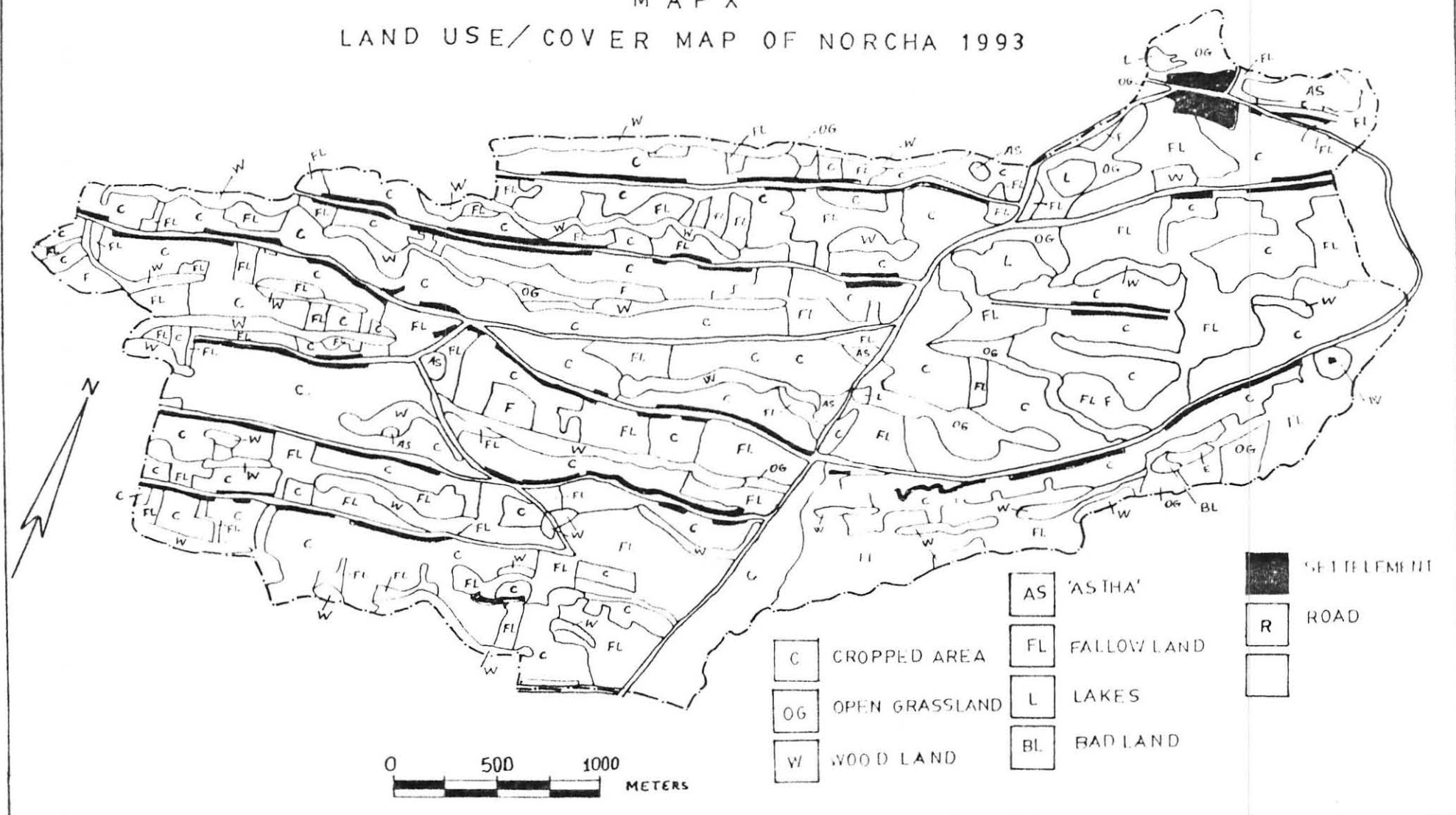
|                      | Norcha PA | Agenna PA | D. Karssa | Overall |
|----------------------|-----------|-----------|-----------|---------|
| Cultivated Land (C)  | 74.5      | 24.6      | 13.8      | 41.9    |
| Grassland (G)        | 4.1       | 30.7      | 65.5      | 30.04   |
| Wood land (W)        | 11.0      | 21.9      | 6.3       | 12.6    |
| Shurb/Bush land (S)  | -         | 4.9       | 12.3      | 5.1     |
| Forest (F)           | -         | 5.2       | -         | 1.5     |
| Road ('Jefuer') (R)  | 6.1       | 6.4       | 1.2       | 4.7     |
| Settlement (ST)      | 3.2       | 5.9       | 2.3       | 3.7     |
| Badlands (BL)        | 0.07      | 0.53      | -         | 0.2     |
| Water bodies (lakes) | 1.1       | -         | -         | 0.5     |

Source: Compiled by the author from actual field survey using aerial photographs.

\* Absolute areas are given in Appendix C.



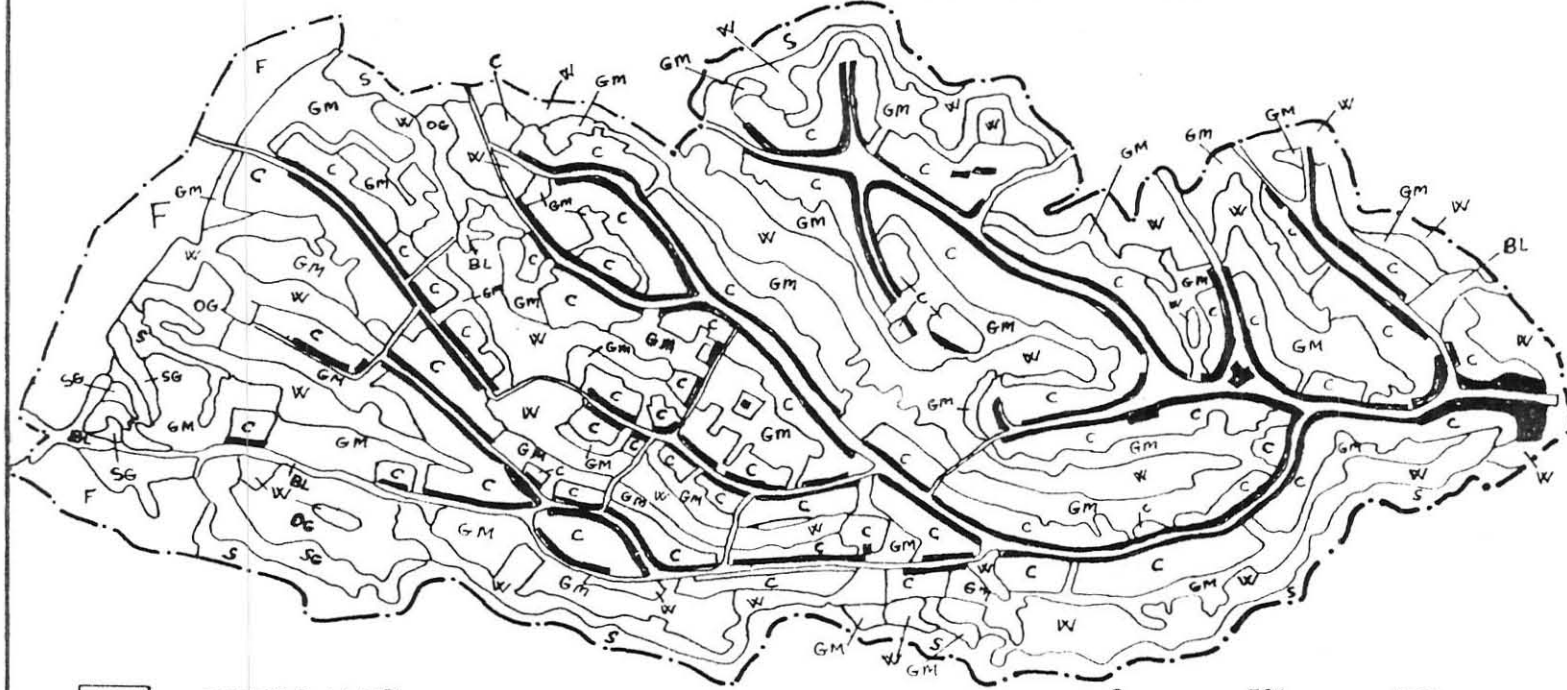
# MAP X LAND USE/COVER MAP OF NORCHA 1993



Source: Compiled and drawn by the author using aerial photographs and field survey 1993

# MAP XII

## LAND USE/LAND COVER PATTERN OF AGENNA PA 1993



C CROPPED LAND

GM MEADOW LAND

OG OPEN GRASSLAND

SG SHRUBED GRASSLAND

F FOREST

W WOOD LAND

S SHRUB LAND

0 500 1000  
METERS

SETTLEMENT

R 'JEFUER'(ROAD)

BL BAD LAND

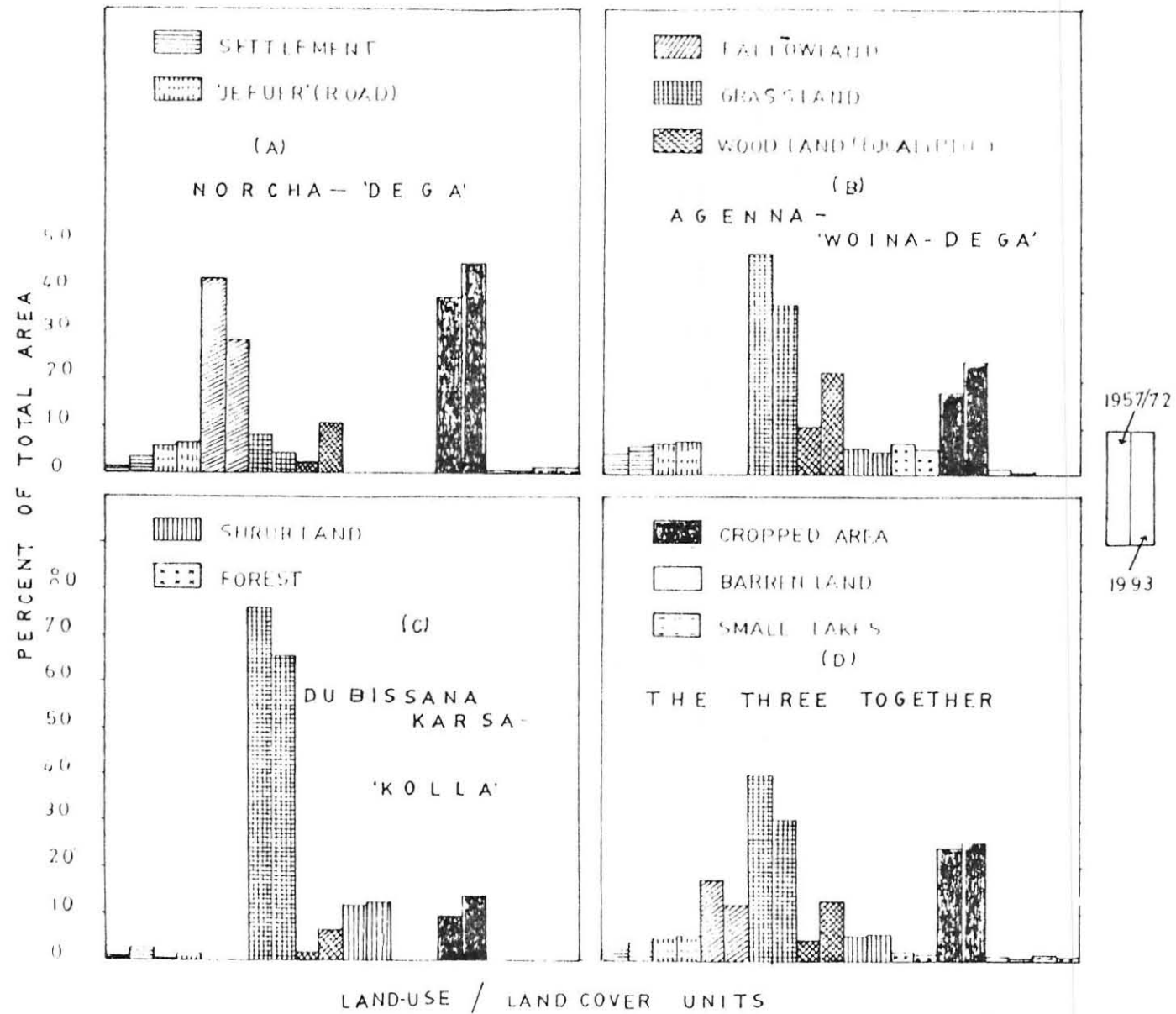
Source: Compiled and drawn by the author using aerial photographs and field survey, 1993

MAP XIV



Source: Compiled and drawn by the author using aerial photographs and field survey data.

FIGURE 4.1 PATTERN OF LAND-USE/COVER CHANGE (1957/72 - 1993)



The second major land use type is grassland and accounts for about 30%. It is followed by woodlands which predominantly are eucalyptus trees (12.6%), shrub lands (5.1%), Jefuer (road) (4.7%), settlements (3.7%), forests (1.5%), water bodies (0.5%), and badlands (about 0.2%) (Table 4.1, Figure 4(d), and Appendix C).

On zonal level, dega, as represented by Norcha, is dominated by cultivated lands nearly (75%) followed poorly by woodland often comprising eucalyptus trees, bamboos and astha (11%), and grasslands (4.1%). Roads, settlements, badlands and water bodies for the remaining nearly 10%. There is total absence of scrub and forest lands.

Kolla on the other hand, represented by Dubissana Karsa is dominated by grasslands (65.5%) while cultivated lands (13.8%) and shrublands (12.3%) stand as poor second and third. There is absence of forest lands in the zone.

The intermediate zone, woina dega, represented by Agenna PA, stands true to its position with fair representation by grasslands (30.7%), cultivated land (24.6%) and woodlands which largely composed of eucalyptus trees (21.9%). This is the only zone where one finds the patches of forest which account for 5.2% of the area of Agenna PA.

Out of the total area of 1339 hectares under cultivation about 73.6% falls in dega zone followed by 16.4% in woina dega and about 10% in kolla. Concerning grasslands, the share of kolla zone is about 66% while that of woina dega and dega respectively is 28.7 and 5.6% of the total grasslands in the three PAs. The share of woodlands, on the otherhand, is about 48.9% in woina dega, 36% in dega and about 15.1% of 403 hectares of wood land in the three PAs occur in kolla zone.

Therefore, ingeneral, considerable spatial variations are observed in the land use/land cover patterns of the three PAs and or agroclimatic zones. The variations are tested to be

statistically significant at 90% level of confidence. It is also evident from current land use maps of the three PAs (Map X, XII and XIV) Table 4.1, Figure 4.1a-c, and Appendix C, that the proportion of cultivated land increases as one moves toward dega from kolla at the expense of mainly grassland. This also leads to conclude that agricultural land appears to be most scarce in dega zone for further expansion of agriculture.

#### 4.1.2. LAND-USE PATTERNS AT DIFFERENT LEVELS OF ADMINISTRATIVE UNITS

As noted by land-use experts (FAO/UNDP, 1986), in sedentary and settled agricultural regions of the world the sum of all land-uses on the individual farm holdings provides the aggregate pattern of land use for the country or any territorial entity excluding areas under such uses as common grazing areas and forests which come under the public realm. But Ethiopia and as may be the case in countries of African Savannah, the land-use patterns at individual farm holdings vary considerably from that prevailing at various administrative levels such as a country, province, district, subdistrict or peasant association (Table 4.2.).

**Table 4.2. LAND-USE PATTERNS IN VARIOUS ADMINISTRATIVE UNITS (in %)**

| Land use/Land cover type    | Ethiopia (1)<br>(1973-77) | Shewa (1)<br>(1973-77) | Chebona<br>Gurage (1)<br>(1973-77) | The 3<br>PAs (2)<br>(1993) | Ind. Peas.<br>Holding(3)<br>(1993) |
|-----------------------------|---------------------------|------------------------|------------------------------------|----------------------------|------------------------------------|
| Cultivated Land             | 14.8                      | 39.8                   | 51.7                               | 42.0                       | 47.4                               |
| Grazing & Browsing Land     | 51.0                      | 39.3                   | 34.5                               | 30.0                       | 42.3                               |
| Forest, woodland and Shrubs | 11.7                      | 7.4                    | 4.1                                | 19.1                       | 9.7                                |
| Currently Unproductive      | 3.8                       | 3.3                    | 1.4                                | 0.5                        | -                                  |
| Unutilizable Land           | 18.7                      | 10.2                   | 8.4                                | 8.5                        | -                                  |

Source:1) Data obtained from landsat imagery scanned during (1973-77) (FAO/UNDP, 1986).

2) Obtained from actual land use survey (Table 4.1.)

3) Data obtained for the ten sample PAs using questionnaires.

From Table 4.2 it is evident that patterns obtained at PA level can not be generalized for the country, i.e. Ethiopia. Because nearly half of the land under peasant holdings (47.4%), in the three PAs (42%), at awraja (district) level 52% and at province about 40% is under crop cultivation, while less than one-seventh of the total land area is under this activity at the national level. The situation at administrative region (province) level is somewhat similar to what it is at PA level.

Based on data collected in various parts of Ethiopia on PA level, land under grazing constitutes less than one-tenth on the average in the peasant holdings (FAO/UNDP, 1986). But the same in the present survey accounts for about four-tenth and three-tenth of peasant holding and PA level in the two weredas respectively. At country level more than one half of the land is put under this kind of land use (Table 4.2). Hence, pattern of land-use in the peasant holding is dominated by crops and for the regions by grazing.

The divergence in the patterns of land-use probably arises due to differences in the ownership of lands which are put to the most important land uses, crop cultivation and grazing. It appears that generally peasants use the land owned by them for crop production to meet their subsistence needs. On the contrary, however, public lands or lands owned by the community are largely utilized for livestock grazing and or to conserve environment by way of afforestation and other activities.

Therefore, land-use patterns observed in the individual peasant holdings do not reflect what is found for the country or a region in the intermediate stage in case of Ethiopia. This significant difference in land-use patterns between the country and peasant holdings is likely to have an important implications in optimizing land use resource management, rural equity, and in turn, in the agricultural development policies and programmes. (FAO/UNDP, 1986).



#### 4.2. ZONATION IN THE GURAGE LAND USE IN THE LIGHT OF VON-THUNEN'S PROPOSITION

In his theory of land-use in 1826, J.H. von Thunen tried to picture out the effect of distance on rural land-use intensity. He propounded that there is a tendency of land-use zonation from a point outwards in the form of concentric circles. The point is either a central market place and or a farm house (or farm village) which is the center of both inputs and consumption or disposal of produce. But his premise was based on a cash economy.

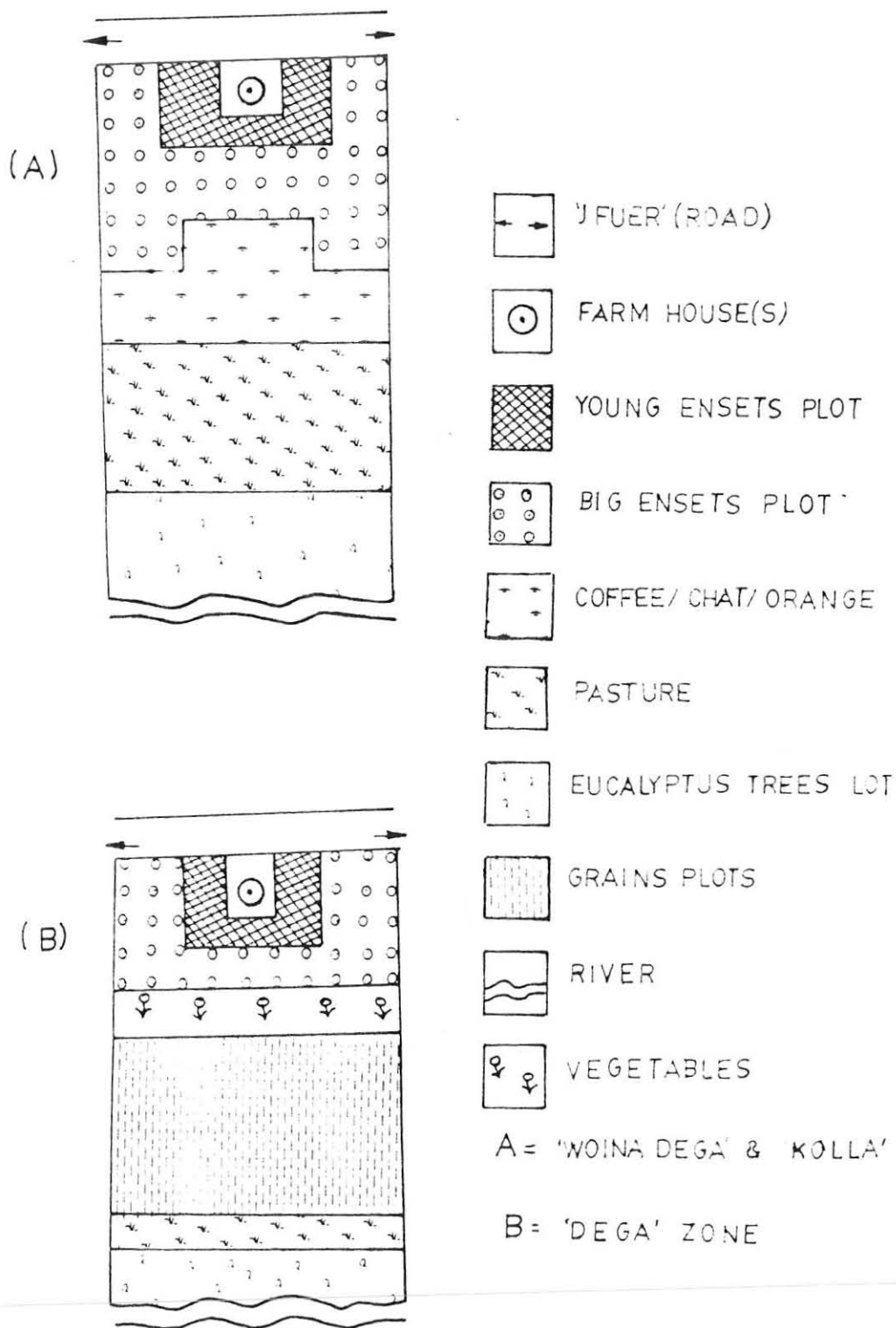
As opposed to von Thunen's promise, the Gurage are subsistent enset cultivators. And yet, their land-uses show a sort of zonation about their farm houses (see Figure 4.2.).

What may be unique in the Gurage cultural landscape is that settlements are in village form, linear in pattern and are uniform. There are no irregularities to be seen in the planning or choice of site of cultivation. Nor do the Gurages, like some other African tribes living in congested settlements, have their fields at great distances from the village (Shack, 1966).

The Gurage homestead and field together with livestock stable form an inseparable unit. Livestocks in the study area and or in Sabat Bet Gurageland at large are kept to pass night together with farm-family members in the same farm house so that the animals are protected from threatening wild animals like hayena and others; and their manure is easily collected and provided to enset, coffee, chat, cabbage, etc. Farm houses, thus, comprise an important centers of inputs and consumption.

Enset in its various stages needs a consistent manure supply. This is due to the fact that it occupies the same position continuously for many years. As a result, the fertility of

FIGURE 4.2 IDEALIZED REPRESENTATION OF LAND-USE ZONES IN THE SABAT-BET GURAGE LAND



its soil gets easily exhausted. Hence there is the need to manure enset plants continuously to get the fertility of soil replenished. Thus, enset farms should be situated very close to farm houses so that manure can be carried to enset plots with lesser efforts. With increasing distance away from the same house, manure and labour input tends to drop. This may be witnessed by more healthier enset plants situated closer to farm houses in contrast to short and thin ensets found on the peripheries. Hence, land-use intensity is expected to decline away from the point of consumption and input. This goes well with the distance-decay proposition of von Thunen.

Accordingly, regardless of zonal variations, young enset plots are situated close to the farm houses because young enset plants need more frequent care and protection from cattle and wild animals. Young enset plot is followed outward by plots with larger ensets. On the outskirts of enset plot are found chat, coffee and or orange plots in most of the woina dega zone.

In kolla parts, perennials are intercropped with enset. Cultivation is supposed does not go beyond the homestead's field (yasat den). Outside yasatden is what the Gurages refer to as agre is largely barren. It is utilized largely for grazing and or as meadows and or followed by woodland/or shrubs and bush lands (Figure 4.2A).

In upper dega zone the land use pattern is some how different as compared of the situation in woina dega and kolla agroclimatic zones (Figure (4.2B)). Enset plots are small in size and are followed by vegetables such as cabbage and potatoe which relatively need more manure input and human care. Vegetable zone, in turn is followed by fields in which grains are cultivated. Grain field is followed by narrow strip of grazing zone which often are marshy. As is normal with the other agro-climatic zones, grazing areas end-up with wood

lots which largely comprise eucalyptus and some patches of bamboos, and or Shrubs.

Homesteads and fields including pastures and wood lots, irrespective of zonal variation, are bounded by a river at the foot of spurs<sup>13</sup>, the farthest agree. Jefuer, a path which is used to connect one village with another, utilized as small common grazing ground (Figure 4.2. A & B).

Despite the activity is subsistence and land use zones do not appear as concentric circles but rather rectangular zones the land use patterns in the study area and the Sabat-Bet Gurageland at large show zonation. Land-use intensity also tends to decline outwards from a Gurage homestead. Thus, the situation, in its generality, appears to be in line of von Thunen's land-use theory in the world of subsistence agriculture.

### 4.3. LAND-USE CHANGES, ITS DYNAMICS & PROSPECTS

#### 4.3.1. CHANGES IN LAND USE/LAND COVER

It is noted earlier that land-use is a manifestation of interaction (which have been going on since human occupancy of an area) between man and his environment. Land-use is under continuous tension between human needs and available land resources. Since man's needs grow and change in time the nature and intensity of interaction between man and his environment also changes. As a result, existing methods of cultivation and the land use

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<sup>13</sup> Gurage settlements in most cases are situated on spurs in such a way homesteads line up symmetrically on either side of or following ridge lines. Along the ridge line runs Jefuer, a narrow but elongated common grazing area, which also used as a road. Settlements therefore vertically end up along small or big rivers. Hence, Gurage settlements are bounded by Jefuer and streams.

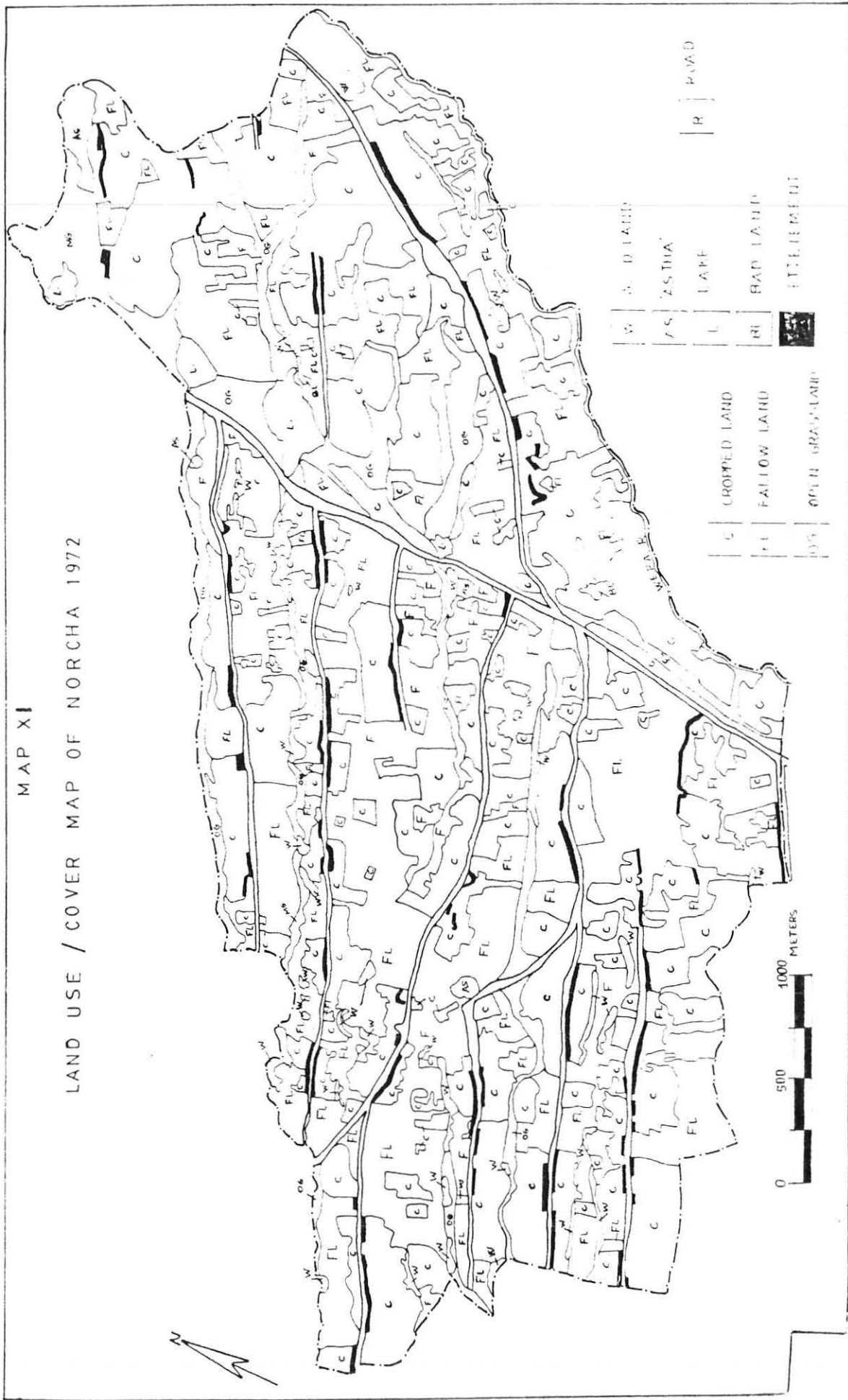
patterns change. The changes necessitate to meet the variable demands of the land by the society in its new ways and conditions of life. The demand for new uses of land may be induced by a technological change, or by a change in the size, composition and requirements of a community.

Based on land use surveys<sup>14</sup> in Norcha, Agenna and Dubissana Karsa PAs (Maps X, XII & XIV respectively) and land uses based on records of 1972, 1957 and 1957 for respective PAs (Maps XI, XII and XV), considerable changes in land use/ land cover pattern were observed (Table 4.3.; Figure 4.1. (a,b,c); Appendix C).

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<sup>14</sup> Current (1993) land uses/land cover of Norcha, Agenna and Dubssana K. which are assumed to represent dega, W. dega and kolla zones respectively were surveyed. To assess changes in their land use patterns using available old aerial photographs of 1957 for Agenna and Dubessana K. were used to determine their land-use/cover patterns in the past. But for Norcha photos of 1972 were used because there is no aerial photograph of 1957 for the area.

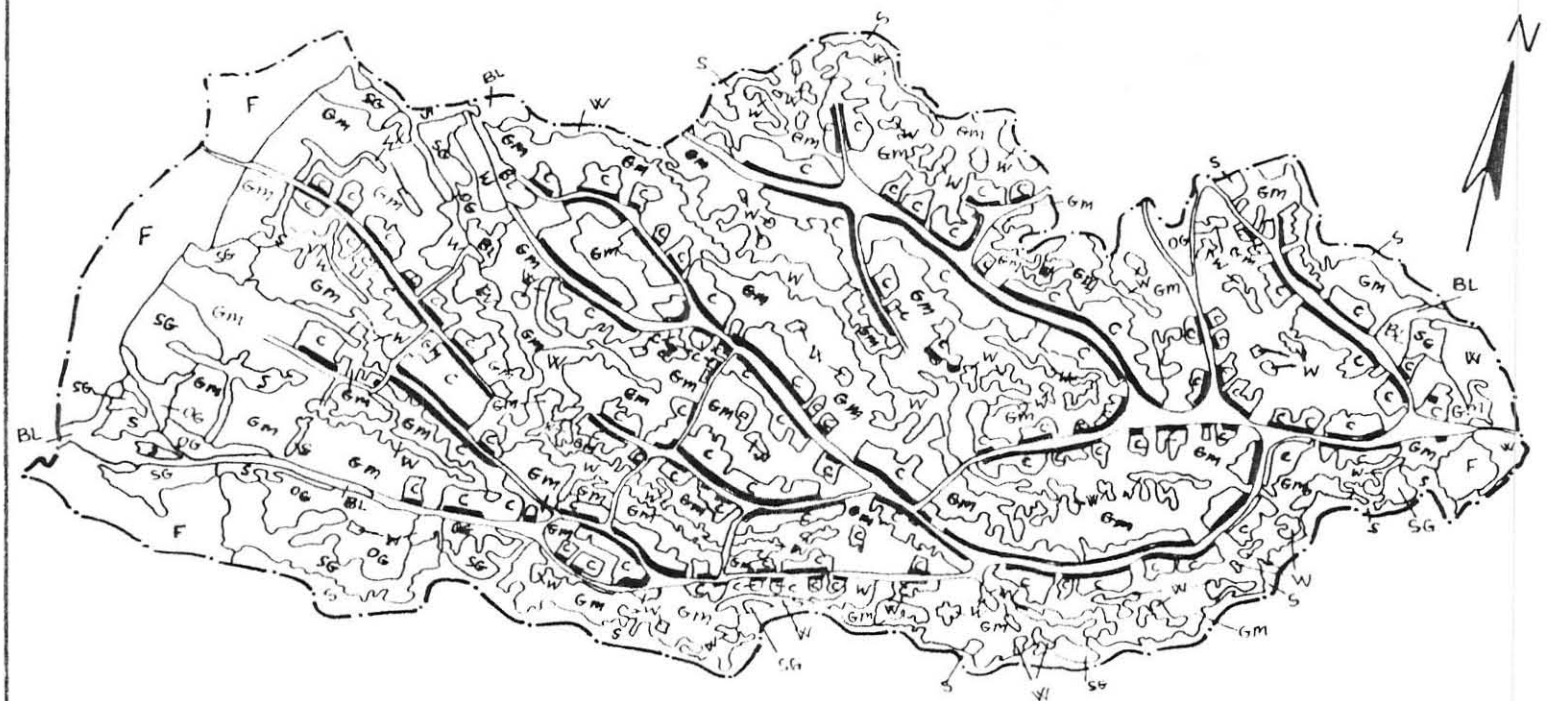
MAP XI  
LAND USE / COVER MAP OF NORCHA 1972



Source: Compiled and drawn by the author using aerial photographic and field survey, 1992

# MAP XIII

## LAND USE LAND/COVER MAP OF AGENNA PA 1957



|    |                   |   |             |    |                 |
|----|-------------------|---|-------------|----|-----------------|
| C  | CROPPED AREA      | F | FOREST      | R  | 'JEFUER' (ROAD) |
| GM | MEADOW LAND       | W | WOOD LAND   | BL | BAD LAND        |
| OG | OPEN GRASSLAND    | S | SHRUB LAND  |    |                 |
| SG | SHRUBED GRASSLAND |   | SETTELEMENT |    |                 |

0 500 1000  
METERS

Source: Compiled and drawn by the author using aerial photographs and field  
check 1993



# MAP XV

## LAND-USE/COVER MAP OF DUBISSANA KARSA PA 1957

- |     |                    |
|-----|--------------------|
| C   | CROPPED AREA       |
| GM  | MEADOW LAND        |
| OG  | OPEN GRASSLAND     |
| SG  | SHRUBBED GRASSLAND |
| W   | WOOD LAND          |
| S   | SHRUB LAND         |
|     | SETTELEMENT        |
| R   | ROAD               |
| CEM | CEMETRY            |

0 500 1000  
METERS

Source: Compiled and drawn by the author using aerial photographs and field survey, 1957.

**Table 4.3. DISTRIBUTION OF LAND-USE/LAND COVER AND CHANGES  
IN 1957/72 - 1993.**

| Land use Type            | Norcha (dega) |       |        | Agenna (W dega) |      |        | D.Karsa (Kolla) |      |        | Aggregates |       |        |
|--------------------------|---------------|-------|--------|-----------------|------|--------|-----------------|------|--------|------------|-------|--------|
|                          | %             |       | Change | %               |      | Change | %               |      | Change | %          |       | Change |
|                          | 1972          | 1993  | %      | 1957            | 1993 | %      | 1957            | 1993 | %      | 1957/72    | 1993  | %      |
| C                        | 38.9          | 46.1  | 18.4   | 17.5            | 24.6 | 41.0   | 9.4             | 13.8 | 44.6   | 23.9       | 30.2  | 26.2   |
| FL                       | 42.2          | 28.4  | -32.7  | -               | -    | -      | -               | -    | -      | 17.5       | 11.7  | -32.7  |
| GL                       | 8.1           | 4.1   | -49.5  | 48.3            | 30.7 | -35.7  | 75.7            | 65.5 | -14.7  | 40.0       | 30.0  | -24.7  |
| W                        | 2.1           | 11.0  | 417.9  | 10.1            | 21.9 | 118.9  | 1.9             | 6.3  | 430.0  | 4.0        | 12.6  | 196.3  |
| S                        | -             | -     | -      | 5.5             | 4.9  | - 8.3  | 11.3            | 12.3 | 6.3    | 5.0        | 5.1   | 1.8    |
| F                        | -             | -     | -      | 6.5             | 5.2  | -18.9  | -               | -    | -      | 1.8        | 1.5   | -18.9  |
| ST                       | 1.4           | 3.2   | 126.3  | 4.1             | 5.9  | 47.2   | 1.0             | 2.3  | 120    | 2.0        | 3.1   | 81.5   |
| R                        | 5.9           | 6.1   | 3.8    | 6.6             | 6.4  | -1.0   | 0.7             | 1.2  | 71.4   | 4.5        | 4.7   | 4.9    |
| BL                       | .07           | 0.07  | 0      | 1.5             | 0.5  | -61.5  | -               | -    | -      | 0.4        | 0.2   | -57.1  |
| WB                       | 1.1           | 1.1   | 0      | -               | -    | -      | -               | -    | -      | 0.5        | 0.5   | 0      |
| TOTAL (KM <sup>2</sup> ) | 13.22         | 13.24 | -      | 9.18            | 8.99 | -      | 9.78            | 9.77 | -      | 32.18      | 32.00 | -      |

Source: Field survey, 1993.

C = Cropped area; FL = fallow land; GL = grassland; W = woodland;  
S = Shrubland; F = forest; St = settlement; R = road; BL = badlands; WB = water body. Changes were calculated in reference to the base years while others are simply percentage distributions.

Table 4.3. in which an aggregated land-use/land cover patterns of the three PAs are given in percent, discloses that land which is actually under crops were about 24% in 1957/72 and increased to about 30% (1993). Therefore, in the period it expanded by about 26%. Fallowland which is mainly practised in Norcha, dega zone, however decreased from about 17.5% (1957/72) to 12% in 1993, resulting in a drop by about 33%.

Furthermore, woodlands which largely are eucalyptus tree lots, increased from 4% (1957/72) to about 13% (1993), and showed an expansion of about 196% in the last 21 to 36 years. But grasslands, one of the very common land uses in the region, accounted for 40% of all lands under consideration in 1957/72 and only 30% in 1993. It showed a drop of about 25% in the period probably at the cost of expansion of crop land and woodland. Forest cover

also decreased by about 18%, while shrublands remained nearly constant and settlements and roads (Jefuer) increased by about 82 and 5%, respectively, in the period. Badlands, however, decreased from 0.4% (1975/72) to 0.2% (1993) most likely because of an increased practice of conservation by way of planing more eucalyptus trees in such areas.

Almost in all zones what had most notably changed was woodland. In Norcha dega woodland expanded most at a rate of about 19.9% while settlements, roads and cropped area at about 6.01, 0.18 and 0.9% rate per annum, respectively, probably at the expense of grassland including fallow land.

In Agenna (woina dega) expansion of woodland, once again, appeared considerable (3.3% p.a.) and followed by expansion of cropped land (1.14% p.a.) which is attributable to adoption of chat cultivation as a cash crop at the cost of "shrinking" grassland areas at a rate of about 1.0% p.a. Settlements and Jefuer also showed an increase at about 1.3 and 0.18% rate in a year (Figure 4.1b; Table 4.3 & 4.4; Appendix C).

**Table 4.4. RATE OF CHANGE IN SOME LAND-USES**

(% per annum)

| Land use Type | Norcha | Agenna | D. Kar | Over-all   |
|---------------|--------|--------|--------|------------|
| Cropped Area  | 0.88   | 1.14   | 1.23   | 0.73-1     |
| Fallow land   | -1.56  | -      | -      |            |
| Grass land    | -2.36  | -0.99  | -0.41  | -0.69-1.18 |
| Wood land     | 19.9   | 3.3    | 6.4    | 5.45-9.35  |
| Settlement    | 6.01   | 1.3    | 3.3    | 2.26-3.88  |
| Road (Jefuer) | 0.18   | 0.18   | 1.98   | 0.14-0.23  |

Source: Derived from field survey, 1993

Similarly, expansion of woodland again observed very important in dega (Norcha), as much as about 12% per annum. Settlements, Jefuer and cultivated land increased at about 3.3., 2.0 and 1.2% in a year during the last 36 years. The expansion were at the expense of grasslands (Figure 4.1c; Table 4.3 & 4.4.; Appendix C).

Thus, generally rate of expansion of cultivated land and woodland appeared the greatest in Dubissan karsa (kolla) and Norcha (dega) respectively (Table 4.4). The rate of increase of cropped area tended to increase towards kolla because there is relatively more land as pastures which could be reclaimed for cultivation as well as planting eucalyptus trees. In most cases, land-use types other than grazing areas, expanded at the cost of grasslands and the possibility of agricultural land expansion appears so marginal in upper dega zone where population pressure is felt more.

#### 4.3.2. DYNAMICS OF LAND-USE/LAND COVER

Land-use land cover is dynamic in nature. The land-use and land cover patterns (or land-use system) prevailing in an area together with methods of cultivation lack permanency. Rather, they are "phases in a process of economic development" (Boserup, 1965). Solomon (1992:27) shares same view and reported that changes in land-use land cover patterns are a reflection of the dynamics in socio-economic development and changes in the natural environment. Understanding the process of land-use /land cover changes and identification of the socio-economic parameters would have facilitated the changes and would be helpful to foresee the direction of change in the land-use land cover of an area and hence to formulate policies for the future.

One very notable factor of land-use changes is the demographic condition. Demographic factors-rapid population growth and hence population pressure-play an important influential role in the evolution of the current as well as of the potential land use, as land-use is the product of interaction of man and nature.

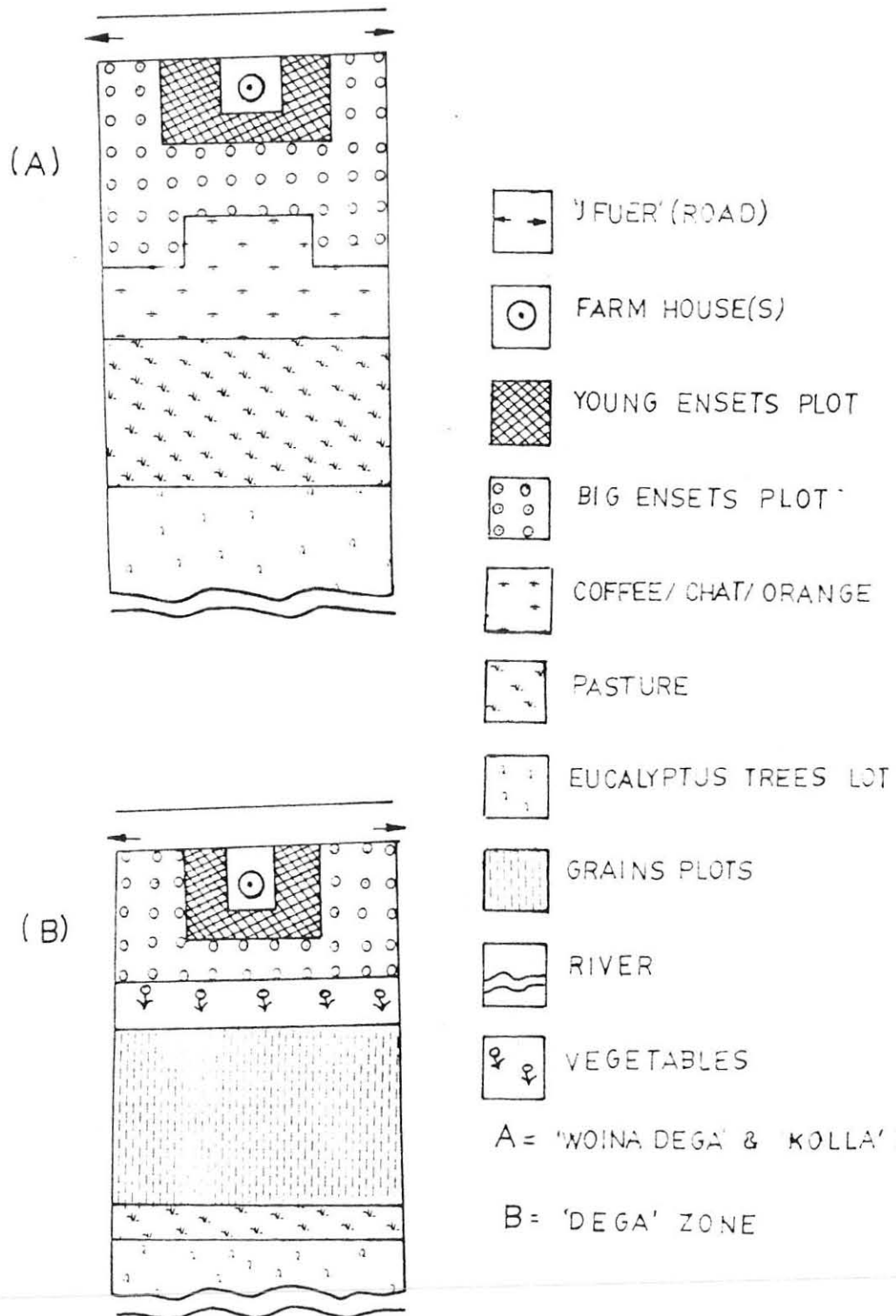
In the two weredas and the Sabat-Bet Gurage areas at large population has been growing very fast, so does population pressure. An increase of population number puts additional pressure on land at even to meet the essential subsistence needs including food and domestic fuel. To combat this growing demand requires increasing of production which can be made possible either through increasing the productivity of existing lands or through expansion of area.

However, taking into account of the traditional nature of enst-based Gurages' agricultural system, low level of technological development, and the inadequate network of extension and input services, the possibilities of increasing production appear to be possible only by expanding cultivated area. This has put forth new demands on land. Hence, the 26.2% expansion of cropped area in the three PAs (zones) in the last 21/36 years can be partly attributed to increasing population pressure.

Increased population pressure and the resultant rapid reduction in available per capita cropped land and or land holding size is further aggravated by the presence of a large number of livestock. Since other land which can be easily brought under cultivation is the grazing land, land available for grazing is sure to be squeezed as it is true of the study PAs (from 1276 hectares (40%) in 1957/72 to 961 hectares (30%) in 1993) (Table 4.3; Figure 4.10; Appendix C).

The other possible effect of increasing population pressure is the additional demand

FIGURE 4.2 IDEALIZED REPRESENTATION OF LAND-USE ZONES IN THE SABAT-BET GURAGE LAND



its soil gets easily exhausted. Hence there is the need to manure enset plants continuously to get the fertility of soil replenished. Thus, enset farms should be situated very close to farm houses so that manure can be carried to enset plots with lesser efforts. With increasing distance away from the same house, manure and labour input tends to drop. This may be witnessed by more healthier enset plants situated closer to farm houses in contrast to short and thin ensets found on the peripheries. Hence, land-use intensity is expected to decline away from the point of consumption and input. This goes well with the distance-decay proposition of von Thunen.

Accordingly, regardless of zonal variations, young enset plots are situated close to the farm houses because young enset plants need more frequent care and protection from cattle and wild animals. Young enset plot is followed outward by plots with larger ensets. On the outskirts of enset plot are found chat, coffee and or orange plots in most of the woina dega zone.

In kolla parts, perennials are intercropped with enset. Cultivation is supposed does not go beyond the homestead's field (yasat den). Outside yasatden is what the Gurages refer to as agre is largely barren. It is utilized largely for grazing and or as meadows and or followed by woodland/or shrubs and bush lands (Figure 4.2A).

In upper dega zone the land use pattern is some how different as compared of the situation in woina dega and kolla agroclimatic zones (Figure (4.2B)). Enset plots are small in size and are followed by vegetables such as cabbage and potatoe which relatively need more manure input and human care. Vegetable zone, in turn is followed by fields in which grains are cultivated. Grain field is followed by narrow strip of grazing zone which often are marshy. As is normal with the other agro-climatic zones, grazing areas end-up with wood



lots which largely comprise eucalyptus and some patches of bamboos, and or Shrubs.

Homesteads and fields including pastures and wood lots, irrespective of zonal variation, are bounded by a river at the foot of spurs<sup>13</sup>, the farthest agree. Jefuer, a path which is used to connect one village with another, utilized as small common grazing ground (Figure 4.2. A & B).

Despite the activity is subsistence and land use zones do not appear as concentric circles but rather rectangular zones the land use patterns in the study area and the Sabat-Bet Gurageland at large show zonation. Land-use intensity also tends to decline outwards from a Gurage homestead. Thus, the situation, in its generality, appears to be in line of von Thunen's land-use theory in the world of subsistence agriculture.

#### 4.3. LAND-USE CHANGES, ITS DYNAMICS & PROSPECTS

##### 4.3.1. CHANGES IN LAND USE/LAND COVER

It is noted earlier that land-use is a manifestation of interaction (which have been going on since human occupancy of an area) between man and his environment. Land-use is under continuous tension between human needs and available land resources. Since man's needs grow and change in time the nature and intensity of interaction between man and his environment also changes. As a result, existing methods of cultivation and the land use

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<sup>13</sup> Gurage settlements in most cases are situated on spurs in such a way homesteads line up symmetrically on either side of or following ridge lines. Along the ridge line runs Jefuer, a narrow but elongated common grazing area, which also used as a road. Settlements therefore vertically end up along small or big rivers. Hence, Gurage settlements are bounded by Jefuer and streams.

patterns change. The changes necessitate to meet the variable demands of the land by the society in its new ways and conditions of life. The demand for new uses of land may be induced by a technological change, or by a change in the size, composition and requirements of a community.

Based on land use surveys<sup>14</sup> in Norcha, Agenna and Dubissana Karsa PAs (Maps X, XII & XIV respectively) and land uses based on records of 1972, 1957 and 1957 for respective PAs (Maps XI, XII and XV), considerable changes in land use/ land cover pattern were observed (Table 4.3.; Figure 4.1. (a,b,c); Appendix C).

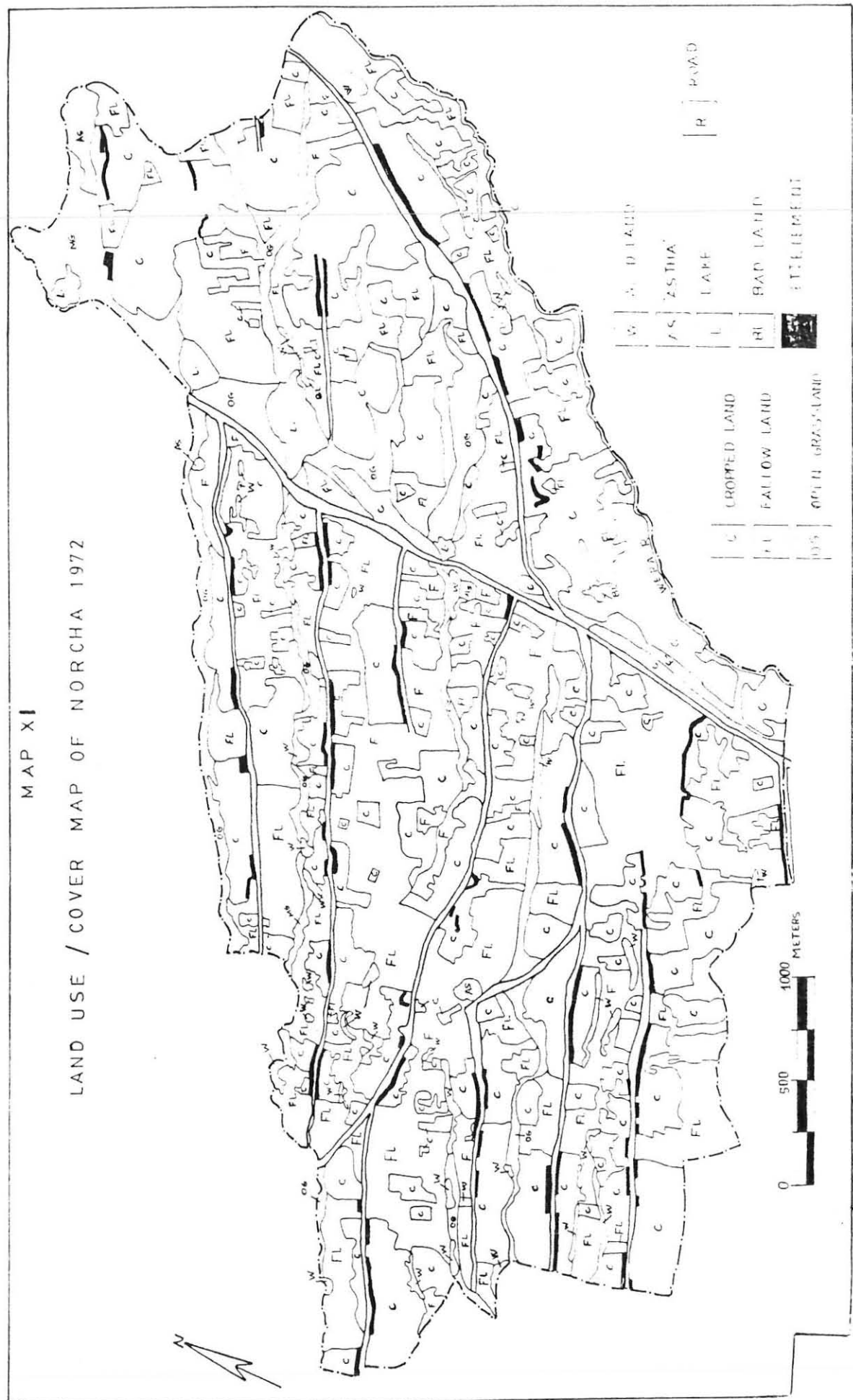
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<sup>14</sup> Current (1993) land uses/land cover of Norcha, Agenna and Dubssana K. which are assumed to represent dega, W. dega and kolla zones respectively were surveyed. To assess changes in their land use patterns using available old aerial photographs of 1957 for Agenna and Dubessana K. were used to determine their land-use/cover patterns in the past. But for Norcha photos of 1972 were used because there is no aerial photograph of 1957 for the area.

LAND-USE IN 1972

MAP XI

LAND USE / COVER MAP OF NORCHA 1972

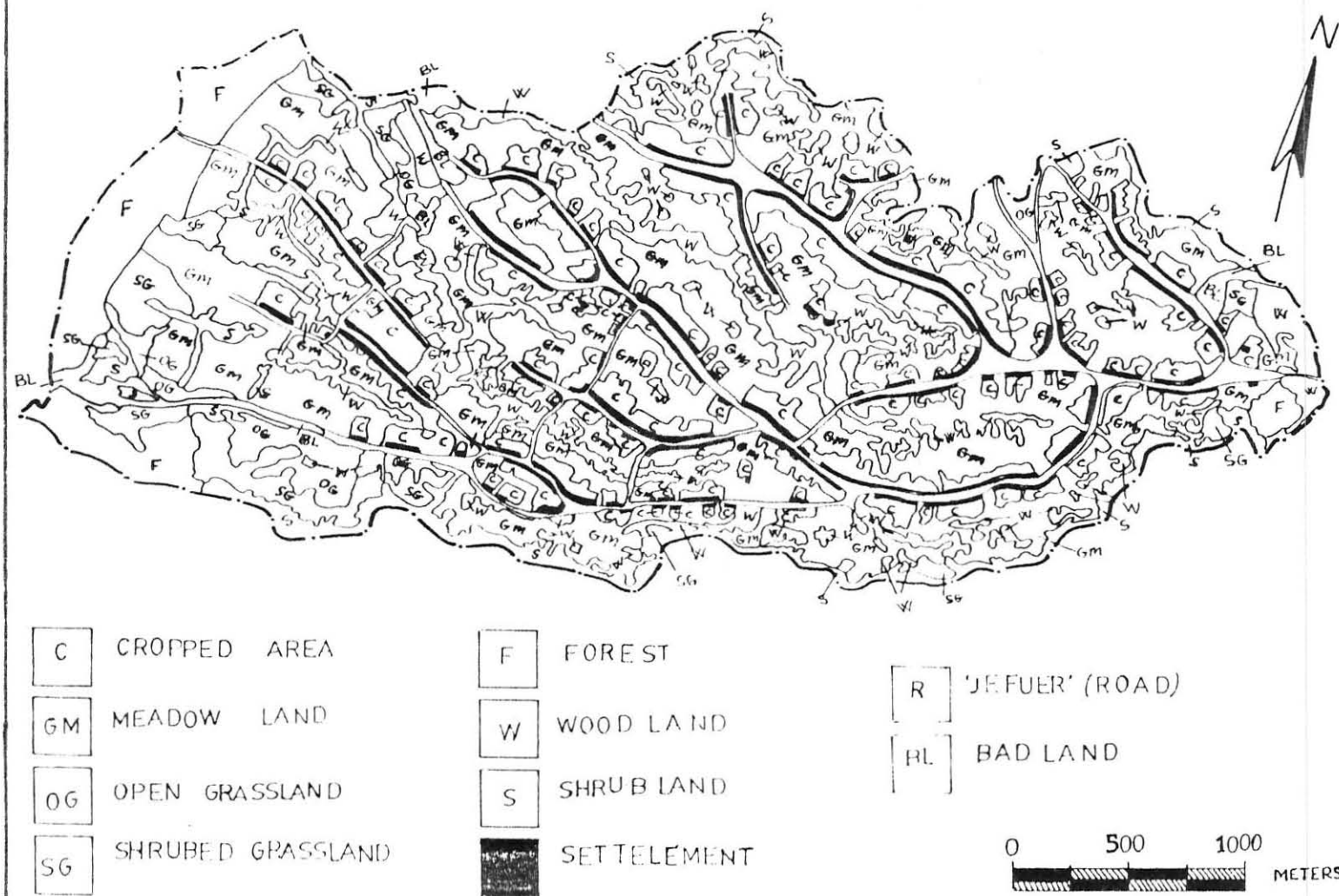


|    |              |
|----|--------------|
| C  | CROPPED LAND |
| FL | FALLOW LAND  |
| GS | GRASSLAND    |
| D  | DITCH        |
| S  | SHRUB        |
| L  | LAKE         |
| R  | ROAD         |
| B  | BAD LAND     |
| E  | SETTLEMENT   |

Source: Compiled and drawn by the author using aerial photographs and field survey, 1972

# MAP XIII

## LAND USE LAND/COVER MAP OF AGENNA PA 1957



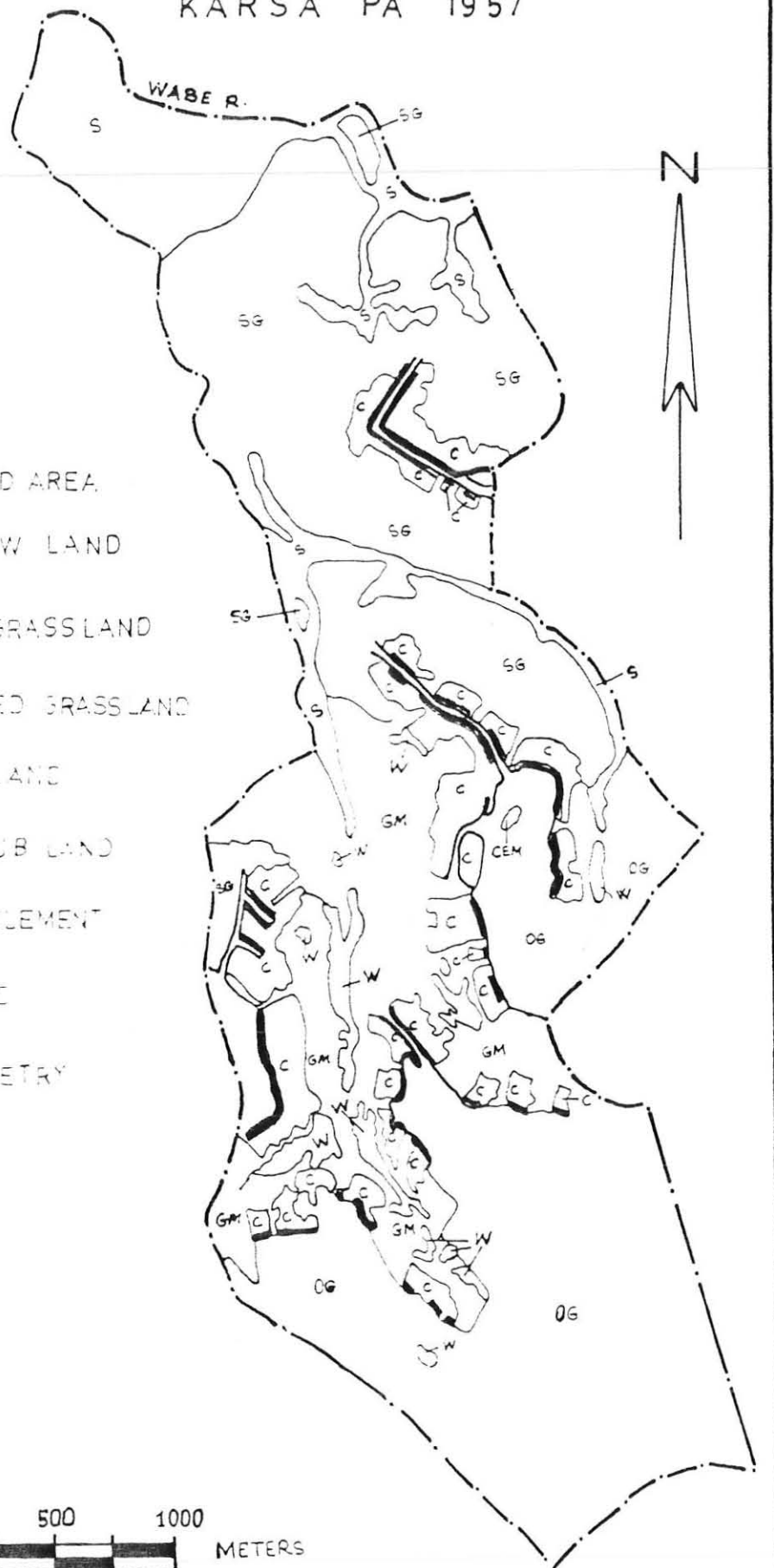
Source: Compiled and drawn by the author using aerial photographs and field notes, 1993.

# MAP XV

## LAND-USE/COVER MAP OF DUBISSANA KARSA PA 1957

- |                                                                                     |                   |
|-------------------------------------------------------------------------------------|-------------------|
| C                                                                                   | CROPPED AREA      |
| GM                                                                                  | MEADOW LAND       |
| OG                                                                                  | OPEN GRASSLAND    |
| SG                                                                                  | SHRUBED GRASSLAND |
| W                                                                                   | WOOD LAND         |
| S                                                                                   | SHRUB LAND        |
|  | SETTELEMENT       |
| R                                                                                   | ROAD              |
| CEM                                                                                 | CEMETRY           |

0 500 1000  
METERS



Source: Compiled and drawn by the author using aerial photographs and field survey data.

**Table 4.3. DISTRIBUTION OF LAND-USE/LAND COVER AND CHANGES  
IN 1957/72 - 1993.**

| Land use Type            | Norcha (dega) |       |        | Agenna (W' dega) |      |        | D.Karsa (Kolla) |      |        | Aggregates |       |        |
|--------------------------|---------------|-------|--------|------------------|------|--------|-----------------|------|--------|------------|-------|--------|
|                          | %             |       | Change | %                |      | Change | %               |      | Change | %          |       | Change |
|                          | 1972          | 1993  | %      | 1957             | 1993 | %      | 1957            | 1993 | %      | 1957/72    | 1993  | %      |
| C                        | 38.9          | 46.1  | 18.4   | 17.5             | 24.6 | 41.0   | 9.4             | 13.8 | 44.6   | 23.9       | 30.2  | 26.2   |
| FL                       | 42.2          | 28.4  | -32.7  | -                | -    | -      | -               | -    | -      | 17.5       | 11.7  | -32.7  |
| GL                       | 8.1           | 4.1   | -49.5  | 48.3             | 30.7 | -35.7  | 75.7            | 65.5 | -14.7  | 40.0       | 30.0  | -24.7  |
| W                        | 2.1           | 11.0  | 417.9  | 10.1             | 21.9 | 118.9  | 1.9             | 6.3  | 430.0  | 4.0        | 12.6  | 196.3  |
| S                        | -             | -     | -      | 5.5              | 4.9  | - 8.3  | 11.3            | 12.3 | 6.3    | 5.0        | 5.1   | 1.8    |
| F                        | -             | -     | -      | 6.5              | 5.2  | -18.9  | -               | -    | -      | 1.8        | 1.5   | -18.9  |
| ST                       | 1.4           | 3.2   | 126.3  | 4.1              | 5.9  | 47.2   | 1.0             | 2.3  | 120    | 2.0        | 3.1   | 81.5   |
| R                        | 5.9           | 6.1   | 3.8    | 6.6              | 6.4  | -1.0   | 0.7             | 1.2  | 71.4   | 4.5        | 4.7   | 4.9    |
| BL                       | .07           | 0.07  | 0      | 1.5              | 0.5  | -61.5  | -               | -    | -      | 0.4        | 0.2   | -57.1  |
| WB                       | 1.1           | 1.1   | 0      | -                | -    | -      | -               | -    | -      | 0.5        | 0.5   | 0      |
| TOTAL (KM <sup>2</sup> ) | 13.22         | 13.24 | -      | 9.18             | 8.99 | -      | 9.78            | 9.77 | -      | 32.18      | 32.00 | -      |

Source: Field survey, 1993.

C = Cropped area; FL = fallow land; GL=grassland; W=woodland;

S = Shrubland; F = forest; St = settlement; R = road; BL = badlands; WB = water body. Changes were calculated in reference to the base years while others are simply percentage distributions.

Table 4.3. in which an aggregated land-use/land cover patterns of the three PAs are given in percent, discloses that land which is actually under crops were about 24% in 1957/72 and increased to about 30% (1993). Therefore, in the period it expanded by about 26%. Fallowland which is mainly practised in Norcha, dega zone, however decreased from about 17.5% (1957/72) to 12% in 1993, resulting in a drop by about 33%.

Furthermore, woodlands which largely are eucalyptus tree lots, increased from 4% (1957/72) to about 13% (1993), and showed an expansion of about 196% in the last 21 to 36 years. But grasslands, one of the very common land uses in the region, accounted for 40% of all lands under consideration in 1957/72 and only 30% in 1993. It showed a drop of about 25% in the period probably at the cost of expansion of crop land and woodland. Forest cover

also decreased by about 18%, while shrublands remained nearly constant and settlements and roads (Jefuer) increased by about 82 and 5%, respectively, in the period. Badlands, however, decreased from 0.4% (1975/72) to 0.2% (1993) most likely because of an increased practice of conservation by way of planing more eucalyptus trees in such areas.

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In Agenna (woina dega) expansion of woodland, once again, appeared considerable (3.3% p.a.) and followed by expansion of cropped land (1.14% p.a.) which is attributable to adoption of chat cultivation as a cash crop at the cost of "shrinking" grassland areas at a rate of about 1.0% p.a. Settlements and Jefuer also showed an increase at about 1.3 and 0.18% rate in a year (Figure 4.1b; Table 4.3 & 4.4; Appendix C).

**Table 4.4. RATE OF CHANGE IN SOME LAND-USES**

(% per annum)

| Land use Type | Norcha | Agenna | D. Kar | Over-all   |
|---------------|--------|--------|--------|------------|
| Cropped Area  | 0.88   | 1.14   | 1.23   | 0.73-1     |
| Fallow land   | -1.56  | -      | -      |            |
| Grass land    | -2.36  | -0.99  | -0.41  | -0.69-1.18 |
| Wood land     | 19.9   | 3.3    | 6.4    | 5.45-9.35  |
| Settlement    | 6.01   | 1.3    | 3.3    | 2.26-3.88  |
| Road (Jefuer) | 0.18   | 0.18   | 1.98   | 0.14-0.23  |

Source: Derived from field survey, 1993



Similarly, expansion of woodland again observed very important in dega (Norcha), as much as about 12% per annum. Settlements, Jefuer and cultivated land increased at about 3.3., 2.0 and 1.2% in a year during the last 36 years. The expansion were at the expense of grasslands (Figure 4.1c; Table 4.3 & 4.4.; Appendix C).

Thus, generally rate of expansion of cultivated land and woodland appeared the greatest in Dubissan karsa (kolla) and Norcha (dega) respectively (Table 4.4). The rate of increase of cropped area tended to increase towards kolla because there is relatively more land as pastures which could be reclaimed for cultivation as well as planting eucalyptus trees. In most cases, land-use types other than grazing areas, expanded at the cost of grasslands and the possibility of agricultural land expansion appears so marginal in upper dega zone where population pressure is felt more.

#### 4.3.2. DYNAMICS OF LAND-USE/LAND COVER

Land-use land cover is dynamic in nature. The land-use and land cover patterns (or land-use system) prevailing in an area together with methods of cultivation lack permanency. Rather, they are "phases in a process of economic development" (Boserup, 1965). Solomon (1992:27) shares same view and reported that changes in land-use land cover patterns are a reflection of the dynamics in socio-economic development and changes in the natural environment. Understanding the process of land-use /land cover changes and identification of the socio-economic parameters would have facilitated the changes and would be helpful to foresee the direction of change in the land-use land cover of an area and hence to formulate policies for the future.

One very notable factor of land-use changes is the demographic condition. Demographic factors-rapid population growth and hence population pressure-play an important influential role in the evolution of the current as well as of the potential land use, as land-use is the product of interaction of man and nature.

In the two weredas and the Sabat-Bet Gurage areas at large population has been growing very fast, so does population pressure. An increase of population number puts additional pressure on land at even to meet the essential subsistence needs including food and domestic fuel. To combat this growing demand requires increasing of production which can be made possible either through increasing the productivity of existing lands or through expansion of area.

However, taking into account of the traditional nature of enst-based Gurages' agricultural system, low level of technological development, and the inadequate network of extension and input services, the possibilities of increasing production appear to be possible only by expanding cultivated area. This has put forth new demands on land. Hence, the 26.2% expansion of cropped area in the three PAs (zones) in the last 21/36 years can be partly attributed to increasing population pressure.

Increased population pressure and the resultant rapid reduction in available per capita cropped land and or land holding size is further aggravated by the presence of a large number of livestock. Since other land which can be easily brought under cultivation is the grazing land, land available for grazing is sure to be squeezed as it is true of the study PAs (from 1276 hectares (40%) in 1957/72 to 961 hectares (30%) in 1993) (Table 4.3; Figure 4.10; Appendix C).

The other possible effect of increasing population pressure is the additional demand

for domestic fuel and wood's need for construction of additional farm house(s), fences, etc. This, in turn, necessitated the expansion of eucalyptus tree lots by about 196.3% in the last 21/36 years.

The laying down of motorable all-weather road network in the region in late 1960's has also contributed significantly in changing the land-use/land cover patterns of the area. These roads not only facilitated the quick intra-sub regional movement of people and farm inputs and outputs within the region but also opened the Sabat-Bet Gurageland to most other parts of Ethiopia, Addis Ababa in specific. Hence, the volume of exports of cash crops such as chat, coffee, orange and most recently, eucalyptus woods and surplus kocho and other products of enset increased. Such circumstances induce specialization depending on best suited environments for different cash crops. As such eucalyptus plantations and orchards of oranges and areas under chat have increased.

The ever increasing needs for cash to pay government and other taxes as well as to satisfy own house-hold needs and social requirements resulted in growing cash crops such as chat, coffee, orange, etc. including eucalyptus trees which has attracted more attention as source of cash since about 5 to 7 years back. The introduction of new cash crops were facilitated by migrant Gurages who had a better exposure to cash economy and cash crops outside the Gurage areas. For instance, the introduction of Bahirzaf (eucalyptus tree) in to the Gurage areas owes to Gurage labour migrants who were involved in planting same tree plant in and around Addis Ababa (Horvath, 1968).

Moreover, changes in demand pattern due to growth of urbanization within and outside of the Gurageland can be another possible influential factor which facilitated the introduction of cash crops to the region and export of their surplus products to urban centres particularly

to Addis Ababa. Mention to this extent may be made of chat, kocho and orange other by products of enset, eucalyptus woods, etc.

As population of Addis Ababa and other urban centres, near by, increased, the demand for chat in particular, and kocho as well as eucalyptus wood and others increased considerably. Hence, the Gurage areas, due to its nearness, accessibility and suitable environment emerged as one of the most important supplying regions. Consequently, areas under chat, eucalyptus trees, orange, enset, etc., expanded in the region at the cost of pasture lands.

In the dega zone annual crops are predominant, population density is very high and is growing fast resulting in scarcity of agricultural land. With annual crops, it is difficult to practise double or triple cropping. The only possible way was to reduce the fallow period which now is only one year. As a result of these and other traditional cultivation practices and perceived change in climate, peasants in the region complain of declining agricultural productivity. Consequently, to combat this worsening situation the farmer in dega zone have started cultivating enset even beyond its optimal growing upper altitude limit of 2600 meter a.m. s.l since about last ten years . Thus enset has now already pushed up hill and has "adapted" to the very cold upper most dega zone climate. The people in this part now appear to have well understood the high supporting capacity of enset, its lesser areal coverage and resistance to drought.

These and other socio-economic, demographic and infrastructural factors have made the land-use patterns in the Sabat Bet Gurageland in general and the two weredas in particular dynamic, which is expected to continue in near future as well.

#### 4.3.3. TRENDS IN LAND-USE/LAND COVER BEYOND 1993

Prevailing political instabilities and absence of a clear-cut economic policy pertaining to agrarian restructuring and land tenureship system in the country today, make it difficult to visualize the prospects of socio-economic development and hence restrict the prediction of magnitude and direction of changes in land-use and land cover patterns. Yet, for sure, changes in the land-use system are inevitable.

In dega areas fallowlands are likely to continue to diminish in area due to increasing land scarcity and population pressure. Increased use of fertilizers and expansion of eucalyptus tree lots are also expected. Because of the new trends in eucalyptus wood in urban market its higher prices, and accessibility of most parts of the region to motor transport, there is a prospect of expansion of area under eucalyptus tree lots throughout the region. But the rate of expansion is expected to be greater in the dega zone.

In woina dega and kolla areas the strong land use competition between enset and other shrubby perennial crops such as chat, coffee and orange; between eucalyptus tree lots and grazing area and between pasture land and perennial crops is likely to continue in the near future. Likewise, strong competition will continue between enset and annual crops such as cereals, pulses, etc.; and between annual crops, and grazing area and/or eucalyptus tree lots in dega zone.

The competition between eucalyptus tree lots and grazing lands, however, has emerged the strongest since very recently. This, probably would in turn badly threaten enset production which is the very subsistence base of the Gurage people at least in the two weredas and the Sabat Bet Gurageland.

## CHAPTER FIVE

### FARMING SYSTEM IN EZANA-WOLLENE AND CHEHA

#### 'WEREDAS'

It is noted earlier (chapter one) that farming system is identified and characterized by patterns of cropping and livestock raising and hence by the land-use system of an area. Moreover, farming system is supposed to be characterized by individual functional units of a farm such as farm operations and management including the technology employed and institutional set ups.

In the two weredas and the Sabat Bet Gurage land at large, the Gurages predominantly practice enset-based perennial cropping complemented by livestock raising. This is so in most part of the region except in the upper dega zone where annual crops predominate (See section 5.4.1.1) the crop enterprise while livestock raising remains equally important all over the region.

#### 5.1. LAND TENURE SYSTEM IN RETROSPECT AND PROSPECT

System of land tenure ship influences land-use system, agricultural organization and performance, the interest to improve the quality of agricultural land and its conservation. In the long past, at least before the conquest of Menilik II in 1875, land was basically owned by lineage family in the Sabat-Bet Gurage areas. This was supplemented by Gabar relationship, after 1875. The tenure system was structured into two forms of ownership i.e. corporate which included the grazing and barren lands including serg land upon which

inter and intra-village roads were built and private consisting of homestead fields (Shack, 1966; Ipcar, 1970).

**Table 5.1 PRE-REVOLUTION OR LANDREFORM DISTRIBUTION OF TENANTS AND 'GABARS' BY AGROCLIMATIC ZONES**

| Zone        | Number of Households | Tenants (%) | Partial Tenants (%) | Petty Land owner (Gabars) (%) | Land Lords |
|-------------|----------------------|-------------|---------------------|-------------------------------|------------|
| Dega        | 100                  | 30.2        | 37.2                | 32.6                          | -          |
| Woina Dega  | 126                  | 20.0        | 26.7                | 53.5                          | -          |
| Kolla       | 17                   | 23.5        | 35.3                | 41.2                          | -          |
| All Regions | 243                  | 24.2        | 31.5                | 44.3                          | -          |

Source: Field survey by the author, 1993

Table 5.1. discloses that in the two weredas about 44% of the peasants were petty land propertied (gabar), nearly 32% were partial tenants and about a quarter of them were completely tenants before the 1975 land reform. The few land lords existing in the area have not got a place in the sample. The distribution was more even in dega zone but was dominated by petty land owners in woina dega (53.5%) and kolla (41.2%) before 1975.

The land reform of 1975 abolished tenancy, all sorts of private land ownership and transformed all peasants into usufructory holders by providing the right to cultivate at most 10 hectares of land without the right to lease, transfer, mortgage and rent (PMC: Negarit Gazetta, Proc. No. 31, 1975).

Based on an opinion survey made in the area in connection with land holding system in the future, the following responses were obtained. To the question, whether one wishes the existing government-based ownership of land to continue without or with some changes or completely change, three-fourth of the 235 respondents agreed that the existing system (i.e.



government ownership) should continue without any change. While about 19% responded that the system should continue but with some basic modifications, the rest 6% were inclined to complete change. Accordingly, those who showed the inclination to changes, irrespective of the degree and nature, may account for about 25% of the sample.

As to the kind of modifications and inspired change 36%, 35% and 29% of 97 respondents wished government based land ownership continue with a chance to rent or lease to any person, with a possibility to rent or lease land only to close relatives, and with no chance to rent or lease land to any person, respectively.

On the other hand out of those who were inclined to non-government ownership of land, about 71% preferred private ownership while 29% wished for public or community ownership. Moreover, from amongst those who were inclined towards private ownership, about 36% wished to own land privately with the provision of renting and leasing to any person but sell it only to close relatives while 32% liked private ownership with no possibility of lease, rent and sell; about 28% favoured the ownership with possibility of selling, renting or leasing to any person; and only 5% favoured the ownership with a possibility of only leasing and renting to any one (Table 5.2). It should also be noted that the one which is favoured by 36% respondents, which is the highest in this regard was the one culturally practised by the people who used to own land before the land reform.

**Table 5.2. RESPONSES TO THE KIND OF PRIVATE OWNERSHIP OF LAND (in %).**

| Zone        | with no chance of selling, renting & leasing to any one | With the possibility to sell, rent or lease to any person | With the chance to rent & lease to any but sell only to close relatives | Only with the chance to rent of lease to any person |
|-------------|---------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------|
| 'Dega'      | 35.7                                                    | 20.0                                                      | 44.3                                                                    | -                                                   |
| 'W.Dega'    | 27.7                                                    | 38.5                                                      | 23.1                                                                    | 10.8                                                |
| 'Kolla'     | 33.3                                                    | -                                                         | 66.7                                                                    | -                                                   |
| All Regions | 32.0                                                    | 27.7                                                      | 35.5                                                                    | 5.0                                                 |

Source: Field survey by the author, 1993.

Despite the fact that land is owned by the government and it is illegal to sell or buy land in what ever form, to a question has land been sold or not after the 1975 land reform, about 70 respondents which accounts for about 29% of 237 sample responses reported that some people were selling land or sell land in "surrogate "i.e. by selling whatever crops and structures found on a land. This is practised ofcourse, with an informal understanding with the local governors (AP leaders). Such practise does imply that peasants in the area prefer landholding system with right to sell it.

Furthermore, initially about 75% of the 235 respondents replied that they do not like change in the existing land holding system. Later on, however, when the same respondents were asked a question, which form of private ownership of land they inspire for in the future land holding policy, about 47% of the 177 changed their mind and said they do need change in the existing system (Table 5.2). Hence some vacillated between the "no need change" and "yes change", changed their mind from the "no" to "yes". This may mean that some of the respondents were not at ease in their responses probably because of political threat (as some of the peasants sometimes were interviewed in the presence of local governors) or they (those who were tenants before the land reform of 1975) probably felt that "change" would mean going back to the old system. Nevertheless, the vacillation would imply that there could have been more opinions which favoured the need of change in the landownership system, had the respondents given relatively more free atmosphere to express their views.

It is widely commented that Ethiopia could not produce enough food to feed the population because Ethiopian agriculture is traditional, basically subsistent, lacks market orientation and specialization. The way out from this and modernize the agricultural system is by increasing technological and other inputs which necessities a shift from only subsistence

to diversified agriculture which, in turn, partly involves change in land holding scale from small to large.

The question now is how the transformation can be achieved whether by adopting socialist-oriented cooperative system which failed to succeed in Eastern Europe and even in Ethiopia, or the "free market economy" approach? Most likely both approaches have their roots in the country. Regarding the future rural land holding system the clear picture on national level can emerge only after the finalization of new constitution. However, it can be predicated that if the constitution approves government based ownership and followed by socialist way of rural production organization, one may not expect a better outcome than what the country experienced previously.

## **5.2. FARM STRUCTURE**

### **5.2.1. SIZE OF HOLDINGS**

Available size of agricultural land holding considerably influences various attributes and characteristics of a farming system. In the Gurage area onset-based farming is partly attributed to small agricultural land holding coupled with high population concentration (Shack, 1966). As expected crude population density has shown a negative correlation with size of land holding in 1993 at a strength of 0.317 which is tested to be significant at more than 99% level of significance which is a clear indication of declining per capita land holding with a growing population in time.

**Table 5.3. DISTRIBUTION OF SAMPLE HOUSE HOLD BY LAND HOLDING BY AGROCLIMATIC ZONES (1993)**

| Size of holdings (in hect.) | Percent of all Sample House holds |      |           |      |            |      |          |       |
|-----------------------------|-----------------------------------|------|-----------|------|------------|------|----------|-------|
|                             | 'Dega'                            |      | 'W.dega'  |      | 'Kolla'    |      | Over all |       |
|                             | N°                                | (%)  | N°        | (%)  | N°         | (%)  | N°       | (%)   |
| <0.10                       | 1                                 | 1.6  | 0         | -    | 0          | -    | 1        | 0.5   |
| 0.10-0.50                   | 24                                | 39.3 | 35        | 32.4 | 13         | 59.1 | 72       | 37.7  |
| 0.50-1.00                   | 15                                | 24.6 | 36        | 33.3 | 4          | 18.2 | 55       | 28.8  |
| 1.0-1.50                    | 6                                 | 9.8  | 12        | 11.1 | 1          | 4.5  | 19       | 9.9   |
| 1.50-2.0                    | 5                                 | 8.2  | 7         | 6.5  | 1          | 4.5  | 13       | 6.8   |
| 2.0-5.0                     | 8                                 | 13.1 | 17        | 15.7 | 3          | 13.6 | 28       | 14.7  |
| 5.0-7.6                     | 2                                 | 3.3  | 1         | 0.9  | 0          | 0    | 3        | 1.6   |
| Total                       | 61                                | 99.9 | 108       | 99.9 | 22         | 99.9 | 191      | 100.0 |
| Mean                        | 1.23                              |      | 1.21      |      | 0.927      |      | 1.18     |       |
| Median                      | 0.68                              |      | 0.76      |      | 0.44       |      | 0.704    |       |
| Standard Dev.               | 1.41                              |      | 1.19<br>8 |      | 1.11       |      | 1.26     |       |
| Coef. of Var.               | 114%                              |      | 98.7<br>% |      | 119.7<br>% |      | 106%     |       |

Source: Field survey by the author, 1993.

Table 5.3. shows that the average land holding per sample household in the study area is about 1.18 hectare (1993). The median size (this is less affected by values of extreme observations as compared to the mean) however, is 0.704 hectare. At zonal level median holding sizes varied from 0.44 (1.1) in kolla zone to as much as 0.76 (1.21) hectares in woina dega and 0.63 (1.23) hectares in dega area (values given in parentheses are averages). The land holding in kolla zone including lower woina dega did not take into account the wide open grazing areas which are communally used. Otherwise, the pattern would have been considerably different.

Furthermore, land holding of about 68% of the house holds is below one hectare while the 16.3% is more than two hectares. Holding diminution appears more prevalent in dega and kolla zones where about 70% and 76% of the house- holds have holdings less than one hectare respectively. In woina dega, however, only 65% households have holdings less than one hectare (Table 5.3). Since communal grazing areas are not included in computation, in case of kolla, the problem may not appear that much serious.

### CHANGE IN THE SIZE OF LAND HOLDINGS

It was disclosed in chapter two that population in the region was growing fast resulting in continuous decline in per capita land holding as is shown in Table 5.4. As revealed in the table, in response to increasing population size, median land holding size per household for the region shrunk by about 0.08 hectare in the last nineteen years. It decreased from 0.78 hectare in 1974/75 to about 0.704 in 1993. Moreover, the rate of change in the median size of holdings has been more pronounced in the dega zone 0.41 hectare which for woina dega and kolla were recording a drop of only 0.02 and 0.03 hectare respectively (Table 5.4)! The decline, however, showed the tendency to increase with altitude.

**Table 5.4. MEDIAN AND AVERAGE SIZE OF LAND HOLDINGS (Ha)**  
(1974-1993)

| Zone         | Just Before the<br>1975 land Reform |      | After the Land Reform |      |        |       |
|--------------|-------------------------------------|------|-----------------------|------|--------|-------|
|              |                                     |      | 1982/83               |      | 1993   |       |
|              | Median                              | Mean | Median                | Mean | Median | Mean  |
| 'Dega'       | 1.04                                | 1.53 | 0.68                  | 1.14 | 0.68   | 1.23  |
| 'Woina Dega' | 0.78                                | 1.12 | 0.76                  | 1.1  | 0.76   | 1.21  |
| 'Kolla'      | 0.47                                | 1.1  | 0.44                  | 0.9  | 0.44   | 0.927 |
| All Zones    | 0.78                                | 1.08 | 0.70                  | 1.09 | 0.704  | 1.13  |
| Coeff of Var | 196.2%                              |      | 122.2%                |      | 128.7% |       |

Source: Field survey by the author, 1993.

In view of spatial equity and assuming other things remain constant, the distribution of land holdings amongst sample households showed a deviation of 1.26 hectare from the mean holding size for all three agroclimatic zones in 1993. The overall relative variation of it, hence, was about 106% while in kolla zone land holding sizes appeared more varied (119.7%) than in dega and woina dega, 114% and 98.7% respectively. Then, it appears evident that there is lack of equity in land holdings and yet the inequity is most accentuated in kolla and dega zones (Table 5.3).

Needless to say, land holding distribution relatively was more unfair, in other words, land was much concentrated in the hands of a few before the 1975 land reform. The relative variation in the holdings was to the extent of 196.2% in the pre-reform period, which now dropped to 128.7% in 1993 and 122.2% 1982/83) (Table 5.4). Hence, probably as a result of the 1975 land reform and land redistribution in the area the spatial inequity, in connection with land holding size variation, slightly tended to decline.



### 5.2.2. LAND FRAGMENTATION AND DISTANCE TO DIFFERENT PARCELS

In Ethiopia, heterogenous resource endowments resulting from high altitudinal variation and topographic diversity together with high population pressure, long history of land occupancy and inheritance law must be responsible for fragmentation of land holdings. In the study area, however, in spite of heterogeneity in resource bases, very high population pressure and small land holdings of the households, the problem of land parcellation is mild and even a rare case. Only less than a quarter of the 243 sample households reported more than one parcels. This may be attributable to the nature and evolution of Gurage settlement and the *enset* culture.

In most part of the Sabat Bet Gurageland's the *enset* farms, homesteads and livestock are inseparable. *Enset* farms, to a large extent depend upon animal dung which can be made available easily when the homestead is located nearby. Therefore, the risk of land fragmentation or the possibility of possessing more than one plot is reduced. This is well supported by responses of the 75% respondents which reported that they have only one compact plot (cf. 40% for Ethiopia). About 13%, 7% and less than 1% of the 243 sample households reported that they have 2, 3 and 4 parcels of lands respectively in 1993. Land fragmentation, though not serious problem in the area, is relatively more common in the upper *dega* zone where annual crop production dominates and population pressure is also high.

Consequent to the rather low degree of fragmentation and location of plots is nearby to the homesteads and the average walking distance from homestead to field was reported to be only 5 minutes.



### 5.3. FARM INPUTS: LABOUR, WORK ANIMAL POWER, MANURE AND FERTILIZER, AND FARM IMPLEMENTS

#### 5.3.1. HUMAN LABOUR SUPPLY AND PARTICIPATION

In the Sabat-Bet Gurage areas, family labour is the basis of farm operation. But to some degree, ploughing and/or hoeing, transplanting and decorticating of enset at harvest and few others may be made by voluntary labour groups whose members come from an immediate and close neighbouring homesteads.

Almost all members of a household, unless one is too young (less than 7 years) or too old (more than 70 years), or is away for schooling or as labour migrant, participate in agricultural production or other subordinate operations of a farm such as child rearing, fetching water and fuel wood, house hold chores, etc.

Although there is no strict specialized distinction of members for various household and agricultural activities a sort of fair division of labour is observable based on age and sex differentials. The division, however, diffuses from one group to another. Accordingly, in the enset, chat and coffee dominant areas of woina dega and kolla zones (lower dega may be included), adult men are primarily engaged with ploughing and hoeing perennial crop fields, weeding and harvesting, cutting grass to feed cattle, and fetching fire woods.

Furthermore, adult men herd cattle and collect animal dung and distribute it to enset and other crops in the absence of able bodied sons, daughters and relatives, etc. i.e. household members other than the wife. In addition to these, men in dega also engage in land preparation, seed broad-casting and harvesting of annual crops grown in that part.

Participation of wives including all able adult women, though confined to enset harvest and processing, collecting manure, preparing food and fetching water. Their job inconnection with the processing of enset-which starts from decorticating and passes through fermenting and storing it in a ground pit and then preparing wesa (kocho) (baking bread from fermented enset), and collecting manure are back-breaking and painful duties which consume most of their time. They also engage themselves in routine domestic chores and marketing activities. Hence their contribution, regardless of zonal variation, is very important and it may be said that women are the back-bone of a house-hold economy in the region.

Very young members who are in their late childhood contribute to the house-hold economy by herding cattle fetching water and other lesser laborious jobs. Those who are in their teens, however, because they are immediate successors of their parents, girls inparticular, work in the field of their mothers and involve in collecting animal dung, preparing the wesa bread, fetching water and take parts in decorticating and processing enset particularly in their late teen ages. On the otherhand, boys in the later half of their teens in specific provide helps to thier father, in all fields. The degree of help, however, generally increases with their age.

According to the present survey, weighted labour force per household averages to 2.9 ranging from 1.0 to a maximum of 6.5. But the number of agricultural workers in the age-group 15 to 59 (unweighted) equals to about 3.2 per household (Table 5.5.).

Table 5.5. AVAILABLE WEIGHTED<sup>15</sup> LABOUR FORCE PER HOUSE  
HOLD

| PA/Zone                 | Labour Force per Household |            |            | Range |      |
|-------------------------|----------------------------|------------|------------|-------|------|
|                         | Male                       | Female     | Total      | Min.  | Max  |
| Norcha                  | 1.93                       | 1.34       | 3.27       | 1.5   | 5.0  |
| Kokera                  | 1.51                       | 1.06       | 2.57       | 1.5   | 4.5  |
| Ketane                  | 2.00                       | 1.29       | 3.29       | 1.75  | 6.5  |
| Cheza sefer             | 2.04                       | 1.53       | 3.57       | 2.25  | 5.25 |
| 'Dega' average          | 1.87 (1.81)                | 1.31(1.51) | 3.18(3.4)  | 1.5   | 6.5  |
| Muttana W.              | 1.34                       | 1.35       | 2.69       | 1.25  | 5.0  |
| Darcha                  | 1.65                       | 1.13       | 2.78       | 1.0   | 5.5  |
| Agenna                  | 1.18                       | 1.05       | 2.23       | 1.0   | 3.0  |
| Sisse                   | 1.65                       | 1.40       | 3.05       | 1.75  | 5.5  |
| Emdeber                 | 1.66                       | 1.14       | 2.8        | 1.0   | 5.25 |
| 'Woina dega' ave.       | 1.5(1.67)                  | 1.21(1.64) | 2.71(3.31) | 1.0   | 5.5  |
| Dubissana Karsa/'Kolla' | 1.52(1.17)                 | 1.23(1.71) | 2.75(1.88) | 1.25  | 5.5  |
| Grand Total             | 1.63(1.55)                 | 1.25(1.65) | 2.88(3.2)  | 1.0   | 6.5  |

Source: Field survey by the author, 1993

(Figures in parentheses refer to unweighted number of agricultural workers from age group 15-59 in one house hold).

Table 5.5. also shows that the distribution of weighted man power show regional variations based on sex. Therefore, it appears that there is high concentration of labour force as much as 3.2 (3.4) in dega zone in contrast to about 2.8 (2.9) and 2.7 (3.3.) in kolla and woina dega zones, respectively . Minimum and maximum values in the study area vary from 1.0 to 5.5 in woina dega and 1.5 to 6.5 in dega areas.

As noted in the preceeding paragraphs, the contribution of women in the region's

<sup>15</sup> Based on an assumption that most members of a farm household contribute to the house hold farm economy, agricultural labour force of the region was determined based on age and sex differentials according to the following weights = Adult men of age 20 to 50 years = 1.0; women of age 20 to 50 = 0.75; both sex of age 8 to 15 = 0.25; all age group of 16 to 19 = 0.5; adults of age 51-65 = 0.75; and beyond 65 years (both sex) = negligible. Age group below 8 is also considered negligible.

enset-based farming system is probably one of the highest in Ethiopia. Female labour accounts for about 43.4% of the total in the region. Their contribution is more than 45% in kolla and woina dega while it is only 41.2% in dega zone (Table 5.5).

Nonetheless, it should be born in mind that since males predominate the seasonal labour out-migrants the contribution of female labour in the region's agricultural activity is likely to be more than what is given in Table 5.5. Otherwise, the average number of workers per house hold (see values in parentheses in Table 5.5.) tends to increase with increasing altitude following patterns of population density.

### 5.3.2. DRAUGHT POWER

An assessment was made with regard to animal power utilization and ownership of oxen in the region on the basis of sample. Because the region is largely an area of perennial crops, animal power (oxen power) is rarely used for main agricultural activities except in the middle and upper dega zones where grains cultivation is predominant. In woina dega and kolla zones, nearly all farm activities are performed by man power. Equines are little utilized for agricultural activities. Horses are extensively used to transport people, and surplus and marketable agricultural products etc.

Accordingly, only 19% of the peasants, in the sample households reported the use of oxen to prepare land for cultivation.

**Table 5.6. DISTRIBUTION OF OXEN IN THE SAMPLE HOUSEHOLDS OF THE TEN PAs**

| PA/Zone                | Number of oxen owned |          | No. of Oxen owned on the average per house ha | Percent of household owned oxen to prepare land |
|------------------------|----------------------|----------|-----------------------------------------------|-------------------------------------------------|
|                        | No Oxen              | One Ox   |                                               |                                                 |
| Norcha                 | 5 (28)               | 13(72)   | 1.0                                           | 86                                              |
| Kokera                 | 12(54.5)             | 10(45.5) | 0.8                                           | 61                                              |
| Ketane                 | 13(65)               | 7(35)    | 0.6                                           | 30                                              |
| Cheza Sefer            | 21(84)               | 4(16)    | 0.16                                          | 5                                               |
| 'Dega' Total           | 51(60)               | 34(40)   | 0.4                                           | 45                                              |
| Muttana Wera           | 15(100)              | -        | -                                             | 0                                               |
| Darcha                 | 15(88.2)             | 2(11.8)  | 0.41                                          | 23.1                                            |
| Agenna                 | 29(95.2)             | 1(3.3)   | 0.03                                          | 0                                               |
| Sissera Denab          | 20(95.2)             | 1(4.8)   | 0.05                                          | 0                                               |
| Emdeber                | 31(96.9)             | 1(3.1)   | 0.03                                          | 0                                               |
| 'Woina Dega' Total     | 110(95.7)            | 5(4.3)   | 0.04                                          | 3                                               |
| Dubissana K. ('Kolla') | 20(95.2)             | 1(4.8)   | 0.05                                          | 0                                               |
| Grand Total            | 181(81.9)            | 40(18.1) | 0.20                                          | 19                                              |

Source: Field survey by the author, 1993. Figures in parentheses are in percent.

The number of oxen owned in the sample households is very low, no one farmer reported owning pair of oxen. Entirely there were only 40 oxen in the 243 sample households of which 34 oxen (85%) were in the dega zone. Nearly 82% of the farmers reported that they do not use oxen while in dega zone, and in Norcha and Kokera PAs 45, 86 and 61% of the peasants use oxen to prepare land respectively. Accordingly, there was much less than an ox for the region per house hold but atleast one ox in upper dega PAs (Table 5.6). This is due to the fact that oxen are needed in dega zone to prepare land and for traction, threshing, etc. In the other two zones oxen are only needed for sacrificing during 'maskal'

and other festivals. Hence there are very few oxen in these zones.

### 5.3.3. METHODS OF REPLENISHING SOIL FERTILITY TRADITIONAL & MODERN

The pivot of every farming system is the technique employed to restore soil fertility because no agricultural system can flourish effectively on an impoverished soil (Benneh, 1972). In spite of regional variation, all methods of restoring soil fertility i.e. fallowing, use of fertilizers and manure, crop rotation and inter-cropping are practised in enset growing regions and in Ethiopia at large, (Smeds, 1955; Shack, 1966; Taye Bezuneh, 1966; Olmsteads, n.d.; Benneh, 1972; Westphal, 1975; Amare, 1975).

#### APPLICATION OF MANURE

Since enset crop is heavy, bulky and permanently occupies a given space for a number of years, it requires an extensive use of manure to maintain the sustainability of the soil. Hence, it is widely practised in the area under study as also being the same in the 'other weredas of Sabat-Bet Gurageland.

As is evident from Table 5.7, 36.6 quintals of animal dung or manure on an average is applied per hectare of cultivated land in the study area in 1992/93. The amount of manure collected averaged to 194 quintals per house hold in a year. On zonal level, the application per hectare of cropped area did not show much variation (38.5 quintals/ha. in kolla, 36.3 in w.dega and 35.2 quintals in dega zone). But significant variation was observed on PA level where it ranges from 50 quintals per annum in kokera PA to as low as 19.7 quintals per

hectare in Darcha PA. Seasonally, the keremt season accounted for 59%.

**Table 5.7. PATTERN OF MANURE SUPPLY<sup>16</sup> 1992/93**

| PA/Zone             | Amount in quintals per hect. of cultivated land |             |       |
|---------------------|-------------------------------------------------|-------------|-------|
|                     | Wet Season                                      | Dry Seasons | Total |
| Norcha              | 18.2                                            | 13.4        | 31.4  |
| Kokera              | 29.3                                            | 20.7        | 50.0  |
| Ketane              | 16.5                                            | 13.0        | 29.5  |
| Cheza Sefer         | 17.0                                            | 12.5        | 29.5  |
| 'Dega' Total        | 20.3                                            | 14.9        | 35.2  |
| Muttan Wera         | 16.3                                            | 12.4        | 28.7  |
| Darcha              | 12.1                                            | 7.6         | 19.7  |
| Agenna              | 23.1                                            | 10.0        | 33.1  |
| Sissena D.          | 15.8                                            | 10.9        | 26.7  |
| Emdeber             | 19.3                                            | 17.0        | 36.3  |
| 'Woina Dega' Total  | 21.7                                            | 14.5        | 36.2  |
| Dubissan K./'Kolla' | 22.5                                            | 16.0        | 38.5  |
| Grand Total         | 21.5                                            | 15.1        | 36.6  |

Source: Field survey by the author, 1993.

The assessment made in connection with the distribution of manure to different crops in the study area showed that about three-fourth of the manure collected from each homestead goes to enset crops while potato/taro and vegetables, chat, and coffee get about 10%, 8% and 2.1% of the total respectively (Table 5.8).

In all the agroclimatic zones, the largest share goes to enset. Potato and cabbage (25%) in dega, coffee (19%) in kolla and chat (12.3%) in woina dega stand as the second

<sup>16</sup> Animal dung is collected in the Gurage areas using a strecker-like simple tool referred to as Matrashye. One Matrashye manure was measured to be equal to 70kg. On the average.



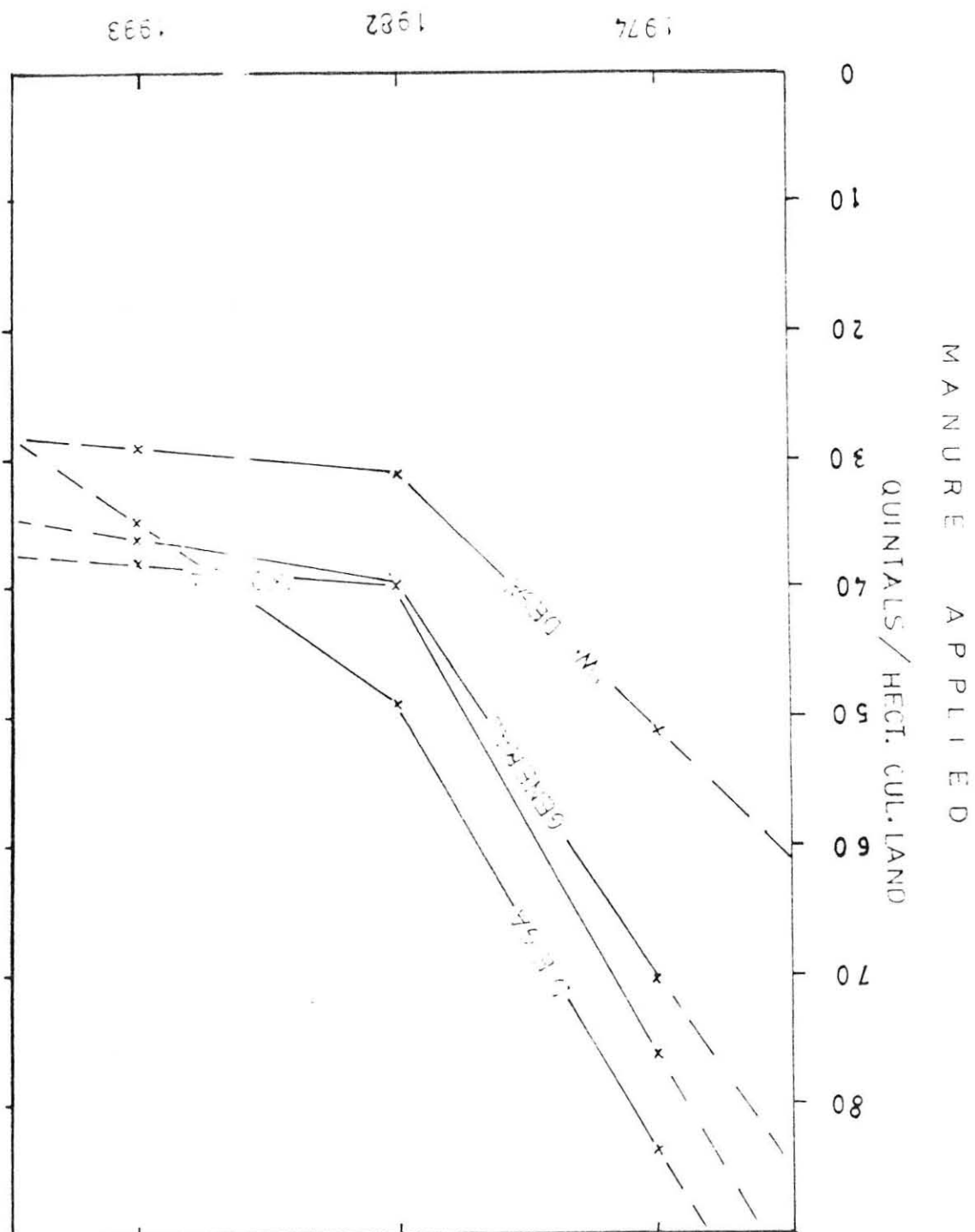
largest consumers in different zones (Table 5.8). Although not reported by many respondents, the interviews with the elders of the community and PA leaders in dega zone revealed that a good portion of animal dung specially in Norcha PA utilized as fuel during dry months. It is this PA that more than 50% of the manure is used for potato and vegetables. The relative share of manure in Norcha and Kokera to enset is low because of its low concentration.

**Table 5.8. DISTRIBUTION OF MANURE APPLIED AMONGST CROPS IN 1992/93 (IN %)**

| PA/Zone             | Enset | Chat | Potato & & Veg. | Coffee | Grains |
|---------------------|-------|------|-----------------|--------|--------|
| Norcha              | 25.6  | -    | 50.6            | -      | 18.3   |
| Kokera              | 55.5  | -    | 37.6            | -      | 7.9    |
| Ketane              | 76.0  | -    | 14.0            | -      | 5.0    |
| Cheza S.            | 85.1  | 6.6  | 1.8             | 1.9    | 1.3    |
| 'Dega' Total        | 63.4  | 0.1  | 25.0            | 0.6    | 6.9    |
| Muttana W.          | 78.5  | 14.8 | 1.1             | 5.6    | -      |
| Dercha              | 78.5  | 10.3 | 0.6             | 11.8   | -      |
| Agenna              | 80.2  | 19.8 | -               | -      | -      |
| Sisse               | 76.4  | 7.2  | 2.1             | 13.0   | -      |
| Emdebir             | 78.6  | 9.7  | 0.4             | 11.1   | -      |
| 'Woina Dega' Total  | 78.8  | 12.3 | 0.8             | 8.0    | -      |
| Dubissana K/'Kolla' | 75.5  | 6.5  | 0.6             | 19.2   | -      |
| Grand Total         | 72.7  | 8.0  | 10.0            | 21.    | 2.6    |

Assessment of temporal pattern of amount of manure collected and applied in the last 19 years showed a drop of about 50% (Figure 5.1.). The supply was about 70 quintals per hectare of cropped area in 1974/75 which decreased to about 36.6 in 1992/93 in the study area. It also showed variation on zonal level as well as a general trend of decline. But the decline was more in dega (83 quintals per hectare of cropped area in 1974/75 to only 35 in 1992/93) and kolla (from 76 in 1974/75 to 38 quintal per hectare of cropped area in 1992/93) than in woina dega zone in from 51 in 1974/75 to 29 quintals per hectare of cultivated land in 1992/93). This may be attributed to the observed change in land use, as cropped land area

FIGURE 5.1 TEMPORAL PATTERN OF MANURE  
APPLIED (1974-'93)



increased in the period share of manure to each hectare of cultivated land is expected to decline. Moreover, the land use showed "squeezing" of grazing area because of expanding crop land and wood land. It was also observed that cattle population decreased (see section 5.6.3) which ultimately resulted in a drop in the amount to be collected. In kolla zone, however, the drop is further to lowered cattle population due to cattle diseases which killed most of the cattle peasants had in the last 10 to 15 years. If this trend is allowed to continue, in general, it would strongly endanger enset cultivation and hence the very survival of the people in the area.

### FALLOWING

In areas where agricultural quality of land is degraded due to continuous cultivation and other soil degrading factors, it would be reasonable to practise field rotation (fallowing) as a means of restoring soil fertility. Fallow period could range from less than one to a number of years depending upon the amount of land available in relation to population pressure. Needless to say, however, fallowing is practised only in areas with sufficient cultivable land.

In the sample PAs of kolla and woina dega where cropping pattern is dominated by enset and other perennial crops, it appears that peasants do not practise fallowing whereas, in grain producing regions more specifically in the middle and upper dega zone fallowing is widely practised. But the fallow period is only one year because of scarcity of agricultural land and high population pressure. In Norcha, for example 42% of the land used to be under fallow in 1972, which has dropped to about 28% in 1993 (see Figure 4.1.a).

If the demographic condition of the study area looked indifferent and allowed to continue in the coming couples of years, fallowing system may be discontinued. This may, prove to be very disastrous to the agricultural land and hence food production in the area if the technology and other farm inputs still remain unchanged.

### **CROP ROTATION AND INTER-CROPPING**

Some writers have reported that the Gurages practice crop rotation by way of transplanting enset at different stages (Ipcar, 1970; Westphal, 1975). But crop rotation as applied to non-perennial crops is confined to dega zone only. In this zone cereals and pulses are alternately cultivated so that soil fertility may be replenished. Period of crop rotation may not be more than one year interval.

On the other hand, crop rotation is rare in woina dega and kolla zones where perennial crops predominate the cropping pattern, except in transplanting enset. This is due to the fact that crops such as chat, coffee and orange as well as enset occupy an area for a number of years. However, in lower woina dega and kolla zones coffee, chat and orange are intercropped with each other and with enset; maize and taro are also grown inter-cropped with young enses.

### **APPLICATION OF CHEMICAL FERTILIZERS AND IMPROVED SEEDS**

Soil productivity may be improved using chemical fertilizers because fertilizers replenish soil fertility. One of the "lasting" solution in raising agricultural productivity is by increasing fertilizer input. In the study area, however, fertilizer is little used and the application is largely confined to dega zone where grains are cropped.

In dega PAs, out of 71 household respondents 41 reported that they applied fertilizers in 1992/93. The proportion of farmers using fertilizers ranges from 19% in Cheza Sefer, 50% in Norcha, 84% in Ketane to 88% in Kokera. Most of the respondents in all zones reported that they do not apply chemical fertilizer to perennial crops to onset in specific because they do not have the information (extension assistance) concerning the possibility and consequences of applying fertilizers to perennial crops. Moreover, no single respondent from any part reported to have used improved seeds. This once again may be attributable to lack of access to extension services.

#### 5.3.4. FARM IMPLEMENTS

Farm implements used are among major inputs to a farming system and may well influence other farm constituents. One peculiarity of agriculture in Ethiopia is that it is traditional and the technological input is at the lowest level. The situation in the study area and the Sabat Bet Gurageland appears even worse. Farm implements, ingeneral, are simple and archaic, and hence are little supportive.

Some of the farm tools the Gurages use are peculiar to the onset cultivation. As plough and ankassay are the two most important farm tools in cereal cultivation including dengora in Harar region, the Gurages use marsha (a forked tall digging stick) to dig holes for planting and construction, harvesting roots and tubers, transfer onset plants and also utilize in the same manner as a plough to turn the soil of the entire field before or after planting. However, Simoons (n.d) alleged that marsha is less efficient than the ox-drawn plough (20 men with marsha may accomplish as much as one plough man with a pair of oxen). Others include aya (short and forked hoe) utilized to cultivate and or soften lumps of tilled soil inside

ensets or other perennials, tebeche (very big knife) is used to cut roots of enset during harvest; murya (a medium-size knife) is used to cut enset leaves into smaller pieces to feed cattle in the dry months and to smash down muds from and outer covers of enset corm (main root of enset) during harvesting; Zbangiba (circular forked wooden tool) which may be used to pulverize enset corm; matrashye (stretcher) used to collect and move animal dung from farm house to enset and other crops. Plough, yoke and mofer (beam of plough) are also used in dega parts where grains are widely cultivated. Sickle, axes and geso are widely used in most part.

The number of implements owned per house hold, on the average, and the proportion of house hold heads who possess different farm tools is given in Appendix D. Nearly all peasants in the study area owned at least one marasha, about 3.6 sickles and one matrashye. About 95%, 78%, 72% 71% and 70% of the respondents possessed 1.3 axe, 1.2 Zbangiba, one small hoe (aya), 0.8 murya and 1.5 watar (smooth and flat wooden tool on which enset bodies get decorticated), respectively. Moreover about 40% of dega peasants owned one plough, a yoke and a mofer for two household heads.

#### 5.4. CROP AND LIVESTOCK PRODUCTION

Ethiopia is a nation of peasants with primitive farming. Here crop production is integrated with livestock farming. Hence, the agricultural system is of a mixed type. Livestocks are equally important not only being used as source of food and social security but also as important ingredients in farm inputs as source of force and manure used in replenishing soil fertility.

In the study area and the Sabat Bet Guragelands at large, under a given agro-climatic zone, peasants, attempt to grow crops which have the highest agronomic suitability and yields (supporting capacity) but conditioned by food habits and domestic needs, and minimization of risks steaming from crop failure as well as price. It very well corresponds with the statement of Amare (1975) about Ethiopian agricultural system.

#### 5.4.1. CROP PRODUCTION

The Gurages in most part of the study area principally cultivate enset which is the staple crop. But the peasants in the area, as noted earlier, are also mixed cultivators, and they suffice the bulk of their own food supply by cultivating crops as well as breeding livestock. Enset is extensively cultivated in the study area except in the upper most dega parts where barley and legumes are principal crops.

Number of adult ensets owned per house hold and matured ensets harvested as well as enset yield per hectare show zonal variation, and in all cases values tend to decrease towards dega zone due to limitation of temperature. As shown in Table 5.9 the average number of big ensets owned by one peasant is about 228, but it ranges from 233 in woina dega to about 190 in dega (only 53 per household in Norcha PA). Accordingly, the number of ensets harvested per year varies from about 40 in woina dega to about 24 in dega and only 9 in Norcha PA. The average however, is about 34 ensets.

Although very crudely measured, yield of enset (number of enset harvested per hectare of homestead field) on the average is 167 but the range is from about 219 in kolla to as low as 154 in dega areas (Table 5.9) where temperature is low/and adverse to enset growth.



Agricultural crops grown in the study area are zonally determined. Barley, peas, horse beans, cabbage and potato other than enset are the chief products in the colder highlands of dega zone. In spite of hostile climate, enset cultivation expands faster in upper dega zone too. In the kolla zone, enset is the principal production. However, some perennial crops such as coffee, chat, orange and banana are produced to meet cash needs of house holds including taro, maize and gesho for domestic consumption. Although not reported by the sample house holds, the writer observed that some peasants who owned oxen cultivated teff in kolla areas.

**Table 5.9. DISTRIBUTION OF ENSET PRODUCTION**

| PA/Zone               | Number of enses per house-hold |                 | Yield (No. of enses/hect.) |
|-----------------------|--------------------------------|-----------------|----------------------------|
|                       | Owne                           | Harvested/annum |                            |
| Norcha                | 53.0                           | 9               | 200.2                      |
| Kokera                | 101.0                          | 17              | 221.0                      |
| Ketane                | 244.0                          | 29              | 163.0                      |
| Cheza S.              | 362                            | 29              | 133.4                      |
| 'Dega' total          | 190                            | 24              | 154.0                      |
| Muttana W.            | 227                            | 32              | 134.0                      |
| Darcha                | 263                            | 34              | 104.4                      |
| Agenna                | 207                            | 42              | 154.0                      |
| Sissena D.            | 242                            | 53              | 270.0                      |
| Emdeber               | 243                            | 38              | 186.2                      |
| 'W.Dega'              | 233                            | 40              | 167.0                      |
| Dubissan K. ('Kolla') | 173                            | 28              | 219.4                      |
| Grand total           | 228                            | 34              | 167.0                      |

Source: Field survey by the author, 1993.

The woina dega zone however is most favourable to the production of enset as well as chat and coffee including orange, banana, gesho, cabbage, etc. However, the latter four are less favoured.

Concludingly, it appears that enset is the major crop in all zones except in upper most dega, followed by barley in dega, chat in woina dega , and coffee in kolla. The third principal production include pulses in mid-dega PAs while cabbage and potato in upper most dega; coffee/orange/in woina dega and chat and orange in kolla zones.

#### 5.4.1.1. CROPLAND AND CROPPING PATTERN

The sample land-use/land-cover surveys of 1993 in Norcha (dega), Agenna (w.dega) and Dubissana Karsa (kolla) showed that cultivated areas were 46%, 25% and 14% of the respective PA area (Table 4.1). On the other hand, cropping pattern which is defined as "the proportion of area under major crops to the cultivated land in an area arranged in descending order of magnitude" (UNDP/FAO, 1986: 4) is shown in Table 5.10.

Assessment of cropping pattern shows that regional cropping pattern is dominated by enset which covers about 61% of total cultivated area of sample house hold in the 10 PAs. This is followed by chat (15.3%), barley (11%), coffee (5.1%), orange (3%), legumes (2.5%), etc. (Table 5.10).

The proportion of area coverage by crops shows variations which of some what lower magnitude on zonal level but it is more pronounced on PA level. The enset ranks first in all zones accounting for 51%, 60% and 66% of croplands respectively in dega, kolla and woina dega. Chat , covering 19.4% and 22% of the area under crop in kolla and woina dega respectively, ranks second but in dega the place is taken by barley with 37% of the area coverage. Thus in the three zones enset and chat/barley accounted for more than four-fifth

or more proportion of cultivated land (Table 5.10). On PA level enset occupies the first place in eight, out of ten PAs, where it covers 54.8% in Ketane to 96.6% in Cheza sefer. Barley predominates the pattern in Norcha and Kokera accounting for about 74% and 43% while it stands good second in Ketane with 33% of areal coverage which lie only in dega zone. Chat stands second in 5 PAs while it is only Sissena Denab PA in woina dega where coffee occupies second position.

The other distinguishing feature of cropping pattern is the extreme dominance of perennial crops which covered nearly 85% of total cropped land in the study area. But the contribution of annual crops is significant and is to the extent of 48% in dega zone (Table 5.10).

**Table 5.10: CROPPING PATTERN IN EZANA WOLLENE AND CHEHA 'WEREDAS'**  
(crops with % of cultivated land according to rank)

|              | 1st      | 2nd      | 3rd      | 4th     | 5th      | 6th      | 7th      | 8th      |
|--------------|----------|----------|----------|---------|----------|----------|----------|----------|
| Norcha       | Ba(74.4) | En(9)    | Pe(6.2)  | Ca(5.5) | Po(3.7)  | Be(0.7)  | -        |          |
| Kokera       | Ba(43.1) | En(38.3) | Pe(8.1)  | Be(5)   | Ca(3.8)  | Po(2.3)  | -        |          |
| Ketane       | En(54.8) | Ba(32.6) | Pe(6.9)  | Be(2.3) | Po(1.8)  | Ca(1.5)  | -        |          |
| Cheza S.     | En(96.6) | Ba(1.6)  | Ch(0.8)  | Po(0.3) | Po(0.3)  | Bo(0.2)  | -        |          |
| 'Dega' Total | En(51.2) | Ba(37.2) | Pe(4.9)  | Ca(2.5) | Po(2.0)  | Be(1.4)  | -        |          |
| Mutta W.     | En(58.6) | Ch(24.4) | Co(9.4)  | Or(7.7) | -        | -        | -        |          |
| Darcha       | En(70.2) | Ch(9.2)  | Or(8.6)  | Co(7.6) | Te(3.5)  | Ma(0.9)  | -        |          |
| Agenna       | En(62.9) | Ch(37.1) | -        | -       | -        | -        | -        |          |
| Sisse D.     | En(65.7) | Co(15.3) | Ch(9.8)  | Or(8.6) | Bn(0.53) | Ma(0.5)  | -        |          |
| Emdeber      | En(81.7) | Ch(15.5) | Co(8.0)  | Or(2.1) | Bn(0.3)  | -        | -        |          |
| W.D.T.       | En(65.9) | Ch(21.9) | Co(6.8)  | Or(4.5) | Te(0.6)  | Ma(0.24) | Bn(0.14) |          |
| D.K./'Kolla' | En(59.7) | Ch(19.4) | Co(11.3) | Bn(3.3) | Ma(1.7)  | Or(1.6)  | Ta(0.64) |          |
| Grand Total  | En(61.1) | Ch(15.3) | Ba(11.0) | Co(5.1) | Or(3.1)  | Pe(1.5)  | Be(1.0)  | Ca(0.74) |

Source: Field survey by the author, 1993

En = enset, Ba = barley, Ch = Chat, Co = coffee, Or = Orange, Pe = peas, Be = beans, Ca = cabbage, Po = potato, Te = teff, Ma = maize, Bn = banana, Ta = taro

#### 5.4.1.2. CHANGES IN CROPPING PATTERN (1974/75 - 1992/93)

The dynamism of cropping pattern is not only disclosed in its spatial variations (Table 5.10) but the pattern also reveals considerable temporal changes in the last 19 years (Table 5.11).

However, enset has remained the most important in the pattern and its dominance has increased during the period. For instance in dega zone enset accounted for only about 25% of all cultivated land in 1974/75. But in 1993 its share increased to as much as 51%. In Norcha PA before 1974/75 enset was either unknown or was insignificant (as small as 3%), but by 1993 its share increased to about 9%. Perennial crops, in general, showed an increasing trend from about 78% (1974/75) to about 85% (1993) for all zones (Table 5.11).

On the other hand, the importance of grains including legumes decreased from about 17% in 1974/75 to 13.5% (1993). Patterns of root crops and vegetables showed similar trend but at different rate. Therefore, it may be safe to conclude that in the cropping patten the share of perennial crops increased probably at the cost of annual crops. But among the perennials, area under coffee recorded a decline probably due to damage caused by "coffee disease" and/or changed climate.

**Table 5.11. CHANGES IN CROPPING PATTERNS**  
(% of cultivated land)

| Zone      | Perennials |       |        |        |            | Grains |              |            | Toot crops     | Vegetables       |
|-----------|------------|-------|--------|--------|------------|--------|--------------|------------|----------------|------------------|
|           | Enset      | Chat  | Coffee | Orange | All Peren. | Barley | Peas & Beans | All Grains | Potatoe/T aroe | Cabbage & others |
| 'Dega'    | 1974/75    |       |        |        |            |        |              |            |                |                  |
|           | 25.2       | 0.03  | -      | -      | 25.24      | 51.4   | 5.51         | 56.92      | 9.26           | 6.8              |
| 'W.'dega' | 66.7       | 21.7  | 8.1    | 3.2    | 99.8       | -      | -            | 0.91       | -              | -                |
| 'Kolla'   | 63.8       | 11.6  | 18.03  | 0.8    | 96.4       | -      | -            | 1.7        | 1.9            | -                |
| All       | 54.5       | 14.6  | 6.64   | 2.07   | 78.03      | 14.84  | 1.59         | 16.6       | 2.7            | 2.0              |
| 'Dega'    | 1982/83    |       |        |        |            |        |              |            |                |                  |
|           | 45.7       | 3.6   | -      | -      | 49.3       | 40.2   | 6.6          | 46.8       | -              | -                |
| 'W.dega'  | 65.6       | 21.4  | 8.5    | 4.4    | 100        | -      | -            | .09        | -              | -                |
| 'Kolla'   | 62.5       | 12.5  | 16.7   | 2.2    | 96.9       | -      | -            | 3.2        | 0.8            | -                |
| All       | 60.0       | 15.2  | 6.85   | 3.1    | 85.4       | 10.6   | 1.8          | 12.7       | 1.07           | 0.86             |
| 'Dega'    | 1993       |       |        |        |            |        |              |            |                |                  |
|           | 51.2       | 0.3   | -      | -      | 51.5       | 37.24  | 6.3          | 43.54      | 2.0            | 2.5              |
| 'W.dega'  | 65.9       | 21.9  | 6.83   | 4.54   | 99.31      | -      | -            | 0.82       | -              | -                |
| 'Kolla'   | 59.7       | 19.43 | 11.3   | 3.3    | 95.34      | -      | -            | 1.7        | 0.64           | -                |
| All       | 61.12      | 15.34 | 5.12   | 3.06   | 85.0       | 11.02  | 1.86         | 13.52      | 0.64           | 0.74             |

Source: Field survey by the author, 1993.

#### 5.4.1.3. CROP COMBINATION

Table 5.10 gives a list of the total number and types of crops grown in the 10 sample PAs. One also can picture out the relative significance of each crop in that areal unit (PA) and then at each agro-climatic zone and regional level. Furthermore, from such cropping patterns crop combinations may be derived, which is a device to show the existing spatial relationship of crops in association with each other in agricultural geography and land utilization (Mandal, 1981: 244).

Although three crops cover more than 87% of the cropland in the region, the dominance of one crop leaves little room to consider crop combination, hence, many PAs can be referred to as monoculture areas. Averaging any combination, here, is just to complete the formality. Thus, on the basis of areal coverage, the study area can be classed as enset-chat-barley region (combination of them).

On PA level, Norcha, Cheza Safer, Darcha, Sissena Denab and Emdeber appeared predominantly as monoculture PAs with the dominance of barley in Norcha and enset in others. But dega and woina dega zones are a two-crop areas. Enset and barley are the two most important crop combinations in dega at large and Kokera and ketane PAs in specific. In woina dega zone, too, a two-crop combination (i.e. enset and chat) is identified at zone level and in Agenna and Muttana Wera PAs, in specific. In Dubissana karsa (i.e. in kolla), however, combination of three crops, enset-chat-coffee, identified.

Needless to say, enset is included in all combinations and in all agro-climatic zones. It is the first ranking in hectarage in all PAs and zone except in Norcha and Kokera, upper most dega, chat ranks second in all non-dega PAs while barley replaces chat in dega PAs.

#### 5.4.1.4. RELATIONSHIP AMONG CROPS

The correlation among the percentages of land devoted to four crops (enset, barley, chat and coffee) was examined at individual farm level. This method enables to examine the degree of variability of crop productions with each individual household at a given point in time and it probably gives information as to which crops farmers are likely to produce simultaneously i.e. crop complements if the association is positive or crop substitutes if the association is negative (Humphreys, 1974).

Farmers in the study area normally seen produce enset in large quantity except in Norcha. Enset and chat show a negative correlation of 0.68 ( $r^2 = 0.47$ ). This is statistically significant at more than 95% level. Hence, it may be said that chat substitutes enset as far as cash need of the peasants is concerned.

In Norcha PA alone barley and enset showed a relatively strong negative association of 0.57 which may imply that barley can be substituted to enset or vis-versa. In dega PAs other than Cheza sefer, however, barley and enset showed positive correlation ( $r$  is weak but statistically significant). Hence, in the areas barley seems to be complementary to enset as a mini-staple crop.

Coffee and chat as cash crops in woina dega and kolla PAs appeared strongly correlated with each other at 0.70 strength and it is statistically significant at 99% level. So they can be regarded as complementary to each other in these zones.

Thus, in upper dega areas it is likely that barley is a substitute of enset. In lower and middle dega zone however, barley simply complements enset. In woina dega and kolla chat and coffee are substitutes to enset in generating income in cash form, while coffee and chat complement each other.



#### 5.4.1.5. CROP SPECIALIZATION AND DIVERSIFICATION

Table 5.12 indicates the mean number of crops cultivated by peasants and the proportion of peasants growing 1, 2, 3,... crops by PA/Zone. The average number of crops grown in the study area ranges from about 2 (Agenna) to 4.7 (Kokera). But the overall average is 3.3 while it is 4.5 in kolla, 3.5 in dega and 3.03 for woina dega (Table 5.12).

It is also recorded in the table that more than half (62%) of the peasants in the sampled woina dega PAs grow up to three crops, while more than (72%) of the farmers in dega grow four or more crops. In kolla 66% the farmers grow five or more crops. At regional level, however, more than four-fifth (82%) of the peasants grow two to four crops which most likely are enset, chat, barley and coffee.

It was noted earlier that the study area in general, was designated as three-crops (see 5.4.1.3.) combination. Nevertheless, about 4 and 5 PAs were identified as monoculture and biculture areas respectively. Furthermore, significant differences among them were also observed in the values of the coefficient of specialization and or diversification (See Table 5.13).

As noted by Bekure (1983: 33-34), the coefficient of specialization (CS) measures the degree of concentration (the level of diversification on the converse) of agricultural activity by comparing the percentage share of individual crops in the area cultivated by a given PA with that of the sampled PAs. Then percentage share of area of a given crop in a PA is subtracted from the percentage share of area of the same crop in the 10 PAs. All positive changes are added and then divided by 100.

Table 5.12 PROPORTION OF PEASANTS GROWING 1,2,3...CROPS

| PA./Zone            | Number of Crops Grown and Number of Peasants Growing a Given No. of crop(s) |          |            |           |           |          | No. of peasants responded | Mean No. of crops |
|---------------------|-----------------------------------------------------------------------------|----------|------------|-----------|-----------|----------|---------------------------|-------------------|
|                     | One crop                                                                    | two crop | three crop | four crop | five crop | six crop |                           |                   |
| Norcha              | -                                                                           | 1(9)     | 3(27.3)    | 5(45.3)   | -         | 21(10.2) | 11                        | 3.9               |
| Kokera              | -                                                                           | -        | 1(6.7)     | 6(40)     | 5(33.3)   | 2(18.2)  | 15                        | 4.7               |
| Ketane              | -                                                                           | 2(12.5)  | 4(25)      | 4(25)     | 3(18.8)   | 3(20)    | 16                        | 4.06              |
| Cheza S.            | 10(41.7)                                                                    | 7(29.1)  | 3(12.5)    | 2(8.3)    | 1(4.1)    | 3(18.8)  | 24                        | 2.2               |
| 'Dega' total        | 10(15.1)                                                                    | 10(15.1) | 11(16.7)   | 17(25.8)  | 9(13.6)   | 1(4.1)   | 66                        | 3.5               |
| Muttana W.          | -                                                                           | 4(23.5)  | 4(23.5)    | 9(52.9)   | -         | 9(13.6)  | 17                        | 3.3               |
| Darcha              | -                                                                           | 2(11.1)  | 6(33.3)    | 10(55.6)  | -         | -        | 18                        | 3.4               |
| Agenna              | 1(3.3)                                                                      | 29(96.7) | -          | -         | -         | -        | 30                        | 2.0               |
| Sissena D.          | -                                                                           | 5(21.7)  | 3(13)      | 12(52.2)  | 3(13)     | -        | 23                        | 3.6               |
| Erndeber            | 1(3.3)                                                                      | 5(16.7)  | 13(43.3)   | 6(20)     | 5(16.7)   | -        | 30                        | 3.3               |
| 'Woina Dega' total  | 2(1.7)                                                                      | 45(38.1) | 26(22)     | 37(31.4)  | 8(6.8)    | -        | 118                       | 3.03              |
| Dubissana k/'kolla' | -                                                                           | 2(9.5)   | 3(14.3)    | 5(23.8)   | 4(19)     | 7(33.3)  | 21                        | 4.5               |
| Grand Total         | 12(5.9)                                                                     | 57(27.8) | 40(19.5)   | 59(28.8)  | 21(10.2)  | 16(7.8)  | 205                       | 3.33              |

Source: Field Survey by the author, 1993.

(Figures in parentheses refers to percentage of peasants of the total growing a given number of crops).

The index of CS ranges between 0 and 1. 0 indicates that cropping pattern in an area corresponds exactly with the base. The higher the values of cs, the higher is the concentration indicating thereby poor level of diversification.

Accordingly, in Norcha, Kokera and Cheza Sefer, and in dega at large coefficient of specialization and/ or crop concentration appears higher while diversification is lower and cropping patten in the area shows more deviation from the regional norm. On the

other hand, PAs in woina dega as well as Dubissana Karssa (kolla) and Emdeber have very low CS values. Therefore, this would imply that cropping pattern in the two agro-climatic zones at large, Dubissana karssa and Emdeber in specific more resembles to that of the regional norm. Moreover, specialization and concentration are lower while diversification is higher than other areas.

**Table 5.13. DIFFERENCE IN PERCENTAGE SHARE OF AREA UNDER CROP IN A PA AND IN THE SAMPLE PAs.**

| PA/Zone          | Enset  | Chat   | Barley | Coffee | Orange | Peas  | Beans | Cabbage | Potato | Coeff. of Sp (CS) |
|------------------|--------|--------|--------|--------|--------|-------|-------|---------|--------|-------------------|
| Norcha           | 52.12  | 15.34  | -63.4  | 5.12   | 3.06   | -4.8  | 0.32  | -4.8    | -3.1   | 0.75              |
| Kokera           | 22.82  | 15.34  | -32.08 | 5.12   | 3.06   | -6.65 | -3.98 | -3.06   | -1.7   | 0.46              |
| Ketane           | 6.32   | 15.34  | -21.58 | 5.12   | 3.06   | -5.45 | -1.28 | -0.76   | -1.2   | 0.30              |
| Cheza S.         | -35.48 | 14.54  | 9.42   | 5.12   | 3.06   | 1.15  | 0.82  | 0.74    | 0.3    | 0.35              |
| 'Dega' total     | 9.92   | 15.34  | -26.22 | 5.12   | 3.06   | -3.45 | -0.38 | -1.76   | -1.4   | 0.33              |
| Mutiana W.       | 2.52   | -9.06  | 11.3   | -4.28  | -4.64  | 1.45  | 1.02  | 0.74    | 0.06   | 0.18              |
| Darcha           | -9.08  | 6.14   | 11.3   | -4.48  | -5.54  | 1.45  | 1.02  | 0.74    | 0.6    | 0.21              |
| Agenna           | -1.78  | -21.76 | 11.3   | 5.12   | 3.06   | 1.45  | 1.02  | 0.74    | 0.6    | 0.23              |
| Sissena D.       | -4.58  | 5.54   | 11.3   | -10.18 | -5.54  | 1.45  | 1.02  | 0.74    | 0.6    | 0.21              |
| Emdeber          | -20.58 | -0.16  | 11.3   | -2.88  | 0.96   | 1.45  | 1.02  | 0.74    | 0.6    | 0.16              |
| 'W.Dega' total   | -4.78  | -6.56  | 11.3   | -1.71  | -1.48  | 1.45  | 1.02  | 0.74    | 0.6    | 0.15              |
| D.Karssa/'Kolla' | 1.42   | -4.09  | 11.3   | -6.18  | 1.45   | 1.45  | 1.02  | 0.74    | 0.6    | 0.17              |
| Average          |        |        |        |        |        |       |       |         |        | 0.30              |

Source: Field survey and calculated by the author, 1993.

CS = Sum of positive changes (differences) divided by 100.

#### 5.4.1.6. CROP CONCENTRATION

While CS measures level of specialization in agricultural activity in a given locality as compared with the regional norm without necessarily indicating the type of crop cultivated, crop concentration (CC), on the other hand, measures the degree to which a given crop is spatially localized (Bekure, 1983: 36).

**Table 5.14 DEGREE OF CROP CONCENTRATION**

| PA/Zone          | Enset | Chat | Barley | Coffee | Orange | Peas | Beans | Potato<br>(Toro) | Cabbage |
|------------------|-------|------|--------|--------|--------|------|-------|------------------|---------|
| Norcha           | 0.023 | -    | 6.8    | -      | -      | 4.3  | 0.7   | 6.2              | 0.74    |
| Kokera           | 0.63  | -    | 3.09   | -      | -      | 5.6  | 4.9   | 3.8              | 0.51    |
| Ketane           | 0.89  | -    | 3.0    | -      | -      | 4.8  | 2.2   | 3.0              | 0.2     |
| Cheza S.         | 1.58  | 0.05 | 1.5    | -      | -      | 0.2  | 0.2   | 5.0              | -       |
| Dega Total       | 0.84  | -    | 3.4    | -      | -      | 3.4  | 1.4   | 3.3              | 0.34    |
| Muttana W.       | 0.96  | 1.6  | -      | 1.8    | 2.5    | -    | -     | -                | -       |
| Darcha           | 1.15  | 0.59 | -      | 1.5    | 2.81   | -    | -     | -                | -       |
| Aganna           | 1.03  | 2.4  | -      | -      | -      | -    | -     | -                | -       |
| Sissena D.       | 1.07  | 0.64 | -      | 3.0    | 2.81   | -    | -     | -                | -       |
| Emdeber          | 1.34  | 1.01 | -      | 1.6    | 0.7    | -    | -     | -                | -       |
| W.Dega total     | 1.08  | 1.43 | -      | 1.3    | 1.50   | -    | -     | -                | -       |
| D.Kanssa (Kolla) | 0.98  | 1.27 | -      | 2.2    | 0.53   | -    | -     | -                | -       |

Source: Field survey and calculated by the author, 1993.

Crop concentration Index (CCI) = [(Area under specific crop in a PA / Area of the crop in all PAs) / (Total field crop area in the PA / Total field crop area in all PAs)]

CCI ranging from:

- 0 to 1 = concentration is insignificant,
- 1 to 2 = low concentration
- 2 to 4 = moderate concentration and
- > 4 = high concentration

Enset which occupies 61% of the total cultivated land of the study area and only about 50% in dega zone appears one of the least spatially limited in the region. However, it is most concentrated (widely grown) in Cheza sefer and Emdeber PAs, and in woina dega zone at large (Table 5.14). The second widely grown crops are chat in woina dega and kolla, and barley in dega accounting for about 20 and 37% of the whole cultivated land in their respective agroclimatic zone. But barley shows the highest concentration in Norcha as well as by Kokera and Katane PAs, and chat in Agenna and Muttana Wera PAs.

Coffee and orange are the third and fourth major crops of the study area but grown mainly in the lower two zones and show a moderate spatial concentration. However, they are most concentrated in Sissena Denab, Muttana Wera, Dercha and Dubissana Karsa PAs (see Table 5.14). Moreover, potato and legumes are almost spatially limited crops in the study area in dega zone in specific. Potato is most widely grown (concentrated) in Norcha while peas and beans in Kokera and Ketane PAs.

#### 5.4.1.7. PROBABLE FACTORS EFFECTING CHANGES IN CROPPING PATTERN

So far attempts were made to show some of the spatial characteristics of the traditional peasant agriculture and changes in the cropping patterns in the study area. But, what are the factors which are responsible for the changes observed in the cropping pattern?

Based on Collins (1972) reasoning, it may be generalized that the traditional farming system and its spatial characteristics in the area are the complex balance between physical and socio-economic and cultural factors, and/or between practices which have

evolved over time and trial and error to meet subsistence priorities.

Among the physical factors such as climate, soil, altitude and relief conditions are supposed to be important in shaping the spatial patterns of farming system in the study area. Temperature which together with an amount of rainfall defines the upper and lower limits of the optimal growth range of crops. Therefore variation in climate, from kolla (tropical) to dega (temperate), in the study area influenced the patterns of cropping. In dega PAs, grains in general and barley in particular predominate while in woina dega which is most ideal zone, enset cultivation dominates the cropping pattern followed by chat. In kolla areas coffee, chat, maize and teff becomes important though enset still dominates the pattern.

In the Ethiopian context, altitude generally explains variation in climate other than natural variables like soil condition and relief situation. Therefore, cropping patterns tend to change with altitude in the study area. Enset, chat and coffee best flourish on nitosols (red soils) hence, nitosols are intensively cultivated. Vertisols (black soils), on the other hand, because of drainage problem often are left for grazing and/or used to cultivate grains such as barley, peas, beans, teff, etc., in either dega or kolla sections.

On the other hand, population density, food habits, land scarcity, increasing needs for cash and the development of road networks, etc are important human factors which have significantly influenced the spatial characteristics of the traditional farming system in the study area.

Because the region is a densely populated one leading to chronic shortage of cultivable land, the inhabitants have no option but to cultivate enset and use it as a staple crop. This is due to the fact that enset requires relatively small area but has one of the highest agronomic yield which enables it to support more population. The people in the area are well known kocho eaters. Hence the cropping pattern is influenced accordingly.

The dominance of enset is still continuing opening of the area to the other parts of the country and resulting in interaction with people from outside since the second half of 1960s with the development of road networks, the need and aspirations of the people are highly effected. This enhanced their cash requirements and also to pay government taxes. This particular aspect is more responsible for changing the subsistence kocho/enset culture into mixed farming which can satisfy the needs for cash. Traditional source of cash had been livestock but not chat, banana, orange, etc. which are making their impact on the land use patterns, resulting in significant changes in the cropping pattern.

### 5.5. THE GURAGES AND THE ENSET CULTURE

*Ensete ventricosum*, the Gurage name for asat, the versatile plant, is the most widely grown crop for food, fibre, medical purposes, etc. It is the most important carbohydrate staple and co-staple crop estimated to cover about 132,834 hectare and gives support to about 20% (10-15 million) of the Ethiopian population (Terefe Belachew, 1993, Seifu Gebremariam, 1993). Moreover, rural Gurages in the Sabat Bet Gurageland, at large and the study area in particular, largely get support from enset. In the study area, it covers about 61% (the range is from 51% in dega to about 65% in woina dega) of the cultivated land) and is the chief source of food. It forms the sole-staple crop except in the upper dega zones where barley, peas and bean complement it.

By way of emphasizing the high supporting capacity and versatility of enset, the Gurages refer enset to as "Yafeya Guardara", meaning the base support of life. The rural Gurages and their socio economic activities rest upon enset which satisfies many of their essential needs (see section 5.5.5). Savard (1970), in the same line, asserts that the economic, political, social and ritual practices of the people in the Gurage areas have their



roots in the cultivation of enset. Regardless of minor differences, enset cultivation dominates the mode of thought and the socio-economic and cultural life of the people to the extent that there has emerged an enset culture, unique in Ethiopian land scape. Hence, William Shack (1966) identified the region as one of the prominent "Enset Culture" zone and distinguished the area from any other cultural areas of Ethiopia.

#### 5.5.1. ORIGIN, ADAPTATION AND EXPANSION OF ENSET

Enset is a single stemmed, monocropic perennial, herbaceous and usually large plant. Once enset was botanically considered as member of *Musa*, a banana family, hence was called as "false banana". In 1862 Horarinow made the first attempt to form a distinct new genus of it under the name of *Enset edule*. But it is only after 1947 that Chessman definitely separated the African and a few Asian and Australian *Musa* species to a new genus *Ensete* and hence the name *Ensete verticousum* (Smeds, 1955). *Ensete verticousum* is among the few known species distributed within Africa and Asia, and is the dominant type cultivated for food, fibre and ornamental purposes (Taye Bezuneh, et.al., 1986; Simmonds, N.W., 1958).

As far as the origin of the enset plant is concerned (not its cultivation), though controversial, Smeds (1955) reported that the center of origin of enset plant is in the lowlands located between Uganda and Tanganika (now Tanzania) around the Ruwenzori and in the Kordofan mountains in the Sudan, and around Mts. Meru and Kivu of Tanganika and Rwanda-Brundi, respectively.

With regards to the origin of enset cultivation, however, there is much uncertainty. Different writers came up with different opinions. In his very recent article Steven A. Brandt (1993) reported that the horticultural way of life of hunters or gatherers of the early

Holocene (ca 7-10,000 years ago) was based in part upon the domestication of enset. Stiehler (1948) connected enset cultivation in Ethiopia with the Negritio or Pygmean population who inhabited the southern Ethiopia plateau. But his assertion was rejected by Simoons (1965) based on the argument that the presence of Pygmies in ancient Ethiopia is questionable, and neither the present Negroes of south Ethiopia nor those of the northern part cultivate enset. Rather Simoons (1965) relates enset to the various Cushitic groups among which the Sidamo people are the most likely.

However, Stanley (1966) disagreed with Simoon's (1965) assertions because he argued that it is unlikely that the Sidamos (or the Cushitics) cultivated enset for they are not the most ancient inhabitants of south Ethiopia. Moreover, their traditions do not satisfactorily explain the use of enset. Hence, based upon the results of the German Frobenius Expedition to Ethiopia, Stanley (1966) traced the use of enset back to the Neolithic times or even earlier and related it to some of the present inhabitants of the Bako highlands in Gamo Gofa, the Gimirra and Maji areas, south west Ethiopia, who are assumed to be the survivors of the people who first cultivated enset in Ethiopia (Westphal, 1975).

In connection with adaptation of enset culture by the Gurages, William Shack (1966) reported that "asat is older than the first Gurage...and whosoever created...the Gurageland, provided asat as a blessing to prevent starvation." Hence, it is likely that the Gurages are not the first cultivators of enset. Rather when the Gurages entered the Gurageland, they adopted the system of cultivation and land-use as practised by thier predecessors the Sidamos who supposed to be the indigenous inhabitants of the area, and hence developed a series of traits that are characterstic to the enset culture (Shack, 1966).

Now a days, the enset culture is adapted by numerous ethnic groups settled in and outside the indegionous centres of enset culture (Stanley, 1966) and covers a good part of

Shewa, Gamo-Gofa, Sidamo, Keffa, Illubabor, Wellega and Arsi regions (OCZP, 1987/1988). It appears as a sole and or co-staple food crop to the Gurages, Kembatas, Hadiyas, Wolaytas, Sidamas, Keffas, Gimmiras, Janjeros, Oromos, etc., which account for about 20% of the population of Ethiopia (OCZP, 1987/1988; Seifu, 1993).

Enset cultivation is emerging as one of the strongest competitor in land-use and is continuously encroaching upon annual crop regions of cereals and legumes. Office of the Central Planning Zone (OCPZ) in its "Enset Sebel Tionat" reported that very recently, since the 1985 drought in Ethiopia, many peasants have started growing enset the first time in the region, specially West Shewa (OCZP, 1987/1988).

Furthermore, in the Sabat-Bet Gurageland and the study area enset cultivation has now expanded to even the upper most dega zone (see section 5.4.1.2.). The expansion may be attributed to the relatively high agronomic-yield, high population supporting capacity and the recognition it has deserved as a "drought security-crop". In the light of this and more frequent recurrences of drought risk in Ethiopia, it is likely that enset would get increased recognition as "drought security" and "strategic crop" and will expand further to drought-prone highlands of Ethiopia.

### **5.2.2. ENSET CULTIVATION CYCLE**

Besically, all sorts of crop cultivation, be it annual or perennials, involve "cyclic" patterns; in case of annual crops the period can be of one year in perennial crop like enset in parrticular, the period may be of 10 to 15 years (Table 5.15). Moreover, the cycle in enset cultivation is more continuos and avoids abrupt break unless cultivation is



abandoned. On the contrary, the annual crop cultivation cycle is less continuous, and there is always a "break" in cropping activities when the cycle comes to an end soon after harvest.

#### 5.5.2.1. CROPPING CALENDAR

The chief cropping activities involved in enset cultivation include harvesting, transplanting, cultivation ("plowing" and hoeing), seedlings propagation, weeding and manuring. Agricultural season (Cropping calendar of enset, Figure 5.2) actually begins at harvest because the space needed to continue the cycle of enset cultivation is made available after the mature enset crop is harvested. Otherwise, transplanting of enset at various levels, starting from the lowest to the highest stage (see section 5.5.2.3) stagnates.

Although enset can be harvested in any season depending on the need of the households, mature ensets, in the study area are often harvested soon after the rainy season starting from about mid-October to the end of December and or mid-January at the latest (see Figure 5.2). Enset is harvested at intervals. Each harvest takes two to three hours depending on the number of mature ensets to be harvested. Men and teen age boys, participate in the activity.

The harvest is immediately followed (associated with) processing of enset which involves dectorticating the stem and pulverizing the corm, extracting fiber and squeezing out enset juice from which bula (most favoured enset product) precipitates, and leave it to ferment for about fifteen days so that it becomes wessa, soft and palatable one from which kocho bread is prepared. After fermentation (first stage), the wessa is stored in Yossa guaje, dug pit for wessa storage and further fermentation. Like the crop its processing is also time consuming. Only women and adolescent girls participate in the

processing and making kocho bread and other preparations.

Enset harvest is followed by transplanting of ensets at various stages. Transplanting is the pivot on which the enset cycle revolves. All ensets which have reached each of the four respective stages of transplanting maturity are transplanted to the area of the next higher and successive enset stage (see 5.5. 2.3). This is largely accomplished by men and young boys in their teen-ages starting from about the mid-November to mid-January (Figure 5.2).

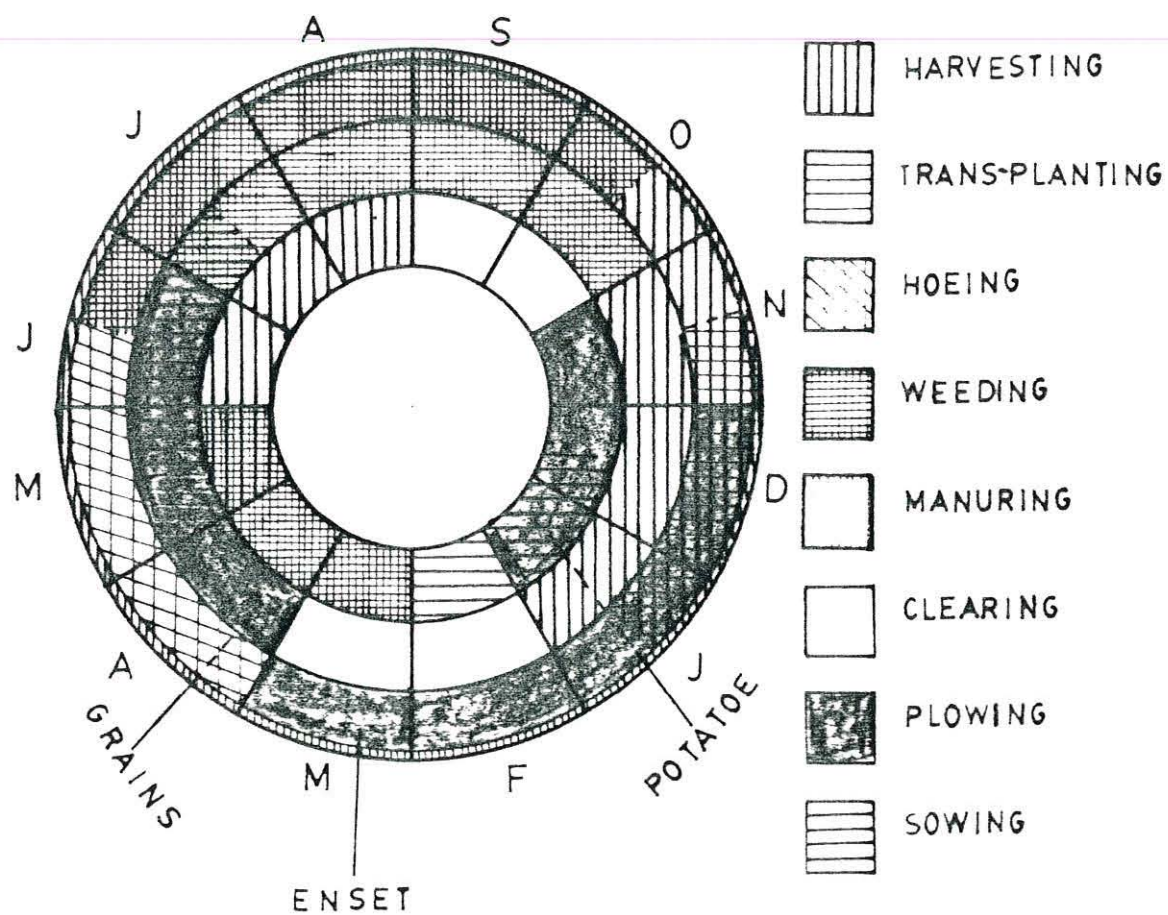
Transplanting is either followed by or associated with enset propagation (not shown as a separate activity in Figure 5.2) which involves the production of enset shoots vegetatively from semi-mature enset of 4 to 6 years old.

Preparation of the soil ("ploughing") inside ensets and other perennials is accomplished mainly using adult male labour employing what the Gurages call marasha and takes place from about the beginning of December until late March. In parts of the woina dega zone such as Agenna, Muttana Wera, Menter, Yegobet, Shebraden etc. Where the soil is hard due to larger content of iron-oxide the soil is further softened and levelled using aya during the time of belg rain from the beginning of April until mid-or late June (Figure 5.2.).

In summer (keremet), what the Gurages refer it to as zar, weeding of enset and other perennial crops is the predominant engagement of men and teen-age boys untill mid-October. Manure is collected and provided to various enset age groups and other perennials including vegetables in different seasons selectively. Moreover, manuring is carried on throughout the year by all able-bodied members of the house hold but more by women and adolescent girls.

In dega zone cropping calendar, in connection with annual crops, show a slightly different pattern (See Figure 5.2.). The agricultural cycle is initiated by clearing farms

FIGURE 5.1 CROPPING CALENDAR OF  
ENSET, GRAINS AND POTATOE/TAROE





in February and March followed by ploughing in the months of April, May and June. Then weeding takes place after sowing from mid May-July) until mid - October, which is followed by activities of harvesting until end of January.

Clearing of farms for potato cultivation takes place in September and October followed by ploughing in November, December and January. Potatoe planting takes place largely in February followed by weeding (hoeing) until end of May, which is followed by harvesting in Zar.

Thus, in dega zone where annual crops (cereals, pulses, root crops and vegetables) are grown together with enset and othe perennials, the crop enterprise and hence the pattern of cropping and cropping calendear should be more complex and the requirement of labour would likely be more than in the middle and lower agro-climatic zones where perennials predominate.

#### 5.5.2.2. ENSET PROPAGATION

Enset may be reproduced either by propagation of seeds or vegetatively. The latter is, however, most commonly practised in most areas of the Sabat Bet Gurageland. The former method is disfavoured because it requires an additonal one to two years of maturation in its stage, no parts of the seed plant can be used as food as the carbohydrates in the stem and leaf sheets are used up during florification and fruitification, and only small number of plants (seed lings) can be produced as compared to 100-200 in the other method (Smeds, 195: 39).

The vegetative method of propagation of enset in the Sabat Bet Gurageland involves first uprooting of 4 to 6 years old semi-mature enset from either hiba or negeneqe (see section 5.5.2.3.). The leaves and roots are pruned and the pseudostem is trimmed at about



15 to 20 centimeter from the corm and is cored and filled with ash and dry manure. In some other places soft crushed stones or soil may be used. Then the 'rhizome' is replanted ("burried") after 3 to 7 days in manured pit close to homesteads. Suckers start sprouting within 4 to 8 weeks , as many as 40 to 200 shoots. The number of suckers sprouting depend on the type and size of enset used for propagation, soil and climate of the locality. The suckers are left in place for about one to two years, then they are transplanted to a second field. This transplanting sets the enset cultivation cycle in motion.

#### **5.5.2.3. DIFFERENT STAGES IN THE CYCLE OF ENSET CULTIVATION**

One most important peculiarity of enset cultivation in Sabat-Bet areas is that it involves four transplantings yearly from one-age group (stage) field to the next higher age group (stage) field.

Enset field is an aggregate of smaller field sizes occupied by plants of 5 to 6 different age groups. It may be broadly divided as "yasat den" (big ensets field) and "Yesmma den" or "Yetebeche meder" (small enset field). Each sub-enset field takes its name from the age of the plants grown from stage one to the last and they are named in increasing succession as fwanfa (range in age 1 to 2 years), mara-summa (may be known as takat in Cheha) (2-4 years old), messere (3-6 years old), neqeneqe (metekia in Cheha, 4-8 years old), heba (5-10 years old), the last to be transplanted to the final stage of asat which stays in one position for 3 to 6 years (see Table 5.15).

Table 5.15. DIFFERENT AGE-GROUPS (STAGES) OF ENSET, MATURITY YEAR(S) AND SPACING OF BIG ENSETs

| PA/Zone       | Spacing<br>(meter) | No. of<br>stages | No. of years each stage takes |           |        |          |      |      | Total<br>maturity yr. |
|---------------|--------------------|------------------|-------------------------------|-----------|--------|----------|------|------|-----------------------|
|               |                    |                  | Pwanfa                        | Marasumma | Mesere | Neqeneqe | Hiba | asat |                       |
| Norcha        |                    | 3.2              | 1.8                           | 2.0       | 2.0    | 2.0      | 2.0  | 6.0  | 15.7                  |
| Kokera        | 2x2                | 4.6              | 2.0                           | 2.0       | 2.0    | 2.0      | 2.0  | 5.3  | 15.2                  |
| Ketane        | -                  | 4.9              | 1.0                           | 2.0       | 2.0    | 2.0      | 2.0  | 6.0  | 15.0                  |
| Cheza S.      | 2x2                | 5.5              | 1.0                           | 2.0       | 2.0    | 1.6      | 1.6  | 5.5  | 13.5                  |
| Dega          | 2x2                | 4.6              | 1.4                           | 2.0       | 2.0    | 2.0      | 2.0  | 5.7  | 14.9                  |
| Mutiana W.    | 2.7x2.7            | 6.0              | 1.5                           | 2.0       | 2.0    | 1.5      | 1.7  | 3.6  | 11.8                  |
| Darcha        | 2.5x2.5            | 6.0              | 1.0                           | 2.0       | 1.7    | 1.4      | 1.6  | 3.8  | 11.3                  |
| Agenna        | 2.7x2.7            | 6.0              | 2.0                           | 1.0       | 1.0    | 2.0      | 2.0  | 3.0  | 11.0                  |
| Sissena D.    | 2.5x2.5            | 6.0              | 1.0                           | 1.5       | 1.3    | 1.4      | 2.0  | 3.0  | 9.8                   |
| Emdebir       | 2.7x2.5            | 5.2              | 1.0                           | 1.4       | 1.4    | 1.0      | 1.2  | 3.8  | 9.1                   |
| Woina D.      | 2.5x2.5            | 5.8              | 1.3                           | 1.6       | 1.5    | 1.5      | 1.7  | 3.4  | 10.4                  |
| D.Karsa/Kolla | 2.75x2.75          | 6.0              | 1.0                           | 1.0       | 2.0    | 1.0      | 1.5  | 3.8  | 10.0                  |
| Grand total   | 2.4x2.4            | 5.5              | 1.3                           | 1.5       | 1.8    | 1.5      | 1.7  | 4.3  | 11.8                  |

Source: Field survey by the author, 1993.

Enset cultivation cycle actually starts with the transplantation of the youngest enset i.e. fwanfa to the field of mara summa which are successively transplanted in to mesere, neqeneqa, heba and, finally into asat . Mesere is transplanted into the pit of transplanted heba and becomes neqemeqe which stays in position for one or two years and attain the status of heba without being transplanted. The heba is transplanted to a pit of harvested mature enset.

### 5.5.3. ZONAL VARIATION IN YEARS OF MATURITY, NUMBER OF STAGES, SPACING AND CLONE DISTRIBUTION

Due to varied ecological potentials of different zones to support enset plants, variations are observed in the number of successive enset stages, maturity duration, clone distribution and spacing of adult enses. Although enset grows as wild plants at an altitude of 1000 meter a.m.s.l. or even lesser in certain parts of the world (humid equatorial zone of Africa), in Ethiopia, its cultivation is confined to the highlands within the altitude range of 1500 to about 3000 meter above sea level (Smeds, 1955; Huffnagel, 1961; Stanley, 1966; Taye B. et. al., 1967; Westphal, 1975; Seifu G.M., 1984). However, Taye Bezuneh and Asrat Feleke (1966) limited the optimal enset growing altitude between 1700 and 2000 meter a.m.s.l. while Seifu G.M. (1984) reported as between 1700 and 2450 meter a.m.s.l. Tolerable temperature limit was confined between 18°C and 28°C by Taye B. et. al (1966) but Westphal (1975) put it between 16 and 20° c. Huffnagel (1961) placed the moisture requirement as evenly distributed mean annual precipitation ranging from 1100 to 1500 mm.

Depending upon local climate, temperature in particular, the number of enset age groups (stages) involving in enset cultivation vary from three in Norcha (Upper dega) to six in most other part of the region (Table 5.15). In upper dega, generally the enset plants are procured from woina dega or warmer dega areas after they have passed second or third stage. The probable reason could be the slower growth rate of enset plants in lower temperature condition as well as retarded accumulation of carbohydrate. So maturity period is extended. In general enset plants become ready for harvest in 11 to 12 years but zonal variation, depending on climate condition pulls the period from 10 years (kolla) to about 15 years (dega).

As to the spacing of adult ensets in the main field is concerned, it is about 2.4 meters between the plants which shows regional variation of 2 meters wide in dega to about 2.57 meters in kolla zone (Table 5.15).

The type of enset clone ("varieties") cultivated are expected to show inter as well as intra regional variation which may be attributed to variations in yield, maturation period, quality of kocho, the use of enset product, and the degree of its resistnace to "bacterial wilt" and othe enset killing diseases. Enset clones (land races) may be identified based on the colour of mid-ribs of pseudostem leafsheats, height of pseudostem leafsheats, height of pseudostem and shape and size of leaves.

According to "Enset Sebel Tinat" (OCZP, 1987/1988) as many as 200 "varieties" were grown in Shewa and Asri regions. Huffnagel (1961) identified about 70 clones in Eastern Gurage. About 195 clones are collected at Areka agricultural research center in Wolayta from various enset growing areas.

In the present study area about 53 "varieties" of different vernacular were reported, 35 each in dega and woina dega, and only 23 in kolla. Nechewe, Yesheraqenqe and Kanchewe clones were found to be common in all zones accounting for about 21 % of the total frequency of occurrence in the region. But, while Ankefuye and Gimbwe are most common in dega parts, Yesheraqenqe and Nechewe dominate the occurrence both in woina dega and kolla zones (see Appendix E). In all zones Guarye, Astara, Kebnar and Dere "varieties" are grown to be used in Gurage pharmacopeia to treat some illnesses and settings of bone fractures, breaks and other body injuries. They are also grown as mere food crops.

The identified enset clones in the study area is given in Appendix E. However, one should borne in mind that the names may not necessarily represent land races which are morphologically distinct, and the names could duplicate.

#### 5.5.5. ECONOMIC VALUES OF ENSET

In spite of its high agricultural productivity, some people argue that enset should be substituted or highly complemented by seed farming because enset has low nutritional value. Would such shift be desirable? The answer to this question should be preceded by an assessment of economic values of enset and its population supporting capacity as compared to cereals and pulses.

Enset is a widely cultivated crop. The rural economy in areas of enset culture largely depends upon enset. Besides, its role as staple food, enset's parts and by products are utilized for several other purposes.

Fibers extracted from the pseudo-stem of ensets are white and strong enough to make high quality ropes from which one can weave mats, baskets, carpets, rugs and even clothes. Dried leaves and pseudo-stems are used to make rope. Ropes made of the former, in particular, are used to fasten materials - house and fence construction - make mats, and the dry leaf ribs may be used to make materess (kapat), pillows, cushions, etc.

Dry pseudo-stems (barks) are also used to make containers, caps, lids of cooking pots, and are indispensable together with raw leaves, for covering and thatching houses, wrapping kocho, chat, honey, tobacco, etc. They are also useful in lining or covering the inside surface of dug pits which are used to store wessa (raw kocho) for a longer period. Most of the parts of enset plant are good fodder for livestock and the leaves, in particular, are often used to feed cattle during the dry-season (abar). Round head piece is constructed from a leaf for carrying heavy head-loads, to form the base-stand for pots and serve as a seat. Leaves are also used as an umbrella during rains. Moreover, enset leaves are cut into small plates (teres) and are used to serve ketcawa, the Gurage national food, at all festivals, marriage feasts, at time of enset planting, etc. They are also used

to cover wessa and even breads during baking.

Furthermore dried barks of both pseudo-stem and leaves are one of the most important source of domestic fuel in time of fuel wood scarcity. In homestead fields ensets provide shades to crops like coffee, chat, taro, orange, etc. against frost and sunshine. Moreover, ensets provide comforts to farm houses and have ornamental values; enset juice is also used as detergent for washing clothes; and reported that "parts of the enset plant are crucial for many Gurage rituals", (Shack, 1966).

Several clones of enset are used in Gurage pharmacopeia, the enset corm (main root), in particular, is used to cure (traditionally) many illness, setting bone fractures and other injured body tissues. It seems there is no end to the possible utility and economic values of enset plant Enset is almost "every thing" to rural Gurages.

In addition to what is noted so far enset is peculiar in that wessa can be stored for about 10 years without getting much spoiled (Liyuwork Zewdie, 1993), and it can be harvested at early stages in case of food shortages. Failure of rain can only retard its growth but "can never kill" it because enset has a large moisture in its pseudo-stem and leaves, hence, it is highly esteemed as "security" against years of poorer rain fall.

Moreover, since enset cultivation largely involves male labour (except manuring and enset processing) only for about six to seven months i.e. during harvest, transplanting, propagation and ploughing/hoeing in the remaining 5 to 6 months are considered as male labour slack season during which they can engage themselves off-farm activities including seasonal labour migration, a "safety value" to the high population pressure problem in the area.

Despite the fact that enset is inferior in its nutritional values as compared to some cereals and pulses, contains only about 200 cal. per 100 gram of "dry" kocho, which is about 60% of the average calorie content of barley or wheat or teff (each containing about



339 cal./100 gram), and contains 0.6 gram protein which again is only 60% of any one of the three crops (Agren, et.al., 1968), its cultivation can be rated as superior to seed farming. Because it can maintain soil fertility through an extensive use of manure and it has a relatively high agronomic yield as much as 40 quintals of dry kocho per hectare which can support more persons than any cereal which has an average yield of 11 quintals per hectare (CSA, 1990).

Assuming a 30 kilogram dry kocho yield from one mature enset (result of 3 yeares survey 1972/73-1974/75 at Emdeber by Teketel Makesso (n.d.) and quoted by Seifu G.M. (1984)), a 0.252 hectare of cropped area (average farm size for the sample house holds), a harvest of 34 mature enses per sample households in a year (from field survey made by the author), a 200 cal. in 100 grams of dry kocho (Agren, et.al., 1968), the total calorie produced from a house hold farm, on the average, would be 2,040,000 cal. ( $200 \text{ cal.} \times 34 \times 30 \times 10$ ). Accordingly, the calorie yield of enset would be 8,095, 238 cal. per hectare.

On the contrary, had enset been replaced by cereals (teff or barley or wheat) with an average yield of 11 quintals at national level (CSA, 1990), 0.252 hectare cropped area and 339 kcal content per 100 gram of grainst (Agren, et.al., 1968), the total colorie produced would have been 939, 708 kcal ( $339 \text{ cal.} \times 1100 \times 0.252 \times 10$ ). Accordingly, the calorie yield would have been only 3,729,000 cal. per hectare. This is only about 46% of calorie yield of enset cultivation.

Thus, on one hectare of enset 8.9-9.5 persons per year can be supported, each consuming about 1169.5 - 1250 gram dry kocho and 2339-2500 cal. per head per day while on cereals the number of persons supported will be only 4.07 - 4.4 per year each consuming 690-737.5 gram of cereals and getting 2339-2500 cal. per head per day. Under such circumstance, the shift from enset to cereal and pulses suggested on the basis enses lower nutritional value, does not appear to be justifiable. Calorie yield of enset per



hectare is more than twice that of cereals and pulses. This is attributable to the high agronomic yield of enset, which is estimated at about 40 quintals dry Kocho per hectare in the study area. Therefore, the assertion that "enset can support more denser population than the seed farming" holds true. Moreover, given the existing high population pressure and land scarcity, substituting enset by cereals and or pulses would not at all be advisable.

## 5.6. LIVESTOCK PRODUCTION

What is most significant but much less appreciated and to some extent should cause concern, is the fact that livestock is the single largest user of land in the country as well as in the study area. A little over one-half of all lands at national level is being used by livestock through grazing and browsing (UNDP/FAO, 1986: 29), while in the study area it accounts for about 30% (Table 4.1.).

In 221 sample house holds of the two weredas there are over 1397 ruminants (equivalent to 827 TLU<sup>17</sup>) and 353 heads of chickens (Table 5.16). Although there is significant variation at PA and hence zonal level, the average livestock size per house hold was 3.8 TLU (6.4 heads) which ranged from 2.2 TLU (3.8 heads) in kolla to as much as 4.7 TLU(8) in dega zones (Table 5.16). Therefore, livestock population appeared to be more concentrated in dega zone where Norcha PA deserves special mention because here the livestock number per household is the highest.

Livestock enterprise in the study area is very important and highly integrated with enset culture (see 5.7). They are the principal wealth of the farmer as well as source of supplementary food, draught power for the farm in dega parts, source of manure, means

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<sup>17</sup> An animal having a liveweight of 250kg. is reckoned as one Tropical Livestock Unit (TLU) = accordingly, 1 head cattle = 0.7979. Sheep = 0.0892; goat = 0.07; horse = 1.3; mule = 0.9; ass = 0.35; oxen = 1.12 (Harris, p., 1989; UNDP/FAO, 1986).

of transport and, though not desirable, people use cattle dung as main source of domestic fuel during the dry season. An opinion survey made confirmed that cattle primarily used as source of food and to use their dung to replenish the fertility of perennial crop farm. The third priority is wealth and social security. In dega however, social security (wealth) was reported more important than rearing up cattle for their manure.

#### **5.6.1. COMPOSITION OF LIVESTOCK POPULATION**

Livestock population in the study area is a mix of various types to meet his various needs as noted in the preceeding paragraph. Cattle are kept as source of food, for manure, the energy for the farm and as the status symbol of wealth. Sheep and goats are reared primarily to meet the cash income needs. Horses, mules and donkeys are kept as pack animals.

Cattle (699 TLU or 1115 heads) constitute by far the largest species among the livestock population in the area accounting for about 85% of the total (Table 5.16). They predominate in all the PAs. Horses account for 11.2% of the total followed by mule (1.7%) and donkeys (0.7%). Small stock like sheep and goats account for 1.5% and 0.3% respectively of the total ruminants.

Table 5.16 LIVESTOCK COMPOSITION, PATTERN AND COMBINATION

| Zone/PA            | Cattle (c) |       |      | Sheep(s) |      |     | Goat (G) |      |     | Horse (H) |      |      | Mule (M) |      |     | Ass(A) |      |     | Total |       | Av.(TLU)<br>P.H.H. | Combination |
|--------------------|------------|-------|------|----------|------|-----|----------|------|-----|-----------|------|------|----------|------|-----|--------|------|-----|-------|-------|--------------------|-------------|
|                    | 1          | 2     | 3    | 1        | 2    | 3   | 1        | 2    | 3   | 1         | 2    | 3    | 1        | 2    | 3   | 1      | 2    | 3   | 1     | 2     |                    |             |
| Norcha             | 102        | 68.9  | 74   | 38       | 3.4  | 3.7 | -        | -    | -   | 16        | 0.8  | 22.2 | -        | -    | -   | -      | -    | -   | 156   | 93.1  | (8.7)<br>5.2       | C-H-S       |
| Kokera             | 96         | 63.7  | 67.8 | 47       | 4.2  | 4.5 | -        | -    | -   | 19        | 24.7 | 26.2 | -        | -    | -   | 4      | 1.4  | 1.5 | 166   | 94    | (7.5)<br>4.3       | C-H-S-A     |
| Ketane             | 99         | 64.0  | 71.4 | 31       | 2.8  | 3.1 | -        | -    | -   | 17        | 22.1 | 24.7 | -        | -    | -   | 2      | 0.7  | 0.9 | 149   | 89.6  | (7.5)<br>4.5       | C-H-S-A     |
| Cheza S.           | 154        | 93.9  | 76.8 | 24       | 2.1  | 1.7 | 5        | 0.4  | 0.3 | 19        | 24.7 | 20.2 | -        | -    | -   | 3      | 1.1  | 0.9 | 205   | 122.2 | (8.20)<br>4.9      | C-H-S-A-G   |
| 'Dega'<br>Total    | 451        | 290.5 | 72.8 | 140      | 12.5 | 3.1 | 5        | 0.4  | 0.1 | 71        | 92.3 | 23.1 | -        | -    | -   | 9      | 3.2  | 0.8 | 676   | 398.9 | (8)<br>4.7         | C-H-S-A     |
| Muttana<br>W.      | 88         | 53.7  | 93.4 | 2        | 0.2  | 0.3 | -        | -    | -   | -         | -    | -    | 4        | 3.6  | 6.2 | -      | -    | -   | 94    | 57.5  | (6.2)<br>3.8       | C-M-S       |
| Darcha             | 92         | 58.6  | 92.1 | -        | -    | -   | 10       | 0.7  | -   | -         | -    | -    | 4        | 3.6  | 5.7 | 2      | 0.7  | 1.1 | 108   | 63.6  | (6.0)<br>3.7       | C-M-A(G)    |
| Agerna             | 167        | 101.9 | 97.9 | -        | -    | -   | -        | -    | -   | -         | -    | -    | 2        | 1.8  | 1.7 | 1      | 0.35 | 0.3 | 171   | 104.1 | (6.3)<br>3.9       | C-M-(A)     |
| Sissena<br>Denab   | 101        | 61.6  | 97.5 | -        | -    | -   | 5        | .35  | 0.6 | -         | -    | -    | 1        | 0.9  | 1.4 | 1      | 0.35 | 0.6 | 108   | 63.2  | (5.1)<br>3.0       | C-M-G(A)    |
| Emdeber            | 146        | 89.1  | 95.1 | -        | -    | -   | 9        | 0.63 | 0.7 | -         | -    | -    | 4        | 3.6  | 3.8 | 1      | 0.35 | 0.4 | 160   | 93.7  | (5)<br>2.9         | C-M-G(A)    |
| 'W dega'<br>Total  | 594        | 364   | 95.5 | 2        | 0.2  | -   | 24       | 1.9  | 0.5 | -         | -    | -    | 15       | 13.5 | 3.5 | 5      | 1.75 | 0.5 | 641   | 382.2 | (5.7)<br>3.4       | C-M-G(A)    |
| D.Karsa,<br>(KOLA) | 70         | 43.7  | 95.4 | -        | -    | -   | 7        | 0.5  | 1.1 | -         | -    | -    | 1        | 0.9  | 2   | 2      | 0.7  | 1.5 | 80    | 45.8  | (3.8)<br>2.2       | C-M-A(G)    |
| All PAs            | 1115       | 699   | 84.5 | 142      | 12.7 | 1.5 | 36       | 2.8  | 0.3 | 71        | 92.3 | 11.2 | 16       | 14.4 | 1.7 | 16     | 5.7  | 0.7 | 1397  | 827   | (6.4)<br>3.8       | C-H-M-S-A-G |

Source : Field survey by the author, 1993

Values in parantheoes are average number of livestock in head counts.

1 = Heads of Cattle, 2 = TLU, 3 = % of Total TLU

### 5.6.2. PATTERN OF LIVESTOCK DISTRIBUTION

The composition of species varies according to the agro-ecological conditions and the land-use system. Cattle dominance is well established in all regions by the proportion of 73% TLU in dega and 95.5% each in woina dega and kolla areas (Table, 5.16). As in crops, peasants keep a mix of animal species to meet the multiple needs of the household specified earlier.

As many as six patterns of combinations of livestock ranked in terms of TLU have been identified in the study area. On zonal level, there are three combinations in dega and three in woina dega while kolla represents only a pattern of combination. Size of the PAs i.e. Kokera, Ketane, Darcha, Sissna Denab, Emdeber and Dubissana Karsa have four species which altogether accounted for about 54% of the livestock population (TLU) in the area, three others (Norcha, Muttana Wera and Agenna) have three species accounted for about 31%, and Cheza Sefer has a pattern of 5 species combination which accounted for about 15% of the total.

In general the patterns could be grouped into two major combinations as cattle-horse-sheep (C-H-S) and cattle-mule-goat (C-M-G). The first combination is generally found in the dega PAs, where the climate is more temperate and annual crops are more important. The latter combination is prevalent in the lower two altitude zones where enset and other perennials are more important. In either case cattle dominates.

### 5.6.3. SUPPORT BASE FOR LIVESTOCK

In the study area livestock are fed both inside and outside of farm houses. The main supports include grazing, feeding with mowed fresh grass and hay, leaves and other

bodies of enset, crop residue, etc. But the primary support is grazing in open, controlled or free, either in common or private or both the types of grazing areas. The responses of the farmers indicated that the grazing on common pasture accounted for 43%, on private lands 35% while nearly 12% confirmed grazing livestock on both. Common open grazing areas are located at about 30 minutes walking distance from the villages, while private grazing areas are at only about 5 minutes walking distance.

The second major livestock support comes from mowen fresh grass in all seasons, but more so in keremet. More than half of the respondents told that they use fresh grass to feed cattle and other animals. This practice is most common in upper woina dega and lower dega zones. Moreover, in areas where meadow land is scarce, at least more than 50% of the respondents spend a minimum of birr 110 per annum in purchase of grass.

Thirdly, cut enset leaves and other parts of enset comprise the third major cattle fodder throughout. About 62% of the respondents use enset as fodder by cutting enset leaves into smaller pieces in the dry season, from December until belg rain starts. Hay, crop residues and others are also used as fodder during the dry months but rarely.

#### 5.6.4. CHANGE IN LIVESTOCK NUMBER PER HOUSEHOLD AND STOCKING DENSITY<sup>18</sup>

Significant variations have been observed in the livestock density and number of livestock per household in the study area at different levels between 1974/75, 1982/83 and 1992/93 (Table 5.17). The stocking density in 1982/83 was 466 TLU for the study area but ranged between 240 for Sissena Denab PA to 1151 for Norcha PA. At zonal scale it

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<sup>18</sup> Stocking density, unless defined otherwise, is the number of livestock (TLU) per square kilometer (100 hectares) of grazing and browsing area.

varied from about 483 TLU per square kilometer in kolla, 503.2 in woina dega to 853 in dega.

The number of animals (TLU) per square kilometer of cultivated area ranged from 983 (TLU) in woina dega, 1556 (dega) to as much as 1792 in kolla in 1992/93 with an overall average of 1326 (TLU). Both rates are in contrast to the average stocking rates for the country which were reported 31 (TLU) (ranging from 6 to 156) per square kilometer of grazing area (UNDP/FAO, 1986).

It is also true that livestock (in TLU) per square kilometer of cultivated land are more than those in grazing area at national level. The pattern in the study area too shows similar reflection. Moreover, both stocking densities are higher in dega areas and lower in woina dega PAs and kolla PAs. But the number of animals per cultivated land in Dubssana Karsa (Kolla), surprisingly, is the highest in the study area because the amount of cultivated land is relatively small. The lowest stocking densities in Dubissana Karsa (175.5), Sissena Denab (220), Muttana Wera (283) and Darcha (297) in TLU may be attributed to their extension of common grazing lands. It should also be noted that Agenna PA, located in woina dega zone, has one of the highest stocking density which is comparable to densities in dega PAs, which may be attributed to high population density and small grazing area in the PA.

Both stocking density and the number of animals (TLU) per household showed a tendency of decline in the study area. On PA level all except Cheza Sefer and Agenna showed decline in livestock number (TLU) ranging from 30% for ketane to the extent of 71% in Dubissana Karsa in the period between 1974/75 & 1992/93. At zonal scale, too, the decline ranged from 36% both in dega and woina dega to 71% in kolla. The overall change however, showed a decline of 40% in the period (Table 5.17). The possible reasons as reported by about 75% of the sample household heads is a response to

**Table 5.17. CHANGES IN AVERAGE HOUSE HOLD LIVESTOCK  
NUMBER AND STOCKING DENSITY.**

| PA/Zone                 | 1974/75                           | 1982/83 |        | 1992/93 |        |        | Change in (%)                        |                                   |
|-------------------------|-----------------------------------|---------|--------|---------|--------|--------|--------------------------------------|-----------------------------------|
|                         | Livestock<br>No<br>(TLU)/<br>H.H. | (1)     | (2)    | (1)     | (2)    | (3)    | Livestock<br>No. (TLU)<br>1974/75-93 | Stocking<br>density<br>1982/83-93 |
| Norcha                  | 9.5                               | 6.2     | 1115.1 | 5.2     | 1151.1 | 971.1  | -45                                  | 3.2                               |
| Kokera                  | 8.7                               | 5.7     | 814.3  | 4.3     | 892.6  | 2220.5 | -51                                  | 9.6                               |
| Ketane                  | 6.4                               | 4.3     | 686.3  | 4.5     | 1003.6 | 1383   | -30                                  | 46.2                              |
| Cheza Sefer             | 4.4                               | 4.3     | 846.1  | 4.9     | 1361.0 | 1852   | 11                                   | 61                                |
| Dega                    | 7.3                               | 5.1     | 853.0  | 4.7     | 1079.5 | 1556   | -36                                  | 27                                |
| Muttana W.              | 6.8                               | 3.8     | 296.9  | 3.8     | 282.5  | 931    | -45                                  | -5                                |
| Darcha                  | 6.6                               | 4.1     | 301.5  | 3.7     | 297.1  | 769    | -44                                  | -1.5                              |
| Agenna                  | 3.2                               | 3.5     | 1008.6 | 3.9     | 1124.0 | 911    | 22                                   | 11.4                              |
| Sissena D.              | 5.4                               | 3.6     | 239.9  | 3.0     | 219.7  | 991    | -44                                  | -8.2                              |
| Emdeber                 | 4.6                               | 3.4     | 433.1  | 2.9     | 343.5  | 1517   | -37                                  | -20.7                             |
| 'W. dega'               | 5.3                               | 4.7     | 503.2  | 3.4     | 347.3  | 983    | -36                                  | -31.0                             |
| Dubissan Kars ('Kolla') | 7.7                               | 6.9     | 482.5  | 2.2     | 175.5  | 1792   | -71                                  | -63.6                             |
| Over-all                | 6.3                               | 4.6     | 466.0  | 3.8     | 428.0  | 1326   | -40                                  | -8.1                              |

Source: Field survey by the author, 1993.

1) = Livestock number (TLU)/ household, (2) - livestock density (TLU/km<sup>2</sup> grazing area; (3) = Livestock number (TLU)/km<sup>2</sup> cultivated area.

expansion of cultivated land and eucalyptus woodland, and a consequent diminution of grazing areas. Death of many cattle in lower woina dega and kolla part in particular, reported as one major attributable factor.



On the other hand, stocking density, though showed decline of about 8% at regional level in a period between 1982/83 and 1992/93, presents two contrasting patterns such as increases in all dega PAs (27%) and Agenna PA of woina dega (11.4%). On the contrary decline on PA levels in woina dega (31%) (except Agenna) and Kolla areas (64%) during same period.

The drop in stocking density in kolla part was very high which may be attributed to many deaths of cattle sometimes in the period between 1982/83 and 1992/93, and little expansion of crop area. In woina dega PAs circumstances appeared to be similar to that of kolla region except cropland expansion was more pronounced and cattle loss due to death relatively was mild. In dega and Agenna the increase in density can only be attributed to "contraction" of grazing lands due to encroachments by agricultural and eucalyptus plantations, because declining number of livestock per household clearly exhibits the decrease in the total number of livestock.

Thus, the assumption (1.3) initially made, livestock number per household has decreased but livestock density increased in the study area, is partly disproved. The assumption holds true only in dega areas as well as in Agenna PA while in woina dega and kolla parts the hypothesis is disproved.

### **5.7. SPATIAL INTEGRATION OF ENSET CULTIVATION, LIVESTOCK RAISING AND THE GURAGE SETTLEMENT**

Probably one among other factors which evolved the agricultural system and the cultural environment of the Guragees in the study area could be the strong and inextricable interdependence which has existed between the Gurage farm house, enset cultivation and livestock raising.

The Gurage settlement (assemblage of farm houses) which is linear in pattern, is located at a closest distance from enset and other perennial crop farm. Gurage farm houses (homesteads) are not only human dwellings but also cattle and other livestock pass their nights together with human beings in one house but in separate compartments.

Although the Gurages principally cultivate enset which is a major constituent of their diet (Kocho), they raise cattle as a supplementary source of food and main source of manure. They control the bulk of their own food supply by cultivating enset (including others) and breeding livestock.

Animal dung which comes from the homesteads is very important to replenish the fertility of enset and other farms. Enset plant is heavy, bulky and occupies one position in a farm permanently for years, hence, involves fast exhaustion of the soil, a consequence which can be avoided only by an extensive use of manure. The problem of soil impoverishment is countered by the use of manure, hence enset culture as a necessity is always combined with pastoral industry (smeds, 1956: 39). Thus, in view of the Gurages and at least in the context of prevailing traditional system of cultivation using archaic and simple farm tools, typified by limited inputs and no use of fertilizers, enset cultivation without manure supply and hence livestock rearing is unconceivable.

The manure required for normal growth and desirable productivity of enset comes from the farm house. By its very nature farm yard manure is bulky and heavy. To facilitate the transfer of the bulky and heavy manure it is better to have the enset fields located near to the farm house.

Cattle provide manure and feed on enset leaves specially during the dry seasons. Hence there is clear cut interdependence. Homestead, the store house of manure and labour input to enset plants, uses a number of materials made of components of enset in its construction such as ropes made from dry enset leaves and extracted fibres. Roofs may

be thatched with dry enset barks, ropes from ensets used in fastening fences and residues from enset may also be used as fire wood, hence help to keep farm houses warmer.

The Gurages also "believe" that cattle should live together with human beings in some houses because they assert cattle need man's breath and warmth. Moreover, they argue that enset plants should be very close to dwellings because they have the mind that enses need what the Gurages call it anfuat, whatever comes off from dwellings in the form of gas (carbondioxide) such as smoke, human out breath, etc,

Thus, the three cultural elements and or activities in the Gurage cultural environment - the Gurage house(s) enset cultivation and pstoral enterprise-can hardly be understood in isolation within the overall "complexity" of the Gurage cultural environemt. One benefits from the existence of the other and vis-versa. Hence, the three subsystems in the general system of the Gurage's cultural environment are well integrated.

## 5.7. PRODUCTION PROBLEMS

Agricultural productivity in the area ,in general, has declined in most in various cropping enterprises such as perennials (including enset), annuals as well as livestock. More than 45% and 36% of the 229 respondents respectivley reported that number of mature enses harvested in a year per household including their size decreased. Moreover, about 34% complained that productivity of annual crops also decreased. As such the problem may be attributed to the traditional nature of the farming system which characterized by low technological inputs, decline in cattle reduced number and hence manure supply, chat and other cash crops started taking away good share of manure collected, change in climate and above all the structural problem that is small size of land holdings and farms as2 aggravated by fast population growth, and shortage of grazing area

particularly in the middle and upper altitude zones, etc. A part from what is noted above, enset production in the region suffers from "enset diseases", what the Gurages refer it to as yaset chere, and several wild animals. The widely spread "enset diseases" are bacterial wilt and bacterial corm rot. Others include fungal foliar diseases caused by nematode parasites and suspected viral diseases (Mesfin Tessera and Quimilo, 1993).

Although "enset disease" widely occurs in most part of the area except in dega part, it tends to be more prevalent in the lower altitude zones. The pathogens which cause "enset diseases" kill enset and are readily transmitted from infected plants to healthy ones through mechanical means, implements used in enset cultivation, animals and human beings.

Of the 197 sample house holds in the study area 43% reported total damage of 3293 young and adult enses by "enset diseases" in 1992/93. The average loss per house hold amounts to 17. So far no steps have been taken control the damage except for traditionally known preventive measures.

The other threat to enset production is damage caused by wild animals such as porcupines, wild pigs, mole rats, monkeys, apes and warthogs (Kerkeros). They eat standing plants. The porcupines are most common through out the area while monkeys, wild pigs, apes and Kerkeros, occur in PAs where there are wide cover of bush and shrublands as in Dubissana Karsa, Darcha and Emdeber. Damage caused by mole rats is most common in dega PAs.

95% of the 197 respondents complained that about 5435 enses were either damaged or completely destroyed by wild animals. On the average each peasant lost about 30 enses in 1992/93. Thus the total number of enses lost annually by "enset diseases" and wild animals amounts to 9025 small and big enses which per household is 47.

Thus, the two threatened the very sustainability and productivity of enset farming.

Under this circumstances any control measure(s) that can minimize the losses is believed to be significantly important for the well-being of the people in the region as well as 10 to 15 million Ethiopian people who depend upon enset culture.

The other threat to the sustainability of the agricultural system in the study area is the observed decline in the size of cattle population caused by cattle diseases and "squeezing" of grazing lands which resulted in a drop in animal product as well as manure supply. The decline registered between 1974/75 and 1992/93 had been about 40% (Tables 5.17). The decline had been the maximum of 70% in Dubissana Karsa PA (Kolla) followed by 44 to 45% in Muttana Wera, Darcha and Sissena Denab PAs in lower woina dega zone.

In the later cases, the drop in number of cattle (45-75%) were attributed to cattle diseases such as Gendi (typanosomiasis), Abasenga (Anthrax), Desta and Sanba mich (rinder pests and C.B.P.P.), Abagorba (blackleg), etc. Among these Gendi, and Abasenga are most prevalent throughout the region but more importantly in lower altitude zones. These are fatal, chronic and communicable diseases. Peasant responses showed that 46% of the cattle death in the area was caused by Aba-senga followed by Gendi (26%), Desta and Smbamich (15%), Wazma Sar (in dega only 26%), Aba-Gorba (3%) and others (6%). The only way of minimizing cattle mortality can be through closer assistance of veterinary extension services which are still lacking in most of the PAs, though it is better than other extension provisions rendered by the MoA wereda offices.

Here it will be worth while to mention that some efforts were made to improve enset cultivation system based on research in connection with "enset diseases", enset processing implements, clone selection for better kocho quality and resistance to diseases, and higher productivity, etc., but very little was achieved. This is, probably because the government did not pay due attention to tackle the problems effectively. Some research

achievements however, were recorded by IRA and MoA. One of the notable achievements by IRA and/or the Rural Technolog Promotion Department (RTPD) of MoA was the newly made enset decorticating implement. But the new implement(s), regardless of the improvement it can make(s) in enset processing by way of relieving women from labouring much, was found locked in the store(s) of IRA and/or MoA. It could not be disseminated (diffused) much outside of Wolayta area. On one occasion the writer could sense the conflict between IRA and MoA/ RTPD as to who should get the credit of improving the archaic enset decorticating implement. This might have blocked the dissemination (diffusion) of the new implement amongst enset growers, which might be attributed to lack of coordination among the offices.

Probably, the only enset research station we have in the country is located at Areka in Wolayta (assuming that the research on enset at Holeta and Debre Zeit are already abandoned) may have relatively appropriate location to most enset growers of the south but not to the Gurageland. This is because there are marked and significant differences in their cultural practises and natural environments. Consequently, problems may arise in applying the findings of enset research at Areka to the Gurage areas where there is large concentration of enset. Hence, bearing in mind the application problem to be encountered and the high enset concentration found in the area, IRA and MoA authorities should pay attention to it.

Agricultural extension services in the study area are found to be poorly developed. Peasants almost in all the 10 PAs complained that they had no access to MOAs extension service. About 80% of the respondents reported that they received little or no support or advice from wereda extension workers. Above 65% mentioned that MoA werda office personnels rarely come to their villages for agricultural extension work. Rather about 15% reported that they used to come for government-based non-agricultural duties. The

remaining 20% accepted their occasional visits. On the other hand, about 75% of the respondents reported that animal health workers visit their villages/ PAs whenever they need and called them.

The peasants in the study area also complained that they had no access to credit facilities, lack of access to fertilizers and its high prices as well as their inavailability when strictly needed, lack of marketing facilities, and travel distances for about 2 hours, on the average, to health centers and grinding mill. More than 75% of the sample households use river water and travel for about an hour to fetch water for household domestic uses. Their cattle need to travel for about 2 hours to get water during the dry season. In Kolla and lower woina dega areas, and upper most dega parts, the infrastructural facilities are even least developed or are completely missing. Hence, these areas should be given priorities by the government and NGOs to set up basic infrastructural facilities in the region and extension services should be provided integratedly.



## CHAPTER SIX

### 6.0. PATTERNS OF AGRICULTURAL PRODUCTIVITY AND ATTRIBUTABLE FACTORS

One of the ingredients which can help evaluate agricultural system is its performance in terms of output/level of productivity. In this connection some writers have expressed their views that agricultural productivity in Ethiopia is not able to feed its present population which means that agricultural productivity has either stagnated or declined (Wood, 1990; Markos, 1990; Tadesse, 1989; Teresa, 1988). In the areas of enset culture too, it was reported that productivity of enset declined from about 30 quintals in 1960 to 28 in 1982/84 (UNDP/FAO, 1982 ; MoA, 1984). Similar reflection has been reported by more than 45% of 229 sample household heads in the study area.

Agricultural productivity, "the outcome of mutually interacting forces of agrarian structure, land resources and technology" (Singh, 1980) and the efficiency of use of inputs is a measure of agricultural performance (Dayal, 1984). When productivity is measured in relation to a particular input it is called partial productivity, while if it is measured in relation to all the inputs taken together, it is referred to as total productivity (Hossain, 1974). Since only production of crops is taken into account in determining agricultural productivity in the study area, it represents the partial productivity.

In areas where labour and land are major inputs and land is scarce and labour is abundant, as in Bangladesh, India, Ethiopia (Dejen area), etc. agricultural productivity is better measured in terms of both land and labour (Hossain, 1974; Dayal, 1984; Tadesse, 1989). Same is true of the study area where land is relatively very scarce, about 0.7 hectare per household (median size) or even less and population pressure is very high. In

the area the possibility of expanding cropped area is limited, hence greater out put can be

achieved only by increasing other input factors.

Thus the partial agricultural productivity of the region is measured using land (areal) productivity and labour productivity. The former measures crop yield per hectare of cultivated land area while the latter measures the output farmers get in return to their efforts. Aggregate areal output (in Ethiopian Birr<sup>19</sup>) for all crops - annuals, perennials, food and non-food crops was calculated from the data collected by field survey (1992/93) and was used as index of land productivity. It is included in the regression analyses as dependent variable denoted as ( $A_p$ ). Market value of agricultural output per worker in Ethiopian birr was taken as index of labour productivity which is also considered in the statistical analyses as the second dependent variable denoted as ( $P_l$ ).

### 6.1. PATTERNS OF AGRICULTURAL PRODUCTIVITY A SPATIAL ANALYSIS

Agricultural productivity in the region, in terms of both output per unit area and per worker, though difficult to make comparison, is expected to be low relative to some parts of Ethiopia (e.g. Teketel Makiso in his 3 year survey (1972/73 to 1974/75) showed that productivity of enset at Emdebir, Kembata and Sidamo respectively were 30, 34 and 27

kilogram dry Kocho or 480,544 and 432 quintals per hectare<sup>20</sup> (Seifu, 1984) and has

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<sup>19</sup>There are two reasons for indexing agricultural outputs in terms of Birr based on market value of individual crops. In spite of fluctuations in market price of different crops, productivity expressed based on market value is comparable irrespective of variations in crop types. Enset plant is big and bulky and is difficult to determine its output in units of weight, hence, the writer was forced to simply count the number of mature enses harvested in 1992/93 and convert it into Birr based on the unit (one enset) market price in the locality.

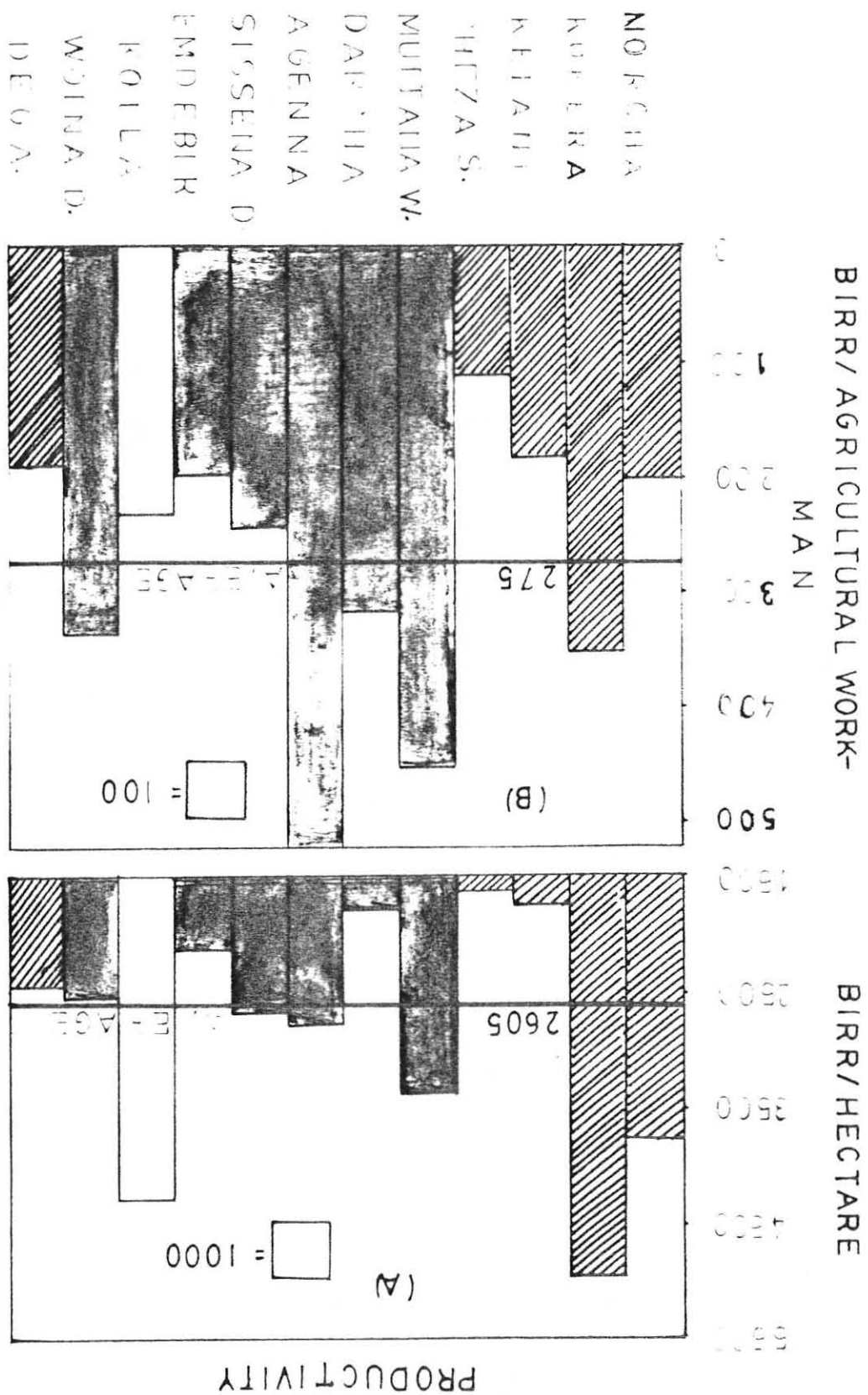
<sup>20</sup> Yield is determined based on 1600 plants per hectare at final transplant stage where the plants take four years to mature.

remained so for many years for several reasons.

Land productivity calculated thus, showed significant variations at individual farm level and hence, at PA and zonal level at 0.0052 level of confidence in the region when tested for ANOVA. It varied from about 1,650 Birr per hectare in Cheza Sefer to 3802 Birr in Dubissana Karsa to about 4994 Birr in Kokera PA (Figure 6.1), while the observed regional average was found to be Birr 2605 which is best approximated by the zonal average of woina dega. In as many as four PAs (cheza Sefer, katane and Darcha) productivity is below the regional average which may be attributed to their cropping pattern which is predominated by enset (not Kocho) which has low market value as compared to other crops. At zonal level, land productivity has increased towards koll probably because of increasing income from cash crops such a chat, coffee, orange, etc. Such vertical (zonal) variation in the pattern is as expected in the assumption (2).

As in areal productivity the ANOVA test proved that patterns of labour productivity showed significant spatial variation (zonal in nature) as initially assumed (3) at about 95 % level of confidence. It varied fro 188 Birr in dega (114 in Cheza Sefer) to 339 Birr per worker in woina dega zone and it is to the extent of 538 Birr in Agenna PA. At PA level, Agenna, Darcha, Muttana Wera and Kokera showed higher productivity values than the regional average of Birr 275. Except Darcha, the rest also appeared to be regions of higher land productivity, hence a sort of spatial accord between the two as expected in assumption (4) (Figure 6.1.). Dega PAs in all, other than Kokera, including Emdeber and Sissena Denab in woina dega and Dubissana Karsa appear areas of low labour productivity which is below the regional norm. Therefore, woina dega which is zone of high

FIGURE 6.1 PATTERN OF LAND(A) AND LABOUR(B)



population density (e.g. Agenna has the highest population density of 728 persons /km<sup>2</sup>) appears zone of high labour productivity which tends to significantly decrease towards dega and also towards kolla but at a lower rate. The pattern appears to be influenced or follows the pattern of changes in income from cash crops and population density.

Thus, explanation to the variation in the pattern of land and labour productivity in the region may be thought more in terms of the quality of the physical environment as modified to some degree by socio-economic variables (e.g. cropping pattern) and demographic variables (e.g. population density), which altogether determined the resource endowment of agriculture in the area.

## 6.2. PRODUCTION FACTORS

Farming as a system and its performance and structuring is determined by (or is the function of ) natural and socio-economic, institutional and infrastructural elements including demographic variables (Maxwell, 1986; Dayal, 1984). On the other hand, Humphrey (1975) grouped these factors as production inputs of stock of land, labour and capital. The stock of cropland input, the size and quality of land available is vital production factor (Humphrey, 1975; Morgan, 1971; Wood, 1979) and determines the rate of growth and number of adult enset owned and harvested (Olmstead, J., n.d.; Alemayehu, 1979).

Land value may be considered as a surrogate measure of soil fertility level, soil problems and topographic defects (Humphrey, 1975; Johnston, 1966). Climate is also critical in determining the type and feasibility of agriculture. In the absence of rainfall (a crucial factor affecting agricultural production in tropical countries (Sen, 1975)) records

and temperature and wind records, then altitude becomes reasonable surrogate measure concurrent with the opinion of Humphrey (1975) and Roy (1982) as in the enset growing weredas of Shewa, altitude is positively correlated with rainfall amount at a moderate strenght of 0.46. Crop production capital inputs include biological and chemical fertilizers. Use of animals for packing, drafting and as source of manure is taken care of by stocking density which is supposed to influnce agricultural production. Number of agricultural workers (all able bodied household members and permanent wage employees within 8 to about 70 years of age available during all cropping season are also supposed to influence agricultural performance (Humphrey, 1975). All these are expected to influence land productivity positively while agricultural labour and stocking would have a negative association with labour productivity.

Relative access to central market places and road serves as a powerful surrogate measure to assess farmers' access to technology, agricultural extension services, financial credits, commercial production inputs, markets, consumption of commercial goods and off-farm employment opportunities (Schultz, 1953). Market places generally and particularly in Ethiopia are also points where people assemble not only for exchange of commodities but also of new ideas (UNDP/FAO/LUPRD, 1984).

The degree of commercialization, crudely defined as the proportion of marketed agricultural production of a household is widely believed to be positively associated with agricultural productivity. As commercialization increases, a unit of land or labour will have larger output by way of increasing the input through the extra cash income.

Time and energy consumed in covering distances from dwelling to the plots is sure to adversely influnce agricultural productivity . If, some how, the inputs are maintained to the optimum level, then, the time and energy will have its impact in cost-benefit analysis- an aspect not considered in this study.

Several writers have reported that the sustainability and population supporting capacity of enset cultivation is increasingly undermined by the prevalence of "enset diseases" and damages caused by wild animals (see section 5.6) (Shack, 1966; Stanley, 1966; Olmstead, n.d., OCP2, 1987/88).

Based on the Malthusian perspective of diminishing returns to labour, Dayal (1984) quoting Keff (1969), Coale and Hoover (1961) reported that high population density is generally associated with low productivity in agriculture. On the contrary, however, Boserup (1965, 1981), Brookfield (1962, 1972), Turner, et.al., (1971) and even Dayal (1974) noted a positive correlation between population density and land productivity because high population density creates demand for agricultural products and agricultural land, leading to smaller holdings and labour-intensive cultivation. It is supposed to represent total demand for agricultural products. Consequently, it is expected to be positively associated with land productivity while negatively with labour productivity (hypotheses 5 and 6, respectively).

Cultivated land intensity would be a reflection of pressure on land/ land use and farm size. Therefore, it is expected to have significant effect on the net income and output in farming (Dayal, 1984).

Thus, in order to test the assumptions stated so far, following thirteen independent variables<sup>21</sup> from the physico- cultural and socio-economic environments of the study area were considered to assess their strengths in explaining the observed variations in the patterns of land as well as labour productivities in the region. These are altitude of individual household farms or villages in meters above mean sea level ( $x_1$ ), access to infrastructures as indexed by average distance to all weather road, central market place and

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<sup>21</sup> Due to time and financial constraints variables which are directly measurable from the physical environment and which are expected to be more contributing are not considered.



wereda town ( $x_2$ ); Agricultural labour index ( $X_3$ ), the number of able-bodied house hold members (8 to 70 years old) as weighted according to age (8-15 years old = 0.25, 16-20 (both sex) = 0.5, 21-50 (female) = 0.75, 21-50 (male) = 1.0, 51-65 (female) = 0.5, 50-65 (male) = 0.75, and beyond 65 (both sex) = 0.25); literacy index, the number of house-hold agricultural labour as weighted according to their literacy status (illiterate = 1, reading only = 2, read and write only = 3, attained grade 3 to 6 = 4, grade 7-8 = 5, grade 9-12+ = 6) ( $x_4$ ); cultivation intensity, the proportion of cultivated land to productive land potential in percent ( $x_5$ ); farmsize i.e. land under various crops ( $x_6$ ); Crude population density ( $x_7$ ), stocking rate, number of livestock in TLU per 100 hectare of cropped area ( $x_8$ ); manure input, amount of animal dung (kg) applied to different crops per year ( $x_9$ ); Index of commercialization, proportion of consumed to totally produced ( $x_{10}$ ); average distance from farm house (s) to various plots ( $x_{11}$ ); number of enset plants destroyed due to bacterial wilt and other "enset diseases" and/or damaged by wild animals ( $x_{12}$ ); and land value, surrogate measure of the quality of land ( $x_{12}$ ). The two dependent variables as noted in section 6.1 are agricultural land productivity ( $P_A$ ) i.e. ( $y_1$ ) and labour productivity ( $P_L$ ) ( $Y_2$ ). They are defined as follows:

$$P_A = \frac{\sum_{i=1}^n (O_i P_i)}{A_i} \quad \text{where, } n = \text{number of crops; } O_i = \text{out put of crop } i$$

$$P_L = \frac{\sum_{i=1}^n (O_i P_i)}{W} \quad \text{crops } i \text{ in household farm; } P_i = \text{market unit price of crop } i;$$

$W = \text{weighted house hold labour input}$   
 $A_i = \text{area occupied by crop } i \text{ in the household farm.}$

### 6.3. RESULTS OF STATISTICAL ANALYSES : SIMPLE CORRELATIONS AND STEPWISE MULTIPLE REGRESSIONS

As there is no priori basis for predicting the exact form of the regressions, the linear model was employed. Correlations and regressions were run for each of the dependent variable and one independent variables at a time. Population density as an independent variable and few other variables were correlated. Then land productivity and labour productivity were individually regressed on thirteen independent variables for each agro-climatic zone and finally at regional level employing a stepwise regression model using P-Stat computer software. The stepwise regression model re-examines the independent variables at each stage to identify the superfluous variables following the introduction of subsequent items or to permit use of previously rejected variables, thereby taking particular note of the problems of multicollinearity (Shaw and Dennis Wheeler, 1985).

Therefore, when the programme was run some independent variables were rejected and dropped. At regional level, in connection with land productivity eight explanatory variables out of thirteen emerged as significant predictors while with regard to labour productivity only five found significant. Hence explanation level is made in accordance.

Furthermore, population density as independent variable was regressed on some of the inputs such as agricultural labour, farm size, stocking density and manure input as well as cultivated land intensity taking one at a time so as to assess the strength and direction of relationship that each has with population density.

### 6.3.1. SIMPLE CORRELATION

As shown in Table 6.1 and 6.2, when land and labour productivity each taken as dependent variable were correlated with selected individual independent variables ( $X_1$  -  $X_{13}$ ), the following results were obtained.

As for interdependences are concerned, no pair can be regarded as having strong correlation. Out of the 11 independent variables having significant correlation with land productivity, five of them (Accessibility, agricultural labour, stocking density, manure input and land value(quality)) are positively correlated with land productivity showing relatively stronger correlation of 0.338 (stocking density) ( $X_8$ ) followed by agricultural labour ( $X_3$ ) 0.322, accessibility ( $X_2$ ) 0.191, etc.

On the otherhand, farm size ( $X_6$ ), enset damages ( $X_{12}$ ) distance to plots ( $X_{11}$ ), cultivated land intensity ( $X_5$ ), degree of commercialization ( $X_{10}$ ) and altitude ( $X_1$ ) showed relatively weaker and negative associations with land productivity. In general, the direction of relationships are as anticipated with the exception of two variables - index of commercialization and elevation but in both cases the coefficients are so weak that they are of no analytical significance (Table 6.1). Population density (crude one,  $x_7$ ) showed no significant association with land productivity, and hence the result contradicts with what was anticipated in the assumption (5).

With regard to labour productivity, manure input ( $X_9$ ) and agricultural labour ( $x_3$ ) emerged as relatively the strongest associates. However weak the relationship may be, both crude population density ( $X_7$ ) and agricultural labour ( $X_3$ ) negatively correlated with labour productivity as expected (Hypothesis 6). With the exception of farm size ( $x_6$ ) and enset damages ( $X_{12}$ ), all appeared to be significantly associated despite the strengths are relatively weaker (Table 6.2). The negative relationships of access to market places and

rural literacy with labour productivity were found to be unusual which may be explained by considering many other variables or simply by increasing the number of samples and cheking the responses of the households.

**Table 6.1 SIMPLE REGRESSION RESULTS OF LAND PRODUCTIVITY AND SELECTED VARIABLES FOR ALL ZONES**

| (1)<br>Explanatory<br>variables | (2) Simple 'r' | (3) 'r <sup>2</sup> ' | % (4)<br>contribution<br>of variance | (5) 'T'<br>Ratio | Level of E1<br>significance |
|---------------------------------|----------------|-----------------------|--------------------------------------|------------------|-----------------------------|
| X <sub>1</sub> (EL)             | -0.057         | 0.003                 | 0.3                                  | 0.80             | 0.4                         |
| X <sub>2</sub> (AC)             | 0.191          | 0.036                 | 3.6                                  | 2.7              | .01                         |
| X <sub>3</sub> (LA)             | 0.322          | 0.104                 | 10.4                                 | 4.75             | .001                        |
| X <sub>4</sub> (LI)             | -0.014         | 0.0002                | 0.02                                 | 0.195            | *                           |
| X <sub>5</sub> (CL)             | -0.082         | 0.0067                | 0.67                                 | 1.15             | .2                          |
| X <sub>6</sub> (FS)             | -0.178         | 0.031                 | 3.2                                  | 2.53             | .01                         |
| X <sub>7</sub> (PD)             | -0.006         | 0.0004                | 0.04                                 | 0.08             | *                           |
| X <sub>8</sub> (SR)             | 0.338          | 0.114                 | 11.4                                 | 5.02             | .001                        |
| X <sub>9</sub> (MA)             | 0.074          | 0.0054                | 0.54                                 | 1.04             | .10                         |
| X <sub>10</sub> (COM)           | -0.059         | 0.0035                | 0.35                                 | 0.83             | .40                         |
| X <sub>11</sub> (DI)            | -0.106         | 0.011                 | 1.1                                  | 1.49             | .10                         |
| X <sub>12</sub> (ED)            | -0.116         | 0.013                 | 1.3                                  | 1.63             | .10                         |
| X <sub>13</sub> (LU)            | 0.042          | 0.0018                | 0.18                                 | 0.59             | .50                         |

**Table 6.2. SIMPLE REGRESSION RESULTS OF LABOUR PRODUCTIVITY AND SELECTED VARIABLES FOR ALL ZONES.**

| (1)             | (2)    | (3)     | (4)  | (5)   | (6)   |
|-----------------|--------|---------|------|-------|-------|
| X <sub>1</sub>  | -0.044 | 0.0019  | 0.19 | 0.62  | 0.50  |
| X <sub>2</sub>  | -0.097 | 0.0094  | 0.94 | 1.36  | 0.20  |
| X <sub>3</sub>  | -0.225 | 0.051   | 5.1  | 3.22  | 0.01  |
| X <sub>4</sub>  | -0.112 | 0.013   | 1.3  | 1.57  | 0.10  |
| X <sub>5</sub>  | 0.048  | 0.0023  | 0.23 | 4.88  | 0.50  |
| X <sub>6</sub>  | 0.027  | 0.0007  | 0.07 | 0.377 | *     |
| X <sub>7</sub>  | -0.144 | 0.021   | 2.1  | 2.03  | 0.05  |
| X <sub>8</sub>  | -0.091 | 0.0082  | 0.82 | 1.28  | 0.20  |
| X <sub>9</sub>  | 0.330  | 0.109   | 10.9 | 4.88  | 0.001 |
| X <sub>10</sub> | 0.125  | 0.0156  | 1.6  | 1.76  | 0.10  |
| X <sub>11</sub> | 0.023  | 0.0005  | 0.05 | 0.32  | 0.8   |
| X <sub>12</sub> | 0.007  | 0.00004 | 0.09 | 0.09  | *0.20 |
| X <sub>13</sub> | 0.097  | 0.0094  | 0.94 | 1.36  |       |

Degree of freedom 197.2 = 195 ; \* = Statistically not significant

### 6.3.2. STEPWISE REGRESSION ANALYSES

#### 6.3.2.1. LAND PRODUCTIVITY AT REGIONAL SCALE

Out of the thirteen explanatory variables considered, eight of them emerged statistically significant and explained about 25.5% of the variance of land productivity (Table 6.3). But all the thirteen variables taken together could explain about 26.3% , hence, the contribution of the five left outs was only less than 1% which is not significant (cf. R equals to 0.513 and 0.505 for the 13 and selected 8 variables respectively).

**Table 6.3. SUMMARY OF STEPWISE MULTIPLE REGRESSION OF LAND PRODUCTIVITY ( $Y_1$ ) AND THE EIGHT SIGNIFICANT INDEPENDENT VARIABLES IN ALL ZONES**

| Explanatory variables                                                                                                         | Partial Regression Coeff. (Standardized, Beta)(1) | Standard Error of 'B'(2) | 'F' value (3) | Level of significance (4) | Partial Cor. Coeff. value (5) | R of Regressors included (6) | R <sup>2</sup> for all regressors included (7) | R <sup>2</sup> An increase in R <sup>2</sup> due to the new regressors (8) | Percentage contribution to variance (9) | 'F' Ratio (10) | Level of Signif. (11) |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------|---------------|---------------------------|-------------------------------|------------------------------|------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------|----------------|-----------------------|
| $X_8$ (SR)                                                                                                                    | 0.199                                             | 0.161                    | 25.21         | 0.001                     | 0.172                         | 0.338                        | 0.114                                          | 0.114                                                                      | 11.4                                    | 25.21          | 0.001                 |
| $X_5$ (LA)                                                                                                                    | 0.191                                             | 0.153                    | 4.99          | 0.01                      | 0.166                         | 0.370                        | 0.137                                          | 0.022                                                                      | 2.2                                     | 15.36          | 0.001                 |
| $X_7$ (PD)                                                                                                                    | -0.104                                            | 0.177                    | 5.25          | 0.01                      | -0.108                        | 0.399                        | 0.160                                          | 0.023                                                                      | 2.3                                     | 12.22          | 0.001                 |
| $X_9$ (MA)                                                                                                                    | 0.184                                             | 1.155                    | 2.58          | 0.05                      | 0.191                         | 0.413                        | 0.171                                          | 0.011                                                                      | 1.1                                     | 9.88           | 0.001                 |
| $X_7$ (AC)                                                                                                                    | 0.161                                             | 2.898                    | 4.65          | 0.001                     | 0.168                         | 0.436                        | 0.190                                          | 0.020                                                                      | 2.0                                     | 8.99           | 0.001                 |
| $X_{13}$ (L.V)                                                                                                                | 0.349                                             | 0.640                    | 2.35          | 0.05                      | 0.265                         | 0.448                        | 0.200                                          | 0.010                                                                      | 1.0                                     | 7.93           | 0.001                 |
| $X_8$ (FS)                                                                                                                    | -0.315                                            | 425.183                  | 11.84         | 0.001                     | 0.232                         | 0.497                        | 0.247                                          | 0.047                                                                      | 4.7                                     | 8.88           | 0.001                 |
| $X_{12}$ (ED)                                                                                                                 | -0.095                                            | 3.589                    | 1.99          | 0.05                      | -0.102                        | 0.505                        | 0.255                                          | 0.008                                                                      | 0.8                                     | 8.05           | 0.001                 |
| $Y_1 = 0.38526X_8 + 0.353446X_5 - 0.263354X_7 + 3.0743X_9 + 6.76119X_7 + 2.40643X_{13} - 1417.35X_8 - 5.06508X_{12} + 1030.8$ |                                                   |                          |               |                           |                               |                              |                                                |                                                                            |                                         |                |                       |

**Table 6.4. SUMMARY OF STEPWISE MULTIPLE REGRESSION OF LABOUR PRODUCTIVITY ( $Y_2$ ) THE FIVE EXPLANATORY VARIABLES IN ALL ZONES**

| Explanatory Variables | (1)    | (2)    | (3)   | (4)   | (5)    | (6)   | (7)   | (8)   | (9)  | (10)  | (11)  |
|-----------------------|--------|--------|-------|-------|--------|-------|-------|-------|------|-------|-------|
| $X_9$ (MA)            | 0.361  | 0.212  | 23.79 | 0.001 | 0.346  | 0.330 | 0.109 | 0.109 | 10.9 | 23.7  | 0.001 |
| $X_5$ (LA)            | -0.148 | .023   | 5.67  | 0.01  | -0.155 | 0.336 | 0.134 | 0.025 | 2.5  | 15.02 | 0.001 |
| $X_4$ (LJ)            | -0.112 | 3.872  | 2.99  | 0.05  | -0.121 | 0.384 | 0.147 | 0.013 | 1.3  | 11.11 | 0.001 |
| $X_{13}$ (L.V)        | 0.177  | 0.095  | 1.771 | 0.10  | 0.165  | 0.394 | 0.155 | 0.008 | 0.8  | 8.81  | 0.001 |
| $X_{11}$ (DI)         | 0.184  | 12.150 | 5.31  | 0.001 | -0.165 | 0.422 | 0.178 | 0.023 | 2.8  | 8.27  | 0.001 |

$$Y = 1.07967X^9 - 0.0491458X^3 - 6.52816X_4 + 0.219015X_{13} - 27.9951X_{11} + 337.5$$

Stocking density ( $x_8$ ), farm size ( $x_6$ ), agricultural working force ( $x_3$ ), and the access to market place, road and wereda town ( $x_2$ ) proved to be better predictors. Population density which was observed statistically not significant before, in simple correlation, emerged as the third important contributor. Altogether, the above four variables accounted for about 23% of the variance in land productivity. Needless to say however, stocking density alone explained the variance by about 11.4%. This may remind that production of perennials, *enset* in particular, in the region is much associated with cattle rearing because the sustainability of *enset* partly depends on animal dung supply.

On the otherhand, so far as the rate of change in land productivity is concerned, variation in land value (land quality), farm size, stocking density and agricultural work force appeared can relatively cause more rapid change than others (see Table 6.3 column 2). While a unit quantity rise in most of the variables considered expected to contribute by increasing land productivity, the effect of farm size, population density and *enset* damages were observed to be unfavourable (adverse).

Population density which appeared to have negative influence upon land productivity found contrary to what was expected (assumption 5). This has important theoretical implications, particularly to that of Boserup's assertion that population growth leads to intensification which is accompanied by land holding diminution which, in turn, necessitates an increase in the level of inputs such as fertilizers, irrigation, pesticides, herbicides, improved technology, labour, etc. Boserup, therefore, contended that a positive relationship exists between population density on the one hand and frequency of cultivation and level of technology on the other. Consequently, what she implied was that if intensification was associated with increased agricultural input including technology, the result would be rise in land productivity. Hence, population density and land productivity show positive association (Boserup, 1965).



**Table 6.5. CORRELATION COEFFICIENTS OF POPULATION DENSITY WITH SELECTED VARIABLES**

| Explanatory variables | Correlation Coefficient | Level of Significance |
|-----------------------|-------------------------|-----------------------|
| Labour input          | 0.29                    | 0.001                 |
| Cult. land intens.    | 0.23                    | 0.001                 |
| Farm size             | -0.13                   | 0.01                  |
| Stocking density      | 0.36                    | 0.001                 |
| Manure input          | 0.14                    | 0.05                  |

However, in light of Boserup's view, it may be inferred that without change in technology and inputs used, population increase may not result in greater land productivity, and may indeed have a negative effect on productivity (Dayal, 1984). The correlation and regression results in Table 6.5 and 6.3, respectively, lend strong support to Boserup's assertions.

Rise in population density appeared to increase agricultural inputs in terms of labour, proportion of cultivated land, manure and livestock. But it resulted in diminution in the size land holdings consequently, drop in land productivity in the area. This is largely attributable to the fact that agricultural practice in the region still has remained traditional despite an increase in population density followed by diminishing land holding size and nominal rise in some of the inputs.

If population increase is not accompanied by improvement in technology, there must come a point when intensification will bring diminishing marginal returns to land and labour (Grigg, 1980). Beyond this point, output per hectare may continue to rise for some time, but eventually it will begin to decline (Dayal, 1984). The analysis so far made

does bring the suspicion that the point is already passed in the study area and population increase might have simply lead to more intensive cultivation of enset and other food crops of low-market value but with decline in per capita production.

As noted in the preceeding paragraphs, the eight socio-economic, demographic and environmental variables which emerged as significant could explain only a quarter of the total variance in land productivity. Out of the total explained, about four-fifth is attributable to the human factors while the contribution of environmental influence as indexed by land value and altitude appeared either very low or negligible which is quite contrary to the expectations.

#### **6.3.2.2. LABOUR PRODUCTIVITY AT REGIONAL LEVEL**

In the stepwise regression model only five explanatory variables namely manure input ( $x_9$ ), agricultural labour ( $x_3$ ), rural literacy ( $x_4$ ), land value ( $x_{12}$ ) and distance to plots ( $x_{11}$ ) emerged as having significant influence on labour productivity in the overall study area (Table 6.4). Although there were significant simple correlations between size of holdings ( $x_6$ ), stocking density ( $x_8$ ), population density ( $x_8$ ) and index of commercialization ( $x_{10}$ ) and labour productivity, they could not stand out in the stepwise multiple regression. The importance of farm size was already accounted for by land value because of the intercorrelation and or colliniarity between the two. Stocking density also could not come forth in the regression because of its strong correlation with density of agricultural workers. Similary, population density could not appear for its influnce might be accounted for by agricultural working force.

Manure input which is traditionally practised and is most required to enset cultivation in the region, appeared as the most importnt of the thirteen variables and

explained about 11% of the variance in labour productivity. Moreover, it is expected to bring about the most rapid change in land productivity. The other variables which contributed importantly, though very low, to the variance of labour productivity were the density of agricultural workers and distance from farm house to plots. Nevertheless, the overall account of the five selected variables was only about 18% as compared to 19.3% of the thirteen variables of the variance in labour productivity.

The relationship between agricultural labour and labour productivity as expected was negative. This result provides an additional support for Boserup's assertion in which she argued that labour productivity is the highest in sparsely populated areas (Boserup, 1965). High labour productivity in agriculture is generally associated with extensive farming rather than with intensive ones. In the study area, households/ PAs in lower altitude zones have relatively lower population density but characterized by relatively higher agricultural labour productivity (e.g. Darcha, Muttana Wera, Sissena Denab and Dubissana Karsa) as compared with dega PAs (Figure 6.1)

### 6.3.3. LAND AND LABOUR PRODUCTIVITY BY AGRO-CLIMATIC ZONES

#### 6.3.3.1. LAND PRODUCTIVITY

It was noted in section 6.1 and Figure 6.1 that land productivity in the region showed zonal variation. It appeared to be increasing with decreasing altitude as it was above the regional "norm" in Kolla and below that in dega.

All the thirteen independent variables taken together could explain the variance in land productivity by about 71.4% in Kolla, 41.8% (dega) and 39.5% in woina dega. The

selected predictors four in kolla, three in dega and five in woina dega however, respectively contributed to 32.4%, 39.3% and 37.3% of the total variance in the land productivity. The contribution of the rejected variables appeared considerable and ranged from 2.2% in woina dega, 12.5%, (dega) to the extent of 39% in kolla.

Although relatively fewer variables emerged as predictors in the stepwise regression analysis, they proved to be stronger enough on zonal level. In the three zones the multiple correlation ( $R$ ) emerged stronger ranging from 0.627 to 0.59 as compared with the regional value of  $R$  equal to 0.505 (cf. Table 6.3 and Table 6.6).

The predictors selected in different agro-climatic zones varied both in number (noted in the preceeding paragraphs) and type. The only three predictors selected in the dega zone includes agricultural labour ( $x_3$ ), elevation ( $x_1$ ) and manure input ( $x_9$ ) which respectively contributed to about 18.3%, 16.7% and 4.3% of the total variance in land productivity. Agricultural work force appeared more important.

In woina dega zone however, five variables(land quality ( $x_{13}$ ), stocking density ( $x_8$ ), manure input ( $x_9$ ), farm size ( $x_6$ ) and degree of commercialization ( $x_{10}$ )) emerged as better predictors. Out of these land quality and stocking density proved to be most influential and contributors, as much as 29%, of the total variance in land productivity. The contribution of population density and agricultural labour is likely to be taken care of by stocking density because each is strongly and significantly correlated with stocking density.

In Kolla zone, land value ( quality) ( $x_{12}$ ), manure input ( $x_9$ ), agricultural work force ( $x_3$ ) and elevation emerged significant contributors i.e. altogether as much as 32.4% while the first two accounted for 12.3 and 8.2% of the total variance in land productivity respectively.

**Table 6.6. SUMMARY OF STEPWISE REGRESSION OF LAND PRODUCTIVITY AND THE SELECTED EXPLANATORY VARIABLES IN THE THREE ZONES**

| Zone   | Explanatory Var.    | Standardized Par. Reg. Coef. (b) | 'F' Value | Level of Signif. | Partial Corr. Coeff. value | R of Regres. errors | R <sup>2</sup> For all Regressors | An increase in R <sup>2</sup> due to the New Regressors | % Contribution to variance | 'F' value | Level of Significance |
|--------|---------------------|----------------------------------|-----------|------------------|----------------------------|---------------------|-----------------------------------|---------------------------------------------------------|----------------------------|-----------|-----------------------|
| 'Dega' | X <sub>1</sub> (EL) | 0.478                            | 12.26     | 0.001            | 0.517                      | 0.409               | 0.167                             | 0.167                                                   | 16.7                       | 12.26     | 0.001                 |
|        | X <sub>3</sub> (LA) | 0.453                            | 16.93     | 0.001            | 0.499                      | 0.592               | 0.350                             | 0.183                                                   | 18.3                       | 16.19     | 0.001                 |
|        | X <sub>9</sub> (MA) | 0.210                            | 4.14      | 0.01             | 0.256                      | 0.627               | 0.393                             | 0.043                                                   | 4.3                        | 12.74     | 0.001                 |

D.F. = 195

|            |                       |        |       |       |        |       |       |       |      |       |       |
|------------|-----------------------|--------|-------|-------|--------|-------|-------|-------|------|-------|-------|
| 'Woina d.' | X <sub>13</sub> (LV)  | 0.470  | 21.14 | 0.001 | 0.496  | 0.400 | 0.160 | 0.160 | 16.0 | 21.14 | 0.001 |
|            | X <sub>8</sub> (SR)   | 0.247  | 20.10 | 0.001 | 0.271  | 0.538 | 0.290 | 0.130 | 13.0 | 22.43 | 0.001 |
|            | X <sub>6</sub> (FS)   | -0.243 | 5.28  | 0.01  | 0.260  | 0.568 | 0.323 | 0.033 | 3.3  | 17.30 | 0.001 |
|            | X <sub>9</sub> (MA)   | 0.206  | 6.1   | 0.001 | 0.241  | 0.599 | 0.359 | 0.036 | 3.6  | 15.11 | 0.001 |
|            | X <sub>10</sub> (COM) | -0.121 | 2.47  | 0.05  | -0.150 | 0.611 | 0.373 | 0.014 | 1.4  | 12.74 | 0.001 |

D.F. = 195

|         |                      |        |      |       |        |       |       |       |      |      |       |
|---------|----------------------|--------|------|-------|--------|-------|-------|-------|------|------|-------|
| 'Kolla' | X <sub>9</sub> (MA)  | -0.508 | 2.20 | 0.1   | -0.485 | 0.286 | 0.082 | 0.082 | 8.2  | 3.25 | 0.10  |
|         | X <sub>3</sub> (LA)  | 1.111  | 1.68 | 0.2   | 0.748  | 0.377 | 0.142 | 0.060 | 6.0  | 4.6  | 0.025 |
|         | X <sub>13</sub> (LV) | 0.561  | 4.22 | 0.025 | 0.558  | 0.515 | 0.265 | 0.123 | 12.3 | 4.0  | 0.05  |
|         | X <sub>1</sub> (EL)  | -0.284 | 2.19 | 0.10  | -0.347 | 0.569 | 0.324 | 0.059 | 5.9  | 5.33 | 0.01  |

D.F. = 195

### 6.3.3.2. LABOUR PRODUCTIVITY

As was the case with land productivity (Figure 6.1A), labour productivity also showed zonal variation (Figure 6.1B). The patterns of labour productivity did show a tendency to increase with decreasing altitude, but not of the same magnitude as in the case of land productivity. It is well established by the fact that in this case it was woina dega which aquaired value above average.

While the selected independent variables varied in number from four each in dega and woina dega to eight in kolla, and their aggregated contribution to the total variance in labour productivity ranged from about 28% in dega, 19% (woina dega) to 91.2% in Kolla. The account of all the thirteen variables, however, differed in the three zones from about 21% in woinadega, 34.4% (dega) to 91.4% in kolla. Moreover, the multiple correlation coefficient (R) of the significant pridictors in each zone not only varied but also emerged less sucessful as compared to that of land productivity at regional level except in kolla (cf. Table 6.4 and 6.7).

In Kolla zone eight predictors were selected other than access to market places ( $X_2$ ), rural literacy ( $X_4$ ), proportion of cultivated land ( $X_5$ ), farm size ( $X_6$ ) and enşet damages ( $X_{12}$ ), which emerged as the most successful in explanning about 91% the variance in labour productivity. The multiple correlaton also appeared as much as 0.96 compared with 0.435 and 0.529 in woina dega and dega zones respectively. Entirely, the thirteen variables accounted for about 91% of the variance in labour productivity.

**Table 6.7. SUMMARY OF STEPWISE REGRESSION OF LABOUR PRODUCTIVITY AND THE SELECTED EXPLANATORY VARIABLES IN THE THREE ZONES**

| Zone       | Explanatory Var.      | Standardized Partial Regression (b) | 'F' value | Level of Signif. | Partial Corr. Coef. value | R. of Regressors | R <sup>2</sup> For all Regressors | An Increase in R <sup>2</sup> due to the New Regr. | % contribution to variance | 'F' value | Level of Signif. |
|------------|-----------------------|-------------------------------------|-----------|------------------|---------------------------|------------------|-----------------------------------|----------------------------------------------------|----------------------------|-----------|------------------|
| 'Dega'     | X1(EL)                | 0.398                               | 10.77     | 0.01             | 0.418                     | 0.387            | 0.150                             | 0.150                                              | 15.0                       | 10.77     | 0.01             |
|            | X9(MA)                | 0.193                               | 5.80      | 0.025            | 0.203                     | 0.474            | 0.225                             | 0.075                                              | 7.5                        | 8.71      | 0.001            |
|            | X3(LA)                | 0.161                               | 2.33      | 0.10             | 0.184                     | 0.505            | 0.255                             | 0.029                                              | 2.9                        | 6.71      | 0.001            |
|            | X10(COM)              | 0.172                               | 2.02      | 0.10             | 0.184                     | 0.529            | 0.280                             | 0.025                                              | 2.5                        | 5.63      | 0.001            |
| 'W. deg a' | X9(MA)                | 0.351                               | 10.88     | 0.001            | 0.330                     | 0.299            | 0.089                             | 0.089                                              | 8.9                        | 10.8      | 0.001            |
|            | X13(LV)               | 0.206                               | 6.462     | 0.01             | 0.219                     | 0.734            | 0.140                             | 0.050                                              | 5.0                        | 8.92      | 0.001            |
|            | X3(LA)                | -0.195                              | 3.24      | 0.025            | -0.201                    | 0.405            | 0.164                             | 0.025                                              | 2.5                        | 7.14      | 0.001            |
|            | X11(DD)               | -0.176                              | 3.27      | 0.025            | -0.171                    | 0.435            | 0.189                             | 0.025                                              | 2.5                        | 6.29      | 0.001            |
| 'KOH'      | X <sub>1</sub> (PD)   | -0.365                              | 21.82     | 0.001            | -0.665                    | 0.731            | 0.535                             | 0.535                                              | 53.5                       | 21.82     | 0.001            |
|            | X <sub>10</sub> (COM) | 0.669                               | 5.34      | 0.025            | 0.853                     | 0.801            | 0.641                             | 0.106                                              | 10.6                       | 16.07     | 0.001            |
|            | X <sub>13</sub> (LV)  | 0.673                               | 14.51     | 0.001            | 0.839                     | 0.898            | 0.806                             | 0.165                                              | 16.5                       | 23.59     | 0.001            |
|            | X <sub>1</sub> (EL)   | -0.310                              | 1.83      | 0.10             | -0.643                    | 0.909            | 0.826                             | 0.020                                              | 2.0                        | 19.02     | 0.001            |
|            | X <sub>11</sub> (DD)  | -0.264                              | 3.53      | 0.05             | -0.542                    | 0.927            | 0.859                             | 0.033                                              | 3.3                        | 18.33     | 0.001            |
|            | X <sub>9</sub> (MA)   | 0.152                               | 1.79      | 0.10             | 0.431                     | 0.936            | 0.875                             | 0.016                                              | 1.6                        | 16.37     | 0.001            |
|            | X <sub>1</sub> (LA)   | 0.371                               | 1.58      | 0.10             | 0.534                     | 0.943            | 0.889                             | 0.014                                              | 1.4                        | 14.84     | 0.001            |
|            | X <sub>8</sub> (SR)   | -0.228                              | 3.22      | 0.05             | -0.460                    | 0.955            | 0.912                             | 0.024                                              | 2.4                        | 15.61     | 0.001            |



It is population density which emerged as the most contributing i.e. as much as 54%, to the total variation in the dependent variable. Others, such as land value (quality) (17%), and level of commercialization (11%) appeared second in importance. But they are the latter ones which appeared most influential in bringing about significant change in the amount of labour productivity. Agricultural labour, altitude and ofcourse, population density also could have a notable impact on land productivity.

Generally, the direction of relationships were as expected except that of agricultural labour which is positive in contrary to the expected and Boserup's assertion. Stocking density and elevation also showed negative associations. This may be either due to the limited number of the data (only 20) considered or explainable in connection with some other conditions.

On the otherhand, in each of the dega and woina dega, zones only four variables emerged as statistically significant. These are agricultural labour and manure input in both and land value and distance to plots in woina dega, and altitude and commercialization level in dega parts. In woina dega all the four together contributed only about 19% of the variance in labour productivity while in dega zone about 28% (Table 6.7). While manure input and land value (quality) emerged the most important in connection with labour productivity in woina dega, altitude and manure input, once again, appeared more influential in dega areas.

In summary, patterns of land and labour productivity, generally, showed spatial accord, i.e. areas of higher land productivity also emerged as regions of high labour productivity and the vis-versa holds true (e.g. Cheza Sefer, Ketane, Kokera, Muttan Wera, Agenna, Sissena Denab and Dubissana Karsa (kolla)). This is as expected in hypothesis (4).

Out of the thirteen variables included in the correlation and regression analysis three and four of them did not contributed to explaining the variance of land and labour productivity, repectively, in all zones. These are rural literacy and distance to plots, on the one hand, and farm size, enset damage caused by diseases and wild animals, and access to roads and market places on the other, inconnection with land and labour productivity respectively. Cultivated land intensity did not contribute to variance in land productivity and could not explain labour productivity either. Although these variables seem important explanatory variables for agricultural productivity, none of them appeared significantly associated with either land or labour productivity or both.

Rural literacy, which was expected to expose farmers to new developments in agriculutre, appeared to have little or no bearing. This may be attributed to the traditional nature of enset cultivation which predominated the cropping pattern in the region. Environmental constraints together with high population density as aggravated by agricultural land shortage and lack of agricultural extension services including credit provisions and others could not give chance to modernize farming system in the region despite some improvements in rural literacy.

Earlier, it was noted that enset cultivation is highly integrated with Gurage farm houses from where manure, labour and other inputs come from. Hence, houses appear so closely located around enset farm. As aresult, the influence of distance to farm plots on land productivity appeared not signigicant. The reason why cultivated land intensity could not come forth in the regressions might have been due to the fact that its distribution was one of the least heterogenous. Others, access to roads and market places, farm size and number of ensets destroyed and damaged showed no significant spatial associatons with labour productivity in all zones for reasons that are not clear.

On the otherhand, manure input, stocking density, agricultural labour and land quality emerged as most contributing to variance and were most influential in both land and labour productivities. Manure input appeared important in all zones in explaining both labour and land productivities while agricultural labour considerably contributed to the variance in labour productivity in all zones and to land productivity in kolla and dega zones.

Furthermore, land value (quality) emerged important in both aspects in kolla and woina dega zones. Farm size, though could not come forth significantly in connection with labour productivity in all regions, it appeared as the second important contributor to variance in land productivity in woina dega zone in specific and at regional level at large.

Thus, they are socio-economic and demographic (human) variables which emerged the largest contributors to the heterogeneity in agricultural productivity and considerably influenced both land and labour productivity. Needless to say, however, the contribution of land quality as "indexed" by land value is considerable in both aspects of productivity.

## CHAPTER SEVEN

### SUMMARY OF FINDINGS AND RECOMMENDATIONS

Ethiopia is a country with more than 2000 years of recorded history and land occupance pursuing traditional way of livelihood. This has resulted in near saturation of some areas with pocket to their population pressure. Sabat Bet Gurageland constitutes one such pocket. The study aimed at highlighting some of the critical problems of this area through the study of Ezana Wollene and Cheha weredas.

The study area totally covers about 1540 square kilometer area and located in Shewa region about 200 kilometers southwest of Addis Ababa occupying kolla, woina dega and dega, well recognized agro-climatic zones in Ethiopia.

In the region there are three major soil groups i. e. Pellic Vertisols, Eurtic Nitosols and Lithosols respectively covering about 45%, 21% and 31% of the area of the two weredas. Because the region is densely settled, its natural vegetation cover is nearly removed in most of the parts. What is left are few patches of residual temperate forests in upper woina dega and dega parts. The region is a highland with varying height and slope, and deeply cut by streams draining the area. Altitude ranges from 1040 to 3500 meter a.m.s.l. The altitude rises in the north-east direction from south west. Topographic "texture" is about one "grain" in dega zone but it is very "coarse" in kolla except in the Wabe and Gibe troughs. Drainage density is about 313 meter per square kilometre area while drainage "texture" ranges from 400 in upper dega to 870 meters in kolla zone. Climate ranges from tropical to temperate characterized by annual mean temperatures varying from 20° to 22.5° c in kolla and 10° to 15° in upper dega. Annual average precipitation is about 1308mm of which about 55%, and 30.4% are lost in the form of

evapotranspiration and surface run off. The rest is available to replenish the underground water. Both annual precipitation and basin yield showed a trend of decline in the last two to three decades.

Population density in the area is about 225 persons per square kilometre. At PA level it varied from 50 in Lukena Aba, (kolla) to 728 persons per square kilometer in Agenna (woina dega). At individual farm level, however, it is much higher and varied from about 353 to the extent of 1400 p/km<sup>2</sup>. Woina dega zone appeared most densely populated and houses about 55% of the population of the two weredas in about 51% area. Dega zone which is about 41% of total area inhabited by about 41% of the total population.

As in other parts of Ethiopia and developing countries, at large, population of the area may be classed as "young", age group from 0 to 15 accounts for about 44% of the total while working age group and aging population (15-59 and 60 and above respectively account for 51 and 5%. Hence, total dependency burden of the population is about 94.4%, and masculinity ratio of the sample households population was 109 males for 100 females. Average household size was 7%, about 56.3%, 37% and 5% of the population was married, single and widowed, while crude illitracy rate on the average was 59% for both sex but it was more prevalent among women (73%) than what was for men (47%).

Farm houses are found in groups and linear patterns. One peasant, owned one to three different size of houses. Spacing of individual peasant farm houses is about 28 meters apart. The region is vey accessible and has a road density of 171 meters per square kilometer area (cf. 10-11.7 meter of the national average).

The area is characterized by high population pressure, scarcity of arable land and inset farming which involves significant labour slack seasons, made the region one of the

most out- migration prone areas in the country. Migration rate was about 12.1% for all members in a household, and as much as 19% for only the household heads in 1992/93. In 1974/75 rate for all household members was about 34% of the current rate. Most of the out migrants were males (78%) and about 80% of the migrants belonged to age group of 16 to 30 years. Those who were younger than 15 years accounted for 16% and more than a quarter (27%) of the Gurage population live outside home area. Nearly three-quarters of the out-migrants were destined to Addis Ababa, 13% to eastern Ethiopia, 6% and 3% to southern and south western Ethiopia respectively. Out-migrants stayed away from home for about 10 months in a year, on the average, while household heads for about 6.5 months and other household members for about 11 months in a year. Most migrants were expected to come back home once in a year in September to celebrate meskal feast and weddings. Out migration starts again soon after Meskal in October and reaches its zenith in January and February.

The current land-use and land cover of the region as inferred from sample survey (1992/93) showed that cultivated land (42%) grazing areas (30%) and wood lands (13%) were the major constituents, altogether, accounted for about 85% of the total area of the three sample PAs. The share of cultivated land varied from about 75% in Norcha (dega) to only 14% in Dubissana Karsa (kolla). Grasslands predominated the land use in kolla with 66% share as compared to 4% in dega, and wood land as much as 22% in Agenna (woina dega) as compared to only 6% in kolla.

Due to high population pressure and growing need for cash followed the introduction of some cash crops and eucalyptus tree into the region by migrants. Hence, export of cash crops and other surplus products to other parts mainly Addis Ababa has been facilitated by introduction of all weather road transportation in the Sabat Bet

Gurageland. This also introduced significant changes in the land use and land cover of the area during the last 21/36 years. Cropped area, woodland, settlement and avenues (jefuer) increased by about 26%, 196% and 5% respectively. While fallowland (mainly in Norcha), grazing area, forests and badlands registered declines about 33%, 25%, 19% and 57% respectively.

In retrospect, before the 1975 land reform of Ethiopia, about a quarter of 237 sample household heads were landless tenants, 32% petty tenants and 44% were land owners (gabar). Nearly three quarters of the respondents wished the government based land ownership to continue in the coming years while 25% opted for a change in one way or the other; out of 76 respondents 71% needed private ownership of land while 29% demanded community ownership.

Landholding size is an important input in agricultural production as it influences the scale of production. In the study area 68% of 191 respondents owned lands less than one hectare of land each and 30.5% of owned between one and five hectares. The average size of holding was about one hectare while median size was computed as 0.69 hectare. At zonal level median holding sizes varied as 0.46 in kolla, 0.63 (dega) and 0.76 in woina dega. Through time median holding size decreased from 0.78 in 1974/75 to 0.7 (1982/83) and 0.69 hectares in 1993. Three quarters of the households reported of possessing one compact plot while 13% 7% and only 1% showed that having 2,3 and 4 parcels of land respectively. But farms were rarely located at more than five minutes from farm houses.

Family labour is the basis of all farm operations and division of labour in a family is made according to age and sex. Available weighted labour per house hold, on the average, was found to be 3.0 but it ranged from 2.71 in kolla, 2.75 (woina dega) to 3.2 in dega. Female labour accounted for about 43.4% of total labour in the sample households. and varied from 41.2% in dega to 45% of the total in kolla and woina dega.



Available labour tended to increase dega wards. Oxen power is little used to prepare land in woina dega and kolla where enset and other perennials dominated the cropping patterns because land is prepared and operated mainly by human labour. It is in dega parts where grains are more important in cropping pattern that oxen power was reported to be utilized in farm operations. Only 19% of the respondents reported using oxen almost all of which belonged to dega zone.

Methods employed to restore soil fertility are pivotal in any agricultural system, and may critically influence the sustainability of the system. Manuring, fallowing, crop rotation and inter-cropping and chemical fertilizers are used to restore the fertility of soil. Animal dung is extensively used in most part of the region. From 210 sample households on the average, about 194 quintals of animal dung was collected per house hold per annum in 1992/93. This can be provided at the rate of 37 quintals per hectare of cultivated land. Zonally, it varied from 39 in kolla to 35 quintals per hectare of cropped area in dega. Nearly 59% of the total collection is made during summer until mid-October 75% of the total available manure is supplied to enset crops while potatoe, chat and coffee got about 10%, 8% and 2.1% respectively. Due to reduced number of cattle because of cattle disease and decreasing grazing area, amount of animal dung collected in 1992/93 recorded a decline of about 50% from 1974/75 when the available manure was about 70 quintals per hectare of cultivated area.

Fallowing is practised only in dega where also the fallow period is only one year. Fallowland in Norcha PA, for example, accounted for about 28% of the total area and 38% of the cultivated land in 1992/93, but 21 years ago (1972) it accounted for 42% and 48% respectively. Moreover, cereals and pulses (peas and beans) are reported to be cultivated alternatively (rotated) at an interval of one year in dega zone only. In the lower

woina dega and kolla areas coffee, chat and orange are intercropped with each other as well as with enset. Young enses intercropped with maize and taro. Only peasants from dega reported of using fertilizer which constituted 50% of the 74 respondents. Each peasant on an average applied a total of 50kg. No peasant reported of using improved seeds however.

Farm tools, in general are found to be traditional, archaic and simple. Nearly every peasant in the area owned at least one marasha, 3.6 sickles, and one matrashye, and 95%, 78%, 72%, 71% and 70% of the sample households owned 1.3 axe, 1.2 Zbangiba, 1.0 small hoe (aya), 0.8 murya and 1.5 watar each respectively. About 40% of the sample households for dega owned one plough each and a mofer (plough beam) and a yoke for every two households.

Enset is extensively cultivated except in upper dega in which barley, peas, beans, cabbage and potatoe are more important. In woina dega chat appeared first the important cash crop followed by orange and coffee, while in kolla coffee was reported more important followed by chat and orange. Each household owned adult enses ranging from 190 in dega to 233 in woina dega. The average was 228 enses in 1993. Number of enses harvested per year also ranged from 24 in dega to about 40 in woina dega, but the average was 34 per house hold. Yield, in terms of matured enses harvested per hectare was 167 which varied from 154 in dega to 219 in kolla.

Regional cropping pattern was found dominated by area under enset which covered about 61% of total cultivated land in the sample households of the 10 PAs followed by chat (15.3%). The areal dominance of enset, however, was as much as 66% in woina dega. On PA level it reached to the extent of 97% in Cheza Sefer, 82% in Emdeber and 70% in Darcha PAs. On the otherhand, barley accounted for 74%, 43% and 33% in Norcha, Kokera, and Ketane PAs of dega zone respectively. Perennial crops, in general,

covered about 85% of all cultivated in the sample PAs.

Significant changes were observed in the cropping pattern in the last two decades. Areal share of enset in dega zone increased from about 25% in 1974/75 to about 51% in 1992/93. In Norcha for instance, enset was either not cultivated or was negligible two decades back. But currently it accounted for about 9% of the total cropped area. The share of perennial crops increased from 78% (1974/75) to about 85% (1992/93) in the period partly at the cost of land under grains and grazing. Importance of grains, however, considerably decreased from 17% (1974/75) to about 13.5% in 1992/93. Root crops showed similar trend of decline but at a slower rate.

The region could be identified as a three crops enset-chat and barley region but some PAs such as Norcha, Cheza Sefer, Darcha, Sissena Denab and Emdeber appeared more as monoculture PAs which may be attributed to the predominance of enset in the cropping pattern. While Kokera and Ketane, and Agenna and Muttana Wera appeared as a two-crop areas: enset and barley, and enset and chat respectively. As to the relationship between crops is concerned, barley and enset appeared negatively correlated in upper dega and positively correlated in middle to lower dega PAs which may imply that the former stand as substitutes while the latter as complementary to each other respectively. In woina dega PAs chat and in Kolla coffee showed negative associations with enset, which may imply that the two crops i.e. chat and coffee as far as cash is concerned.

The average number of crops grown in the region found to be three while the range is from two in Agenna to five in Kokera (dega = 4, woina dega = 3 and kolla = 5). Nearly three-fourth of the peasants in the sample households grow two to four crops which most likely are enset, chat, barley and coffee.

Enset is not only grown as food crop but also is a source for some house hold industries used as construction material like rope etc. and has its medicinal value. Hence

it is so integrated with the socio-economic and cultural traits of the people that the Gurages call it "Yafeya Guardara". The cycle of its cultivation involves propagation, transplantings, hoeing/ploughing, weeding, manuring through a year and harvesting. Depending upon local climatic conditions, cycle of enset cultivation involves stages (phases) as many as 6 in most part of the study area with spacing of "adult" ensets ranging from 2 by 2 meter in dega zone to about 2.75 by 2.75 meter in kolla areas (the average = 2.4x2.4 meter). Enset has varied period of maturity as well as ranging from 10 years in kolla to the extent of 15 years in dega (average 11-12 years). Although about 53 enset "varieties" were identified in the 243 sample households, only three of them, Nechawe, Yesheraquenque and Kanchewe were found to be most common almost in all zones. On the otherhand, Guarye, Astara, Kebenar and Dere "varieties" were also found common for their medical uses.

Enset, as reported, has lower nutritional value as compared to some cereals and pulses. Nonetheless, it has a higher agronomic yield as high as 41 quintal of dry Kocho per hectare (or 30 kg. of dry Kocho from one enset in Emdeber area, 1974/75) as compared to 11 quintal per hectare for grains (CSA, 1990).

Assuming 0.252 hectare of cropped area per household, 34 mature ensets harvested in a household, 30 kg. of dry Kocho product form one enset and a 200 cal in 100 gram, of dry Kocho, caloric yield of enset is about 8,095,235 cal per hectare. On the other hand, based on same assumption but 11 quintals per hectare of cultivated land for grains and 339 cal content per 100 gram of grains (Agren, et.al., 1968) calorie yield for most cereals and pulses is only about 3,729,000 cal per hectare. This is only 46% of enset's calorie yield. Accordingly, assuming a minimum colorie requirement of 2339-2500 per person per day, enset can support 9 to 9.5 persons per hectare while grains can only support 4 to 4.4 persons. Hence, regardless of variation in nutritional values, enset culture

appeared to be superior and can provide support to more people per hectare than grains. Thus an anticipated shift from enset to other crop may not be beneficial.

Livestock is the other component that supports population in the area. Cattle are kept as source of food, for their manure, social security (wealth) and as source of support energy for the farm, while sheep and goats, and equines are reared primarily to meet the need for cash income and as pack animals respectively. Cattle account for about 85% of the livestock composition while horses for 11.2%, mule 9.7%, donkeys 0.7%, sheep 1.5% and goats 0.3% in TLU. Each peasant owned 3.8 livestock in TLU. But this ranged from 2.2 TLU (3.8 heads) in Kolla to as much as 4.7 TLU (8 heads) in dega. About 6 livestock patterns, three each in woina dega and dega, and one pattern in kolla (same as one of the three in woina dega) was identified. But these could be regrouped into two major combinations as cattle mule-goat in the lower two zones and cattle-horse-sheep found in dega parts.

Stocking density i.e. number of livestock (TLU) per square kilometer of grazing land, on the average, was found to be 428 in the sample households in 1992/93. This figure was 466 in 1982/83. The number of livestock, however, decreased from 6.3 (TLU) in 1972/75, 4.6 (TLU) 1982/83 to 3.8 (TLU) per household in 1992/93. It follows that livestock number decreased by about 40% in the last 19 years while stocking density increased by about 9% in the last 10 years, which may be attributed to decrease in grazing area. However, at regional level, stocking density increased in whole of dega zones and Agenna PA of woina dega but it decreased in the rest of the area during 1982/83 - 1992/93. Livestock density per square kilometer of cropped area showed decline for the same periods due to expansion of cultivated area. It was also observed that population density and stocking density have strong positive correlation ( $r=0.81$ ). Cultivated land intensity and stocking density were directly associated though weakly. A moderate

positive association of  $r=0.4$  was also observed between population density and proportion cultivated land.

Several writers reported that agricultural productivity has declined in Ethiopia, a situation which was confirmed in the region as well. More than 45% and 36% of 229 respondents respectively reported that the number of ensets harvested and their size decreased in 1992/93. Productivity of other crops was also reported as decreased by about 34% of the respondents. But considerable increase in enset production was reported in the dega part because enset cultivation has been under expansion for it is most recently introduced one in the region.

Nonetheless, an overall decline in agricultural productivity was reported. This was attributed to factors such as reduced manure supply due to the effect of reduced cattle size, good share of available manure went to chat and other cash crops, change in climate, loss and damage of enset caused by wild lives and "enset diseases", decreasing farm size as a result of fast population growth, and shift in attention and care from enset to chat and other cash crops, etc.

Enset diseases appeared more prevalent in lower two zones while damages caused by wild animals is common throughout. A total loss of 3293 and 5735 plants of "adult" and "young" ensets respectively was reported because of "enset diseases" and wild life in 1992/93. The average losses per house hold respectively were 17 and 30 which aggregate to give 47 enset loss per house hold in a year. Drop in the amount of farm yard manure was also reported due to deaths of cattle caused by prevalent diseases and poor feeding. This also was reported as cause of decline in production. In the sample house holds about 70.2 TLU (116 heads) deaths were reported in 1992/93, out of which cattle accounted for 88%. The over all livestock mortality rate was revealed as 7.7%.

Inadequate onset research provisions, lack of access to infrastructural settings including agricultural extension services were reported as major agricultural constraints in the area.

The study disclosed that both land and labour productivities showed significant variations at farm, PA and zonal levels. Land productivity which was determined in terms of 1992/93 market prices of crops in the region, varied from 1,650 birr per hectare of cultivated area in Cheza Sefer (dega), 3802 (Dubissana Karsa, Kolla) to 4994 birr in Kokera (dega) with the average for 197 sample households as 2605 birr per hectare of cultivated land. At zonal level land productivity showed decline with increasing altitude in consequence of increasing population density. Labour productivity, on the other hand, varied from 114 birr per agricultural worker in Cheza Sefer (dega), 233 birr in Dubissana Karsa (Kolla) to the extent of 538 birr in Agenna (woina dega). Regardless of slight deviations, the trend of change may be generalized as labour productivity increased kolla wards but in woina dega it is above the regional average. Generally, spatial accord in the two was observed.

Simple correlation results between land and labour productivity and the thirteen variables selected showed that stocking rate and agricultural labour emerged relatively strong and positively associated with land productivity while others (supply of manure and land value) showed direct but weak correlation. All other attributes such as farm size, number of onset damaged, cultivated land intensity, commercialization level and distance to plots showed inverse relationship with land productivity. In connection with labour productivity however, manure input appeared as relatively the strongest positive associate while population density and agricultural labour showed negative relationship. Others, setting aside of farm size and onset damages, emerged significantly correlated with labour productivity.



When put to stepwise multiple regression analysis only eight out of thirteen variables could emerged as significant predictors based on their strength to explain the variance in land productivity while in case of labour productivity there were only five. The eight out of thirteen, which emerged as significant predictors in connection with land productivity succeeded to explain about 25.5% of the total variance in land productivity, while the five (agricultural labour force, rural literacy, manure input, distance to plots and land value) altogether successfully explained 17.8% of the total variance associated with labour productivity of all zones.

However, manure input, stocking density, agricultural workforce (labour) and land quality (value) emerged most contributing to variances and are influncial in both land and labour productivities. On zonal level manure input appeared imporant in all zones inconnection with both land and labour productivities, while agricultural labour considerably contributed to variance in labour productivity in all zones and land productivity in kolla and dega zones only. Land quality emerged important predictor of land and lahour productivites in kolla as well as in woina dega zones. Although farm size did not emerged as predictor of labour productivity in all the regions, it emerged as the second importnat contributor to variance in land productivity in woina dega in specific and for the study area as a whole.

Thus the above mentioned variables were idnetified relatively as the best pridictors or, in other words, the most influncial factors in determining the pattern of land use and its productivities.

By way of conclusion it should be emphasised that enset-based farming system is traditional which employs very simple and archaic hand tools, needs an extensive manure supply to restore soil fertility and, to a large extent, is dependent upon human labour. The system, as such, appears likely have no much scope for modernization.

While maintaining food security, the Gurage farmers had to continually shape and reshape the organization of food production to meet the challenge of the new forms of states, demands for cash and market conditions through introducing cash crops to their farms and seasonal migration because enset is well apt to facilitate intercropping with some of the cash crops as well as provides sufficient labour slack season which could be used for off-farm activities without affecting the house hold production as such.

In the area, enset plant husbandary and pastoral industry emerged as the two major land uses but they complement each other with little or no competition between the two. Cash crops such as chat, coffee, orange, etc. including eucalyptus woods do show competition with livestock and enset cultivation. The competition prevailing between eucalyptus wood land expansion and grazing area appeared much notable, and all sort of land-use competitions are likely to accelerate and aggravate the stress on land resources. Hence, there is the need to regulate the rate and direction of land use changes in the area.

There is a good deal of spatial accord among land and labour productivities in most part of the study area. The middle to lower altitude zone PAs emerged as areas of both high land and labour productivity. Only dega lagged behind. The dominance of grains in dega and cash crops in woina dega and kolla can be used for zonal complementarity. Necessarily this zonal specialization in cropping should be given priority because it can result in better yield and provide possibility of exchanging surplus grain and perennial crop products zonally.

The selected thirteen variables became able to explain only about 26% and 18% variances associated with land and labour productivity, respectively. Therefore it is

noteworthy to mention that the consideration of only socio-economic variables could not adequately explain agricultural productivity in the area, which may partly be attributed to yield measurement errors and the reluctance that respondents showed in the household survey. The incorporation of more factors from the physical environment into the analysis could perhaps increase the explained variance. This, however, is open for future research to be verified as this study failed to include factors from the physical environment.

It should also be noted that the regression result and the land-use zonation pattern identified provide some support for two theoretical propositions: von Thunen's land-use model and Boserup's theory of 'agrarian change'. In the study area and the Sabat Bet Gurageland, at large, land use showed zonation in rectangular form and intensity decreases away from the Gurage farm house outwards. As such this appears an empirical test in support of von Thunen's land-use model, despite what was observed in the area showed land use zonation about the farm house in rectangular form as compared to von Thunen's land use zones which appeared as concentric circles about a central market place, and the farming system in the area is subsistence based while von Thunen assumed a cash economy.

Boserup admitted that population increase is associated with rise in agricultural inputs such as fertilizer, pesticides, herbicides, etc. including improved seeds and technology can result in an increase in agricultural productivity. Otherwise, productivity could suffer. Likewise, since farming system in the study area is traditional and land use technology has stagnated population density appeared negatively correlated with land productivity which showed a trend of decline. Hence, this supports what Boserup suggested as an exception to positive correlation of population increase and land productivity, under the circumstance of increasing farm inputs. Moreover, the negative correlation observed between available agricultural labour force and labour productivity in the regression analysis

was also in accordance with Boserup's argument that output per worker is more likely to decline than increase when labour input is raised (Boserup, 1965).

Enset, inspite of its low protien and calorie values, longer period of maturation which may be due to five or more transplants it involves which might have facilitated communicability of "enset diseases" pathogens from infected ensets to healthy ones, it must be retained for its high agronomic yield which is about 217% of most of the seed crops. Hence it can support more population per unit area as compared to most of the seed crops. Enset also has better tollerance to short range drought and has numerous other economic uses. Hence, the author is against the idea of replacing enset by seed crops provided that population still continue growing fast and per captia size of land holding decreases or remain the same.

So long as population continues growing faster, per capita land holding and food production will go on decreasing or in short if rural poverty continues prevailing, seasonal rural out-migraion would continue acting as a "safety value" in relieving population pressure. But, at the same time, it may also continue badly drain away good number of the region's working force, a situation which can adversely affect the agricultural performance of the area.

## RECOMMENDATIONS

Two decades back ENI reported that protein and calorie intake of people in the Sabat Bet Gurageland respectively was only about 42% and 60% of the requirement. As population continued growing faster and per capita size of land holding grew more dimunitive, farm input decreased and the technology stagnated, as a result, agricultural productivity declined, a situation which was confirmed by a good number of sample

household heads in the area. In consequence, this might adversely affected food supply condition and aggravated rural poverty which in turn stimulated an ever larger rural out-migration from the region. Hence, the need to avert the worsening rural living condition by way of increasing food production which necessitates improve the land use and restructure the farming system should be a pressing one. Thus as a solution, in light of the problems so far noted, the following policy measures are suggested.

First, one of the foremost task should be the one involving the restructuring of enset-based farming system. But the restructuring should still revolve around enset crop and enable to supplement (or complement) the nutritional value or protein and calorie intake of the people. To this effect some calorie and protein rich crops can be cultivated together with enset. But if this does not prove to be economical, cash crops which may not interfere with enset cultivation may be grown so that people can earn cash which enables to purchase rich nutritional items to compensate the nutritional deficiency due to preponderance of enset (Kocho).

Second, such restructuring should be followed by or associated with increasing agricultural productivity which may be obtained in the first place by improving land quality through an increased manure, chemical fertilizer, pesticides, improved seeds, etc. inputs, and secondly by introducing cash crops as well as developing irrigation schemes in all zones but specially in dega PAs in connection with the latter. As to manure, so far it was more applied to perennial crops in enset growing PAs, but the possibility of increasing manure supply depends on the number of livestock which can be raised, which in turn partly determined by available grazing area. Hence, the land use system need be optimally planned by balancing the demand for various uses.

Thirdly, the processing of enset for use as food is arduous, laborious and time

consuming. The technique of initiating the fermentation process by way of decorticating and pulverizing enset is subtle. They are women who mainly engage in the processing of enset, hence they devote much of their labour to it. The need to improve the existing archaic technology in this regard and other simple hand tools employed in enset cultivation appears urgent. This of course will require some research.

Fourth, Gurage area at large and Sabat Bet Gurageland, in particular, is well known for its high enset concentration. But it lacks a single enset-based research station which is meant to identify and check "enset diseases", raise enset yield and improve enset cultivation system in connection with the spacing of enset, clone selection, number of transplantings (stages) involved, the possibility of using chemical fertilizer to enset and other perennials, shortening maturation period, etc. Since the area's physical environment and cultural settings are distinct from that of Wolayta area where the only one enset research station is situated at Areka, at least one enset-based research station should be established in the area. The need to control "enset diseases" and damages caused by wild animals, though appeared contributing little to variance in land and labour productivities probably because of measurement errors in yield, it is urgent and critical to raise enset productivity.

Fifth, to maintain and increase per capita production of enset and other crops which means keeping balance between population and resources necessitates to curb and then slow down of current fast population growth rate. Success in this regard may take some time but it is expected to pave the way to improve the living condition of the people in the area in many respects. To this effect, the National Population Policy (1993) should be strictly observed, educational and health facilities including family planning provisions and other infrastructural settings improved.

Sixth, integrating agriculture with other occupational activities or income generating activities so as to combat the out-migration of work force. Amenities such as electricity can be extended as well as media facilities to be extended. Artisans in the area should be supported so that native cottage industry develops. Indigenous and other investments should also be attracted toward the region to establish agro-industries and other small and medium scale industries which can make use of agricultural and other raw materials (e.g. enset fiber for manufacturing sacks, carpets, ropes, bags and even clothes of various quality (as the Japanese developed it) and the excess labour particularly during agricultural labour slack seasons.

Seventh, infrastructural development to facilitate the availability of items (e.g. fertilizer, pesticides, improved seeds, improved technology, etc) as well as to market their surpluses easily and credit facilities. Moreover, an integrated agricultural extension services (based on inter- sectoral relationship) and training of multi-purpose agricultural development agents should be intensified. These are crucial to modernize agriculture.

Eighth, regional and local governors, and other affiliated bodies including NGOs such as the Gurage People Self-Help Development Organization and others may pursue the following options to increase food production in the region. Existing wide plains of vertisols occurring in the lower woina dega and kolla zones may be cultivated to produce teff and other crops using fertilizers and mainly depending on rain and/ or irrigation. Capital investment is also warranted toward small and medium scale irrigation schemes in some river basins (e.g. lower Megecha, Gotam, Wenke, etc.) in the lower wiona dega and kolla zones. The wide plains may also warrant capital investment to medium and large scale modern ranching development.



Nineth, peasants in the area should be advised and supported to employ appropriate soil and water conservation measures so as to maintain soil fertility, minimize soil degradation and loss through erosion by way of developing bad lands so as to combat the drought effects. Maintain the livestock population merely by improving the grazing fodder and breeding methods and restrict the expansion of cultivated areas to marginal lands, vulnerable lands which are more to accelerate degradation /erosion/ to increase the badlands. The transitional slope zones in upper woina dega and lower dega zones deserve special attention in this regard.

As such all these measures, if rationally pursued, would ultimately narrow considerably the gap in supply and demand of food in the region.

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## Appendix A

### WATER BUDGET CALCULATIONS FOR BOTH EMDEBER AND WELKITIE

Thornthwaite's method (Thornthwaite and Mather, 1957) of calculating water budgets for two climatic stations are used in this study. The calculations make use of the common inflow-outflow relationship in the hydrological cycle as expressed in the Moisture Balance Formula:

$P = PET + S + \Delta SM$  where,  $p$  = precipitation which reaches the surface;  $PET$  potential evapotranspiration;  $S$  = water surplus;  $\Delta SM$  = Soil moisture storage change.

If " $t$ " is the mean monthly temperature of the consecutive months of the year expressed in degree centigrade, the monthly heat index ( $j$ ) can be expressed as:

$$j = (t/5)^{1.514} \dots (1)$$

Based on (1) above the yearly heat index ( $J$ ) is given by:

$$J = \sum_{i=1}^{12} j \dots (2)$$

Accordingly, the gross potential evapotranspiration ( $PET$ ) for any month with mean monthly temperature ( $t$ ), is given as

$$PET = 1.6 (10t/J)^a \text{ in centimeter per month} \dots (3)$$

$$\text{where, } a = 0.49239 + (1792 \times 10^{-5})J - (771 \times 10^{-7})J^2 + (675 \times 10^{-9})J^3$$

Since the above formula (3) gives  $PET$  for 30 days and 12 hours of sunshine, it has to be adjusted for the number of days per month and length of day which is a function of latitude. Thus the  $PET$  results from (3) are multiplied by appropriate latitude factors (see Table 2.5 row 5).

Based on the procedure adopted in the work of Thomas Dune and Luna B. Leopold (1978: 238-247), potential evapotranspiration heat index values in row 1 and 2 respectively. The values in row 6 have been found by multiplying values in row 4 (gross potential evapotranspiration) by values of latitude correction factors in row 5 to get corrected potential evapotranspiration values in row 6.

The difference between precipitation (row 3) and corrected potential evapotranspiration (row 6) gives values in row 7 which defines the months in which

precipitation exceeds potential evapotranspiration and the vis-versa. Hence, this also defines months of dry and wet season.

The severity of dry season increases during the sequence of months with excessive potential evapotranspiration and this is expressed in row 8 as accumulated potential water loss. This is the total of negative values and the sum begins at the end of the wet month.

In the two weredas the color of soil considerably is red in the transitional slope zones while in the lower and Upper Plateaus soil color is black with the largest proportion of clay. Some writers also reported that soil texture in Eza and Cheha areas are largely fine textured (Ipcar, 1970). Hence, soils of the two stations are assumed to be clay loam.

The available water holding capacity of clay loam soils is approximately 25% (250mm of water per meter depth of soil) (Thornthwaite Mather, 1957). Assuming the average root penetration of 0.8 meter (for the region is dominated by perennial crops such as enset, coffee, chat, orange and wide cover of eucalyptus trees and bushes and scrubs, etc) in the soil, the root zone could hold 200mm (0.8m x 250mm) of water of field capacity.

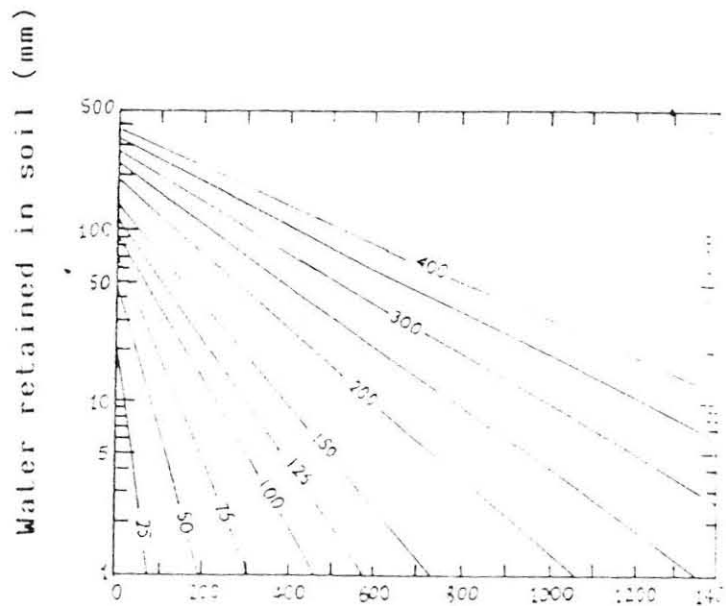
If a soil with an available holding capacity of 200mm is subjected to a potential water loss of 17.3mm in October at Emdeber (given in row 8) the amount of water which will be retained by the soil is 185.7. This value of soil moisture is entered for October in row 9. The same was done for the other dry season months. However The entered value of soil moisture is found by reading soil moisture graph in Appendix B. Soil moisture values for the wet season months are obtained by adding the excess precipitation from row 7 (P-CPET) to the soil moisture level at the end of dry season month February and March for Emdeber and Welkitie respectively.

From row 9 (soil moisture) the change in soil moisture is entered in row 10.

When precipitation exceeds the corrected potential evapotranspiration (row 6) the actual evapotranspiration in row 11 equals the potential rate. But when corrected potential evapotranspiration exceeds precipitation, actual evapotranspiration is the sum of precipitation and the amount of soil moisture withdrawn from storage (row 10).

The amount by which the actual and potential evapotranspiration differ in any month defines what is called the soil moisture deficit (row 12). However, when there is excess rainwater (precipitation minus actual and or potential evapotranspiration) it is stored in the soil at the beginning of the wet season. The soil moisture will eventually attain field capacity. After the soil reached field capacity precipitation in excess must leave the soil by percolation to underground water table. The excess water in this connection which is drained off is termed as moisture surplus and listed in row 13.

## A P P E N D I X B



Water retained in the soil against an accumulated potential water loss. The number on each curve is the available water capacity for the soil in millimeters.

(Data from Thornthwaite and Mather 1957, Adapted from Dunne and Leopold, 1978\* 241).

## Appendix C

## LAND-USE AND LAND COVER DISTRIBUTION AND CHANGES (1957/72-1993) IN THE THREE PAs

|                     | NORCHA ('DEGA') |      |       |      | AGENNA ('WOINA DEGA') |      |      |       | DUBISSANA K. ('KOLLA') |      |      |      | AGGREGATES (ALL) |       |       |       |
|---------------------|-----------------|------|-------|------|-----------------------|------|------|-------|------------------------|------|------|------|------------------|-------|-------|-------|
|                     | 1972            |      | 1993  |      | 1957                  |      | 1993 |       | 1957                   |      | 1993 |      | 1957/72          |       | 1993  |       |
|                     | Area            |      | Area  |      | Area                  |      | Area |       | Area                   |      | Area |      | Area             |       | Area  |       |
|                     | (km)            | %    | (km)  | %    | Km2                   | %    | km2  | %     | km2                    | %    | km2  | %    | km2              | %     | km2   | %     |
| Area under crop     | 5.15            | 38.9 | 6.10  | 46.1 | 1.56                  | 17.5 | 2.2  | 24.6  | 0.92                   | 9.2  | 1.33 | 13.8 | 7.63             | 23.9  | 9.63  | 30.2  |
| Fallowland          | 5.59            | 42.2 | 3.76  | 28.4 | -                     | -    | -    | -     | -                      | -    | -    | -    | 5.59             | 17.5  | 3.76  | 11.7  |
| Grasslands          | 1.07            | 8.1  | 0.54  | 4.1  | 4.29                  | 48.3 | 2.76 | 30.7  | 7.40                   | 75.7 | 6.31 | 65.5 | 12.76            | 40.04 | 9.61  | 30.04 |
| Grassland meadow    | -               | -    | -     | -    | 3.61                  | 40.7 | 2.31 | 25.64 | 1.83                   | 18.7 | 2.03 | 21.0 | 5.44             | -     | 4.33  | -     |
| Open grazin area    | -               | -    | -     | -    | 0.29                  | 3.29 | 0.18 | 2.1   | 2.46                   | 25.1 | 0.70 | 7.3  | 2.75             | -     | 0.88  | -     |
| Shrubed grassland   | -               | -    | -     | -    | 0.26                  | 3.0  | 0.27 | 3.1   | 3.11                   | 31.8 | 3.58 | 30.2 | 3.37             | -     | 3.85  | -     |
| Woodlands           | 0.28            | 2.1  | 1.45  | 11.0 | 0.90                  | 10.1 | 1.97 | 21.9  | 0.18                   | 1.9  | 0.61 | 6.3  | 1.36             | 4.3   | 0.03  | 12.6  |
| Eucalyptus & others | 0.17            | 1.3  | 1.29  | 9.8  | 0.81                  | 9.2  | 1.87 | 20.8  | 0.18                   | 1.9  | 0.61 | 6.3  | 1.16             | 3.7   | 3.77  | 11.8  |
| 'Astha'             | 0.11            | 0.8  | 0.16  | 1.2  | -                     | -    | -    | -     | -                      | -    | -    | -    | 0.11             | 0.34  | 0.16  | 0.5   |
| Shrublands          | -               | -    | -     | -    | 0.48                  | 5.5  | 0.44 | 4.9   | 1.11                   | 11.3 | 1.18 | 12.3 | 1.59             | 5.0   | 1.62  | 5.1   |
| Settlements         | 0.19            | 1.4  | 0.43  | 3.2  | 0.36                  | 4.1  | 0.53 | 5.9   | 0.10                   | 1.0  | 0.22 | 2.3  | 0.65             | 2.04  | 1.18  | 3.7   |
| Road ('Jefuer')     | 0.78            | 5.9  | 0.81  | 6.1  | 0.58                  | 6.6  | 0.57 | 6.4   | 0.07                   | 0.7  | 0.12 | 1.2  | 1.43             | 4.5   | 1.50  | 4.7   |
| "Badlands"          | 0.01            | 0.07 | 0.01  | 0.07 | 0.13                  | 1.5  | 0.05 | 0.5   | -                      | -    | -    | -    | 0.14             | 0.4   | 0.06  | 0.2   |
| Small lakes         | 0.15            | 1.1  | 0.14  | 1.1  | -                     | -    | -    | -     | -                      | -    | -    | -    | 0.15             | 0.5   | 0.14  | 0.46  |
| Forests             | -               | -    | -     | -    | 0.58                  | 6.5  | 0.47 | 5.2   | -                      | -    | -    | -    | 0.58             | 1.8   | 0.47  | 1.5   |
| Total               | 13.22           | -    | 13.24 | -    | 9.18                  | -    | 8.99 | -     | 9.78                   | -    | 9.77 | -    | 32.18            | -     | 32.00 | -     |

Source: Actual Field Survey by the author, 1993

Note that total areas in 1957/72 and 1993 for each PA and the aggregate may vary some how due to scale problem of aerial photos and measurement errors.

**Appendix D**  
**DISTRIBUTION OF AVERAGE NUMBER OF FARM IMPLEMENTS OWNED PER HOUSE HOLD**  
**AND PERCENT OF PEASANTS OWING**

| AP/Zone             | 'marasha' |     | 'Aya' |      | Plow |     | Yoke |     | 'Mofer' |     | Sickle |     | Axe |     | 'Tebeche' |     | 'Marya' |     | 'Walar' |     | 'Zbangiba' |     | Matrashye' |     | Proportion using own land (%) |
|---------------------|-----------|-----|-------|------|------|-----|------|-----|---------|-----|--------|-----|-----|-----|-----------|-----|---------|-----|---------|-----|------------|-----|------------|-----|-------------------------------|
|                     | (1)       | (2) | (1)   | (2)  | (1)  | (2) | (1)  | (1) | (2)     | (1) | (2)    | (1) | (2) | (1) | (2)       | (1) | (2)     | (1) | (2)     | (1) | (2)        | (1) | (2)        | (1) |                               |
| Norcha              | 1.0       | 100 | .91   | 52.2 | .83  | 74  | .91  | 74  | 1.1     | 83  | 1.9    | 100 | 1.3 | 100 | .2        | 22  | .17     | 17  | .22     | 13  | .13        | 1.3 | .91        | 91  | 83                            |
| Kokera              | 1.2       | 100 | .5    | 55   | .6   | 55  | .6   | 55  | .6      | 55  | 3      | 100 | 1.2 | 100 | .4        | 35  | .8      | 75  | 1.2     | 75  | .9         | 65  | .95        | 95  | 61                            |
| Ketane              | 1.0       | 100 | .52   | 52   | .3   | 29  | .3   | 29  | .3      | 29  | 2.8    | 100 | 1.1 | 91  | .8        | 76  | 1.04    | 95  | 1.8     | 86  | .9         | 81  | .95        | 95  | 30                            |
| Cheza S.            | 1.3       | 100 | 1.2   | 88   | 0    | 0   | 0    | 0   | 0       | 0   | 3.5    | 100 | 2   | 96  | 1.2       | 96  | 1.1     | 96  | 3       | 96  | 1.4        | 100 | 1.1        | 96  | 5                             |
| 'Dega' Total        | 1.2       | 100 | 0.8   | 67   | .4   | 39  | .42  | 39  | .5      | 44  | 2.7    | 100 | 1.4 | 98  | 0.6       | 58  | .8      | 71  | 1.6     | 68  | .8         | 67  | .98        | 93  | 45                            |
| Muttan W.           | 1.1       | 100 | .7    | 55   | 0    | 0   | 0    | 0   | 0       | 0   | 4.1    | 95  | 1.2 | 95  | 0.7       | 80  | .9      | 85  | 1.8     | 75  | 1.2        | 80  | 1.0        | 100 | 0                             |
| Darcha              | 8.4       | 100 | 1.4   | 88   | .2   | 17  | .1   | 12  | .1      | 12  | 3.6    | 94  | 1.4 | 94  | 1.1       | 94  | .9      | 94  | 2.2     | 88  | 1.4        | 94  | 1.1        | 100 | 23.1                          |
| Agenna              | 1.1       | 100 | 1     | 87   | 0    | 0   | 0    | 0   | 0       | 0   | 4.1    | 100 | 1.2 | 93  | 0.8       | 88  | 1.1     | 100 | 1.1     | 83  | 2.4        | 87  | 1.1        | 100 | 0                             |
| Sissena D.          | 1.1       | 100 | .8    | 73   | 0    | 0   | 0    | 0   | 0       | 0   | 4.1    | 100 | 1.4 | 96  | 0.8       | 82  | 1.2     | 95  | 2       | 86  | 1.5        | 91  | 1.2        | 100 | 0                             |
| Emdeber             | 1.3       | 100 | .5    | 50   | 0    | 0   | 0    | 0   | 0       | 0   | 4.4    | 100 | 1.1 | 92  | .7        | 61  | .9      | 81  | 1.9     | 83  | 1.4        | 78  | 1.1        | 100 | 0                             |
| 'Woina Dega' Total  | 1.2       | 100 | .9    | 70   | -    | -   | -    | -   | -       | -   | 4.1    | 96  | 1.3 | 94  | .8        | 75  | 1       | 88  | 1.8     | 82  | 1.6        | 86  | 1.1        | 100 | 3                             |
| Dubissana K/'Kolla' | 1.1       | 100 | 1.2   | 76   | 0    | 0   | 0    | 0   | 0       | 0   | 4.1    | 100 | 1.1 | 94  | .4        | 35  | .7      | 53  | 1.1     | 59  | 1.1        | 82  | 1.0        | 100 | 0                             |
| Grand Total         | 1.2       | 100 | .97   | 72   | .15  | 14  | .15  | 14  | .17     | 16  | 3.6    | 99  | 1.3 | 95  | .6        | 56  | .8      | 71  | 1.5     | 70  | 1.2        | 78  | 1.0        | 98  | 19                            |

Source: Field survey by the author, 1993.

- (1) = Average number of implements owned per household  
 (2) = Percent of total respondents owing the implements in question.  
 - = negligible



## APPENDIX E

## IDENTIFIED LAND RACES ("VARIETIES") OF ENSET BY NAMES IN THE STUDY AREA

| Zone         | No. Species identified | Commonest Enset Land races ("Varieties")                                                                                                                                                                     | Frequent of occurer (%) | Less Common Enset "Varieties" include                                                                                                                                   | "Varieties" grown for medical and other special purposes |
|--------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 'Dega'       | 35                     | Ankefuye' (11.4); Gimbwe' (10), Badet (7), Agade (6.8), 'Yesheraqenge' (63), Tary (6), Ferezye (5.4), Nechewe (2.4), Zober (2.2), Yeregye (2.2), Lemat (2.2), Kanchawe (2.2), Benezye (2.2), Yedeberye (1.6) | 67.9                    | Ameratye, Badedet, Busenet, 'Derewetye, Demyet, Enhab, Gerwetye, Kematrye, manyet, oret, Senevet, Sebra, Soro, Tomas, Yeqeswe, Yefaga Guarye, Goshwe                    | Guarye, Astara Kebnar Dere                               |
| 'Woina Dega' | 35                     | Yesheraqenge (11.1), Nechewe (10.7), Kanchewe (9.4), Ameratye (6.6), Yeregye (5.3), Yeqeswe (4.9), Beresye (4.1), Ferezye (3.6), Agade (3.0) and Zober (2.3)                                                 | 61.0                    | Ankefuye, Badedet, Badet, Busenet, Damed,a, Gimbwe, Kematanye, Lemat, Newerye, Oret, Senewet, Sebra, Tarye, Yegura, merat, Emer, Agagur, Engeda, Weka, Meshenatye, Egda | 'Guarye, Astara Kebnar Dere                              |
| Kolla        | 23                     | Yesheraqenge (14.5), Nechewe (10.1), Kanchewe (8.7), Badedet (8.7), Ameratye (3), Beresye (3), Teteret (3), Emael (3), Zober (3), Kunke (3), & Weka (3)                                                      | 63                      | Agade, Bedesya, Gimbwe, Wetine, Yeregye, Yeqesive, Goshewe, and Guferye.                                                                                                | Guarye Astara Kebnas Dere                                |
| All Zones    | 53                     | Nechewe (7.3) Yesheraqenge (6.9) Kanchewe (6.5), Ankefuye (4.9), Gimbwe (4.8) Agade (4.4), Ferezye (4.1) Ameraty (3.8), Badet (3.0), Yeregye (2.9), Yeqeswe (2.9), Beresye (2.3), Zober (2.3) etc.           | 56.1                    | 32 of the above                                                                                                                                                         | Guarye Astara Kebnar Dere                                |

Source: Field Survey by the Author, 1993.

Values in parentheses refer to the probable frequency of occurrence of each enset clones (in percent) amongst adult enset plants in the areas.

## Appendix F

## QUESTIONNAIRE USED IN THE HOUSE HOLD SURVEY

## I. IDENTIFICATION

1. Serial number \_\_\_\_\_ 2. Name of farmer \_\_\_\_\_
3. Name of PA \_\_\_\_\_ 3. Name of wereda \_\_\_\_\_
5. Agro-climatic zone \_\_\_\_\_ 4. Village name \_\_\_\_\_
6. Village/ farm elevation \_\_\_\_\_ meter
7. Walking distance from the village to market place \_\_\_\_\_ minutes.
8. Walking distance from the village to market place \_\_\_\_\_ minutes.
9. Distance to wereda capital \_\_\_\_\_ minutes

## II Household Background Information

10. Household head
  - 10.1. Sex----- 1.2.2. Age \_\_\_\_\_ or year of birth \_\_\_\_\_
  - 10.3. Marital status: married \_\_\_\_\_; Single \_\_\_\_\_; Divorced \_\_\_\_\_;  
Separated \_\_\_\_\_; Polyganist \_\_\_\_\_; Widowed \_\_\_\_\_
11. If the household head is married
  - 11.1. Wifes age \_\_\_\_\_ or year of birth \_\_\_\_\_ 11.2.2. Occupation \_\_\_\_\_
12. Literacy level of the couple:
 

|           |      |          |                      |     |      |
|-----------|------|----------|----------------------|-----|------|
| illitrate | read | read and | Grade level attended |     |      |
|           | only | write    | 1-6                  | 7-8 | 9-10 |

12.1. Husband \_\_\_\_\_

12.2. Wife \_\_\_\_\_

13. Children and other dependents

13.1. Children:-

|          | Age   | Sex   | Occupation | It student-<br>grade level | Watering<br>distance to<br>school (min.) |
|----------|-------|-------|------------|----------------------------|------------------------------------------|
| 13.1.1.  | _____ | _____ | _____      | _____                      | _____                                    |
| 13.1.2.  | _____ | _____ | _____      | _____                      | _____                                    |
| 13.1.12. | _____ | _____ | _____      | _____                      | _____                                    |

13.2. Others: relatives or dependents of house-hold members

|         | Age   | Sex   | Relationship to<br>household head | Occupation<br>completed | Grade level |
|---------|-------|-------|-----------------------------------|-------------------------|-------------|
| 13.2.1. | _____ | _____ | _____                             | _____                   | _____       |
|         | _____ | _____ | _____                             | _____                   | _____       |
| 13.2.3. | _____ | _____ | _____                             | _____                   | _____       |

14. Household size: Males \_\_\_\_\_; Females \_\_\_\_\_; Total \_\_\_\_\_

### III FARM ACTIVITY

15. In what farm activity you and other members of the household participate? (make "X" mark).

[illegible]

## IV. MIGRATION

16. Do you migrate to areas and towns outside your region?  
Yes \_\_\_\_\_ No \_\_\_\_\_
17. To which region/town you often migrate?  
1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_
18. How often you migrate out? (make "x" mark)  
18.1. Once in a year \_\_\_\_\_ 18.2. Twice in a year \_\_\_\_\_  
18.3. Three times in a year \_\_\_\_\_ 18.4. Once every \_\_\_\_\_ year
19. During which month(s) you are away from home? (put "x" mark)  
September, October, November, December, January, February, March,  
\_\_\_\_\_  
April, May, June, July, August  
\_\_\_\_\_
20. Howlong you stay away \_\_\_\_\_ days or \_\_\_\_\_ months
21. Does your wife migrate? (put "x" mark)  
Yes \_\_\_\_\_ No \_\_\_\_\_
22. If yes, to which region/town she migrates? (1) \_\_\_\_\_  
2) \_\_\_\_\_ 3) \_\_\_\_\_
23. How often she migrate?  
23.1. Once in a year \_\_\_\_\_ 22.2. Twice in a year \_\_\_\_\_  
23.3. Three times in a year \_\_\_\_\_ 22.4. Once every \_\_\_\_\_ year
24. During which month(s) she is away from home (put "x" mark)  
September, October, November, December January, February, March,  
\_\_\_\_\_  
April May, June, July, August  
\_\_\_\_\_
25. How long often she is away? \_\_\_\_\_ days or \_\_\_\_\_ months
26. Reseasons of your or your wife migration (put "x" mark).  
26.1. To obtain funds for immediate household needs \_\_\_\_\_  
26.2. To obtain funds for long-term needs \_\_\_\_\_  
26.3. To solve some immediate personal problem \_\_\_\_\_  
26.4. To obtain funds needed during feasts, holdays, marriage \_\_\_\_\_.
27. Do you have sons/daughters away from house?  
Yes \_\_\_\_\_ No \_\_\_\_\_

28. If yes, where are they, for howlong they go away and in which month(s) they are away?

28.1. Sons-Age      Town/Region      For howlong?      In which month(s)

28.1.1. \_\_\_\_\_ months \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

28.1.2. \_\_\_\_\_ " \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ etc.

28.2. Daughters Age

28.2.7. \_\_\_\_\_ " \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

28.2.8. \_\_\_\_\_ " \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ etc.

29. Reasons for their migration is \_\_\_\_\_ (put "x" mark)

29.1. To obtain money to support their parents \_\_\_\_\_

29.2. Lack of employment so that to find support \_\_\_\_\_

29.3. To escape tribal and domestic control \_\_\_\_\_

29.4. To obtain fund needed for wedding ceremony \_\_\_\_\_

29.5. For training \_\_\_\_\_

30. In your opinion, which of the following has stimulated migration in your area?

30.1. Land scarcity \_\_\_\_\_ 30.2. Fast population growth \_\_\_\_\_

30.3. Lack of employment during off-farm season \_\_\_\_\_

30.4. Availability of long labour slack season \_\_\_\_\_

30.5. Life hardship and poverty \_\_\_\_\_

31. What you do with the money remitted during migration by the household?

31.1. Invest to buy more land \_\_\_\_\_

31.2. Invest in house, fence, etc. repair and construction \_\_\_\_\_

31.3. Invest in livestock \_\_\_\_\_

31.4. Use it to buy gift and other readily consumable goods \_\_\_\_\_

31.5. Use it to meet social obligations at home and in the villages--32. The number of migrants from the household members (give number)

male      Female      Total

1974/75 \_\_\_\_\_

1982/83 \_\_\_\_\_

1992/93 \_\_\_\_\_

#### V LAND-USE AND ITS CHANGE

33. What is the land-use/land cover pattern :specialy areas under different uses in 'zeng' or 'wedere'.

|       |                    | Land-use type | 1974/75     | 1982/83     | 1993 |
|-------|--------------------|---------------|-------------|-------------|------|
| 33.1. | Total holding size | _____x_____   | _____x_____ | _____x_____ |      |
| 33.2. | Pasture land       | _____x_____   | _____x_____ | _____x_____ |      |
| 33.3. | Land under forest  | _____x_____   | _____x_____ | _____x_____ |      |
| 33.4. | Bamboo land        | _____x_____   | _____x_____ | _____x_____ |      |
| 33.5. | Eucalyptus Lots    | _____x_____   | _____x_____ | _____x_____ |      |
| 33.6. | Shrubland          | _____x_____   | _____x_____ | _____x_____ |      |
| 33.7. | Land under crop    | _____x_____   | _____x_____ | _____x_____ |      |

|            |                              |              |              |                   |
|------------|------------------------------|--------------|--------------|-------------------|
| 33.7.1.    | Land under all enset         | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.2.    | Land under enset (Nurseries) | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.3.    | Land under chat              | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.4.    | Land under coffee            | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.    | Land under Grains            | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.1.  | Under Teff                   | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.2.  | Under Barley                 | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.3.  | Under Wheat                  | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.4.  | Under Peas                   | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.5.  | Under Beans                  | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.6.  | Under Maize                  | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.7.  | Land under Potatoe           | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.8.  | Land under Taro              | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.9.  | Land Cabbage                 | <u>  x  </u> | <u>  x  </u> | <u>  x  </u>      |
| 33.7.5.10. | Land Orange                  | <u>  x  </u> | <u>  x  </u> | <u>  x  </u> etc. |

## VI PRODUCTION OF CROPS AND LIVESTOCK

38. Amount produced : give in number, birr or quintal, etc.

|    | Product                   | Unit           | 1974/75 | 1984/83 | 1993 |
|----|---------------------------|----------------|---------|---------|------|
| 1  | Num. of adult enset owned | number         | —       | —       | —    |
| 2  | Harvested ensets          | "              | —       | —       | —    |
| 3  | Price of med size enset   | birr           | —       | —       | —    |
| 4  | Chat sold                 | birr           | —       | —       | —    |
| 5  | Teff harvested            | Qut./'kumeta'  | —       | —       | —    |
| 6  | Barley                    | Qut./'Kumta'   | —       | —       | —    |
| 7  | Wheat                     | "/"            | —       | —       | —    |
| 8  | Beans                     | "/"            | —       | —       | —    |
| 9  | Peas                      | "/"            | —       | —       | —    |
| 10 | Maize                     | "/"            | —       | —       | —    |
| 11 | Potatoe                   | "/"            | —       | —       | —    |
| 12 | Cabbage                   | 'Esser'        | —       | —       | —    |
| 13 | Orange                    | Qut./birr      | —       | —       | —    |
| 14 | Taro                      | Basket/birr    | —       | —       | —    |
| 15 | Coffee                    | 'Joniya/'Kuna' | —       | —       | —    |
| 16 | Banana                    | birr           | —       | —       | —    |

39. If your enset harvest (in number and size) decreased, why? If you have more than ones answer, order according to decreasing importance.

39.1. Amount of manure provided to enset decreased \_\_\_\_\_



- 39.2. Good portion of manure supply goes to chat \_\_\_\_\_
- 39.3. " " " " " goes to coffee and Orange \_\_\_\_\_
- 39.4. Enset is harvestet before the usual maturity is reached \_\_\_\_\_
- 39.5. Change in Climate \_\_\_\_\_
- 39.6. Growing land scarcity because of population pressure \_\_\_\_\_
- 39.7. Soil erosion \_\_\_\_\_
- 39.8. Shift of Labour input and human care & attention to chat and others \_\_\_\_\_
- 39.9. Others, specify \_\_\_\_\_.
40. Which one do you think can improve your household increase? Given in order of decreasing importance by writting 1,2,3,.....
- 40.1. By planting more number of ensets \_\_\_\_\_
- 40.2 By starting plantting chat \_\_\_\_\_
- 40 By planting more chat \_\_\_\_\_
4. By starting plantting ' bahirzaf' \_\_\_\_\_
- 40.5. By planting more 'bahirzaf' \_\_\_\_\_
- 40.6. By planting orange and other cash fruits \_\_\_\_\_
- 40.7. By cropping some other cash crops \_\_\_\_\_
- 40.8. By raising more livestock \_\_\_\_\_
- 40.9. Engaging more in part-time works \_\_\_\_\_
- 40.10. By planting more coffee crops \_\_\_\_\_

41. Give Number of livestock you owned in kind, and died:

|    |            | 1974/75   |          | 1982/83   |          | 1992/93   |          |
|----|------------|-----------|----------|-----------|----------|-----------|----------|
|    |            | No. owned | No. died | No. owned | No. died | No. owned | No. died |
| 1  | Cow        | —         | —        | —         | —        | —         | —        |
| 2  | Heifes     | —         | —        | —         | —        | —         | —        |
| 3  | Oxen       | —         | —        | —         | —        | —         | —        |
| 4  | Young bull | —         | —        | —         | —        | —         | —        |
| 5  | Adult bull | —         | —        | —         | —        | —         | —        |
| 6  | Calf       | —         | —        | —         | —        | —         | —        |
| 7  | Sheep      | —         | —        | —         | —        | —         | —        |
| 8  | Goat       | —         | —        | —         | —        | —         | —        |
| 9  | Donkey     | —         | —        | —         | —        | —         | —        |
| 10 | Horse      | —         | —        | —         | —        | —         | —        |
| 11 | Mule       | —         | —        | —         | —        | —         | —        |
| 12 | Poultry    | —         | —        | —         | —        | —         | —        |
| 13 | Bee Hives  | —         | —        | —         | —        | —         | —        |

42. What you feed your livestock? Order your answer according to decreasing importance (1, 2, 3, ...)

42.1. Hay \_\_\_\_\_ 42.2. Fresh cut grass \_\_\_\_\_

42.3. Body of enset (leaf) \_\_\_\_\_ 42.4. Fagulo and the like \_\_\_\_\_

42.5. Grains \_\_\_\_\_ 42.6. Atela \_\_\_\_\_

43. Which ones you use during keremt and bega? (order them) season

43.1. Bega \_\_\_\_\_

43.2. Keremt \_\_\_\_\_

44. Where do your livestock graze in Keremt and bega? (put "x")

Grazing area                      Keremt                      Bega

44.1. Common grazing ground \_\_\_\_\_

44.2. Private " area \_\_\_\_\_

44.3. Both Private & Common grazing \_\_\_\_\_

44.4. Stand feeding \_\_\_\_\_

45. Distance in minutes from farmhouse to private grazing area is \_\_\_\_\_ while to common grazing area takes \_\_\_\_\_

46. Why do you raise livestock (order your answer according to decreasing importance 1, 2, 3, etc.\_.

- 46.1. For wealth \_\_\_\_\_ 4.6.2. For food \_\_\_\_\_  
 46.3. For insurance against bad time \_\_\_\_\_ 46.4. For their manure \_\_\_\_\_  
 46.5. For plowing \_\_\_\_\_ 46.6. For social security (value) \_\_\_\_\_  
 46.7. Others, specify \_\_\_\_\_
47. The number of livestock I raise  
 47.1. increased \_\_\_\_\_ 47.2. decreased \_\_\_\_\_
48. If your livestock number decreased, why? order the answers if you have more than one 1, 2, 3, ....  
 48.1. As cropped area increased pasture land decreased, so scarcity of feed \_\_\_\_\_  
 48.2. Because of land scarcity, grazing areas are very scarce \_\_\_\_\_  
 48.3. I have lost many cattle due to cattle disease \_\_\_\_\_  
 48.4. Due to drought I have lost many cattle \_\_\_\_\_  
 48.5. I sold many cattle \_\_\_\_\_  
 48.6. Others, specify \_\_\_\_\_
49. If your grazing area and meadow decreased, possible reason (s) to it is \_\_\_\_\_  
 (order your answers as 1, 2, 3, ...).  
 49.1. expansion of cultivated land \_\_\_\_\_  
 49.2. planting more eucalyptus trees \_\_\_\_\_  
 49.3. Landholding size decrease because of population growth \_\_\_\_\_  
 49.4. portion of my land was taken by PA \_\_\_\_\_  
 49.5. I sold part of my land \_\_\_\_\_  
 49.6. If any other : specify \_\_\_\_\_
50. If you lost cattle by death, which cattle disease(s)?  
 50.1. \_\_\_\_\_ 50.2. \_\_\_\_\_  
 50.3. \_\_\_\_\_ 50.4. \_\_\_\_\_

## VII CULTIVATION OF ENSET AND OTHERS

51. One adult enset occupies \_\_\_\_\_ x \_\_\_\_\_ meter space.
52. How many phases (stages) of enses are there in your enset farm ?  
 52.1. Two \_\_\_\_\_ 52.2. Three \_\_\_\_\_ 52.3. Four \_\_\_\_\_  
 52.4. Five \_\_\_\_\_ 52.5. Six \_\_\_\_\_ 52.4. Seven \_\_\_\_\_

53. What are the stages (phase) and how many year(s) each phase involves?

Phase                      Number of years each take

Fanafua \_\_\_\_\_

Mara summa \_\_\_\_\_

Mesere \_\_\_\_\_

Neqongge \_\_\_\_\_

Hiba \_\_\_\_\_

Asat \_\_\_\_\_

54. Total number of years one ensat takes until full maturity is \_\_\_\_

55. Cropping calendar of inset: (specify the time (month(s))

55.1. Harvest season is from \_\_\_\_ to \_\_\_\_ (month)

55.2. Month(s) of transplanting is from \_\_\_\_ to \_\_\_\_

55.3. Do you plow (hoe) your ensat land? yes \_\_\_\_ No \_\_\_\_

55.4. If "yes", how often?

55.4.1. once in a year \_\_\_\_\_

55.4.2. twice in a year \_\_\_\_\_

55.4.3. three times in a year \_\_\_\_\_

55.4.4. once in 2 years \_\_\_\_\_

55.4.5. once in 3 years \_\_\_\_\_

55.4.6. once in four years \_\_\_\_\_

55.5. Plowing/hoeing takes place in \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_ month(s)

55.6. Ensat weeding takes place in \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_ month(s)

56. What ensat species you cultivate?

56.1. most dominant species include \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_

56.2. less common ones include \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_

56.3. species which are cultivated for medical purposes \_\_\_\_, \_\_\_\_, \_\_\_\_,

57. Cropping calendar of grains specify

57.1. Plowing time is from \_\_\_\_ to \_\_\_\_ month

57.2. Sowing time is from \_\_\_\_ to \_\_\_\_ "

57.3. Weeding season is from \_\_\_\_ to \_\_\_\_ "

57.4. Harvesting season is from \_\_\_\_ to \_\_\_\_ "

57.4.1. Moving and threshing time \_\_\_\_, \_\_\_\_, \_\_\_\_ (months)

- 57.5. Farm clearing period is from \_\_\_\_ to \_\_\_\_ month.
58. Cropping calendar of potatoe
- 58.1. plowing month(s) is from \_\_\_\_ to \_\_\_\_
- 58.2. planting month (s) from \_\_\_\_ to \_\_\_\_
- 58.3. Weeding season is from \_\_\_\_ to \_\_\_\_
- 58.4. Harvesting months is from \_\_\_\_ to \_\_\_\_

## VII MAINTAINING SOIL FERTILITY

59. Do you use fertilizer? Yes \_\_\_\_ No \_\_\_\_
60. If yes, to which crop you apply? (make "x" mark)
- 60.1. To pulses \_\_\_\_ 60.2. To cereals \_\_\_\_
- 60.3. To potatoe \_\_\_\_ 60.4. To enset \_\_\_\_
- 60.5. To chat \_\_\_\_ 60.6. To vegetables \_\_\_\_
- 60.7. To enset \_\_\_\_
61. How many kilograms of fertilizer you have used in 1993? \_\_\_\_\_ kg.
62. Do you apply animal dung to crops? Yes \_\_\_\_ No \_\_\_\_
63. If your answer is "yes" to what you apply?
- 63.1. to ensets \_\_\_\_ 63.4. to potatoe \_\_\_\_
- 63.2. to chat \_\_\_\_ 63.5. to coffee \_\_\_\_
- 63.3. to grains \_\_\_\_ 63.6. to vegetables \_\_\_\_
64. What is the proportion of animal dung applied to
- 64.1. enset \_\_\_\_ %
- 64.2. Chat \_\_\_\_ %
- 64.3. Potatoe \_\_\_\_ %
- 64.4. Cabbage and vegetables \_\_\_\_ %
- 64.5. Coffee \_\_\_\_ %
- 64.6. Grams \_\_\_\_ %
65. What is the amount and frequency of animal dung collected in one week during the wet (keremt) and dry (bega) seasons in 1974/75, 1982/83 and 1992/93? (make "x")

mark)

|              |                    | 1974/75   |        | 1982/83  |        | 1992/93  |        |
|--------------|--------------------|-----------|--------|----------|--------|----------|--------|
|              |                    | 'Keremet' | 'Bega' | 'Keremt' | 'Bega' | 'Keremt' | 'Bega' |
| 65.1.        | -once in a week    | —         | —      | —        | —      | —        | —      |
| Howmany      | -twice in a week   | —         | —      | —        | —      | —        | —      |
| times        | -3 times in a week | —         | —      | —        | —      | —        | —      |
| manure is    | -four times a week | —         | —      | —        | —      | —        | —      |
| collected in |                    |           |        |          |        |          |        |
| your house   |                    |           |        |          |        |          |        |

65.2 What amount of loads 1974/75 1982/3 1992/93  
 (matrashye) each time 'keremt' 'bega' 'keremt' 'bega' 'ker.' beg.'  
 collected? ----- (in figure)

66. What other methods you employ to restore soil fertility?

66.1. Fallowing \_\_\_\_\_ 66.2. Crop rotation \_\_\_\_\_

66.3. Inter-cropping \_\_\_\_\_ 66.4. if any other specify \_\_\_\_\_

67. If you use crop rotation, what crops rotated \_\_\_\_\_

68. Indicate the type and number of farm tools you own. (use "x" mark) and write the quantity.

| Farm tool              | Quantity | Farm tool          | Quan. |
|------------------------|----------|--------------------|-------|
| 68.1. 'Marasha'        | _____    | 68.9. 'Murya'      | _____ |
| 68.2. 'Aya' (smallhoe) | _____    | 68.10. 'Water'     | _____ |
| 68.3. 'Plough'         | _____    | 68.11. 'Zbangiba'  | _____ |
| 68.4. 'Yoke'           | _____    | 68.12. 'Sebisa'    | _____ |
| 68.5. 'Mofer'          | _____    | 68.13. 'Matrashye' | _____ |
| 68.6. 'Sickle'         | _____    | 68.14.             | _____ |
| 68.7. 'Axe'            | _____    | 68.15.             | _____ |
| 68.8. 'Tebeche'        | _____    |                    |       |

69. Do you use oxen to prepare land, for traction, etc. Yes \_\_\_ No \_\_\_

### VIII LAND TENURSHIP

70. What was your status before the 1975 land reform?

70.1. Tenant \_\_\_\_\_ 70.4. Land lord \_\_\_\_\_

- 70.2. Petty tenant \_\_\_\_ 70.5. Owned much land \_\_\_\_
- 70.3. Petty land owner and ('gebar') \_\_\_\_
71. Do you wish the existing government - based land ownership continue?
- 71.1. Yes \_\_\_\_ 71.2. Yes, but with modification \_\_\_\_
- 71.2. No, Indeed change \_\_\_\_
72. If you wish the existing tenure system changed, which one you prefer?
- 72.1. Private ownership of land \_\_\_\_ 72.2. Community ownership \_\_\_\_
73. If you say the existing one continue with modification, which one?
- 73.1. Land remained under gov't ownership with no right of lease or mortgage \_\_\_\_
- 73.2. With the right to rent or lease \_\_\_\_
- 73.4. With the right to rent and lease land to any person but no selling right \_\_\_\_
74. Under what condition you wish (if) land to be held privately?
- 74.1 With the right to sell, rent and /or lease to any one.
- 74.2 With the right to rent and/ or lease to any one but sell only to close relatives.
- 74.3 With the right to rent and/or lease to any one but no selling.
75. Since the 1975 land reform, do people in your local area informally sell and buy land?
- 74.1. Yes \_\_\_\_ 74.2. No \_\_\_\_
- 74.3. Yes, but what is sold and bought is not the land but crops a n d structures on it \_\_\_\_

### IX FARM STRUCTURE

76. How many parcels of land you have had?
- 76.1. Before the 1975 land reform \_\_\_\_ 75.2. In 1982/83 \_\_\_\_
- 76.3. In 1992/93 \_\_\_\_
77. How many minutes you need to reach from your farm house to each land parcel?
- 77.1. To 1<sup>st</sup> land parcel \_\_\_\_ minute.
- 77.2. To 2<sup>nd</sup> land parcel \_\_\_\_ minute.
- 77.6. To 6<sup>th</sup> land parcel \_\_\_\_ minute.
78. If your land holding size decreased in size, why? Order your answers by writing 1,2.....



- 78.1. Because I sold land \_\_\_\_\_
- 78.2. As family size increased a portion is shared to married son(s) \_\_\_\_\_
- 78.3. Because PA took a portion of my share \_\_\_\_\_
- 78.4. \_\_\_\_\_
79. If on the other hand, your holding increased in size, why?
- 79.1. Gain in effect of 1975 land reform \_\_\_\_\_
- 79.2. Buying some more land \_\_\_\_\_
- 79.3. Due to leasing and renting of land \_\_\_\_\_
- 79.4. \_\_\_\_\_

### X EXTENSION & INFRASTRUCTURAL FACILITIES

80. How often MoA people come to your village and provide you advice concerning your agriculture?
- 80.1. They come only once in a year \_\_\_\_\_
- 80.2. They come only twice in a year \_\_\_\_\_
- 80.3. They come 3 times in a year \_\_\_\_\_
- 80.4. They come 4 times in a year \_\_\_\_\_
- 80.5. They come sturies in a year \_\_\_\_\_
- 80.6. They rarely come \_\_\_\_\_
- 80.7. They come but for non-agricultural purposes \_\_\_\_\_
81. Whenever you need advice concerning your agriculture how do you obtain it?
- 81.1. By talking to fellow farmers. \_\_\_\_\_
- 81.2. By going to wereda MoA Office \_\_\_\_\_
- 81.3. By calling extension workers to our village \_\_\_\_\_
- 81.4. \_\_\_\_\_
82. Have you ever recieved advice as to how to improve your enset cultivation and control 'enset disease' and others?
- 821.1. Yes \_\_\_\_\_ 81.2. No \_\_\_\_\_
83. Do you have access to veterniary service?
- 83.1. Yes \_\_\_\_\_ 83.2. No \_\_\_\_\_
84. Do you have an access to gov't financial credit facility?
- 84.1. Yes 84.2. No \_\_\_\_\_
85. Where do you feteh water for domestic use? from \_\_\_\_\_

Spring River Pond Well Pipe

- 85.1. 'Keremt' \_\_\_\_\_
- 85.2. 'Bega' \_\_\_\_\_
86. Where do your cattle drink water?
- 86.1. 'Keremt' \_\_\_\_\_
- 86.2. 'Bega' \_\_\_\_\_
87. How many minutes your cattle travel (one way) to get water
- 87.1. in 'keremt' \_\_\_\_\_ minute.
- 87.2. in 'dega' \_\_\_\_\_ minute.
88. What pack animals you use?
- mule Horse Donkey Man
- 88.1. To transport goods \_\_\_\_\_
- 88.2. To transport man \_\_\_\_\_
89. Do you receive credit to buy fertilizer, improved seed, pesticide, etc?
- 89.1. Yes \_\_\_\_\_ 89.2. No \_\_\_\_\_

#### XI MISCELLANEOUS

90. Do wild life damage your enset? Yes \_\_\_\_\_ No \_\_\_\_\_
91. How many ensets you got destroyed by wild life?
- 91.1. Before the revolution \_\_\_\_\_
- 91.2. In 1982/83 \_\_\_\_\_
- 91.3. In 1992/93 \_\_\_\_\_
92. Have you got "enset disease" problem? Yes \_\_\_\_\_ No \_\_\_\_\_
93. If your answer is "Yes", how many enset you lost?
- 93.1. Before the revolution \_\_\_\_\_
- 93.2. In 1982/83 \_\_\_\_\_
- 93.3. In 1992/93 \_\_\_\_\_
94. Which wild animals destroy enset in your area?
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
95. In your opinion can enset be cultivated independent of cattle rearing? Yes \_\_\_\_\_
- \_\_\_\_\_ No \_\_\_\_\_
96. Can enset be grown (cultivated) far away from farm houses?
- Yes \_\_\_\_\_ No \_\_\_\_\_

97. Which Gurage house you own and how wide it is ?

Type                      Radius in feet

97.1. 'Guye Bet'        \_\_\_\_\_

97.2. 'Harar'            \_\_\_\_\_

97.3. 'Zeger'            \_\_\_\_\_

97.4. \_\_\_\_\_

98. Which one of the following you use as fuel wood? Give in order of importance as 1, 2, 3, .....

98.1. Enset Crop residue \_\_\_\_\_                      98.2 Dry Manure \_\_\_\_\_

98.3. Forest wood \_\_\_\_\_                      98.4. Eucaluptus wood \_\_\_\_\_

98.5. Charcoal \_\_\_\_\_                      98.6. Kerosine \_\_\_\_\_

98.7. Other crop residue \_\_\_\_\_

99. Compared to so called to very fertile farms in your locality how do you grade your own?

99.1. Comparable \_\_\_\_\_                      99.2. Considerably high \_\_\_\_\_

99.3. Moderate \_\_\_\_\_                      99.4. Low \_\_\_\_\_

99.5. Very Low \_\_\_\_\_

100. The colour of your soil is

100.1. Red \_\_\_\_\_                      100.2. Brown \_\_\_\_\_

100.3. Black \_\_\_\_\_                      100.4. Light brown \_\_\_\_\_

101. If you were to sell your land, how much you would have sold one zeng wide and \_\_\_\_\_ zeng long land? \_\_\_\_\_ birr

102. What percent of the peasants in your village buy grass for their cattle? \_\_\_\_\_ %.

103. For how much you buy grass in one year? Birr \_\_\_\_\_.

## DECLARATION

I, the undersigned declare that this thesis is my work and that all sources of materials used for the thesis have been duly acknowledged.

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