Household Seasonal Food Insecurity in Oromiya Zone, Ethiopia: Causes

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HOUSEHOLD SEASONAL FOOD INSECURITY IN OROMIYA ZONE, ETHIOPIA: CAUSES

Abstract: The main objective of the study is to identify the environmental and socio-economic causes of transitory food insecurity among farm households in Oromiya Zone. The necessary data were generated from both primary and secondary sources. Household survey, key informant interview, focus group discussion and interpretations of topographic and thematic maps were the principal means of generating data from primary sources. The data analysis techniques involved household food balance model, descriptive statistics, multivariate regression, point score analysis, and GIS for mapping.

The results of the measurement of per capita food availability indicate that over eighth-tenth of the households were facing seasonal food shortage in 1999. The variation across the study *weredas* has shown that households in Batti had faced greater food deficiency. The findings reveal that households headed by women, the young and the illiterate and those with large family size were found to be more vulnerable to seasonal food shortage. In contrast, farmers with fertile farmlands, those who owned a relatively large number of livestock, those who harvested a large amount of grain, those who obtained farm credit and those who utilized irrigation for crop cultivation were found to have better food availability and hence were less affected by food insecurity.

The farmers studied perceived a multitude of environmental, demographic, economic, infrastructural and social factors causing seasonal food insecurity. They identified drought, erratic rainfall patterns, livestock and crop diseases, dependency on a single *meher* harvest per year and pests as the major environmental problems hindering them from being self-sufficient in food production. Among the demographic factors, rapid population growth and the resultant diminishing land holdings were felt to be the most important causes of food insecurity. The farmers also perceived poverty factors specifically, lack of investable surplus cash and shortage of draft power as the main bottlenecks against the expansion of agricultural production. The zone under consideration is one of the poorest with respect to the development of rural infrastructure. The absence of irrigation and the resultant dependency on rain for crop cultivation, and the lack of sufficient veterinary services are among the infrastructural obstacles about which the majority of the farmers complained. Health problems and poor savings were perceived to be the most important social factors adversely affecting household food security.

The major recommendations of the study include: the degraded environment of the zone should be rehabilitated and protected from further degradation; population policy should be implemented effectively; the problem of land scarcity should be solved; provision of rural credit and off-farm employment should be enhanced; promotion of livestock and crop sub-sectors should take the potential of the zone into consideration; and the development of small-scale irrigation should be given a priority.

1. Introduction

1.1 Background

Food is one of the basic human needs. This is why almost every government in the Third World declares the provision of sufficient and adequate nutrition as its first development objective (Sijm 1989, 1). In Africa, food has become the most important item in any discussion of development during the last three decades. To this end, there have been attempts of varying degrees to find effective ways of ensuring that all Africans have access at all times to the minimum quantities of food necessary to lead active and healthy lives (ECA 1992). In spite of this intention and great emphasis on the food production sector, food deficiency remains a persistent problem in Africa, particularly in Sub-Saharan Africa. As a result, the number of hungry and malnourished people in the 1970s reached 80 million, which jumped to a level exceeding 100 million in 1984 (Tekolla 1990, 3). The corresponding figure in the 1990s was projected to be 140 million. Currently, Sub-Saharan Africa produces less food per person than it did three decades ago (FAO 1998). It remains the most malnourished region in the world: one in every three under the age of five years is underweight and about 42% are stunted (Yambi 1999).

The causes of food crises in Africa are numerous, varied and complex. The principal factors attributed to the continent's failure to adequately feed its population include: i) climatic hazards; ii) severe environmental degradation; iii) rapid population growth outstripping agricultural growth; iv) unstable macroeconomic environment and inappropriate government policies in some nations; v) low purchasing power of the people (poverty); vi) the absence of food security policies at national or regional levels; vii) lack of storage facilities; viii) limited access to infrastructure and basic services; ix) civil war; x) inappropriate incentives; and xi) low productivity of agriculture resulting from insufficient fertilizer use and poor control of weeds (Akeredolon-Ale 1990; Braun et al. 1990; Sijm 1990; Tekolla 1990; ECA 1992; FAO 1994). However, empirical investigations attempting to establish causal association between the above listed constraints and food shortages have been scattered.

As is true in most Sub-Saharan African countries, Ethiopia is currently facing challenging problems ranging from those induced by environmental crises to those caused by demographic and socio-economic constraints, which adversely affect peoples' production system. The country is generally characterized by extreme poverty, high population growth rate, severe environmental degradation and recurrent drought (World Bank 1992; Getachew 1995; Markos 1997). This has resulted in agriculture being poor for several years, to the extent that the country could not adequately feed its population from domestic production. This has been manifested in the prevailing food insecurity, both chronic and transitory, which has almost become a structural phenomenon and the way of life for a significant proportion of the population of the country.

According to various studies, the principal indicators of the magnitude of the problem at national level include: i) sharp decline in per capita food available for consumption, in response to the rapid population growth on one hand, and the stagnant or very slow growth in agricultural production, on the other, which has been far below the recommended rate[1] (2100 Kcal) (Getachew 1995); ii) considerable increase in the volume of imported food both through purchase and in the form of aid (Tesfaye and Debebe 1995); iii) prevalence of energy deficiency among adults; and iv) high rate of children's malnutrition as evidenced by high rates of stunting[2] (64.2%), wasting (8%) and being underweight (47.6 %) (CSA 1992). For at least 50% of farm families, production systems do not satisfy basic needs. Increasing numbers each year become food insecure, and most rural households face a hungry season every year (TGE/ UNDP 1993). The season of shortage of food supply, in most cases, is just before the harvest when the previous year's stored grain is nearly finished and market prices are high. Hence, an identification and understanding of the root causes and magnitude of the transitory food insecurity at the household level deserve the undertaking of empirical researches at various localities of the country, particularly in areas where food shortage has been pronounced.

1.2 Statement of the Problem

In Ethiopia, the seriousness of the food shortage problem varies from one area to another depending on the state of the natural resources and the extent of development of these resources. According to various sources, some 42 periods of food shortages (including the 1999 and 2000 food shortages) have been recorded in Ethiopia (Webb et al. 1992), most of which were concentrated along two broad belts, generally described as drought and famine prone areas. One of these is the *mixed farming production system* area of highland Ethiopia, involving central and northeastern highlands stretching from Northern Shewa through Wello into Tigray. The land resources mainly the soils and vegetation of this part of the country have been highly degraded because of the interplay between some environmental and human factors such as relief, climate, population pressure and the resultant over-cultivation of the land, deforestation of vegetation and overgrazing. The second belt is the *range-based pastoral economy* of lowland Ethiopia, ranging from Wello in the north through Hararghe and Bale to Sidamo and Gamo Gofa in the south. Apparently, this belt is generally considered as resource poor with limited potential and hence highly vulnerable to drought.

The present study area, Oromiya Zone, forms the transitional zone between those two belts, as it comprises escarpments of highlands that roll into the Rift Valley lowlands. Therefore, the environment of Oromiya Zone exhibits a combination of the underlying constraints characterizing the area under these two belts. Studies of the history of the area as well as frequent visits to the zone have enabled the researcher to observe that a considerable number of farm households of the zone have been affected by serious seasonal food shortages. The zonal Disaster Prevention and Preparedness Commission (DPPC) office indicated that the number of people needing food assistance in May 1999 was about 110,000, constituting about a quarter of the rural population of the zone. Some farm households disclosed that although the seriousness varied from year to year, they faced seasonal food shortage almost every year. The theme of this investigation is, therefore, to examine the causes, magnitude, and duration of seasonal food shortages faced by farm households in Oromiya Zone of Amhara Region.

Specifically, the research questions are the following:

i) What are the roots of transitory food insecurity that farm households encounter almost every year?

ii) How do farm households rate the impact of each attribute to the problem of seasonal food shortage?

iii) Is there a significant difference of food shortage between the households inhabiting the three *weredas* of the zone?

iv) How are different socio-economic groups affected and whose livelihood is most vulnerable to seasonal food shortage?

v) What coping mechanisms do the households practice while facing seasonal food shortage?

1.3 Objectives and Significance

The study aims at examining the transitory food shortage among farm households and at identifying the environmental, demographic, economic, social, and infrastructural constraints that contribute to the households' seasonal food insecurity in Oromiya Zone of Amhara Region.

The specific objectives of the study are:

i) To assess the physical resource base (relief, climate, soil, vegetation, etc.) of the area in view of its impact on agricultural production;

ii) To study the social and demographic characteristics of the population, which are expected to have implications for the households' food production and supply;

iii) To examine the situation of farm structure, i.e., land tenure, holding size, fragmentation of farms, and access to and use of modern agricultural inputs;

iv) To carry out an inventory of the households' asset base such as livestock possession, farm oxen possession and size of crop output;

v) To measure the households' food security status; and

vi) To identify the underlying causes of the households' seasonal food shortage/insecurity.

Carrying out such in-depth empirical research would obviously have both basic (academic) and applied (practical) purposes. It is possible to argue that literature concerning our country's transitory food insecurity is scarce. Hence, the findings of the study are expected to contribute a little toward breaching the existing literature gap on understanding the causes, duration and dimension of seasonal food insecurity.

With regard to the practical purposes, the empirical findings may be utilized by planners for the formulation of new policies as well as policy reforms in the areas of population, environment, agriculture and food security. Moreover, indigenous as well as international NGOs interested in intervening with the aim of promoting rural development into the study area would benefit from the findings of the study.

1.4 Methodology

1.4.1 Data Set

The primary data for the study were generated through four main tools: topographic and thematic maps, key informant interviews, focus group discussions and household surveys.

i) Existing topographic and thematic maps were the sources of data on physical resource bases (relief, drainage, vegetation cover and soil) of the zone and their implications for agricultural production. The researcher's direct observation of the area has also generated some data. Raw meteorological data, particularly of rainfall data for three stations and temperature for one station were used to examine the climatic features of the area under investigation.

ii) Key informant interviews were carried out to obtain information on community profile. The informants included Community Elders, Development Agents working at the study sites and Peasant Administration (PA) Officials. The community profiles, which were obtained during earlier phases of the fieldwork, were helpful in designing and finalizing questionnaires for both focus group discussion and household sample survey.

iii) Focus group discussions were held in study communities. The participants involved representatives from different age groups, from various villages of the communities, from different economic strata and from both sexes to maintain gender balance. The participants expressed their own feelings (perceptions), and offered their experiences regarding the issues under study.

iv) Household sample survey generated both qualitative and quantitative data pertaining to the social, demographic and economic characteristics of the households. Information on food consumption patterns and food security indicators were also collected through the survey. For this purpose, questionnaire (a combination of open-ended and close-ended) was designed and pre-tested before the actual survey. The researcher and trained field assistants carried out face-to-face interview with 60 sample households at three selected sits in March 2000. The sites are Shakilla in Dawa Chaffa wereda, Charitti Debaso in Artuma Jille wereda and Kamme in Batti wereda. Sixty households were randomly selected from PA registration books in each site. About 2.7% of the sample households were female-headed.

v) The 1994 Population and Housing Census reports were the secondary sources for the demographic characteristics of the population of the zone and its weredas. Supplementary data were gathered through discussions with governmental authorities that were directly or indirectly dealing with food security. Specifically, the wereda Administrators, the wereda Agriculture Office heads and zonal DPPC officers were consulted.

1.4.2 Methods of Data Analysis

Data from the existing maps were partly processed and analysed by mapping through Geographic Information Systems (GIS), and various physical characteristics of the zone have been mapped. Information generated through key informant interviews and focus group discussions were qualitatively analysed.

The household survey data were coded and entered into a computer for analysis. A computer software known as Statistical Package for Social Scientists (SPSS) was used. The specific methods of data analysis involved tabulation and cross-tabulation, computation of frequencies and percentages, and computation of descriptive statistics such as mean, standard deviation and coefficient of variation. Furthermore, inferential statistics such as simple correlation and multiple regression models were employed to examine and establish statistical relationship between food availability (as dependent variable) and various independent variables.

The household food balance model was utilized to quantify food availability at the household level. The point score analysis was employed to measure farmers' perceptions on the most important causes of transitory food insecurity.

2. Literature Review and Conceptual Framework

2.1 Literature Review

The review of literature for the study is organized under two sections. The first section presents some cases of seasonal food insecurity documented in some countries of Africa, Latin America and Asia. The second part summarizes the findings of certain previous studies concerning seasonal food shortages and famines experienced in Ethiopia over the recent past decades.

2.1.1 Causes of Seasonal Food Shortage in Other Countries

Causes of seasonal food insecurity facing farm households in various developing regions, particularly Africa, Latin America and Asia, have been documented in some literature. Much of the Sub-Saharan African population, particularly in rural areas, experiences some degree of hunger over the rainy, or "hungry" season, when food stocks dwindle and roads become muddy and impassable (Bonnard 1999, 3). A study by Fortes (cited in Messer 1989) among the Tallensi reveals grain was short during the planting season and the problem was largely attributed to poor allocation of resources and poor rationing. In somewhat similar way, Sharman's (1970) observation in Uganda indicates that it is not household supply but the care and skill with which mothers rationed or distributed food that determined which household's children were seasonally malnourished.

Migration of male labour is also recognized as a cause of seasonal hunger. A study conducted in a Lesotho village found that women and children suffered from lack of food and poor hygiene because women were too exhausted to cook and clean at times of peak agricultural work (Huss-Ashmore 1984). Haswell (1953) observes that growing cash crops at the expense of subsistence crops has largely contributed to seasonal food deficit among the Gernieri in Gambia. He also observes that illness of adults at critical times in the production process adversely affects labour efficiency and productivity, which in turn contributes to seasonal food shortage. Likewise, a recent study by Ashimogo and Hella (2000) in Iringa, Tanzania, reveals that the transition to commercial agriculture has had negative influence on food security.

Deterioration in the ecological conditions of production has also been seen as a cause of seasonal hunger in several African nations. Closely associated with this, Ogbu (1973) notes insufficient farmland, low yields on farms and high storage losses of staples were the principal causes of seasonal food shortage in Nigeria. Nurse's (1975) findings in central Malawi are contrary to the findings in the Lesotho village (Huss-Ashmore 1984), because in the former men normally do not work in local subsistence production. Thus, the seasonal food shortage is blamed on inadequate storage facilities. Nurse (1975) states that wicker granaries allowed a large proportion of the grain to rot during the rainy season and fall prey to rats and mice during the dry season.

According to a study by Toulmin (1986), the people of Bambara Village of Kala in Mali face seasonal food shortages that are mainly induced by two principal factors. One of the factors is climatic, specifically low and highly variable rainfall making the people very vulnerable to crop failure. The second class of risk is demographic, consisting of high level of mortality, varying levels of fertility and vulnerability of all producers to sickness and disability (Toulmin 1986, 58).

Land-use competition between pastoralists and farmers has also become the cause of seasonal food shortages in some Sub-Saharan African countries. Regarding this, Longhurst (1986, 68) observes "the pastoralists of central Niger are probably typical of many others in losing land to agriculturists, being increasingly forced to sell off their young cattle and heard cattle owned by non-pastoralists for low wages, and holding herds whose numbers and composition are no longer viable". As a result, they become less able to cope with bad years and more vulnerable to regular stress.

Regarding seasonal food insecurity among poor farmers in Asia, Hartman and Boyce (1983) mention that hunger occurs principally before the major rice harvests, when food supplies of land-poor households are exhausted, wage labour is scarce, and food prices peak. In Mexico, peasants complain about *Sepi-hambre* (hunger September), the lean month when the maize from the previous harvest is exhausted, and the new maize not yet harvested. People seek to minimize the suffering with seasonal crafts and other occupational diversification (Warman 1980).

2.1.2 Ethiopian Cases

Literature regarding Ethiopian catastrophic famines such as the 1973 and 1984/85 seems to be voluminous. Nevertheless, proper "transitory food insecurity" has received little attention, despite its prevalence even in what we call "normal years" as well as in the so-called "high potential" and "surplus areas".

Although investigations concerning farm households' transitory food shortage have been limited, the situation in Ethiopia does not deviate much from the condition in other developing regions. Mesfin's (1991) investigation in Northcentral Ethiopia indicates that most farmers could not produce enough to meet the annual requirements, from both the farmers' annual requirement perceptions and the ENI's (1990) estimates. My own empirical research (Degefa 1996) in Arssi, a zone considered to be a surplus producer at an aggregate level, examines seasonal food shortage among farm households and assesses variations between households practising double cropping (during *meher* and *belg* seasons) and those relying on a single harvest (*meher*). The study found out that 40% of the households (out of 220 sampled households) faced seasonal food shortage. The proportion of farmers practicing double cropping who reported to have faced seasonal food deficit was 29%, while the proportion among single harvesters was 52%. An assessment of the causes of transitory food insecurity identified various physical and socio-economic constraints to subsistence production. These were insufficient farmlands for 99% of the households, lack of cash income to purchase farm inputs for 79% of the households, poor quality of their farmland for 67% of the households, reliance on single harvest for 55% of the households, and shortage of pulling power for 33.7% of the households. The study reveals that the pre-harvest periods as the time for food shortage, and that 69.7% of the households encountered food deficit before *meher* harvest and about 23.6% of the households before *belg* harvest (Degefa 1996).

Another research finding by Markos (1997) shows that "household's average cereal production during normal harvest years is persistently lower than annual food requirements and hence many households feed themselves from their farm outputs only for less than three-fourth of the year." Martha's (2000) study in Meket, Habru and Gubalafto *weredas* of North Wello Zone found out that 30%, 21% and 40% of the sample households, respectively, were unable to satisfy the food demand of their family for more than five months in a year. Based on an empirical study in Northern Shewa, Yared (1999) argues that the seasonality of agriculture introduces fluctuations in the income, expenditure and nutritional patterns of peasant households. He further states, "the coincidence of diminishing grain supplies and increasing grain prices is a liability for the economic status and food security of households" (Yared 1999, 123).

Sen (1981) argues that famine can occur in a region when certain groups of people lack the ability to command enough food. Mesfin (1984) comes out with an interesting model that demonstrates the responsible factors for farm households' vulnerability to famine. He states that vulnerability to famine is a product of a system, that is, a subsistence production system, which consists of three components: the peasant world, the natural forces (physical environment) and the socio-economic forces. Regarding the relationship between these factors, Mesfin (1984) argues that an agricultural population must first be made vulnerable to famine by socio-economic and political forces before any adverse natural factor initiates the process of food shortage that leads to famine.

In their study on Ethiopian famine, Webb et al. (1992) found strong positive correlation between famine and poverty. Accordingly, they have identified a number of interrelated factors that contribute to famine. These are: proneness to climatic-driven production fluctuations, lack of employment opportunities, limited asset bases, isolation from major market, low level of technology, constraints to improvements in human capital and poor health and sanitation environments. The other quite remarkable observation made by the study is that famine does not happen suddenly - famine builds on high levels of food insecurity that the present households cannot withstand and that the government is not prepared for (Webb et al. 1992, 133-140).

Similarly, Getachew (1995, 342) concludes, "Households' risk of food insecurity and famines were greatly increased by long-term secular decline in resource endowment, combined with unfavourable food policy intervention." Emphasizing on subsistence farmers' food insecurity situation, he underlines that the prevailing inability of Ethiopia's small-scale agriculture to feed its population is mainly generated by the neglect of the policy and the decline in access to productive resources upon which most of the livelihoods are built.

Research findings from a community assessment of 21 *Kebeles* of South Wello and Oromiya Zones of Amhara Region in 1999 has come out with several factors resulting in severe food shortages and household food insecurity including drought, crop pests, frost, rust, hailstorms, untimely or excessive rainfall, land shortages and degradation, lack of oxen, population growth and diseases (Yared et al. 1999).

In sum, many of the natural and human-induced factors that made Ethiopia a food-insecure country at the national level over the last few decades are cited in a paper by Kifle and Yosef (1999) including fragile natural resource base, inadequate and variable rainfall, improper farming practices, inaccessibility to productive resources (rural credit), diminishing land holdings and tenure insecurity, poor development of human resources, poor storage technology, inaccessibility to transport infrastructure, heavy work load on women, poor health status, lower productivity of livestock, high level of unemployment, inappropriate use and non-integrated free distribution of food aid, socio-cultural barriers, and lack of baseline information.

2.2 Conceptual Framework

2.2.1 Definition of Concepts

Food security is conventionally defined as "access by all people at all times to enough food for an active and healthy life" (World Bank 1986,1). It is generally accepted as entailing not only *food availability* (adequate supply of food) but also *food access* through home production, purchase in the market or food transfer. Recent definitions of the concept of food security introduce a third dimension, that is, *utilization* which refers to the appropriate biophysical conditions (good health) required to adequately utilize food to meet specific dietary needs. Food security and its achievement can be targeted at global, regional, national, sub-national, household or individual levels. However, nowadays, the latter two have increasingly become a focus of study. In the context of subsistence farmers' households, food security refers to the ability to establish access to productive resources such as land, livestock, agricultural inputs and family labour, combined to produce food or cash (Getachew 1995). Consistent with this, Bonnard (1999, 2) argues that with respect to the three components of food security, agriculture constitutes the most important factor in availability, a primary factor in access where livelihoods are agriculture-based and a complementary factor regarding food quality and processing for utilization.

Food insecurity is a situation in which individuals have neither physical nor economic access to the nourishment they need (Reutlinger 1987). A household is said to be food insecure when its consumption falls to less than 80% of the daily Minimum Recommended Allowance (MRA) of caloric intake for an individual to be active and healthy. Based on temporal dimension, two types of household food insecurity can be distinguished: *chronic and transitory*.

Chronic (permanent) food insecurity refers to a continuously inadequate diet resulting from lack of resources to produce or acquire food (Reutlinger 1987). It is argued that chronic food insecurity at the household level is mainly a problem of poor households in most parts of the world. *Transitory food insecurity* refers to a temporary decline in the households' access to enough food. It results from instability of food prices, production or incomes. The worst form of transitory food insecurity is famine. Hence, transitory food insecurity faced by farm households should be understood in the study as a seasonal food shortage of any magnitude ranging from mild to severe. We should also note here the concepts of transitory food insecurity and seasonal food shortage are synonymous and will be used interchangeably.

Another important concept that should be defined here is *seasonality*. Thomas and Leatherman (1990) define it as a fluctuating phenomenon that entails significant alterations in the biotic potential of the landscape within the annual cycle. Seasonality exerts a strong organizing influence on the actions of agricultural producers, especially those dependent on the local environment to provide food and other basic needs. Rain-fed agriculture that dominates in the Ethiopian farming system would rightly demonstrate how seasonality adversely affects the food security situation of the country.

2.2.2 Theoretical Orientation

There exist two broad methodological approaches to the analysis of famine. The first approach is the "general explanation". In this regard, a number of environmental and socio-economic attributes assumed to explain famine have been pointed out. The principal ones include: rapid population growth, war and civil strife, drought, ecological degradation, government mismanagement, unequal access to resources and unequal exchange, and socio-economic and political dislocation (Da Corta 1985 cited in Getachew 1995). The argument of this approach is that one or a combination of these can disrupt food production. However, production failure may or may not result in famine. Due to this fact, the attributes (factors) are not precise explanations of the causation of the process of famine. It is in response to this major weakness that the specific models of famine emerged.

The second approach comprises models of famine: Food Availability Decline (FAD) model and Food Entitlement Decline (FED) model. Alamgir (1980) defines FAD as the availability decline per capita of food for the consuming unit. The central argument of this model is that "anything which disrupts food production such as drought, flood or war can cause famine, the logic being that a drought, flood or war causes crop failure and cattle death, reducing the availability of food in the affected region, and that such a food availability decline for an extended period by definition constitutes a famine" (Devereux 1988, 270). The model demonstrates the situation of subsistence farmers, such as the farmers under investigation, and reveals how a failure of production during one growing season would lead to food shortage. Nevertheless, the model is criticized because it overemphasizes food supply and undermines the demand for available food.

The FED model was pioneered by Sen (1981) as an alternative method for the analysis of famine. The model suggests that food availability in the economy or in the market does not entitle a person to consume it, and famine can occur without aggregate availability decline. This means access to food plays a crucial role in securing command over food, which is, in turn, determined by production, exchange or transfer. Generally, food security signifies the complementarities of the two models because enough food must be available, and households must have the capacity to acquire it.

The framework of the study, as depicted in figure 1, mixes the premises of the `general explanations to famine' and the famine models briefly highlighted above. It consists of five major variables adversely affecting the farmers' food production, which in turn determines the situation of the households' food security. These are environmental crises, population pressure, poor asset base, social (cultural) issues, and poor rural infrastructure.

i) *Environmental crises*: comprise two elements, i.e., climatic hazards (drought, flood, hailstorm, frost, etc.), and land degradation through soil erosion, loss of nutrients, deforestation and overgrazing.

ii) *Population pressure*: rapid growth of human and livestock population resulting in diminishing holding size and fragmentation of farmland and absence or shortage of fallow periods.

iii) *Poor asset base*: involve aspects such as lack of investable surplus cash, lack of farm oxen, absence of off-farm employment opportunities and inability to purchase modern farm inputs.

iv) *Social* (*cultural issues*): poor rationing of grain produced at home because farmers utilize a considerable proportion of their annual production for various ceremonies and celebrations immediately in post-harvest periods. Low level of educational background among the people in the area under study can also be the other variable.

v) *Poor rural infrastructure:* inaccessibility to roads, absence of rural credit, lack of irrigation practices, lack of agricultural extension services, poor health facilities, poor storage and unfavourable market for agricultural produce.

Figure 1. Environmental and socio-economic causes of subsistence farmers' transitory food shortage

2.2.3 Hypotheses

The following hypotheses serve as the guiding research assumptions for the investigation.

i) Farm households face seasonal food shortage because they fail to produce adequate grain to cover all year consumption requirements, which is attributed to environmental stresses, prevailing socio-economic constraints and poor rural infrastructure.

ii) Per capita food available in calorie increases with an increase in the age of the household head, education level of the household head, land holding size, fertility of the farmland, the total number of livestock, the number of farm oxen and the size of crop harvest. All variables are assumed to positively correlated with the food availability.

iii) Per capita food available in calorie decreases with an increase in the households' family size.

iv) Per capita food available for male-headed households is greater than for female-headed households.

v) Per capita food available is positively correlated with the utilization of modern farm inputs, namely, chemical fertilizers, improved seeds, herbicides, pesticides, irrigation, extension services, farm credit and off-farm income.

3. Physical Setting and Land Resources

3.1 Location

Oromiya Zone is one of the eastern administrative zones in Amhara Region. The zone shares boundaries with South Wello Zone in the west, with North Shewa Zone in the south and with Afar Region in the east and northeast. The zone's capital, Kammisie, is found at about 325 kilometres northeast of Addis Ababa along the highway to Dessie. Astronomically, Oromiya Zone lies between 10^0 5' and 11^0 26' north latitudes, and between 39^0 48' and 40^0 25' east longitudes. The zone has the smallest area of all the zones in Amhara Region, with an area[3] of 4434.53 km^2, which makes up about 2.79% of the area of the region. The zone is divided into three administrative *weredas*, namely, Dawa Chafa, Artuma Jille and Batti[4](see figure 2). Their respective *wereda* towns are Kammisie (a zonal town as well), Chafa Robit and Batti.

3.2 Relief, Geology and Geomorphology

The altitude of Oromiya Zone ranges between about 3000m above sea level and less than 600m above sea level. It consists of three agro-climatic zones: *dega, weyna dega* and *kolla*, which comprise about 2.6%, 26.2% and 71.2% of the area of the zone, respectively (see figure 3).

The zone's surface configuration is somehow diversified and it consists of all types of landforms, namely, deep valleys, plains, plateaus and mountains. Landforms in the zone had their genesis as *Residual, Structural* and *Alluvial* according to their order of area coverage (table 1). The main parent material origins for all except for those formed by alluvial processes were identified as quaternary volcanics. Figure 4 provides spatial patterns of the principal landscape units in the zone.

From the proportion and distribution of the types of landscapes provided in table 1 and figure 4, it is possible to infer that the landscapes in the zone have been severely eroded, induced by a combination of a multiple of environmental and man-made factors over the past several decades. Thus, in order to bring about sustainable use of the existing land resources, much effort has to be made with respect to minimizing unwise use and over-utilization of land resources as well as with respect to rehabilitating the degraded lands.

Table 1. Geomorphic characteristics of Oromiya Zone

Genesis of landform	Land-scape unit	Area (km^2)	Description	Distribution by *wereda*
Alluvial	Ac^6	105.09	Alluvial slopes and outwash fans	Right bank of Borkena and left bank of Jera in eastern margin of Artuma
Alluvial	Ac^7	44.00	Alluvial slopes and outwash fans	Hills northeast of Kamisse in Dawa and hills south of Borkena Valley in Artuma
Alluvial	As^3	53.23	Seasonal swamps and marshes	Jewiha and Siwir River Valleys in southern Artuma
Alluvial	Aw	55.44	Permanent fresh swamps and marshes	Water logged swamps of Borkena Valley occupying eastern margin of Dawa
Residual	Rj_v	174.61	River gorges	Borkena Valley lying between Artuma and Dawa, and Nejeso Valleys forming the southern tip of Artuma.
Residual	Rl^4_v	313.77	Low to moderate	Lowlands of Batti and southeastern part of Artuma

			relief hills	
Residual	Rn^4_v	103.03	Hilly plains consisting of undulating plains and low plateaus	Southern centre of Artuma
Residual	Ro^4_v	309.07	Hilly terrain of low to moderate relief	Area encircling the town of Batti, southern margin of Batti, northern tip of Dawa and central Dawa
Residual	Rq^1_v	420.54	Hilly terrain of moderate to high relief	Northern tip and southwestern half of Artuma
Genesis of landform	Land-scape unit	Area (km^2)	Description	Distribution by *wereda*
Residual	Rt^4_v	202.99	Moderately dissected side slopes and piedmont	Southeast escarpments of Batti and northeast escarpments of Dawa
Residual	Rt^5_v	66.33	Moderately dissected side slopes and piedmont	Small hills falling between the valleys of Borkena and Jera in lowlands of Artuma
Structural	Sh^4_v	746.57	High to mountainous relief parallel ridge and valley topography	Western highlands in Dawa, southwest ridges of mountains in Artuma and central part of Batti
Structural	Sl_v	201.97	Low to moderate relief parallel ridge and valley topography	Lowlands of Artuma

Structural	Sm^2_v	1212.4	Moderate to high relief parallel ridge and valley topography	Northern part of Batti, southern margin of Dawa (Borkena Valley) and central landmass of Artuma

SOURCE: MoA/FAO (1983).

3.3 Surface Water Resources

The entire landmass of Oromiya Zone falls in the Awash River Basin. Due to the inclination of the slope eastwards, all streams that originate from the zone as well as those from the neighbouring highlands west of the zone and flow across the zone constitute the tributaries of the Awash River. According to their arrangement from the northern part of the zone in Batti through the southern margin of Artuma *wereda*, the major river valleys include Cheleka, Borkena, Jerra, Alela and Nejeso (see figure 5).

Cheleka, with headstreams such as Kersa, Abaha, Abonsa and others, rises roughly from the hills northwest of Batti town. Some small-scale irrigation is practiced by the farmers in certain communities crossed by this river. Borkena is the major river that flows across the zone. "It rises from the mountains near Dessie. It first runs southward through a relatively narrow valley and then passes through mountains on either side to open up in Kembolcha, from where it flows southeastward into the Awash. The Borkenna Basin is about 1735km^2 in area and its mean annual discharge is about 283,120,000m^3, at its peak period it carries more than 605,000,000m^3 of water" (Mesfin 1991, 27). The middle course of Bokenna, where its valley is relatively wider, lies in Oromiya Zone. Nevertheless, its potential for irrigation agriculture has been under-utilized. The wetland in this valley is still under traditional grazing even during the dry seasons when water logging problem is not severe.

The Jerra River is another important river valley in the zone. It rises from Antsokia Mountains and flows eastwards. It is a relatively more irrigated valley producing both food crops and cash crops. Jera joins Borkena before flowing into Awash. South of Jera, we find Alela River Valley of which Ataye forms its major tributary. The southern part of the zone is drained by Nejeso River, which has tributaries such as Siwir, Jewiha and Robi. According to Mesfin (1991), it is the most naturally suitable part for water conservation and irrigated agriculture at an altitude of 1300 to 1500m.

Generally, the zone is endowed with certain potential for irrigation. The zone's low altitude partly results in low annual rainfall and unreliable patterns of rain distribution, which clearly shows the risks of crop production under rain-fed situations. However, despite the availability of irrigation potential, only 5.5% of the farmers grow crops using irrigation, thus necessitating special consideration by agricultural extension services and to raising farmers' awareness of the benefits of irrigation.

3.4 Climate

3.4.1 Rainfall

Most part of Oromiya Zone falls in the leeward escarpments for the moisture bearing Equatorial Westerlies blowing to the Northwestern Highlands of Ethiopia during summer. This position of the zone coupled with its relatively low altitude plays a significant role in determining the duration and amount of rainfall received by the area. Rainfall data at meteorological stations of Batti (1660m above sea level), Kammise (1450m above sea level) and Artuma (1920m above sea level) depict that the zone receives big rains in summer proceeded by small rainfall peak in spring or by a prolonged period of moderate rainfall. The long-term means (20 years for Batti and 15 years for both Kammise and Artuma) of annual rainfall were 850.7 mm, 1035 mm and 1424.6 mm, respectively. Thus, despite its higher altitude, Batti receives lower amount of rainfall than Kammise, which is attributes to the positional differences in relation to the moisture bearing winds (see table 2).

Table 2. Monthly average rainfall amount (in mm) at Batti (1980 - 1999), Kammise (1981 - 1998) and Artuma (1975 - 1996)

Station	Month											
	Jan	Feb	Mar	Apr	Ma	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Batti	36.3	19.8	75.2	83.9	57.7	14.1	183.6	192.2	78.4	35.2	24.0	22.5
Kammise	31.4	31.4	85.7	110.7	59.3	25.2	239.3	279.2	115.6	47.4	44.5	11.5
Artuma	93.6	96.7	102.9	173.0	85.1	34.0	238.3	303.1	114.7	63.9	69.5	63.4

SOURCE: Author's computation based on data from NMSA.

In terms of seasonal distribution, summer is the time for maximum rainfall while winter is a period for little or no rain occurrences at all stations. About 55.2%, 50% and 58.6% of the total rainfall was received during summer by Batti, Kammise and Artuma, respectively. In view of its implication for agricultural production, temporal rainfall variability was another aspect that the study attempted to examine based on the available data. Ranges and coefficient of variations (CVs) at all stations indicate that the rainfall in Oromiya Zone varied considerably over the last decades. At Batti, the annual range was between 310.6 mm (in 1984) and 1181.9 mm (in 1995), with a coefficient of variation of 22.9%. The range for Kammise lies between 597.7 mm (for 1983) and 1414 mm (for 1995), with CV of 27.4%. The minimum recorded rainfall at the two stations coincided with the 1984/1985 drought. Rainfall variability at Artuma was very high as portrayed by the range and the CV. The range for 15 years was between 502.8 mm and 2758 mm, and the CV was 38.3%. An important issue worth mentioning regarding the temporal variation of rainfall at Artuma is the declining trend of the annual rains during three trends (see figure 6). This would suggest the expansion of aridity into highlands, which is technically termed as desertification.

3.4.2 Temperature

Due to an inverse relationship between temperature and altitude, atmospheric temperature in Oromiya Zone sharply decreases from the top of the escarpment in the west to the floor of the

Rift Valley in the east. About seven thermal belts exist in the zone and as can be seen in table 3, the mean temperature during the growing seasons ranges between 10.1^0c and 27.5^0c.

Table 3. Distribution of thermal zones in Oromiya Zone

Zone	Altitude (meter)	Mean temp. (^{0}c)	Climatic zone	Distribution by *wereda*
8	3000-3400	10.1-12.5	*Dega* - Wurch	Ridges of mountains in Artuma
7	2600-3000	12.6-15.0	*Dega*	Hillsides of mountains in Artuma
6	2200-2600	15.1-17.5	*Weyna dega* - *Dega*	Hillsides of mountains in Artuma
5	1700-2200	17.6-20.0	*Weyna dega*	Hillsides of mountains in Artuma, Mountains northeast of Kammise in Dawa and big hills nortwest of Batti town
4	1300-1700	20.1-22.5	*Kolla* - *Weyna dega*	Most part of Batti to the west, central and western Dawa and central Artuma
3	900-1300	22.6-25.0	*Kolla*	Lowlands of Batti, Dawa and Artuma
2	500-900	25.1-27.5	*Kolla*	Extreme lowlands of Artuma

SOURCE: MoA/FAO (1984).

Temperature records in the zone were available only for Batti station, and the long term monthly minimum, maximum and average values are depicted in figure 7. May, June and July, with respective temperatures of 23.4^0c, 24.7^0c and 23.1^0c, constitute the warmest months. On the other hand, the coldest months of the year in the area are December and January. The extremely low minimum temperature during the months of October, November and December creates the problem of frost on the highland parts of the zone.

3.5 Natural Vegetation

The Amhara Region Atlas (1999) identifies four belts of the climax vegetation[5] in Oromiya Zone: Podocarpus Forest, Juniperous Woodland, Acacia Woodland, and Hyparrhenia Rufa Grasslands. Nonetheless, as in other parts of Ethiopia, the zone has undergone extensive deforestation and other forms of adverse human interventions.

Original Podocarpous forestlands used to cover large parts of the highland areas of the zone. At present time, however, those forests have been removed and the lands have been put under intensive or moderate cultivation, which in terms of area extends from the northern tip to the southern margin of the zone. The remaining patches of Podocarpous forests may be seen at marginal areas particularly at the top of hills where the slopes and poor soil conditions do not allow crop cultivation.

The central part of Batti was originally dominated by Juniperous woodland. It has now been replaced by farmlands in most cases. Even on marginal areas where cultivations were not extended, one may observe shrubs rather than big trees. Down in the Rift Valley, the extreme lowlands are presently covered by bushlands and shrublands. Although the lands there have little significance for crop production, under rain-fed situation, the acacia woodlands that constituted the original vegetation cover have considerably been deforested mainly for the purposes of firewood and producing charcoal.

The vegetation belt that has probably undergone little disturbance in Oromiya Zone is the Hyparrhenia Ruffa Grassland locally known as *chaffa*. It occupies the water logging valley of Borkenna River, which makes up a considerable area of Dawa *Chaffa*. Apparently, the open grassland extends southwards into an insignificant portion of Artuma *wereda*.

As one mechanism of conserving patches of the remaining natural vegetation, the PA officials at the study sites are attempting to halt further deforestation. However, as far as the selling of wood, firewood and charcoal remain important off-farm activities and coping mechanisms for food deficits for the people of the zone, the efforts made by PAs in this regard may not be effective. In terms of afforestation, some farmers in the highland portions of Dawa and Artuma *weredas* are carrying out plantation of trees, particularly eucalyptus, around their homesteads.

3.6 Soils

According to MoA/FAO (1984), six major soil associations cover the landscape of Oromiya Zone. These are Lithosols, Eutric Cambisols (Lithic), Eutric Cambisols (Stony), Eutric Regosols (Lithic), Chromic Vertisols and Orthic Solonchaks[6]. For their distribution and proportions, refer to figure 8.

Lithosols occupy the highest escarpment in the western part of the zone where land slopes range between 30% and 50%. They cover ridges of mountains in Artuma, northeastern structural highlands of Dawa and central parts of Batti. The middle valley of Borkena River and upper part of Nejeso River are also dominated by these soils. Due to their location on steep slopes and rugged topography, Lithosols are severely eroded. Thus, extensive rock outcrops are widespread phenomena in areas occupied by them. Lithosols' potential for crop production seems very limited and further cultivation of land should be accompanied by appropriate conservation practices.

Eutric Cambisols found in the zone are at the stages of Lithic and Stony. Eutric Cambisols (Lithic) cover probably the largest area of the zone. As can be seen in figure 8, they occupy the northern half of Batti, the southern part of Dawa and a large part of Artuma. They are characterized by immaturity, shallowness, extensive rock outcrop and stoniness. Eutric Cambisols at a stony phase are situated on the higher parts of Eutric Cambisols (Lithic). Some of the soils there are eroded and the remaining appears very stony. Generally, the main agricultural constraints for all types of Cambisols are their location on rugged topography (which results in shallowness and stoniness) and the scarcity of water that these soil types require.

Eutric Regosols (Lithic) cover the lower escarpments and the floor of the Rift Valley in the three *weredas* of the zone. They occupy areas with wider range of slopes, between 8% and 30%. These soils are shallow, well drained, very rocky, very stony, severely eroded and with low organic content. These characteristics coupled with the scarcity of water limit their importance for agricultural uses under rain-fed conditions.

Chromic Vertisols are confined to the upper valley of Borkena (in Dawa) and the upper valley of Jewhia (in Artuma). They are well-developed soils, with a depth of about 150 cm and having clay to clay-loam texture. The only agricultural constraints of these soils are poor drainage and susceptibility to seasonal water logging. Of course, small-scale irrigations are carried out on these soils, with much potential to be exploited.

Orthic Solonchaks are semi-arid soils occupying the floor of the Rift Valley between Borkena and Jera Rivers. Their average depth is about 150cm, which would imply the relative maturity of the soil. If the problem of salinity is overcome by applying appropriate drainage, the soils have extensive potential for irrigation agriculture. Besides the soil associations presented here, the sizeable area of Dawa is occupied by permanent swamps and marshes (see figure 8).

In sum, the zone's location in relation to the northeastern escarpments makes it disadvantageous and fragile with respect to its soil resources in particular, and its environment in general. Almost all soil associations in the zone were found to have some inherent limitations, of varying degrees, for agricultural development.

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4. Demographic Characteristics

This section of the paper briefly highlights the demographic and social characteristics of the population in the study zone. The issues treated here would be those that have direct or indirect relations with food availability and consumption including population size, age and sex composition, variables of population dynamics (fertility, mortality and migration), language and religion, education and settlements.

4.1 Population Size and Density

The 1994 Population Census result puts the total population of Oromiya Zone at 462, 951, making up about 3.3 % of the population of Amhara Region. The number of male and female population was 232,461 and 230,490, respectively, giving a sex ratio of 101 males to 100 females (CSA 1998). According to the CSA projection, the population of the zone would have reached 530, 258 by July 1999 (CSA 1999). Thus, the absolute increase of the zone's population between October 1994 and July 1999 was 67, 307, with an average annual increase of 13, 461 people and a rate of 2.54% per year, suggesting a rapid rate of population growth in the zone. The majority of the people (over nine-tenth) of the zone are inhabitants of rural areas.

By July 1999, the population size of the three *weredas* had reached 188, 321 for Dawa; 175, 425 for Artuma and 166, 897 for Batti (CSA 1999). The sex ratios for the respective *weredas* were estimated at 99.3 males, 102.2 males and 100.4 males for 100 females, respectively. Accordingly, for Artuma and Batti, the male population slightly exceeds the female population. The sex ratios deviate somehow from the expected for the predominantly Muslim area where polygamy is a widespread practice, as a result of which women's number should have been greater than the men's. Batti *wereda*, with about 13.4 % of the people residing in towns, is relatively more urbanized than the other two *weredas*. Some 94.6% in Artuma and 92.7% in Dawa are settlers of rural communities (see table 4).

Table 4. Population size, sex distribution and place of residence by *weredas* (October 1994)

Wereda	Population Size						
	Rural		Urban		Total		
	Male	Female	Male	Female	Male	Female	Rural as %

													of total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Dawa	76397	50.1	76181	49.9	5945	49.4	6099	50.6	82342	50.1	82280	49.9	92.7
Batti	63394	50.5	62158	49.5	9093	47.0	10259	53.0	72487	50.1	72417	49.9	86.6
Artuma	73679	50.8	71476	49.2	3953	47.8	4317	52.2	77632	50.6	75793	49.4	94.6
Oromiya Zone	213470	50.4	209815	49.6	18991	47.9	20672	52.1	232461	50.2	230490	49.8	91.4
Amhara Region	6370354	50.7	6198628	49.3	577192	45.6	688123	54.4	6947546	50.2	6886751	49.8	90.9

SOURCE: CSA (1996).

The overall population crude density for Oromiya Zone was estimated at 119.6 persons per square kilometre. Of course, there exists a considerable disparity among its *weredas* - it ranges from 93.5 in Artuma to 155.4 in Dawa (see table 5). Comparing the zone with other zones in Amhara region, it is one of the high population concentration areas and ranks sixth[7] among the rural zones of the region. Agricultural density, which relates size of population to cultivated area, measures the degree of population pressure on land resources more than crude density does. The agricultural density for Oromiya Zone, 11.8 persons per hectare of cultivated land, appeared the highest of all the zones in Amhara Region. Another indicator of high population concentration is average family size on which the zone has again recorded the highest, 4.8 persons per household. The average family size for the sample households was found out to be 5.5 persons per household. Over one-quarter of the overall households in the zone had seven and above family members. Given the low carrying capacity of the zone because of the largely lowland nature of the landmass coupled with extensive degradation of land resources, Oromiya Zone, indeed, is overpopulated.

Table 5. Population size, area and crude density (July 1999)

Wereda/zone	Population size	Area (km^2)	Density persons per km^2
Dawa	188321	1212.03	155.4
Batti	166897	1350.94	123.5

Artuma	175040	1871.56	93.5
Oromiya Zone	530258	4434.53	119.6
Amhara Region	15849991	159173.66	99.6

SOURCE: CSA (1999).

4.2 Age and Sex Composition

Age and sex structures are crucial demographic data in examining population characteristics. These demographic variables have direct implications for several issues related to socio-economic aspects of a population such as trend of population increase, food supply, size of school age population, labour force, and female population in the reproductive age. Therefore, any socio-economic development planning should consider the age and sex structure of the population. Regarding the age distribution of Oromiya Zone, the number of children (age group 0- 4) was found to be smaller than the next age group (5 - 9 years) implying a tremendous decrease of birth rates as an outcome of the launching of family planning services in the area.

The number of women in four consecutive age groups between 25 and 45 years was persistently greater than the corresponding number of men in the zone and in its *weredas*. Two factors may explain this pattern. First, the practice of polygamous marriage may have inflated the number of women. The marital status of about 4% of the sample farmers was found to be polygamous. The second factor is the out-migration of more men than women to other areas, to escape the problem of seasonal food shortage that regularly hit the area almost every year. The sex distribution of older people deviates from expectation since the number of men was considerably greater than that of women hinting that the expectancy of life at birth for women may be relatively short in the area.

The population age and sex distribution for Batti *wereda* depict that the population in the age group 20-24 years was smaller than the population in the next age group (25 -29). The time of birth for people in the former age group exactly coincided with the disastrous famine of 1972/73 in the area, which might have resulted in low births and excessive child mortality.

The overall Age Dependency Ratio for Oromiya Zone was found to be 85.5, which means for every 100 working people there were, on average, another 85 dependants for their basic needs. Of course, young dependents constituted the largest ratio (over 90%). The data in table 6 portrays slight disparity between the study *weredas*, with ranges from 77.4 dependents in Artuma to 95.7 dependants in Batti out of 100 active persons. The old age dependency ratio for Batti was relatively high, which may be partly explained by a higher degree of urbanization and longer life expectancy.

Table 6. Age dependency ratio, by *wereda*

Wereda	Young age dependency	Old age dependency ratio	Overall age dependency ratio

	ratio (per 100 active persons)	(per 100 active persons)	(per 100 active persons)
Dawa	78.0	7.6	85.6
Batti	82.8	12.9	95.6
Artuma	71.8	5.6	77.4
Oromiya	77.2	8.3	85.5

SOURCE: Author's computation from CSA data.

4.3 Fertility, Mortality and Migration

Fertility, mortality and migration are regarded as elements of population dynamics because the increase or decrease of any population would be in response to a change in one or a combination of them. Table 7 presents data on certain measures of fertility and mortality for Oromiya Zone. In terms of the total number of births in a year per 1000 people (CBR) and the average number of children a woman may produce during her reproductive period (TFR), the zone ranked last of all the zones in Amhara Region, including Bahir Dar Special Zone. The disparity between urban and rural with respect to both CBR and TFR was found out to be unique and it deviated from the normally expected situations as well as from the figures for all the other zones. As can be seen in the table 7, the TFR and CBR are considerably higher for the urban population of the zone. This may call for further demographic investigation.

Table 7. Adjusted fertility and estimated mortality measures for Oromiya Zone (1994)

	Fertility measures		Mortality measures		
	CBR	TFR	IMR	CMR	E0
Rural	29.16	4.80	132	74	47.8
Urban	51.72	7.29	124	67	49.5
Overall	30.68	5.00	132	73	48.0
Amhara R.	44.12	6.76	116	61	50.8

SOURCE: CSA (1998).

Note: CRR = Crude Birth Rate, TFR =Total Fertility Rate, IMR = Infant Mortality Rate, CMR = Child Mortality Rates, and E_0 =Expectancy of Life at Birth.

In contrast to fertility measures, the zone is generally characterized by high mortality rates. The deaths of children under year one per 1000 live births (IMR) and the deaths of children between year one and five (CMR) of 132 and 73, respectively, were found to be the second highest among the zones in Amhara Region, following the figures for East Gojjam (IMR 142 and CMR 73). The relatively low life expectancy at birth in the zone would be another indicator of the high overall mortality rate. Part of the explanation for the generally high death rate in the zone may be the prevalence of lowland diseases, specifically malaria and yellow fever, which were identified as serious health threats almost for the entire parts of the zone. Besides, the problem of malnutrition in causing infant and child mortality should not be belittled.

Regarding migration status, about 63,423 or 13.7% of the inhabitants of Oromiya Zone reported to be immigrants from other areas. Male and female migrants accounted for 46.4% and 53.6%, respectively. Some 85.9% of the migrants moved into the zone from rural areas. By October 1994, over half of the migrants (57.2 %) have continuously lived in the zone for ten years and above and the remaining have stayed there from nine years to less than one year (see table 8).

Table 8. Migration status, areas of previous residence and length of residence since migration to Oromiya Zone

Population Size	Migration status							
Total	Non-migrants		Migrants Not stated					
	No.	%	No.	%	No.	%		
462555	396947	85.5	63423	13.7	2185	0.5		
	Previous residence							
Migrants	Urban		Rural		Not stated			
	No.	%	No.	%	No.	%		
63423	8919	14.0	54455	85.9	49	0.1		
	Length of continuous residence in years							
Migrants	<1 1 - 4 5 - 9 10 and above							
	No.	%	No.	%	No.	%	No.	%
63423	3299	5.2	16307	25.7	7551	11.9	36266	57.2

SOURCE: CSA (1998).

4.4 Ethnicity, Language and Religion

With regard to ethnic composition, Oromia Zone is one of the three special zones[8] in Amhara Region. The majority (about 65%) of the people in the zone belong to Oromo ethnic group; the second largest group belongs to Amara. The zone comprises negligible numbers of Argoba, Affar, Weyito, Tigraway and other ethnic groups.

In Ethiopia, the mother-tongue language would be mostly consistent with the ethnicity of the people. Hence, Oromiffa and Amharic are the mother tongues for 65% and 34.3% of the people in the zone, respectively, according to the 1994 census. In fact, there are several other Ethiopian languages spoken by the people ranging from one person to more than one thousand, all of them, making up to less than 1% of the total population of the zone. People in Oromiya Zone are affiliated to three religions, namely, Islam, Orthodox Christianity and Protestantism. The religions constitute 98%, 1.9% and 1% of the total population of the zone, respectively. Hence, the zone is predominantly inhabited by Muslim population.

4.5 Educational Attainment

The literacy rate of Oromiya Zone was found to be 10.27% (see table 9). The figure is the lowest of all the zones in Amhara Region, except for Wag Hemera with a literacy rate of only 5.07%. The two neighbouring zones, namely, South Wello and North Shewa, with respective literacy rates of 23.64% and 20.95%, have relatively performed well in educational attainment. This disparity, to a certain extent, indicates the little attention that Oromiya and Weg Hemera zones have received in terms of intervention in promoting the education sector in particular, and the development endeavours as a whole.

Table 9. Percentage distribution of population aged ten years and over by literacy status and highest grade completed in Oromiya Zone (1994)

Sex	Literacy status				
	Literate		Illiterate		Not stated
Male	12.98		86.94		0.08
Female	7.57		92.40		0.03
Total	10.27		87.67		0.06
	Highest grade completed				
	1- 6	7 - 8	9-12	Above 12	Non-regular
Male	42.70	8.33	9.74	1.56	37.68
Female	51.69	10.54	8.00	0.61	29.16
Total	46.01	9.15	9.10	1.21	35.54

SOURCE: CSA (1998).

The data in table 9 depict gender disparity in literacy rate since only 7.57 % of the females were literate compared to 12.98% of the males.

4.6 Settlement Patterns

Two types of settlements have been identified in rural Oromiya Zone, i.e., scattered and irregular-shaped villages. Scattered dwellings mainly occupy the relatively gentle plains and valleys. Regarding the types of dwellings for the sample households, the survey results indicate that 85% (155 farmers) lived in thatched grass/straw huts with a considerable variation in the quality of the *tukuls*. Almost the same number of farmers' houses did not have any form of internal partition. Some 33% of the households have reported to share their dwellings with their livestock such as cattle, sheep, goats and camels during night hours.

5. Access to Production Resources and Farming System

The two important issues to be presented under this part are the farmers' access to the production resources and the farm economy. Among the production resources, land and its different features such as land use patterns, the prevailing tenure system, ways of getting access to land, farmers' land holding size and its dynamics, and fragmentation of holdings are treated. Farmers' access to modern farm inputs and the adoption rate are the other aspects to be dealt with.

5.1 Land-Use and Land Cover Patterns

The discussion on land-use/land cover patterns for Oromiya Zone is based on MoA/FAO Land-use/Land Cover Map of 1984 and CSA Agricultural Sample Survey data for 1995 and 1998. MoA/FAO (1984) have identified seven main land-use and land cover types in the area presently falling under the territory of Oromiya Zone. These are State Farm, Intensively Cultivated Area, Moderately Cultivated and/or Dense Bushland, Riverine Woodland or Dense Bushland, Bushland, Open Shrubland and Open Grassland. Figure 9 depicts the spatial distribution of the land-use and land cover types.

In the intensively cultivated parts of the zone, rain-fed cultivation of annual crops such as grains (sorghum, *teff* and maize), pulses and oil seeds is carried out. Here, the people also raise livestock on grasslands, which in certain areas may cover up to 25% of the lands. Generally, the intensively cultivated areas are concentrated on the relatively highland portion of the zone. With regard to area, it probably covers the second largest portion of the zone, occupying the western half of Artuma, the central and eastern part of Dawa and a large portion of Batti. The upper valley of Borkena was previously under *Chaffa* State Farm, which at the present is partly leased to private investors and the remaining having been redistributed among the farmers.

The moderately cultivated or dense bushland covers the highest parts of the zone, specifically the top of the western escarpment. The people in this area dominantly carry out mixed farming, that is, cultivation under rain-fed and sedentary livestock grazing. Both annual and perennial crops are common. In southwestern parts of Artuma, dense bushlands are seen on marginal lands, particularly where the slopes are too steep for cultivation.

The lower escarpment and the floor of the Rift Valley that extend from the northern to the southern margins of the zone are under open shrubland. Here, pastoral livestock grazing and browsing constitute the main occupations of the people. In terms coverage, this makes up the eastern half of Artuma, northeastern margin of Dawa and the lowland fringes of Batti. A pocket of riverine woodlands occupies the confluence of Borkena and Jera Rivers. It is mainly devoted to pastoral livestock grazing and scattered seasonal crop cultivation on flood plains. There exists open grassland that is still utilized for pastoral livestock grazing in the centre of the zone. This is particularly confined to the northern tip of Artuma and southwestern part of Dawa.

As is shown in table 10, land under private holding forms about one-tenth of the entire area of Oromiya Zone. The farmers in the zone have devoted the majority of their holdings to crop cultivation. About 87.7% and 90.6% of the holdings were under crop cultivation during 1995 and 1998 harvest years, respectively. Two factors may explain the considerably small proportion of land that has been put under cultivation. The lowland part of the zone has little potential for rain-fed agriculture; thus, it is mostly left for livestock grazing. The second factor may be limited irrigation practices that await further exploitation. The fact that the perennial cash crops constituted a negligible proportion of croplands would clearly show the subsistence nature of the farmers in the zone.

Table 10. Area under different land-use for private holdings in Oromiya Zone in 1995 and 1998

Type	1995		1998		Per cent of change
	Area (ha)	%	Area (ha)	%	
Temporary crops	40810.0	85.3	36120.0	86.3	- 11.5
Permanent crops	1130.0	2.4	1800.0	4.3	+ 37.2
Grazing land	1620.0	3.4	710.0	1.7	- 56.2
Fallow land	1390.0	2.9	1180.0	2.8	- 15.1
Other land-use	2880.0	6.0	2040.0	4.9	- 29.2
Total	47830.0	100.0	41850.0	5980.0	- 12.5
Per cent of area of zone	10.8	10.8	9.4	9.4	

SOURCE: CSA (1995) and CSA (1998).

5.2 Tenure Systems and Access to Land

Historically, land tenure in what was previously Wello Province and currently Oromiya Zone has evolved through various systems. The earliest one was probably the feudal system known as *rist*, which was common in most part of Northern Ethiopia. Under this system, land was practically owned by the community as defined by the local kinship structure. The rights of those using this tenure system were of two types: tenure system based on inheritance and tenure system based on village (Berhanu 1997). The *rist* system gave way to the tenure system introduced by the 1975 Land Reform. The Land Reform Proclamation No. 31 gave use-right only and ownership was denied to every individual and organization. The proclamation prohibited the sale, lease, inheritance, exchange or transfer of land to other persons. Several land distributions and redistributions have taken place between 1975 and 1990 in Oromiya Zone, in order to even out holdings as well as to accommodate new land claimants. The most recent land redistribution in the zone was in 1996, when the Amhara National Regional State promulgated a law that provided for the readjustment of rural land holdings. This redistribution was implemented not in all areas of the zone for some of them were excluded intentionally. Still, redistribution has been carried out at three of the current study sites.

At the time of the survey, 95.6% of the sample households had land to be utilized for agricultural purposes, and only 4.4% reported to be landless. Survey result regarding the ways in which the landholder farmers had gotten access to land is depicted in table 11. The studied farmers acquired their current holdings through three major ways: inheritance from parents, land reallocations and sharing from relatives. Slight difference was observed among the *weredas*. In Batti, over half of the respondents inherited land from their parents, while the largest percentages of farmers in Dawa and Artuma had gotten access to land through redistributions carried out during both the *Derg* regime and under the 1996 Amhara Region Land Redistribution. A few farmers also had gotten land through transactions including unofficial land purchase, cash rental and sharecropping.

Table 11. Methods of getting access to land by landholder sample households, by *wereda*

Methods of access	Dawa		Batti		Artuma		Total	
	No.	%	No.	%	No.	%	No.	%
Redistribution	27	46.6	16	27.6	27	47.4	70	40.5
Share from parents/relatives	7	12.1	9	15.5	8	14.0	24	13.9
Inheritance	21	36.2	33	56.9	19	33.3	73	42.2
Share cropping	0	0.0	0	0.0	1	1.8	1	0.6
Cash rental	1	1.7	0	0.0	0	0.0	1	0.6
Purchase	2	3.4	0	0.0	2	3.5	4	2.3

SOURCE: Field survey, March 2000.

5.3 Land Holding Size and Its Dynamics

Land holding size is considered a critical production factor that determines the type of crops grown and the size of crop harvests. About 80% of the increase of agricultural output in Africa has been attained through the expansion of cultivated land. Moreover, availability of pastureland is an important issue for livestock rearing. Therefore, under subsistence agriculture, holding size is expected to play a significant role in influencing farm households' food security. In the survey, farmers' holding size was asked by separating into various land uses, assuming that farmers' estimation errors and data unreliability could be minimized. The results are summarized in tables 12, 13, and 14.

On average, holding size per household was found to be 0.93 ha, which appears very small even when compared to the figures for the national average (0.95 ha) and for Amhara Region (0.97 ha) (CSA 1998). The holding size varied from 0.015 ha to 2.75 ha. Given the deteriorating and exhausted land conditions as well as backward agricultural practices and the resultant poor yields, the average holding is generally smaller than the economic level necessary to adequately feed farm households in the zone under consideration (see table 11).

Table 12. Land holding* size distribution

Farm size category (ha)	NHH	%	Cum. %	Area (ha)	% of area
_.51	28	16.7	16.5	10.8	6.8
.51-1.00	97	57.1	73.5	80.8	50.9
1.01-1.50	30	17.6	91.2	37.4	23.6
1.51-2.00	8	4.7	95.9	14.1	8.9
2.01-2.50	6	3.5	99.4	12.8	8.1
2.51-3.00	1	0.6	100.0	2.8	1.7
Total	170	100.0	100.0	158.7	100.0

SOURCE: Field survey, March 2000.

Note: ***** Holding size of individual farmers comprises land under cultivation, fallow land, grazing land and land under settlement.

Tables 12 and 13 present six categories of holding sizes and the proportion of farmers that fall under each group and the total land occupied by the respective groups. About one-quarter of the respondents owned land holdings of 1 hectare or less, making up 57.7 % of the total land area held by the studied farmers. Less than 5% of the respondents had land holdings of greater than 2 ha.

Table 13. Percentage distribution of farmers, by farm size category and *wereda*

Wereda	No. HH	Farm holding size					
		_.51	.51 - 1.0	1.10 -1.50	1.51 - 2.0	2.01 - 2.50	2.51- 3.00
Dawa	56	11.9	42.9	23.2	8.9	5.4	-
Batti	59	8.5	77.9	10.2	1.7	-	1.7

Artuma	55	21.8	49.1	20.0	30.6	5.5	-
Total	170	16.5	57.1	17.6	4.7	3.5	0.5

Source: Field survey, March 2000.

The variation in mean land holding was quite significant among the study *weredas*, with a range between 1.03 ha in Dawa and 0.86 ha in Batti. The disparities at households' level appear considerably wider as is witnessed by the coefficient of variations given in table 14. Farmers in Dawa are relatively better off than their counterparts in other *weredas* in terms of size of holdings. In this *wereda*, over one-third (37.5%) of the sample farmers work on more than one hectare. The corresponding proportions for Artuma and Batti are 29% and 13.6%, respectively.

Table 14. Mean, maximum and minimum land holding size, by *wereda*

Wereda	Mean	Minimum (ha)	Maximum (ha)	St. Dev.	C.V.
Dawa	1.030	0.040	2.25	0.474	46.1
Batti	0.860	0.250	2.75	0.355	41.5
Artuma	0.890	0.015	2.75	0.503	56.6
Total	0.934	0.015	2.75	0.449	48.1

SOURCE: Field Survey, March 2000.

Regarding changes that occurred to the farmers' land holdings, about 16.7%, 29.4% and 53.9% of the farmers have reported an increase, a decrease and no change, respectively, in their land holdings during the last ten years (see table 15). Thus, no change had happened to the land of the majority of the households under investigation. This may be partly explained by the fact that the size of the holdings is small and already below the optimum. At *wereda* level, this fact holds true for Batti and Artuma. In contrast, in Dawa, farmers whose lands have decreased constituted the largest proportion.

The reported reasons for the decline of holding size, according to order of importance, included: loss of land to others by redistribution, giving up land from cultivation in response to depletion of soil nutrients, renting land to someone else, and sharing of land with family members. On the other hand, those who got additional land mainly benefited from recent land reallocation, and a few households from purchasing land as well as from renting land through share cropping arrangements.

Table 15. Changes that had happened to the size of farmers' land holdings during the last ten years

Change	Responses by *wereda*			
	Dawa	Batti	Artuma	Total

	No.	%	No.	%	No.	%	No.	%
Increased	12	20.0	11	18.4	7	11.7	30	16.7
Decreased	25	41.7	14	23.3	14	23.3	53	29.4
No change	23	38.3	35	58.3	39	65.0	97	53.9
Total	60	100.0	60	100.0	60	100.0	180	100.0

SOURCE: Field survey, March 2000.

The farmers were asked to identify the general topography and fertility status of their farm plots. The responses depicted in table 16 show that most of the farmlands are situated on plains where fertility situations are generally felt to be better by the farmers. In fact, the majority of the farmers (56.5%) rated their plots as moderate and poor with regard to soil fertility.

Table 16. Farmers' responses on the fertility status and topography of their farm plots

Topography of farmlands	***Dawa***		***Batti***		Artuma		Total	
	NP	%	NP	%	NP	%	NP	%
Plain	73	74.5	44	45.4	61	83.6	178	66.4
Moderate	21	21.4	31	32.0	9	12.3	61	22.8
Steep	4	4.1	22	22.6	3	4.1	29	10.8
Total	98	100.0	97	100.0	73	100.0	268	100.0
Fertility status								
Fertile	54	55.1	24	24.5	39	53.4	117	43.5
Moderate	18	18.4	41	41.8	22	30.1	81	30.1
Poor	26	26.5	33	33.7	12	16.4	71	26.4
Total	98	100.0	98	100.0	73	100.0	269	100.0

SOURCE: Field survey, March 2000.

Note: NP refers to the number of plots whereby 268 plots were reported for topography and 269 for soil fertility status.

5.4 Land Fragmentation

Land fragmentation, also known as pulverization, morcellement, parcelization, and scattering, is the type of land ownership pattern where "a single farm consists of numerous discrete parcels, often scattered over a wide area" (Binns 1950 cited in Bentley 1987, 31). Another way of looking at land fragmentation can be by dividing land into small farms.

Land fragmentation is a common landscape feature of Ethiopian agriculture. The causes of land fragmentation may be put under three main groups: socio-cultural and demographic causes (inheritance transfer, land reform, reallocation, etc.); economic causes (risk minimization, transfer through gift, sale or purchase, rental, share cropping); physical or environmental causes such as variations in climate, soil, flood, etc. (Grigg 1984; Bentely 1987).

The field survey data reveal a substantial variation with respect to the number of plots belonging to the studied farmers (see table 17). The number of plots ranged between 1 and 5. Despite this wide gap, the overall average (1.21 plots) and cumulative frequency distributions suggest a low degree of land fragmentation in the zone. In the face of the rugged topography of the escarpment covering the landmass of the study *weredas*, one would expect fragmentation much higher than the present finding. The disparities among the *weredas* seem slight as the mean number of plots lies between 1.21 in Artuma and 1.62 in Dawa. The relatively low degree of farm fragmentation among the farmers in Artuma may be attributed, among the others, to two factors. First, the already small holdings of the farmers might have discouraged further land reallocation. Second, most farmlands are reported to be situated on plain topography (see table 16).

Table 17. Percentage distribution of the number of plots, by *wereda*

Wereda	N	Mi.	Ma.	X	Farmers with plots of				
					1	2	3	4	5
Dawa	56	1	4	1.62	49.1	40.4	8.8	1.8	0.0
Batti	59	1	5	1.59	59.3	28.8	8.5	0.0	3.4
Artuma	58	1	3	1.21	80.7	17.5	1.8	0.0	0.0
Total	173	1	5	1.48	63.0	28.9	6.4	0.6	1.2

SOURCE: Field survey, March 2000.

Note: N= number of household; Mi. = minimum number of plot; Ma. = maximum number of plot and X = Mean

5.5 Farming System

Oromiya Zone is characterized by subsistence mixed farming system. A large number of the zone's population get their livelihoods by cultivating a variety of crops and rearing livestock simultaneously. The importance of crop cultivation, however, decreases with a drop of altitude as the people in the extreme lowlands largely depend on pastoralism. A few number of farmers in highland parts of Dawa and Artuma practice double cropping during *meher* and *belg* growing seasons.

5.5.1 Crop Production

Cropping Patterns

According to the CSA's (1999) Agricultural Sample Survey, some 17 types of field crops are cultivated by farmers in Oromiya Zone. Of these, cereals are the dominant crops accounting for about 94% of the croplands and 97.7% of the total harvests in 1998/99 cropping year. Among cereals, sorghum, maize and *teff* are the three principal crops. These crops cover 48.5%, 22.3% and 21.2% of the total croplands, respectively. In terms of output, the three crops together comprise 96.5% of the total crop harvests (CSA 1999).

The sample farmers at three sites grow eight types of field crops. These according to the order of the number of growers are sorghum (in 140 cases), maize (in 53 cases), *teff* (in 53 cases), barley (in 8 cases), wheat (in 6 cases), millet (in 4 cases), linseed (in 1 case) and horse bean (in 1 case). The distribution rightly demonstrates a typical *weyna dega* cropping pattern. A few households also grow perennial cash crops such as sugar cane, mango, coffee, papaya, chat and banana. Besides, vegetables such as potato, garlic and onion are grown in rare cases.

Crop Harvests and Yields

Data generated on the size of crop harvests for 1999 among the studied farmers depict the salient feature of subsistence agriculture, under which the size of crop harvest is strongly correlated with the size of cropland. Accordingly, the scope of increasing crop output by small farmers would largely rely on expanding farmlands. As a result, sorghum that accounted for the largest proportion (56.5%) of farmland was found to make up over half of the overall harvests as well. The other major crops with respect to harvest included maize and *teff*. These crops constituted about 77.5% of the total crop harvests for the study year (see table 18).

Table 18. Area, production and yields of major crops of the sample households, by *wereda* in 1999

Crop type	Dawa			Batti			Artuma			Total		
	Ar.	Pr.	Y	Ar.	Pr.	Y	Ar.	Pr.	Y	Ar.	Pr.	Y
Sorghum	33.50	143.00	4.27	66.27	63.52	0.96	51.53	97.48	1.89	151.30	304.00	2.01
Maize	27.00	109.50	4.10	4.00	2.00	0.50	16.01	29.00	1.81	47.01	140.50	3.00
Teff	21.88	77.05	3.50	4.50	7.50	1.66	25.48	26.68	1.50	51.86	111.23	2.14
Barley	0.00	0.00	-	2.45	5.50	2.24	0.50	4.30	8.60	2.95	9.80	3.32
Wheat	1.00	10.00	10.00	5.06	1.06	0.21	0.13	1.00	7.69	6.19	12.06	1.94
Horse bean	0.00	0.00	-	0.25	0.40	1.6.0	0.00	0.00	-	0.25	0.40	1.60
Linseed	0.00	0.00	-	0.50	0.08	0.63	0.00	0.00	-	0.50	0.08	0.63
Millet	0.00	0.00	-	7.75	10.00	1.29	0.00	0.00	-	7.75	10.00	1.29
Total	83.38	339.55	4.07	90.78	90.06	0.99	93.65	158.46	1.69	267.81	588.07	2.19

SOURCE: Field survey, March 2000.

Note: Ar. = area in hectare, Pr. = production (output) in quintal, Y= yield of crop in quintal per hectare.

Slight variations were observed among the studied *weredas* in terms of cropping patterns and size of harvests. An important issue that has to be mentioned here is the size of crop harvest for the year on which the survey was collected (1999) was extremely poor because of drought and very bad economic situations of the farmers since the previous year's (1998) harvest had almost completely failed.

The yield of major crops given in table 18 indicates extremely low figures. Variations are seen among crops, and among *weredas* for the same variety of crop. The highest and the lowest yields per hectare fall between 332 kg/ha (barley) and 63 kg/ha (linseed). Yield differences for the same variety are quite considerable. For example, sorghum ranges between 96 kg/ha (Batti) and 427 kg/ha (Dawa) and maize between 50 kg/ha (Batti) and 410 kg/ha (Dawa). According to the data, farmers at Shakilla site in Dawa collected a relatively better yield, while farmers at Kamme in Batti collected the least yield. Several factors ranging from environmental to socio-economic features may explain the difference in crop yields, which of course, calls for a detailed investigation. However, it is possible to safely argue that better access to and more adoption of modern farm inputs among farmers of Dawa might have contributed to better yields (see Section 5.6).

5.5.2 Livestock and Farm Oxen Possession

Animal husbandry forms the other important source of livelihood for the studied farmers. Livestock contribute to households' economy in different ways; i.e., as a source of pulling power, source of cash income, source of supplementary food, and means of transport. Besides, livestock are considered a means of security and coping methods during crop failure and other calamities. In view of this, an inventory of livestock for the sample households was carried out. Table 19 provides the total number of livestock, the average number per farm household and their distribution by type. The total number is 449 heads which is equivalent to 356 Tropical Livestock Unit (TLU), giving an average of 2.49 heads (1.98 TLU) per farm household. For the mixed farming areas such as Oromiya Zone, the figure appears very small and the farmers can generally be regarded as being extremely poor in terms of livestock resources. As a result, the farmers have limited capacity to cope with the problem of crop failure. The food insecurity problems experienced in the study communities would be a clear manifestation of this dire condition.

According to distribution by type, cattle comprise the majority (83.9%) of the livestock population, followed by goats that account for 8.2% of the livestock. Others with very small shares include sheep, camels, donkeys, mules and horses. Besides, some 41 households own 169 chicken and only 7 farmers own beehives. Farmers in Dawa own more livestock than their counterparts in Batti and Artuma.

Table 19. Distribution livestock population, by type and *wereda* in March 2000

Wereda	Livestock type				No. per HH	TLU per HH
	Cattle	Sheep and	Equines	Total		

			goats							
	No.	TLU	No.	TLU	No.	TLU	No.	TLU		
Dawa	179	155.55	34	2.18	12	8.7	225	166.43	3.75	2.77
Batti	118	110.26	9	0.69	6	3.7	133	114.64	2.22	1.91
Artuma	80	73.49	9	0.74	2	0.7	91	74.94	1.52	1.25
Total	377	339.30	52	3.61	20	13.1	449	356.01	2.49	1.98

SOURCE: Field Survey, March 2000.

Note: Tropical Livestock Unit (TLU) is equivalent to a livestock weight of 250 kg, and the conversion factors vary according to the type of livestock. Accordingly, an ox = 1.12 TLU, other cattle = 0.7979, a sheep = 0.0892 TLU, a horse =1.3 TLU, a goat =0.07 TLU, a mule = 0.9 TLU, a donkey = 0.35 TLU, a camel = 1 TLU.

For farmers such as the ones in Oromiya Zone, who almost entirely rely on traditional farming methods, farm oxen possession would be a critical production factor. The study findings on farm oxen ownership show that about 37% of the households are without farm oxen. Surprisingly, another 40% of the farmers own only one ox. This means over three-quarters of the studied farmers had faced severe problems of traction power. From the findings, it is not difficult to deduce that crop cultivation in the zone is partly constrained by lack of farm oxen. Comparison of farmers in the three *weredas* with regard to farm oxen possession reveals a substantial variation. Shortage of pulling power is the worst in Artuma as more than six farmers out of ten are without oxen.

Table 20. Distribution of farm oxen ownership, by *wereda*

Wereda	Total farm oxen	Mean	Percentage of farmers with					Total no. of HH
			0	1	2	3	4	
Dawa	60	1.62	38.3	30.0	26.7	3.3	1.7	60
Batti	50	1.39	40.0	36.7	23.3	0.0	0.0	60
Artuma	30	1.43	64.9	21.7	11.7	1.7	0.0	60
Total	140	1.49	37.0	40.1	20.6	1.7	0.6	180

SOURCE: Field survey, March 2000.

Note: The mean values given in the table are when accounting only the farmers who possess farm oxen.

5.6 Agricultural Inputs and Extension

Various studies in our country have proved that appropriate application of modern farm inputs such as chemical fertilizers, improved seeds and herbicides can increase crop yield and productivity. Because of this fact, Ethiopian farmers have been for long encouraged to adopt utilization of modern farm inputs. The importance of these inputs becomes more significant in highly eroded soils and fragile environments as in Oromiya Zone to improve land productivity and to boost overall production. Therefore, utilizations of modern farm inputs are expected to enhance farm households' food security. The sample farmers were asked whether they utilize modern farm inputs to increase yields of their crops. As is shown in table 21, although varied across inputs, the proportion of farmers applying inputs is very low.

A. Chemical Fertilizers

About one-third (31.6%) of the sample farmers reported to apply artificial fertilizers. The disparity between *weredas* in terms of adoption appears significant as the proportion varied between 43.3% in Dawa to 20% in Artuma. The relatively high adoption of fertilizers among farmers in the former is probably explained by better accessibility of Shakilla, the study site, to the zonal town that acts as the major distribution centre. Group discussion with farmers indicated that fertilizer application may not be economical and currently has much risk. As a result, the majority of farmers in lowland Batti have still resisted the use of chemical fertilizers on their farms.

B. Improved Seeds

The introduction of improved seeds that can withstand the problem of aridity and erratic rain distribution seems an important issue to the zone under investigation. The field data shows that only 17.2% of the study farmers have adopted the utilization of improved seeds. The main constraints against applying this input among the farmers are limited supply and high prices. At *wereda* level, the percentage of improved seed users ranges between 23.3% in Artuma and 11.7% in Batti.

Table 21. Participation of farmers in the application of modern farm inputs, by *wereda*

Input	*Wereda*							
	Dawa		Batti		Artuma		Total	
	No.	%	No.	%	No.	%	No.	%
Chemical Fertilizer	26	43.3	19	31.7	12	20.0	57	31.6
Improved seeds	10	16.7	7	11.7	14	23.3	31	17.2
Herbicides	5	8.3	0	0.0	8	13.3	13	21.7
Insecticides	12	20.0	38	63.3	25	41.7	75	41.7
Irrigation	0	0.0	6	5.0	4	5.0	10	5.5
Extension services	24	40.0	8	13.3	16	26.7	50	27.8

Farm credit	18	30.0	9	15.0	18	30.0	48	25.5

SOURCE: Field survey, March 2000.

C. Herbicides

Utilization of herbicides by the sample farmers in Oromiya Zone was found to be low with only 21.7% reporting to have used them. A large number of farmers remove weeds in sorghum and maize farms manually. Farmers at all of the study sites have shown their concern that the existing technology is not effective for killing weeds growing under maize and sorghum. Moreover, weeds are considered as an important source of feed for livestock, contributing to curbing out the shortage of pasture. As a result, the farmers are very much reluctant to use chemicals.

D. Irrigation

The fact that the largest part of the zone is characterized by semi-arid climate, with limited scope of transforming rain-fed agriculture, would clearly imply the magnitude of the demand for irrigation practices. The achievement so far, however, seems discouraging as only 4.4% of the respondents were found to practice crop cultivation under small-scale irrigation. Like other inputs, the variation at *wereda* level is quite considerable. The percentage of farmers using irrigation in Batti and Artuma was 5% in each. None of the samples in Dawa reported the use of irrigation.

E. Insecticides

Because of a serious problem of pests, particularly the invasion of *Tinziza* during recent years, insecticide application has become a critical input in the zone. Some 41.7% of the farmers in the *weredas* apply insecticides to prevent their farm produce from pest attacks. The figure seems high compared to other inputs, although it is far from satisfactory as almost everybody has been a victim of losing his crop at least to *Tinziza*. Besides, the considerably high post-harvest crop losses require the application of appropriate chemicals.

G. Farm Credit

The availability of agricultural credit to the subsistence farmers who have little or no capital or savings to invest in farming is an important component in small farm development programs. In line with this view, an attempt was made to know the number of farmers who had benefited from farm credit. The result provided in table 21 shows that one-quarter of the studied households got farm credit. When associated with the degree of the production resource deprivation, the proportion seems very small.

F. Extension Services

In a country such as Ethiopia, where the majority of farmers are illiterate, agricultural extension would play a significant role in assisting them by identifying and analysing their production problems and by making them aware of opportunities for improvement. Hence, the effectiveness of the other inputs in production partly relies upon the availability of sound agricultural extension services at community levels. However, only 27.8% of the sample households identified themselves to be beneficiaries of extension services. The percentage of farmers using extension services is relatively high at Shakilla site. This may be because of the accessibility of the site to the zonal town.

6. Household Food Security and its Determinants

The objective of the study is to identify the root causes of transitory (seasonal) food insecurity among the farm households in Oromiya Zone. In order to attain this specific objective, household data were generated and analysed through two different but complementary approaches. The first one was to directly quantify the food available for consumption in 1999 and to examine the kind of relationship that exists between per capita food availability in calorie and the various socio-economic factors influencing the amount and sources of food at the household level. The current chapter presents the results and discussions from the first approach. Chapter 7 will deal with the second approach, which is the assessment of farmers' perceptions of why they face seasonal food shortages.

6.1 Household Food Balance

The Household Food Balance Model has been utilised to quantify available food at the household level. The model is a modified form of the Regional Food Balance Model (see Degefa 1996), to fit into the context of the studied households, which is expressed as follows:

Nij = (Pij + Bij + Fij + Rij) - (Hij +Sij + Mij)

Where: Nij is net food available for household i in year j.

Pij is total grain produced by household i in year j.

Bij is total grain purchased by household i in year j.

Fij is total grain obtained through FFW by household i in year j.

Rij is total relief food received by household i in year j.

Hij is post harvest losses to household i in year j.

Sij is total crop utilized for seed from the home by the household i in year j.

Mij is total marketed output by household i in year j.

All the data needed for the model, with the exception of post-harvest losses, were obtained through household survey. The 1998 crop harvest was used as production data. Post-harvest crop loss is an average value estimated at 10% of the total harvest for each crop. The data for the other variables were based on the inventory for the 12 months between November 1998 and 1999. The model enables us to estimate adult equivalent per capita daily kilocalories available for home consumption. In order to convert grain available in kilograms into equivalent kilocalories, conversion factors[9] were utilized for crops grown at home as well as for those acquired through other means.

The results of the household food balance analysis reveals that the majority of the farmers at the study sites were facing serious food shortage during the year under investigation. This is demonstrated by the1414.6 cal mean daily per capita food available, making up only 67.4% of the Minimum Recommended Allowance (2100 cal). Table 22 shows the range of per capita food available to be extremely wide, falling between 34.5 cal and 7680.3 cal. Out of the total sample, only 18% of the households had food availability greater than the MRA. Households with per capita calorie of less than 50% of the MRA constituted 44%, and about 70% of the sample had less than 80% of the MRA. These figures are good indicators of the magnitude of the prevailing transitory food shortage facing farm households in Oromiya Zone. Of course, it should be noted that in the study year (1999), food availability was one of the worst with respect to households' shortage of food supply.

Households were asked to quantify the amount of food crops (cereals, pulses and oilseeds) that could satisfy their families' food requirements. The amount offered in quintal/kilogram by each household was converted into equivalent food calories. The summary of the mean is offered in table 24. The overall mean is estimated at 2780 cal, making up 136.7% of the MRA, and only 7% of the households could meet the amount they felt to be sufficient. The mean food made available for the sample households constituted less than half of what is regarded as adequate by the farmers. The figures for the amount identified by the households should be understood and interpreted with due precaution since the farmers exaggerated their demand deliberately, by relating the inquiry with an assessment for relief food distribution.

As is depicted in tables 22 and 23, the disparity among the three *weredas* seems quite significant in terms of food available for consumption. The findings show that Dawa *wereda* is in a relatively better position than the other two *weredas*. The average per capita food available in this *wereda* was 74.9% of the MRA and 52.8% of what the farmers felt adequate. About 19% of the households in this *wereda* had attained the MRA for the year under study. The *wereda* had the least number of households with food availability of less than 50% of the MRA. However, it exhibited the widest range of average per capita food available, i.e., 64.7 cal to 7608 cal.

Table 22. Average net food available for consumption in kilocalories and per capita calories between November 1998 and November 1999, by *wereda*

Wereda	Total kg per house-hold per year	Total kcl per house-hold per year	Daily per capita food available in calories					
			Mean	Per cent of MRA	Min.	Max.	St. dev.	Coef. of variation
Dawa	721.7	2892.9	1572.2	74.9	64.7	7608.3	1358.4	86.4
Batti	680.6	2561.4	1255.3	59.8	34.5	3080.6	824.6	65.7
Artuma	752.7	2816.5	1416.3	67.4	44.4	4815.6	1043.3	73.7
Total	718.3	2755.9	1414.6	67.4	34.5	7608.3	1099.8	77.7

SOURCE: Field survey, March 2000.

Artuma came next with a mean daily per capita calorie of 1416.3 (67% of the MRA). Some 18.2% of the farm households had access to food greater than the MRA. Apparently, farmers in the *wereda* had highly inflated their consumption demand, thus the amount of food available made up only 46.9% of the stated demand. The amount that the farmers claimed to be sufficient was on average 143.8% of the MRA (see table 24).

Table 23. Percentage distribution of households with per capita food available of above MRA, over 80% of MRA, and over 50% of the MRA, by *wereda*

Wereda	No. HH	Households with per capita calorie of							
		< 50% MRA		50-80% of MRA		81% of MRA		Over MRA	
		No.	%	No.	%	No.	%	No.	%
Dawa	58	21	36.2	20	34.5	6	10.3	11	19.0
Batti	58	31	53.4	10	17.2	7	12.1	10	17.2
Artuma	55	23	41.8	15	27.3	7	12.7	10	18.2
Total	171	75	43.9	45	26.3	20	11.7	31	18.1

SOURCE: Field survey, March 2000.

Farm households in Batti were seriously stricken by food insecurity in 1999 (table 24). For over half of the sample households, the calorie intake was found to be less than 50% of the MRA during the year under study. The variations among households within a *wereda* were very wide as shown by the ranges as well as the coefficient of variation. The coefficient of variations for Dawa, Artuma and Batti were 86.4%, 73.7% and 86.4%, respectively.

Table 24. Per capita calorie requirement as reported by the household and availability by *wereda*

Wereda	Per capita calorie requirement (a)	Per capita calorie available (b)	Difference(a - b)	(b) as % of (a)	(a) as % of MRA
Dawa	2976.3	1572.2	1404.1	52.8	141.7
Batti	2614.4	1255.3	1359.1	48.0	124.5
Artuma	3020.2	1416.3	1603.9	53.1	143.8
Total	2870.3	1414.6	1455.7	49.3	136.7

SOURCE: Field survey, March 2000.

6.2 Factors Influencing Agricultural Production and Household Food Security

Some social, demographic and economic factors affect agricultural production: both crop cultivation and livestock husbandry. It is assumed from the outset that farm households get the larger portion of the food to be consumed at home from their own production. Therefore, any factor that influences farm production has positive or adverse implications on food availability.

6.2.1 Food Availability and Household Demographics

In Ethiopia, it is apparent that the head of a household strongly influences the household's livelihood and food security. His/her salient demographic features would then influence, to a certain extent, the type and amount of food made available from different sources. In view of this, an attempt was made to assess the difference of per capita food available that exists between households headed by men and those by women. Although the percentage of female-headed households was small in the sample, the households' per capita calorie intake from crops (697 cal) was found to be extremely low, less than half of the mean for the male-headed households (1415 cal). Hence, it is possible to infer that sex difference in headship of farm households may influence the households' food security.

The age of a household head was the other demographic variable that was tested for any association with food availability. The assumption here was the higher the age of the head, the better the food security situation as there can be more options of making food available from both agricultural and non-farm opportunities. As expected, households headed by older people (over 40 years) were found to be more likely to be better in terms of food availability (see table 25). Although this may call for further investigation, it is tentatively possible to argue that being young and able with respect to labour has contributed little to household food security as far as the study zone is concerned.

Table 25. Mean daily per capita calories, by age of household head

Age group	*Weredas*			
	Dawa	Batti	Artuma	Total
< 20	1118	1719	-	1419
20 - 29	1376	1115	1500	1427
30 - 39	1284	923	1237	1173
40 - 49	2184	1266	1202	1427
50 - 59	1710	1375	1422	1539
60 - 69	1601	1416	2469	1723
70^{+}	1351	1391	564	1321

SOURCE: Field survey, March 2000.

It was also attempted to compare the mean per capita food availability with the educational status of the household head. The basic premise here is that farmers that are more educated adopt new technology and farm practices faster, which in turn enhances agricultural productivity. The results in table 26 show that the amount of food consumption was relatively higher for literate heads compared to their illiterate counterparts, and higher for those who attended primary school than for those who attended literacy education. Nonetheless, the number of farmers that completed secondary education was the smallest and the food availability for these farmers was the lowest. This may be due to other factors.

Table 26. Mean daily per capita calories, by education of household head

Wereda	Level of education			
	Illiterate	Read and write	Primary	Secondary
Dawa	1507	1408	2328	1019
Batti	1193	1256	1638	-
Artuma	1445	1512	1085	1251
Total	1351	1413	1688	1172

SOURCE: Field survey, March 2000.

The relationship of per capita food availability of households with family size was also examined. In a traditional society under which the farm economy and consumption tends to be mainly family-centred, the per capita food availability declines when the number of consumers increases as shown in table 27. This is, in fact, one of the reasons for blaming rapid population growth and the resultant large family sizes.

Table 27. Mean daily per capita calories, by family size

Wereda	Family size			
	≤ 3	4 - 6	7 - 9	≥ 10
Dawa	1721	1565	1550	752
Batti	1070	1285	1277	559
Artuma	2221	1230	1448	1460
Total	1757	1349	1412	1074

SOURCE: Field survey, March 2000.

6.2.2 Food Availability and Households' Asset Ownership

Farmers' economic status is expected to affect the quantity and quality of food available for consumption. In this regard, the study examined the variations of the calorie intake in relation to differences in access to a few production resources, specifically land holding size, fertility status of farmlands, livestock size, ownership of farm oxen, off-farm income opportunities and access to farm credit.

Having access to sufficient land appears a critical input for both crop production and livestock rearing. Hence, it is assumed that households' food security and size of land holding have a strong positive correlation. The discussion in Chapter 5 has shown that land holding for the sample is very small, and that over nine-tenths of the households get their means of subsistence from lands of 1.5 ha or less. The result of the comparison of the farmer's food consumption level with the land holding size deviates from what is expected (see table 28). The farmers with over 1.5 ha of land had considerably low per capita food available, which may be explained by various factors such as deprivation of other production resources.

Table 28. Mean daily per capita calories, by size of land holding

Holding size Category (ha)	*Weredas*			
	Dawa	Batti	Artuma	Total
< 0.50	1602	942	1814	1558
0.51 - 1.0	1525	1259	1200	1306
1.01 - 1.5	2030	1669	1603	1815
1.51 - 2.0	1067	514	1301	1056
2.01 - 2.5	1120	-	1923	1521
2.51 - 3.0	-	746	-	746

SOURCE: Field survey, March 2000.

In connection with land, per capita food consumption difference by soil fertility level is assessed. Assuming other factors remain constant, fertile lands are generally expected to yield better harvests, which results in better food availability (see table 29). A remarkable observation to be recorded here is how much the farmers' indigenous knowledge and experience are important in evaluating household resources.

Table 29. Mean daily per capita calories, by fertility status of farmlands

Wereda	Fertility status		
	Fertile	Moderate	Poor
Dawa	1593	1505	1231
Batti	1455	1007	1191
Artuma	1342	1539	1325
Total	1482	1258	1224

SOURCE: Field survey, March 2000.

Livestock possession particularly the ownership of farm oxen forms the cornerstone of farm economy. Here, an attempt was made to see the difference brought about by the number of livestock available to a household's food security. The results are given in tables 30 and 31. Households that possessed a large number of livestock were found to be better in food security. Except in Artuma, households with more than 10 heads of livestock had consumption levels higher than the MRA. The case of farm oxen was, however, different from expectation. In Dawa, farmers with one ox were found to be better in terms of food availability than those with a pair of oxen were. In Batti, oxen-less farmers had better per capita food than those who possessed one ox. Similarly, the per capita food availability of households with three oxen was by far smaller than that for a pair of oxen.

Table 30. Mean daily per capita calories, by number of livestock

Livestock size category	*Wereda*			
	Dawa	Batti	Artuma	Total
0	1435	1049	1447	1343
1 - 5	1572	1299	1301	1381
6 - 10	1084	1299	1535	1198
11 - 15	2944	2027	1556	2234
16 - 20	2666	-	3235	2856

21 - 25	-	-	-	-
26+	2263	-	-	2263

SOURCE: Field Survey, March 2000.

Employment in off-farm and non-farm activities has a paramount significance to diversify the sources of farm households' livelihoods. It enables farmers to modernize their production by giving them an opportunity for applying the necessary inputs, and reduces the risks of food shortage during periods of unexpected crop failures. From this perspective, it was attempted to see any significant difference existing between farmers who worked in off-farm activities and those who did not. The findings in this case, except for farmers in Batti, are somehow contrary to expectation. Those who did not engage in off-farm activities had relatively higher per capita calories. This shows the existence of few opportunities and the negligible contribution of income from those activities to household food security.

Table 31. Mean daily per capita calories, by size of farm oxen

Wereda	Number of farm oxen				
	0	1	2	3	4
Dawa	1388	1663	1560	1887	3820
Batti	1303	1071	1454	-	-
Artuma	1316	1463	1931	1380	-
Total	1333	1366	1581	1718	3820

SOURCE: Field survey, March 2000.

Farm credit is an input that helps overcome small farmers' cash deficiency. As depicted in table 32, access to farm credit resulted in substantially better household food consumption. The gap of per capita calories between credit users and non-credit users was quite significant.

Table 32. Mean daily per capita calories for households that work in off-farm activities and get farm credit and for those that do not work

Wereda	Off-farm activities		Farm credit	
	Yes	No	Yes	No
Dawa	1439	1712	1836	1464
Batti	1778	955	1252	1221
Artuma	1075	1790	1649	1318
Total	1395	1431	1654	1325

SOURCE: Field survey, March 2000.

6.2.3 Food Availability and Technological Inputs

Subsistence farmers aim at producing sufficient food crops that enable them to satisfy their families' consumption requirements. This means any farm input that augments agricultural productivity would be expected to boost the overall production, which in turn contributes towards attaining household food security. Bearing this in mind, the study compared the food security situation of the farmers who applied modern farm inputs with those who did not. The considered technological inputs were commercial fertilizers, improved seeds, herbicides, insecticides and irrigation. Farmers' participation in extension is also taken into account. In fact, the percentage of farmers adopting these technological inputs was small (see Section 5.6). The imbalance between the number of the experimental group (users) and the controlled group (non-users) may have implication for the mean difference.

Table 33 shows that the average per capita food availability for the farmers who did not use fertilizers is greater than for those who did. The mean calorie intakes for the fertilizer users at Batti, Artuma and Dawa were smaller than for the non-users by 220 cal, 213 cal and 70 cal, respectively. The main explanation for this could be the 1998/99 tremendous crop failure that was induced by drought in the zone. The same situation was applicable in case of improved seeds and herbicides because the food availability of the farmers who did not utilize them was relatively higher. The exception here, however, was for the farmers in Artuma where the food situation of those who adopted improved seeds and herbicides was found to be better. It should be stressed that the findings did not disprove the positive correlation that exists between technological inputs and yields of crops because other factors also play significant roles in the success of crop production. Even in the case of modern farm inputs, aspects such as application rates and methods of application have something to do with responses in terms of yield.

Table 33. Mean daily per capita calories for households using chemical fertilizers and improved seeds and for those not using

Wereda	Chemical fertilizers		Improved seeds	
	Yes	No	Yes	No
Dawa	1565	1635	1438	1641
Batti	1055	1275	993	1257
Artuma	1272	1485	1497	1424
Total	1331	1451	1360	1433

SOURCE: Field survey, March 2000.

Insecticide is an input that is being adopted by a large number of farmers. A comparison of the food intake situation for insecticide users and non-users shows a mixed result. In Batti and Artuma, the users had relatively better food availability, whereas in Dawa they did not (see table 34).

Table 34. Mean daily per capita calories for households using herbicides and insecticides and for those not using

Wereda	Herbicides		Insecticides	
	Yes	No	Yes	No
Dawa	1213	1644	1198	1707
Batti	-	1224	1258	1162
Artuma	1646	1416	1542	1373
Total	1449	1417	1338	1480

SOURCE: Field survey, March 2000.

The use of irrigation is a good strategy for promoting the crop production sector in Oromiya Zone. Table 35 shows that farmers that use irrigation had better food availability than those who did not use it. The reason obviously seems that irrigation users do not lose crop through drought.

Table 35. Mean daily per capita calories for irrigation and extension service user and non-user households

Wereda	Irrigation		Extension services	
	Yes	No	Yes	No
Dawa	-	1604	1335	1722
Batti	1458	1203	1787	1215
Artuma	1917	1408	1235	1507
Total	1662	1409	1374	1448

SOURCE: Field survey, March 2000.

The food scarcity problem was quite severe among farmers who reported to be extension package users in Dawa and Artuma. This may be attributed to two factors. First, those who benefited from the extension package and got inputs based on credit had unfortunately faced crop failure for which they became indebted. Secondly, the effectiveness of the extension service is somehow questionable (see Section 7.4). Some of the farmers became beneficiaries of the package by imposition. The case of Batti was quite different since the extension package at the study site had focused on livestock fattening. Unlike crop package, the livestock sector did not collapse.

6.3 Sources of Food Available for Home Consumption

As is clear from the household food model, farmers in the study *weredas* had access to food from four sources, namely home (own) production, purchase from market, food grains obtained through working in Food for Work (FFW) schemes, and relief food distribution. The overall proportions of the amount of food from the respective sources were 39.4%, 57.4%, 0.8 % and 2.4%. This is a clear picture of the severe seasonal food insecurity (famine) year. Under normal situations, whatever the level of consumption may be, one would expect the larger amount of food to come from own production. The finding shows that the studied households met their consumption by purchasing from the market. For such food insecure farm households, food obtained from both free relief distribution and food for work opportunities tended to be minimal and inadequate.

Table 36 shows a considerable difference among *weredas* with respect to the size of food made available from own production. The proportion ranged between 29.1% in Batti and 47.9% in Dawa. This is one of the indicators of the variation of food insecurity under small holding farm situations. In the case of relief food, the largest share went to Batti, nearly half of the total grain distributed for the sample households.

Table 36. Sources of total food available for consumption between November 1998 and November 1999

Wereda	Sources of food made available								Total net food
	Production		Purchased		FFW		Relief food		in kg
	Kg	%	Kg	%	Kg	%	Kg	%	
Dawa	20761	47.9	21744	50.2	110	0.2	685	1.6	43300
Batti	11868	29.1	27028	66.2	463	1.1	1477	3.6	40836
Artuma	18327	40.6	25452	56.4	470	1.0	911	2.0	45160
Total	50956	39.4	74224	57.4	1043	0.8	3073	2.4	129296

SOURCE: Field Survey, March 2000.

6.4 Determinants of Household Food Availability

The study forwarded the following testable hypotheses at the outset.

i) Per capita food available in calorie increases with an increase of age of the household head, educational level of the household head, land holding size, fertility of farmland, total number of livestock, number of farm oxen and size of crop harvest. All variables are assumed to be positively correlated with food availability.

ii) Per capita food available in calorie decreases with an increase in the household family size.

iii) Per capita food available for male-headed households is greater than for female-headed ones.

iv) Per capita food available is positively correlated with the utilization of modern farm inputs, namely chemical fertilizers, improved seeds, herbicides, pesticides, irrigation, extension services, farm credit and off-farm income. Accordingly, the food security situation of farmers who use technological inputs is better than of those who do not use.

v) The basic assumptions have partly been verified through cross-tabulation of the mean per capita calorie intake with several factors (see Section 6.2). In what follows, attempt is made to examine the statistical association of those factors with food availability and to measure how far the variation of per capita food available (as dependent variable) is explained/predicted by the independent variables. The multivariate regression model is employed for this purpose.

6.4.1 Variables

The variables in the model are:

Dependent Variable (Y): The daily per capita food available for each household estimated by Household Food Balance Model for 12 months (November 1998 to November 1999).

Independent Variables:

X1 = Sex of household head (1=male and 0= female)

X2 = Age of head (in years)

X3 = Educational status of head (0= illiterate, 1= read and write, 2= primary education, 3= secondary education)

X4 = Family size (number)

X5 = Land holding size (hectare)

X6 = Fertility status of land (0= poor, 1= intermediate, 2 = fertile)

X7 = Total number of livestock (number)

X8 = Farm oxen possession (number)

X9 = Employment in off-farm activities (1= yes, 0= no)

X10 = Farm credit (1= yes, 0= no)

X11 = Commercial fertilizer (1= yes, 0= no)

X12 = Improved seeds (1= yes, 0= no)

X13 = Herbicides (1= yes, 0= no)

X14 = Insecticides (1= yes, 0= no)

X15 = Irrigation (1= yes, 0= no)

X16 = Extension service (1= yes, 0= no)

X17 = Size of crop harvest (in kg)

6.4.2 Results and Discussion

The relationships between the per capita food availability in calories and various variables were examined. The findings from the multiple regression model confirm the results of the cross-tabulations for the type and directions of the relationship of most of the independent variables with the per capita calorie intake. As depicted in table 37, the seventeen predictors explained about 28% of the variations of the food availability ($r = 0.529$ and $r^2 = 0.28$). The food availability variation with an ANOVA of F- ratio of 2.792 was statistically significant. Among the independent variables, the size of crop harvest, family size, age of the head, use of irrigation and sex of the head were found to be the major determinants of food availability (see the significance of **t** in table 37).

Table 37. Summary of the results of multiple regression analysis

Variable	Betta (B)	T	Significance
Sex of the head	785.8	1.278	0.204
Age of the head	14.6	2.186	0.031
Education of the head	143.5	0.539	0.591
Family size	-151.2	-3.170	0.002
Land holding size	-181.7	-0.847	0.399
Fertility of farmland	81.1	0.648	0.518
Total livestock	18.8	0.777	0.438
Farm oxen	-74.8	-0.551	0.583
Off-farm activities	-55.0	-0.281	0.779
Farm credit	258.0	1.145	0.255
Commercial fertilizer	-257.6	-1.031	0.304
Improved seeds	182.4	0.669	0.505
Herbicides	99.4	0.263	0.793
Insecticides	-1.5	-0.008	0.994
Irrigation	789.0	1.739	0.085
Extension	-244.9	-1.010	0.314
Size of crop harvest	110.7	4.883	0.000
Constant	385.4		
R	0.529		
R square	0.280		
Adjusted R square	0.180		

F change	2.792		0.001

SOURCE: Author's computation from survey data.

Per capita food availability has shown an increase with an increase in the educational level and age of the head. The impact of education on household food production might be through promoting awareness on the possible advantages of modernizing agriculture through technological inputs and by diversifying household incomes, which in turn enhance households' food supply. The higher the age of the head, the more stable the economy of the farm household. Older people have also relatively richer experiences of the social and physical environments. Moreover, older heads are expected to have better access to land than the younger heads. As expected and in line with the cross tabulation, the per capita food availability of male-headed households was greater than that of female-headed households.

Having a large number of livestock and possessing fertile farmlands were found to enhance households' food security situations. The positive correlation of these variables with food availability confirms the hypothesis. The correlations were also consistent with the assumption that per capita food availability decreases with an increase in the number of household members (see table 37). This shows that large family size has more implication on food consumption than on labour supply to boost agricultural production.

The regression results show a decline of food availability with an increase in the number of farm oxen and land holding size. This result is against the assumptions made by the study. The inverse relationship may be explained by the crop damage facing the studied farm households during the year under consideration, and the big loss was for farmers with large land holdings and for those with better access to pulling power. Because of this fact, home production was not the major source of food for consumption.

The hypothesis on the relationship between the availability of food and the application of technological inputs was found to be mixed; that is, positive relationship for some as expected, and negative for others (see table 37). The utilization of farm credits, improved seeds, herbicides and irrigation, indeed, has enhanced the volume of food at the household level. Thus, the inputs could serve, to some extent, the intended purposes. On the other hand, per capita food availability has declined for the farmers who utilized commercial fertilizers and insecticides as well as for the farmers who had the advantage of getting access to off-farm employment and extension services. Although it is very difficult to reach a conclusion about the relationship between the size of harvest and the inputs, other factors such as drought and pests might have undermined the possible contribution of those modern inputs.

7. Perceived Causes of Household Seasonal Food Shortage and Coping Mechanisms

Chapter six has dealt with the statistical relationship between food availability and various demographic, social and economic characteristics of the studied farmers. The current section presents the results of the assessment of farmers' viewpoints as to why they encounter seasonal food shortage. An attempt was also made to see the consistency between the findings of the quantitative data in the foregoing part and the farmers' perceptions regarding the causes of seasonal food insecurity. Data input for this purpose has been generated in different ways. First, the researcher carried out field observations in the study *weredas* and held informal interviews with PA officials and a few farm households. During the same phase of fieldwork, discussions were made with *wereda* officials and with *wereda* agriculture officers. All these have contributed in identifying a multiple of environmental and socio-economic factors that were assumed to constrain farmers' crop cultivation and livestock husbandry, and thus induce seasonal food deficits among the farmers in the zone. A few variables were also derived from existing literature concerning the problem under investigation.

Therefore, the designing of the main instrument for the inquiry on why farm households are unable to produce adequate food at home was largely based on those preliminary assessments. The investigation was based on two basic assumptions. First, subsistence farmers face seasonal food shortages due to their inability to produce adequate food at home, which can be attributed to many factors. Second, households can face transitory food shortages due to poor management of harvests and their stocks. All factors (about 35 variables) that were assumed to directly and/or indirectly induce seasonal food shortage among the farmers of Oromyia Zone were grouped into five categories: environmental problems, demographic factors, economic constraints, infrastructural constraints and social factors. These are regarded as bottlenecks to rural development. Nevertheless, not all factors can have equal magnitude of influence on every household or on all study sites. Hence, in order to identify the main perceived causes of seasonal food shortages, the sample farmers were asked to respond to each variable by rating either as *nil* for not applicable, as *moderate constraint* (*problem*) or as *severe constraint* (*problem*) for their food supply. The survey data were analysed through point score analysis. In what follows, the results and discussions are presented.

The households were asked if own production could meet their annual food requirements. Of 180 households, only 5 reported to regularly produce sufficient food from their own crop production and animal husbandry to cover all year round demand. The distribution of households who do not encounter seasonal food shortages by *wereda* was only 3 in Dawa and 2 in Artuma (see table 38).

Table 38. Farmers' response on whether they produce adequate food to cover all- year- round consumption requirements

Wereda	Responses			
	Yes	%	No	%

Dawa	3	5.0	57	95.0
Batti	0	0.0	60	100.0
Artuma	2	3.3	58	96.7
Total	5	2.9	175	97.1

SOURCE: Field survey, March 2000.

7.1 Environmental Problems

Farmers deal with living things: plants and animals whose inherent biological characteristics determine their productivity, and they only function efficiently in environments in which they are adapted (Grigg 1984). Hence, any deviation of environmental element from the normal situation could adversely affect farmers' livelihoods. Of course, the magnitude of the environmental influence varies according to the level of development, and subsistence farmers in developing regions are generally regarded as more susceptible to environmental changes.

Regardless of the differences in perceived magnitude of their influence, it is possible to group the environmental factors presented in tables 39 and 40 into climatic, relief, edaphic and biological. Among climatic factors, the farmers rated drought and erratic rainfall patterns as the most influential of all environmental factors and other variables under consideration. The studied farmers have had several experiences of crop failure and resultant severe seasonal food shortages. The informants at three study sites recalled the disastrous droughts and famines of the years 1973, 1984/85, 1994 and 1999. It should, however, be underlined that drought has not been a continuous phenomenon in Oromiya Zone although its cumulative effect on subsistence farmers can be long lasting. A year's drought erodes farmers' asset ownership and makes them more vulnerable to various risks. Farmers' complaints of the dependency on single harvests, that is, *meher* season is also an issue largely explained by rainfall distribution patterns. Under rain-fed situation, most parts of the zone have only one growing season. Some 70% of the sample households have also reported crop failures due to other climatic factors specifically hail storms and frosts.

Table 39. Frequency distribution for the perceived environmental problems causing seasonal food shortage, by *wereda*

Problem	Number of respondents											
	Dawa			Batti			Artuma			Total		
	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe
Drought	0	1	55	0	0	60	0	0	56	0	1	171
Erratic rain	0	1	55	0	1	59	0	4	52	0	6	166
Soil erosion	13	10	33	5	14	41	14	18	24	32	42	98
Water logging	12	8	36	16	16	28	21	17	18	49	41	82

Diseases	2	11	43	0	7	53	1	20	35	3	38	131
Pests	1	11	44	3	16	40	3	26	27	7	53	111
Hail storms	13	22	21	21	24	15	14	22	20	48	68	56
Frosts	17	24	14	16	27	17	14	29	13	47	80	44
Rugged topography	24	14	18	13	28	19	33	18	4	70	60	41
Weed	17	21	18	17	27	16	17	20	19	51	68	53
Poor soil fertility	13	15	28	6	15	39	14	20	21	33	50	88
Stoniness of farmland	15	13	27	4	16	40	18	18	20	37	47	87
Dependency on single harvest	0	10	46	2	15	42	0	18	38	2	43	126

SOURCE: Field Survey, March 2000.

The direct impact of relief on agricultural production as well as its influence through various features of soil is also a well-recognized cause of seasonal food shortage. The entire part of Oromyia Zone constitutes the rugged escarpments of the central highlands that roll into the main Ethiopian Rift Valley. Its impact on land utilization for agricultural purposes is obvious. Expansion of cultivation into marginal and sloppy areas has facilitated soil erosion and depletion of basic soil nutrients. The proportion of farmers that have complained about poor harvests of their crops due to soil erosion, poor soil fertility and stoniness of their farmlands were 80%, 78.9% and 76.9%, respectively (see table 40). On the other hand, level terrains in the valleys of the major rivers such as Borkena and Jera constrain farmers' crop production through a water logging effect.

The farmers felt that some biological factors such as diseases, pests and weeds have been negatively affecting their agricultural production. The former two were particularly rated highly and they follow drought and erratic rain in terms of rank order. Emphasizing the influence of those factors on food production, an informant at Kamme site, Batti *wereda*, stated that the environment was very favourable for various macro- and micro-organisms that have in fact threatened their health.

Table 40. Results of point score analysis for perceived environmental problems

Problem	Dawa		Batti		Artuma		Total		Per cent of applicability
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Drought	111	1	120	1	112	1	343	1	98.3
Erratic rain	111	1	119	2	108	2	338	2	98.3
Soil erosion	76	7	96	5	66	6	238	6	80.0

Water logging	80	6	72	9	53	11	205	9	70.3
Diseases	97	5	113	3	90	4	300	3	96.6
Pests	99	4	96	5	80	5	275	5	93.7
Hail storms	64	10	54	13	62	7	180	10	70.9
Frosts	52	12	61	11	55	10	168	12	70.9
Rugged topography	50	13	66	10	26	12	142	13	57.7
Weeds	57	11	59	12	58	9	174	11	69.1
Poor soil fertility	71	8	93	8	62	7	226	7	78.9
Stoniness of farmland	67	9	96	5	58	9	221	8	76.6
Dependency on single harvest	102	3	99	4	94	3	295	4	96.6

SOURCE: Computed from table 39.

Note: 1. The scores given to the responses were: 2 for severe problem (constraint); 1 for moderate problem (constraint); and 0 for nil (not applicable). Response values were then multiplied by the number of respondents and summed up to get total scores.

2. Per cent of applicability refers to the sum of the percentage of farmers that reported the factor to be severe and moderate.

What seems very important regarding the environmental factors is that more than half of the respondents were aware of these factors as being the causes of households' food insecurity. The percentage of applicability of the factors ranged between 57.7% for rugged topography and 98.3% for both drought and rainfall unreliability. Generally, slight variations can be seen among the studied *weredas* with respect to both frequency distribution and ranks of total scores for each factor.

7.2 Demographic Factors

One of our country's development challenges now is the rapid population growth rate that by far exceeds the pace of the economic growth. The other demographic constraints under consideration here seem to be the direct outcome of this factor. The farmers perceive that overpopulation has caused diminishing holding size for individual farmers to a mean size of 0.93 ha. Resulting from this, they have very limited scope to give up land as fallow. Farmers do normally keep large numbers of livestock on a small grazing area when holding sizes shrink, which results in considerable overgrazing. Official periodic redistribution and reallocation of land to entertain new land claimants as well as transfer through inheritance to children have induced fragmentation of farmlands. The effect of periodic land reallocations on farmers' tenure security is another issue that has to be underscored in view of agricultural productivity. An assessment of the farmers' perception toward the factors is given in tables 41 and 42.

Table 41. Frequency distribution for the perceived demographic factors inducing seasonal food shortages

Problem	Dawa			Batti			Artuma			Total		
	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe
	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ
Rapid population growth	0	5	51	0	18	42	1	5	50	1	28	143
Diminishing land holdings	0	7	48	0	21	39	3	8	45	3	36	132
Farm fragmentation	9	12	35	13	30	16	4	13	39	26	55	90
Absence of fallow	4	15	37	3	34	23	16	8	32	23	57	92
Overgrazing	7	19	30	5	31	24	11	17	28	23	67	82

SOURCE: Field survey, March 2000.

Note: FRQ refers to the number of respondents.

The demographic factors reported as causing seasonal food deficits according to the rank order of the scores for the farmers' responses at aggregate level are rapid population growth, diminishing land holding, absence of fallow, farm fragmentation and overgrazing. The factors were reported to moderately or severely influence the agricultural production of 97.7%, 96%, 85.1% and 82.9% of the study households, respectively (see table 42).

Table 42. Results of point score analysis of perceived demographic factors for seasonal food shortage

Problem	Dawa		Batti		Artuma		Total		Per cent of app.
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Rapid population growth	107	1	102	1	105	1	314	1	97.7
Diminishing of land holding	103	2	99	2	98	2	300	2	96.0
Farm fragmentation	82	4	62	5	91	3	235	4	82.9
Absence of fallow	89	3	80	3	72	5	241	3	85.1

Overgrazing	79	5	79	4	73	4	231	5	85.1

SOURCE: Computed from table 41.

As can be seen in table 42, except for rank 1 and 2, the ranking of the scores at Batti and Artuma differ from each other as well as from the overall and from Dawa's. This is because farmers at Batti complained more about the lack of fallow than farm fragmentation, while the opposite is true in the case of Artuma. This actually deviates from the findings for the degree of fragmentation, which was found to be relatively high in Batti (See table 17).

7.3 Economic Constraints

Among the economic variables presented to the farmers, lack of cash income was identified as the main bottleneck against promoting agricultural development by 97.7% of the study farmers in the three *weredas*. The farmers are purely subsistence cultivators, with no surplus production at all. The scope to diversify their cash income through employment in off-farm or non-farm activities appears very limited, since 83.4% of the farmers mentioned the absence of such kinds of opportunities in their areas.

The poverty factor (because of lack of cash) manifests itself not only in the livelihoods of the farmers but it is also directly reflected in the lack of capacity to modernize their agriculture. Lack of investable cash among farmers means inability to purchase modern farm inputs as well as limited scope to innovate archaic farm implements that has been under use for decades. In response to this, both labour and land productivity have been extremely low. Some 95.4% and 88% of the households have attributed seasonal food shortages to inability to purchase and properly apply modern farm inputs, and to backward farm implements and practices, respectively (see table 44 which is based on calculations from table 43).

Table 43. Frequency distribution for the perceived economic constraints to agricultural production

Constraints	Dawa			Batti			Artuma			Total		
	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe
	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ
Lack of cash	0	14	42	0	23	37	1	15	40	1	52	119
Absence of off-farm incomes	7	19	30	3	33	24	16	17	23	26	69	77
Shortage of farm oxen	6	11	37	2	21	37	4	21	30	14	53	104
Low modern farm inputs	8	27	27	1	23	36	2	27	27	5	77	90
Traditional	2	25	25	9	32	19	3	27	26	18	84	70

farming implements and practices												

SOURCE: Field Survey, March 2000.

Note: FRQ refers to the number of respondents.

Shortage of farm oxen is the other economic constraint that adversely affects the cultivation of crop among the farmers in Oromiya Zone (see Section 5.5). Lack of farm oxen greatly affects farmers' livelihoods. A farmer with no ox cannot properly and timely prepare his farmlands. He has to either rent out his land to other farmers with adequate pulling power or he has to get oxen on rent. This means under both circumstances a farmer has to lose some of his produce through shares, which would be directly reflected in his households' food security.

Table 44. Results of point score analysis for perceived economic constraints

Constraints	Dawa		Batti		Artuma		Total		Per cent of app.
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Lack of cash	98	1	97	1	95	1	290	1	97.7
Absence of off-farm incomes	79	4	81	4	63	5	223	5	83.4
Shortage of farm oxen	85	2	95	2	81	2	261	2	89.7
Low modern farm inputs	81	3	95	2	81	2	257	3	95.4
Traditional farming implements and practices	75	5	70	5	79	4	224	4	88.0

SOURCE: Computed from table 43.

7.4 Infrastructural Constraints

Infrastructural predicaments are related to the absence or inadequacy of certain physical structures and economic services that are expected to facilitate the processes of production and distribution of agricultural commodities. In view of this, the farmers' perception regarding the impact of the status of seven infrastructures was assessed (see tables 45 and 46).

Most parts of Oromiya Zone are characterized by lowland and semi-arid climate. As a result, irrigation is a very important input for promoting crop production. Irrigation plays a significant role in minimizing the risk of crop failures due to drought and rainfall variability. Furthermore, irrigation makes possible an intensification of agriculture and production of more than one harvest per year from the same plot. This may help relieve the problem of land scarcity, to a certain extent. The farmers felt that their dependency on rain-fed agriculture and their failure to utilize irrigation have considerably affected the size of their crop harvests and their food supplies. That is why they rated irrigation to be the most important infrastructural constraint directly reflected in household food insecurity.

The second important infrastructural constraint about which some 82.9% of the farmers complained is lack of veterinary services for their livestock (see table 46). A study by Mesfin (1991) in Northcentral Ethiopia, where the current study *weredas* are situated, identified some 125 diseases of cattle, sheep and goat. This would clearly show the existence of much demand for veterinary services. In relation to this, an informant at Cheritti site, Artuma, stated that government efforts toward promoting agriculture has been highly biased against the livestock sub-sector and that extension packages focus on crops, which has shown little success in the community. Some 57.1% of the farmers were in favour of this comment as they complained about the inadequate extension services offered by the Ministry of Agriculture (MoA). It was observed that only one or two Development Agents were stationed at each PA. The main problem in relation to the DA, however, seems lack of professional competence to render the expected services. DAs have limited training of not more than ten months, in most cases. On top of this, the incentives they get for staying in rural areas, where social and economic services are non-existent, highly discourage them from offering genuine and efficient services.

Table 45. Frequency distribution for the perceived infrastructural constraints to agricultural production

Constraints	Dawa			Batti			Artuma			Total		
	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe
	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ
Inaccessibility to roads	35	18	3	12	27	20	45	7	4	92	52	27
Absence of irrigation	2	16	38	2	19	39	4	25	26	8	60	103
Absence of rural credit	25	19	12	20	17	23	22	21	11	67	57	46
Inadequate extension services	24	21	11	20	16	24	28	22	6	72	59	41
Poor storage facilities	24	23	9	19	20	21	36	13	6	79	56	36
Low prices of agricultural output	13	28	14	6	21	32	27	15	14	46	64	60
Lack of	10	23	22	4	24	32	12	24	20	26	71	74

veterinary services												

SOURCE: Field survey, March 2000.

Note: FRQ refers to the number of respondents.

The other infrastructural constraint that was perceived to be one of the causes for agricultural underdevelopment is related to marketing. Despite the fact that most of the sample farmers were subsistence farmers, over 70% of them felt the significantly wide gap that exists between the prices for agricultural produce and the manufactured consumer goods and farm inputs see table 46). The farmers stressed that they could not afford most of the inputs for modernizing their agriculture under these circumstances. Small farmers' cash deficiency is expected to be compensated by giving access to farm credit provisions. However, according to over half of the studied households, no such supportive and crucial inputs were provided.

Table 46. Results of point score analysis for the perceived infrastructural constraints

Constraints	Dawa		Batti		Artuma		Total		Per cent of app.
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Inaccessibility to roads	24	7	67	4	15	7	106	7	45.1
Absence of irrigation	92	1	97	1	77	1	266	1	93.1
Absence of rural credit	43	4	63	6	43	3	149	4	58.9
Inadequate extension services	43	4	64	5	34	5	141	5	57.1
Poor storage facilities	41	6	62	7	25	6	128	6	52.6
Low prices of agricultural output	56	3	85	3	43	3	184	3	70.9
Lack of veterinary service	67	2	88	2	64	2	219	2	82.9

SOURCE: Computed from table 45.

Over half of the farmers admitted post-harvest crop losses due to poor and traditional storage. Given the small number of chemical users and the high temperature of the area, the proportion of crop losses is expected to be higher than the estimated national average. The farmers also complained about not having any access to working roads. In this regard, significant variation was observed among the farmers in the three *weredas*. Farmers at Shakilla and Cheritti are almost along the main highway. Thus, only one-third and less than one-quarter of the households at the respective sites reported the problem they faced in terms of transportation services. In the case of Batti, Kamme is situated off the highway and thus 80% of the respondents complained of the unavailability of this infrastructure.

7.5 Social Factors

Five variables related to social characteristics were considered. A study by Mesfin (1991) has identified a diversity of diseases that threaten the health of people, the principal of which include eye illness, disability, deafness, skin disease, chest disease and others. The current observation, however, slightly deviates from those mentioned diseases since the people at the three study sites directly pointed to malaria and yellow fever as the main killer diseases now. It is due to this that about 88% of the households understood health problems as the main social factor affecting food security. Malaria's direct effect on households' food security would be through inefficient use of labour in farm operations. The outbreak of an epidemic during critical agricultural operations such as cultivation, weeding and harvesting adversely affects agricultural productivity. Otherwise, given the rapid population growth and land scarcity problems, labour supply cannot be a very important constraint to production in the areas under study.

With regard to labour supply and efficiency for production, two crucial observations need to be made. First, food shortage and malnutrition facing households during land preparation, crop planting and weeding have significant influence on productivity. Second, unlike the Oromo farmers in other areas of the country, the people in the zone under study were found to be, in most cases, neither hard working nor innovative enough in their agricultural undertakings.

The studied farmers are aware that their poor food rationing system (second ranking) as well as low saving habits (third ranking) has contributed to the seasonal food shortages that they face almost every year. Focus group discussion at different communities indicated that various social ceremonies and celebrations taking place in the immediate post-harvest months use up sizeable proportions of annual farm households' incomes. Expenses on the weddings of their children and ceremonies related to the death of relatives and family members were identified as social practices taking up much investment.

Table 47. Frequency distribution for perceived social factors for seasonal food shortage

Constraints	Dawa			Batti			Artuma			Total		
	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe	Nil	Mod	Severe
	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ	FRQ
Shortage	22	13	21	17	16	27	33	13	10	72	42	58

of human labour												
Health problems	5	17	34	2	13	45	11	17	28	18	47	107
Low levels of education	6	18	32	5	8	47	17	18	21	28	44	100
Poor food rationing	14	3	39	5	4	51	16	7	33	35	14	123
Absence of saving tradition	18	6	32	11	7	42	17	9	30	46	22	104

SOURCE: Field survey, March 2000.

Note**:** FRQ refers to the number of respondents.

The studied farmers felt that their low level of education has adversely affected their production activities, which is clearly manifested in their poor agricultural performance. Literacy rates in Oromiya Zone are the lowest of all the zones in Amhara Region. A comparison of the perception of the farmers at *wereda* level regarding education shows interesting results. According to the farmers' response point score regarding social factors that adversely affect food security, low education was rated as the most important in Dawa, while it held third and fourth place in Batti and Artuma, respectively (see table 48). The reason for the disparity might be the frequent visits of the farmers in Dawa to the nearby town, Kamisse, which gives them more chance to perceive the gap that exists between the living conditions of the rural people and those of the relatively more educated urbanites.

Table 48. Results of point score analysis for perceived social factors

Problem	Dawa		Batti		Artuma		Total		Per cent of app.
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	
Shortage of human labour	55	5	70	5	33	5	158	5	57.1
Health problem	85	1	103	2	73	1	261	1	88.0
Low level of education	82	2	102	3	60	4	244	3	82.3
Poor food rationing	81	3	106	1	73	1	260	2	78.3
Absence of saving	70	4	91	4	69	3	230	3	72.0

tradition									

SOURCE: Computed from table 47.

7.6 Seasons of Food Shortage

Seasonal food shortages facing subsistence farmers are partly explained by seasonality of the agricultural operation per se. Under normal circumstances, harvest and immediately post-harvest periods are generally the times when food supply is adequate. On the other hand, planting and pre-harvest times are seasons of food shortage. The data in table 49 demonstrate this situation. The farmers' reliance on a single harvest of *meher* season per year at study sites has, of course, greatly contributed to the relatively longer duration of food short supply at the household level.

November, December and January are the months when 69%, 79.2% and 73% of the respondent households do not face any kind of food shortage. By contrast, more than 85% of the households encounter severe food shortage during the months of July, August and September. July appears to be the worst month since almost all households face severe food shortage. Although the year of study (1999) coincided with the worst seasonal food insecurity (famine) year in the area under investigation, it should be noted that the findings indicate a general pattern for even the so-called `normal years'. Table 49 depicts that there existed slight differences among the studied *weredas* with respect to the farmers' response on periods of food shortages. The minimum percentages of households reporting severe food shortages (during food shortage months: July, August and September) in Dawa, Batti and Artuma were 78.3%, 83.3%, 93.3%, respectively. This would suggest, to a certain extent, that Dawa is relatively better than the other *weredas* in household food security.

Table 49. Households' response to the degree of food shortage in each month, by *wereda*

Months	Dawa			Batti			Artuma			Total		
	Degree of shortage			Degree of shortage			Degree of shortage			Degree of shortage		
	None	Less	Severe	None	Less	Severe	None	Less	Severe	None	Less	Severe
January	41	6	6	42	12	5	42	9	8	125	27	19
February	20	27	10	23	26	11	23	24	12	66	77	33
March	7	37	14	4	40	16	14	29	16	25	106	46
April	1	34	25	2	37	21	6	30	24	9	101	70
May	0	21	38	0	31	29	2	25	33	2	77	100
June	0	13	47	0	10	50	0	4	56	0	27	153
July	0	4	56	0	1	59	0	0	60	0	5	175
August	0	4	55	0	1	58	0	0	60	0	5	173
September	2	13	41	4	14	41	6	13	40	12	40	122
October	22	14	16	29	20	10	19	21	19	70	55	45

November	39	7	5	43	12	4	35	17	7	117	36	16
December	42	4	4	45	11	3	46	9	4	133	24	11

SOURCE: Field survey, March 2000.

The number of meals per day for each sample household was assessed. The result given in table 50 shows that the number of meals under normal situation ranged between one and four. About 3.9%, 7.9%, 86.5% and 1.7% of households eat once, twice, three times, four times a day, respectively. Nevertheless, from the data in table 51 and from the group discussion results at the study sites, it was realized that the number of meals per day is considerably reduced, and the type of foodstuffs for consumption is changed during the months of food shortage. These are among the ways of how households cope with food shortages.

Table 50. Frequency distribution of number of meals per day under normal circumstances, by *wereda*

Wereda	Number of meals per day							
	Once		Twice		3 times		4 times	
	No.	%	No.	%	No.	%	No.	%
Dawa (N=59)	2	3.4	4	6.8	51	86.4	2	3.4
Batti (N=60)	2	3.3	1	1.7	57	95.0	0	0.0
Artuma (N=59)	3	5.1	9	15.3	46	78.0	1	1.7
Total HH (N=178)	7	3.9	14	7.9	154	86.5	3	1.7

SOURCE: Field survey, March 2000.

7.7 Households' Mechanisms of Coping with Food Shortage

Farm households respond to the problems caused by seasonal food insecurity in different ways. Various coping mechanisms that are identified by different authors (Messer 1989; Degnew 1994) can be put under three broad categories. These are production-based responses (expansion of production and improving productivity); market-based responses (food grain purchase through sale assets mainly livestock); and non-market-based responses (including institutional and societal income transfer systems such as gift, relief food distribution, etc.).

Farm households' coping mechanisms in Oromiya Zone were consistent with those strategies that can be seen in table 51. Accordingly, over three-quarters (79.7%) of the food insecure households overcame the problem through the purchase of grains. When asked about the sources of cash income to buy grains, the farmers pointed out a multiple of possible means presented in table 52. Employment in occasional labour (77.3%), selling of their livestock (69.9%) and petty trading (18.3%) were identified to be the principal ways of getting access to cash income. Also mentioned were working as daily labourers in their own areas and by migrating to other regions. The major destinations of the migrants from Oromiya Zone, according to the informants, include Wellega and Hararghe within the country and Djibouti in certain cases. Sales of livestock to purchase grain during food supply shortages have a considerable effect on farmers' economy mainly because of the sharp decline in livestock prices.

Table 51. Households coping mechanisms for the seasonal food shortage (multiple response is possible)

Mechanism	Respondents by *wereda*							
	Dawa		Batti		Artuma		Total	
	No.	%	No.	%	No.	%	No.	%
Purchasing grains	54	93.1	58	96.7	29	49.2	141	79.7
Borrowing grains from other farmers	11	18.6	5	8.3	19	31.7	35	19.6
Borrowing grain from `*Kire*'	2	3.4	1	1.7	5	8.6	8	4.5
Reducing consumption	38	64.4	25	41.7	49	83.1	112	62.7
Changing dietary habits	30	50.8	30	50.0	39	66.1	99	55.6
Receiving relief aid freely	28	47.5	37	61.7	50	84.7	115	64.6
Obtaining food through food for work	19	32.2	38	63.3	35	59.3	92	51.7
Migrating to other areas to work as labourers	32	55.2	39	65.0	34	57.6	105	59.3

SOURCE: Field survey, March 2000.

Reduction of consumption in terms both the number of meals per day and amount of food in one meal was identified to be the coping means for the largest proportion (62.9%) of households (see table 51). Households also change the type of foodstuffs during short supply. Thus, it may be said that passing food shortage seasons under serious malnutrition is a common phenomenon in the area.

About 64.6% of the food insecure households reported that they overcome food shortage problems by receiving relief food freely from governmental and non-governmental organizations, and over half of the respondents used to obtain food through working in various food for work development schemes (see table 51). The two approaches have been widely practiced in the zone under study for several decades. Nonetheless, they could not bring about long lasting solutions for the problems that seem to increase from time to time.

Table 52. Sources of cash to purchase grains (multiple response is possible)

Source of cash	Respondents by *wereda*							
	Dawa		Batti		Artuma		Total	
	No.	%	No.	%	No.	%	No.	%
Borrowing from others	11	18.6	1	1.7	14	24.6	26	14.8
Borrowing from *Kire*	0	0.0	0	0.0	1	1.8	1	0.6
Gift from relatives	3	5.1	4	6.7	5	8.8	12	6.8
Selling livestock	45	76.3	54	90.0	24	42.1	123	69.9
Petty trading	5	8.5	8	13.3	20	35.1	33	18.8
Working as a labourer	41	69.5	46	76.7	49	85.9	136	77.3
Sale of wood	2	3.4	12	20.0	1	1.8	15	8.5
Obtaining aid	0	0.0	0	0.0	1	1.8	1	0.6
Sale of firewood	0	0.0	5	8.3	0	0.0	5	2.8

SOURCE: Field survey, March 2000.

8. Summary, Conclusions and Recommendations

8.1 Summary

The study has attempted to identify environmental and socio-economic causes to households' transitory food insecurity among farmers in Oromiya Zone of Amhara Region. Various approaches were employed to generate the necessary data from both primary and secondary sources. The main methods of acquiring the primary data included: analysis and interpretation of existing maps, field observations, focus group discussions, key informant interviews and household sample survey. CSA census reports, agricultural sample survey reports and other published and unpublished documents constituted the sources for the secondary data.

Qualitative and quantitative techniques were employed for analysing the data. The Statistical Package for Social Scientists (SPSS) was used for coding, compiling, and analysing the 180 households' questionnaire data from the three *weredas*. The specific statistical methods used were the household food balance model (for measuring per capita food availability), descriptive statistics and multivariate regression model (for examining the relationship of food availability with several factors); and point score analysis (for identifying the main perceived environmental and socio-economic causes of seasonal food insecurity). GIS software was employed for mapping purpose.

8.2 Conclusions

The fact that the entire landmass of Oromiya Zone falls in the escarpment of the Northcentral Highlands of Ethiopia is clearly manifested in the characteristics of its environmental elements. Among the salient physical features of the zone are: dominantly lowland (K*olla)* agro-climate; rugged topography; moderately high temperature; low amount and variable rainfall; and highly eroded and stony soils in most cases. This would lead us to the conclusion that the environment of the zone is considerably fragile and very susceptible to various environmental risks. Unwise utilization of the land resources has been exacerbating the situation of environmental degradation. It should be noted, however, that apparently there exists micro-level diversity in the characteristics of various environmental elements in the zone. The valleys of certain rivers that flow across the zone have enormous potential for irrigation.

Oromiya Zone is one of the most densely populated zones in the region as is manifested by its average crude density of 119 persons per square kilometre and 11.8 persons per hectare of cultivated land. Given the low carrying capacity of the land as well as the extremely low productivity, the zone tends to be overpopulated. An assessment of the zone's demographic parameters indicates a high age dependency ratio, high mortality rate, moderately high fertility rate and low literacy rate.

Because of extended human intervention, the land-use/land cover of Oromiya Zone has undergone dramatic changes. Agricultural activities have been among the contributors to land resource degradation. The findings show that the rapid population growth has resulted in diminishing land holdings, to an extent of below the economic level to sustain farm households' livelihoods. The parcelling out of individual holdings is another indicator for the scarcity of land for expanding agricultural production at the household level. Farmers' access to technological inputs was found to be limited. As a result, only 41.7%, 31.6%, 27.8%, 25.5%, 21.7%, 17.2% and 5.5% of the households reported to be users of insecticides, chemical fertilizers, extension services, farm credit, herbicides, improved seeds, and irrigation, respectively.

Crop harvest during the last two cropping calendars (1998 and 1999), for which the data were generated, was extremely poor in terms of both total harvests and yields per hectare. Although drought and pest infestations were blamed to cause crop damage and failures, the findings show the limited potential of the zone for grain production purely under rain-fed situations. Yields for few warm-weather crops such as sorghum and maize were relatively better, suggesting the possibility of specializing the area in the production of such crops. Like other mixed farming areas of Ethiopia, livestock husbandry constitutes the second source of livelihoods for over 70% of the study farmers. Nevertheless, an inventory of livestock possession shows a very small mean of 2.49 heads or 1.98 TLU per farm household. This would indicate that the farmers in the zone have limited capacity of coping with food shortage due to crop failure. The situation regarding farm oxen ownership was found to be the worst as 37% of the households were oxen-less, and another 40% reported to have only one ox. The implication of the lack of pulling power for the smallholder subsistence farmer is quite clear.

The measurement of the per capita food availability at household level has shown that over eight-tenths of the households were food insecure in 1999 since their consumption was under the MRA as well as under the amount they perceived as sufficient. A significant variation was found out between the *weredas* with respect to both the mean per capita food available and the proportion of food-secure households. Farmers in Dawa were relatively better than their counterparts in the other *weredas* were.

The results from the cross-tabulation of mean per capita food availability with various characteristics and the multivariate regression distinguished between households with better food availability and those highly vulnerable to seasonal food insecurity. Accordingly, households whose heads were women, young or illiterate, and those with large family size were found to face seasonal food insecurity. On the other hand, farmers with fertile farmland, those who owned a relatively large number of livestock, those who harvested a large amount of grain, those who obtained farm credit and those who utilized irrigation for crop production had relatively better food security. Due to crop failure, which was mainly induced by drought, farmers with large holdings, farmers who had better access to pulling power and who applied modern inputs (such as chemical fertilizers and insecticides) and those who worked in off-farm activities and who benefited from extension services had no better food consumption level during the year under consideration.

The findings from the farmers' perceptions of the causes of seasonal food shortages facing them are consistent with the results from the cross-tabulations and multivariate analyses. The households' inability to produce adequate food has been explained by the interplay between some environmental, demographic, economic, infrastructural and social factors. The farmers have identified drought, erratic rainfall patterns, livestock and crop diseases and pests, and dependency on a single *meher* harvest per year as the major environmental problems hindering them from being self-sufficient in food production. Among the demographic factors, rapid population growth and the resultant diminishing land holdings were felt to be the most important causes of food insecurity. The farmers also perceived poverty factors, specifically lack of investable surplus cash and shortage of pulling power, as the main bottlenecks to expand agricultural production. The zone under consideration is one of the poorest with respect to the development of rural infrastructure. The absence of irrigation and the resultant dependency on rain for crop cultivation, and lack of sufficient veterinary services were among the infrastructural shortcomings about which the majority of the farmers have complained. Health problems and poor savings were perceived to be the most important social factors adversely affecting the households' food security. The households in the zone under consideration cope with seasonal food shortages through various mechanisms, the principal of which include purchasing grains, receiving relief grains freely, reducing consumption (both the amount at a meal and the number of meals per day), and migrating to other areas to work as daily labourers.

8.3 Recommendations

The fact that an interaction of a multitude of factors is involved in causing seasonal food insecurity in Oromiya Zone calls for an integrated approach of dealing with the problems of rural developments. In order to improve the households' food security in the zone, the following may be the major areas of intervention.

i) The highly degraded environment should be rehabilitated and the existing land resources should be protected. In this respect, soil and water conservation activities such as gully treatment, establishment of nurseries, and afforestation/reforestation are highly recommended. Promoting environmental awareness among the people of the study *weredas* will greatly contribute to land resource conservation.

ii) The regional government should seek ways and options through which the land carrying capacity and population size would be balanced.

· One possible option in this regard could be resettling some segment of the population, on voluntary basis, into other areas with relatively good potential and low population densities. Great care should be taken in terms of planning and implementing such kinds of critical and somehow sensitive issues.

· The rapid population growth should receive a special consideration and the national population policy has to be effectively implemented in the zone.

· Attempts should be made to minimize the danger of a malaria epidemic.

iii) The problem of insufficient farmlands should be relaxed. The following can be among the direct and indirect measures to deal with the problem.

· Promoting off-farm and non-farm employment opportunities, through which some proportion of the farmers could shift from direct reliance on land for their livelihoods;

· Intensifying agriculture and increasing yield of crops through adequate and proper applications of modern farm inputs such as fertilizers, improved seeds and herbicides;

· Improving traditional farm implements and production practices; and

· Encouraging the farmers to grow crop varieties with relatively better yields.

iv) All options listed under iii) above can be materialized only if the farmers' problem regarding shortages of cash income could be overcome. Therefore, enhancing rural credits to the subsistence farmers in the zone should be one of primary areas of intervention during the coming years. Rural credit can indeed overcome the farmers' capital problem to buy farm oxen, the lack of start-up capital to work in off-farm and non-farm activities, and the lack of money to buy modern farm inputs.

v) Attempts to promote livestock husbandry and crop production should take into account the zone's potential. Production of perennial crops, fruits and vegetables through small-scale irrigation seems a promising option. In this regard, changing the farmers' subsistence mentality and converting the farmers to cash crop producers can be a challenging issue. In terms of livestock husbandry, the traditional method needs to be improved and attention should be given to quality rather than mere quantity. Expanding veterinary services can reduce the livestock mortality.

vi) The fact that the climate of the zone is dominantly semi-arid and the existence of a serious problem of frequent crop failure caused by drought and erratic rains clearly suggest that introducing small-scale irrigation can enhance food security at the household level. Therefore, any infrastructural development intervention should give special attention to irrigation development.

vii) The agricultural extension services should focus not only on promoting crop production but also on improving the livestock sub-sector. Furthermore, efforts should be made to enhance the awareness on proper management of harvests and the ways through which both pre-harvest and post-harvest crop losses can be minimized.

The success and effectiveness of the suggested interventions towards improving the households' food security will be partly based on the collaborative and integrated efforts of the different development actors, namely, the government, NGOs and private investors. Therefore, enhancing networks and information exchanges among these actors may help in the planning and implementation of appropriate development activities. Otherwise, resources may be wasted by duplicating similar interventions whereby other constraints would remain without receiving the necessary attention.

Notes

. This is recommended by the Ethiopian Medical Association as a minimum average caloric requirement per day for an average individual.

2. Stunting (Height-for-Age) measures chronic malnutrition and is a long term nutritional deprivation, wasting (weight-for-Height) measures acute

malnutrition and is a recent nutritional situation; and underweight (weight-for-Age) is an indicator of general malnutrition and measures past and/or current nutritional status.

3. The area of the zone and the boundaries adapted in the study are not official ones because the delineation along with other zones and regions has not yet been finalized. Thus, the figures may not be quoted.

4. The *weredas* are divided into rural Peasant Adminstrations and Urban *Kebeles*. Accordingly, Dawa has 26 PAs and 4 UKs, Batti is divided into 22 PAs and 3 UKs, and Artuma consists 33 PAs and 2 UKs.

5. The climax vegetation refers to the natural vegetation that would grow in the absence of human influence, which reflects the optimal vegetation of an area, as determined by environmental conditions.

6. This account does not include the minor soil associations that occasionally exist along with the major ones (see MoA/FAO Geomorphology and Soil Map, 1983).

7. Oromiya zone held the sixth rank among the zones in Amhara region following West Gojjam (145.5), South Wello (143.7), South Gonder (140.9), East Gojjam (138) and Agewawia (129.1) in 1999.

8. The other two special zones in Amhara Region are Wag Hemra and Agew Awi, which are dominated by the ethnic groups of Agew/Kamyr and Agew/Awingi, respectively.

9. According to the calorie conversion table by Agren et al. (1968) 1kg of maize = 4.03 kilocalories; 1kg of other cereals = 3.78 kilocalorie; 1 kg of legumes = 4.07 kilocalories and 1kg of oilseeds = 4.07 kilocalories.

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