DEMOGRAPHIC AND SOCIO-ECONOMIC DETERMINANTS OF HOUSEHOLDS INVOLVEMENT IN CHARCOAL PRODUCTION IN RURAL AREAS OF ZIWAY DUGDA WEREDA OF ARSI ZONE

BY

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Acronyms

ABRDPO	Arsi Bale Rural Development Project Office
AEC	Africa Economic Commission
ARDCO	Addis Resource Development Company
ARDO	Agriculture and Rural Development Office
AUU	Addis Ababa University
CDR	Crude Density Rate
CSA	Central Statistic Authority
DPPC	Disaster Prevention and Preparedness Commission
EPA	Environmental Protection authority
EPD	Environment Protection Department
FEDO	Finance and Economic Development Office
FGDs	Focus Group discussions
LRFA	Low Return Forest Activities
MEDaC	Ministry of Economic Development and Cooperation
NOP	National Office of Population
OBPED	Oromia Bureau Of Planning and Economic Development
OSSREA	Organization of Social Sciences Research for Eastern Africa
SPSS	Statistical package for Social Scientists
TLUs	Tropical Livestock Units

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Abstract

This study examined the demographic and socio-economic determinants of households' involvement in charcoal production in rural areas of Ziway Dugda Wereda of Arsi Zone. Both primary and secondary data were used. Primary data were generated from household survey, key informants and Focus Group Discussions.

Secondary data were collected from Journals, books, Ziway Dugda Wereda and Arsi Zone Government Offices. Using SPSS, data were analyzed and some relationships between dependent variable (engagement in charcoal production) and independent variables (demographic and socio-economic features of the households) were explored. Logistic Regression Model was used to explore variation of the dependent variable based on variations made by independent variables and to rank the relative importance of each in dependent variable.

As expected, households with large landholding and livestock holding size less involve in charcoal production. Similarly, male-headed households more involve in charcoal production. In contrary to what was expected, ages of the household heads and households' family size are positively correlated with involvement in charcoal production. Moreover, as literacy level of household heads increase, involvement in charcoal production also increases.

The findings of this study have both academic and practical purposes. The academic benefit is improving knowledge on how various socio-economic factors shaping the attitudes and activities of the rural households towards the environment. The practical benefit is for policy formulation in the areas of poverty, energy and environment linkage. Finally, the author of this thesis calls for further studies in other charcoal producing areas to validate the results obtained in this study.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Agriculture is the major source of cash income and the dominant sector to generate employment opportunity for the rural population of developing countries. However, due to erratic rainfall pattern, shortage of farmlands and low modern farm inputs, its productivity is low. The problem is further exacerbated by severe soil erosion, rapid population growth and lack of alternative sources of income. As a result, average per capita food production has declined in many countries. Per capita calorie consumption had stagnated at very low levels and roughly 100 million people in Sub-Sahara Africa are food insecure (World Bank, 1992; AEC, 1987).

Farm households respond to the problem food insecurity in different ways. Degefa's (2002) study in Oromia Zone of Amhara Region indicates that 79.7 percent of the food insecure households overcome the problem through the purchase of grain. According to his findings, the respondents' sources of cash income to buy grains include employment in labor (77.3 percent), followed by selling livestock (69 percent), selling of wood and wood products accounted for 11 percent.

Even though earnings from forest products play important role in the economies of most peoples of African countries, inefficient production and unwise use create a heavy strain on local environment. From the factors responsible for the massive deforestation that are currently experienced in Sub-Saharan Africa, firewood[1] and charcoal production take a lion's share. For instance, according to Misana's (1996) study in Kahama district of Tanzania, about 40 percent of his respondents identified firewood and charcoal production as a cause of deforestation, followed by tobacco cultivation and curing (31.6 percent). In Oromia Regional State also, firewood and charcoal account for 30-40 percent for forest clearance (OBPED, 1999).

However, compared to fuelwood, the impact of charcoal on forest resources is very significant, because charcoal production inevitably impose collateral damage, where many non-charcoalable trees would be lost for making pavement, firing trunks, covering, etc (Daniel, 2005).

[1] Firewood and fuel wood have same meaning and are biofuels and hereafter they used interchangeably.

As a result, charcoaling leads to considerable deforestation, which is now one of the most critical environmental problems faced by most African nations. Reduction of natural forest resources on which the poor depends[2] and land degradation is contributing to the downward spiral of poverty in Africa. Deforestation has a negative implication for the local environment and increases soil erosion, accelerates the global climatic change and threatens biodiversity. The reduction of forest also reduces the existing capacity to absorb carbon.

In order to address the current problem of deforestation, it is important to understand the contribution of various socio-economic factors such as households' asset possession, demographic and institutional factors such as forest policy, land tenure system, erosion of traditional values towards forest management, etc. The study intends to answer the question: What could be the underlying factors behind involvement in charcoal production? Are demographic factors to be blamed as underlying causes? If not, what other factors could explain households' dependence on forest resources for their livelihood? Is there any relationship between overuse and misuse of resources and institutional factors such as land tenure system, technology and deterioration of traditional values towards common resource management system? This thesis endeavors to provide answers to these basic questions.

1.2. Statement of the Problem

A study carried out in 1999 indicates that in Ethiopia about 46 percent of the population is under the poverty line (MEDaC, 1999). Under such condition, the national savings to facilitate transition to and investment in modern energy is minimal. Electrification is woefully inadequate and only 12 percent of urban households are electrified (AUU, 2004; Daniel, 2005). As a result, in Ethiopia biomass is the main source of energy, which accounts for about 90 percent of the total energy consumption (Yacob, 2003) as opposed to only 25-65 percent in middle income countries and less than 5 percent in high income industrialized countries (Leach and Mearns, 1988).

In the lack of sustainable livelihood coupled with increasing demands for energy from the urban centers, the rural populations are forced to depend on forest resources to which they have free access. The only cost being incurred is time spent on collection (ARDCO, 1999). Consequently, they sell firewood and charcoal to generate income.

[2] The poor depends on forest resource in different ways. For example collection of honey, wild plants, medicine, fodder, building materials, etc.

The activity is often practiced in conjunction with agricultural works. For instance, owing to the shortage of cultivable-land and failure of crop production, nearly all peasants who resided in the vicinity of Addis Ababa are engaged in supplying fuelwood to the city. For them, the sale of firewood is an important source of income (Bekure, 1996: 232). Moreover, in the Rift Valley areas, because of recurrent drought and variability of rainfall, processing charcoal has become a common practice (Assamenech, 1999: 23). This belief goes in line with Daniel (2005) who suggests that charcoal production was undertaken by poor peasant only indicating strong linkage between poverty and heavy dependency on environmental resources.

Similarly, in the Ziway Dugda Wereda, gathering fuel wood and processing charcoal is the main non-agricultural employment. Producing charcoal for sale to the main urban centers and small towns has become common activity.

Charcoal production is, however, a very serious issue and is one of the major causes of deforestation. The damage to trees is causing soil erosion, which in turn causes food insecurity, because fertile soil is lost. Depletion of forest reserves also brings energy crisis and high fuel prices. Shortage of energy forces the people to change the type of food prepared and reduction of the frequency of cooking (Terefe, 1989). Forest depletion also changes the energy use patterns from firewood or charcoal to animal dugs and crop residues, which further leads to the deterioration of soil fertility and land productivity (Hirut, 2000). Woldeamlak (2005) has reported 100 percent energy consumption in the form of cattle dung in north western highlands of Ethiopia due to shortage of firewood.

Undoubtedly, for sustainable socio-economic development, controlling deforestation is, therefore, very important. For this purpose, having a clear picture on the areas of linkages between households' socio-economic parameters and the environmental resources is very essential. To this end, however, so far very little research has been undertaken in capturing the relationships between these variables at household level. The available studies undertaken recently give more emphasis to macro level issues. Therefore, lack of enough research report on the subject matter suggests that it has been one of the least researched areas in the field of development studies.

Having this in mind, the major thrust of this thesis is to identify and quantify the demographic and socio-economic determinants of the involvement of households in charcoal production in rural areas of Ziway Dugda Wereda of Arsi Zone.

1.3. Rationale of the Study

The researcher initiated to select the study topic and area based on the following rationale:

1. As the linkages between population and environmental degradation are complex and area specific, they require locally specific studies to fully understand them. However, more studies undertaken recently concentrate on macro-level models that relate population to resource availability and environmental carrying capacity. However, the limitations of macro-level analysis are obvious. This means, macro-level analysis fail to take into account the contribution of households' demographic and socio-economic parameters in environmental resources degradation. Hence, the wide recognition of the importance of population-environmental linkage at micro-level is paramount important to deal with such a study.
2. The study area is famous in charcoal production. Some people call the area as "Charcoal Industry". Because of unsustainable charcoal production, risks of vegetation loss have been increased in the area. As a result, the area becomes one of the rapidly degrading areas overlaid with widespread poverty and food insecurity.
3. The study area is located in the Rift Valley drainage system, containing Lake Ziway, which is economically important for the Arsi Zone and Oromia Regional State. Moreover, the area is ecologically very sensitive or fragile. Therefore, unsustainable use of forest resources for fuelwood, charcoal and expansion of land for cultivation together increase the rate of deforestation, loss of biodiversity of the area, soil erosion and sedimentation of the lakes.

1.4. Objectives of the Study

The general objective of the study is to investigate the demographic and socio-economic determinants of households' involvement in charcoal production in rural areas of Ziway Dugda Wereda of Arsi Zone. The specific objectives are:

1. To analyze the link between households size and involvement in charcoal production;
2. To explore the connection between households' livestock holding size and engagement in charcoal production;
3. To investigate the relationship between households' landholding size and involvement in charcoal production;
4. To examine the association between age of household heads and engagement in charcoal production activity;
5. To identify the correlation between sex of household heads and participation in charcoal production; and
6. To explore the association between educational level of household heads and involvement in charcoal production.

1.5. Research Hypothesis

The study is aimed at testing the following relationships:

1. Households with small family size are less likely to engage in charcoal production activity, holding other things remain constant.
2. Households with large livestock holding size are less likely to engage in charcoal production activity;
3. Landholding size of the households and involvement in charcoal production are negatively correlated;
4. Households with younger heads are more likely to engage in charcoal production activity;
5. Male headed households are more likely to engage in charcoal production activity than female headed households; and
6. Households involvements in charcoal production and education level of the household heads have negative relationship.

1.6. Significance of the Study

At present, one of the challenges facing Ethiopia is the alarming rate of deforestation being experienced in many parts of the country. However, the root causes of the problem are not clearly understood. Studies undertaken recently give more emphasis to macro level issues. Most studies fail in capture the relationship between socio-economic and environment at households level. Therefore,

in the first place, this study is considered to be an important step towards bridging this information gap. The relationship between socio-economic characteristics of the households and the environment are expected to be better understood. Second, since most of the data on which the study is based are generated from micro-level, the findings of the study will be used for intervention as well as formulation of policies in the area of households' poverty, energy and environment.

1.7. Limitations of the Study

This study intends to investigate the demographic and socio-economic determinates of households' involvement in charcoal production in rural areas of Ziway Dugda Wereda of Arsi Zone with special emphasis on four Kebele Administrations based on 403 sampled households due to budget and time constraints. The sample size taken is small to represent the rural areas of the study wereda and Arsi Zone. At the same time, the variables included in the study are not exhaustive due to limitation of related review literatures. Therefore, there is a need for future work using the wereda and zonal representative data set to better explore the patterns observed in the current study.

1.8. Organization of the Thesis

The thesis is composed of seven chapters. The first chapter deals with introduction which includes the general background of the study, statement of the problem, rationale of the study, objectives of the study, research hypothesis, , significance of the study and limitations of the study. Chapter two focuses on methods of data collection and analysis. Chapter three, deals with review of related literatures. Chapter four presents the general background of the Ziway Dugda Wereda while Chapter five deals with description of the study population. Chapter six concerned with statistical analysis of relationship between socio-economic characteristics of the households and involvement in charcoal production. The last chapter provides summary, conclusions and recommendations

CHAPTER TWO

METHODS OF DATA COLLECTION AND ANALYSIS

2.1. Data Sources

The basic source of data upon which the analysis is based is both primary and secondary. The primary data were derived from the following sources.

Household survey- household survey was used to collect detail primary quantitative data on demographic and socio-economic characteristics of the households. Qualitative data are used to explore the relationship between demographic and socio-economic variables and households' involvement in charcoal production. Mainly closed-ended standardized questions were used to collect such data type from the field. The questions were posed to household heads. However, the information obtained refers to the whole member of the household. The questions were prepared in English language and translated into Oromiffa since more than 95 percent of the population of the study area is Oromo and speak Oromiffa (CSA, 1996). To check whether questionnaires are standardized or not and make some adjustment where there are some unclear questions and concepts, before the actual field survey, the pilot survey was conducted. To ensure consistency, the translated questionnaires are again translated back into original English version during data entry and processing.

Key informants-in-depth interviews were made with knowledgeable persons who have immediate attachment with charcoal production control such as community leaders, Development Agents, and Kebele Administrators, Police, Natural Resource and Agricultural Development Office experts.

Focus Group Discussion (FGD)–used to assess local perception on charcoal production, factors forced the households to involve in charcoal production and impact of charcoal production on local environmental changes. The participants involved were representatives from different age groups, from different socio-economic strata and both males and females to keep sex balance, because these groups have different interests and perceptions. The discussions were made with both sexes separately and together. The group members were identified by the help of Kebele Administration Development Agents. The group formed consisted of 12 members (eight males and five females). Both the FGD and key informants were used to collect qualitative information

that used to substantiate the results of quantitative data that were collected from respondents using close-ended questions.

Secondary data were generated from published and unpublished materials including books, journals, Central Statistical Agency, Arsi Zone Atlas and Ziway Dugda Wereda and Arsi Zone Government Offices. Moreover, the Maps and Atlas of Arsi Zone and Oromia Regional State were used.

2.2. Sampling Design for Household Survey

In the first stage, primary sampling unit (Kebele Administrations) and in the second stage ultimate sampling unit (households) was selected. The Kebele Administrations and households are used as a sample frame. The following procedures were followed to select these sampling units.

I. Selection of the Kebeles:-here systematic purposive sampling was employed to select four Kebeles based on the consultation made with Ziway Dugda Wereda Administration and Agriculture and Rural Development Offices experts.

II. Lists of the names of all households of each Kebele were taken from the respective Kebele Administration Offices and their names were arranged in alphabetical order.

III. To know the sample size to be taken from each Kebele, the total sample size was distributed by using proportion.

IV. Households interviewed during actual field survey were selected through systematic random sampling techniques. Every n^{th} household head number was chosen but where the chosen households were found reluctant or not available, the immediate neighbor was selected. Accordingly, 403 households were interviewed from the selected four Kebeles.

The Questionnaires incorporated were closed questions to help ensure standardization in data collection. Eight data collectors (two for each Kebele) and two supervisors administered the survey questionnaires. Before the commencement of the actual field survey, one day training was given to data collectors and supervisors.

2.3. Sample Size Determination

A sample size of 403 households was selected for household survey. The contingency was five percent, because some households were either not willing to be interviewed or not available during survey. The underlying assumption used to determine the sample size is:

1. The maximum tolerable error value = 0.05.
2. The desired level of confidence is 0.95, which corresponds to a z value of 1.96.
3. Since there is no estimate of the population having relationship with charcoal production, 0.50 was used.
4. Contingency was 5 percent.

$n = \frac{P.C.\ (1-P.C)Z^2 + 5\ \%}{T^2}$, (Wilkinson& Bhandarkar, 1990) where:

n= the sample size;

P.C= an estimate of the population proportion assumed to have relationship with charcoal production in the study area;

Z=the standard normal value corresponding to the desired level of confidence;

T=the maximum acceptable error margin value, 0.05 in this case;

$n = \frac{0.50(1-0.50)1.96^2 + 5\%}{0.05^2} = 403$

2.4. Methods of Data Analysis

The data gathered through structured questionnaires were analyzed using Statistical Package for Social Sciences (SPSS) Soft Ware. Information generated from key informants and FGDs was described and presented qualitatively to substantiate the results of quantitative data. The chi-square test was employed to identify possible associations between dependent variable and a set of independent variables. Binary Logistic Regression Model was used to examine and establish relationships between dependent and a set of independent variables, to determine the amount of variation explained by the independent variables, and to rank the relative importance of each independent variable.

Descriptive statistics such as percentage, frequency, cross tabulation, etc, are used to analyze as well as compare the various demographic and socio-economic characteristics of the households. Further, Maps were utilized to portray the spatial distribution of the physical features such as location of the study Wereda and the relief features.

CHAPTER THREE

REVIEW OF RELATED LITERATURES ON POPULATION- ENVIRONMENT NEXUS AND DETERMINANTS OF INVOLVEMNET IN CHARCOAL PRODUCTION

In the previous chapters, the rationales, objectives and hypothesis, the contribution of the findings of the study for socio-economic development and methodology used in the process of research were discussed extensively. In this chapter, review of the literatures related to population-environmental nexus and demographic and socio-economic determinants of households' involvement in charcoal production both in Ethiopia and other developing countries are widely discussed.

3.1. Population-Environment Linkage

The link between population and the environment is one of the most critically debated issues. There is general consensus among scientists and often among the local people that environmental degradation is taking place in the third world. However, there is a far less agreement on its causes and on its duration and direction (Whitney, 1984; Muluneh, 2003). In general, two dominant theoretical perspectives have emerged in the literature linking population and environment: Malthusian and Boserupian. They consider linear relationship. Apart from these, there are other perspectives on rise that consider non-linear population-environment relationship (Bereket, 1996; Marcos, 1997; Chalachew, 2004).

3.1.1. Linear Relationship Views

They consider linear relationship between population and environment. According to them, population is the sole major determinants in population-environmental linkage. However, they have different views.

Malthusian Views have negative expectation and consider that rapid population growth is incompatible with sustainable management of the environment. They believe in that population size and growth unless controlled deplete the earth's natural resource. To meet the ever increasing demands for fuel wood, pasture and arable land, trees are cut down. Cultivation

expands to the steeper slopes and marginal lands with high erosion risks (Hardin, 1972; Ehrilich et at, 1977; Whitney, 1987; Blaikie, 1992; Goldfarb, 1993; Ness, 1993).

With more people more of the land resources will be devoted to food production and fewer will be permitted to remain in their natural state (Preston, 1994:86) As already witnessed in Sub-Sahara African countries, the increasing number of population has direct impact on deforestation as more and more trees are cut for construction purpose, cultivation, as well as fire wood (Meyers, 1996). In Ethiopian, the sharp decline of the area covered with forest to almost 2 percent of the total land area of the country currently against estimated 40 percent during the 20th century (Seife-Selassie, 2003) is a particular witness. Hence, the Malthusian suggests the need for argent population control to over come the environmental problem.

However, population size and growth alone may not cause environmental degradation. Population size cause environmental degradation when combined with socio-economic and institutional factors (poverty and inappropriate land tenure system).

On the other hand, Boserupian, the followers of eastern Boserup, Danish Agricultural Economist believe in the compatibility of population growth with environmental recovery. Simon (1981) argues that the larger the population, the more vigorous the development of science and technology and the better the man kind's ability to provide technological solutions to environmental problem.

Nevertheless, some studies indicate that Boserupian hypothesis may not work under certain conditions. Both Malthusian and Boserupian criticized of their linear relationship linkages between population and environment, which becomes the fertile ground for the emergence of other views

3.1.2. Rising Views

Critics of the above approach, however, feel that population growth and size alone may not explain the current environmental problem widespread in developing countries; relating the environmental problem with population size alone is a simple generalization. The catastrophic impact occurs due to specific circumstance of underdevelopment (Dessalegn, 1996). Chalachew, (2004) also argues that the relationship between population and the environment is not simple and straight foreword. They are linked in a complex ways and are difficult to establish an exact

form of relationship between them. There is, however, no dought that population growth, size, structure and spatial distribution are significant factors affecting the environment. In turn, the environment affects population through affecting population variables such as fertility, mortality, migration and morbidity. Therefore, what one can surely tell is a two way interaction between socio-demographic factors and the environment.

Currently, not all areas in Sub-Saharan Africa countries are experiencing environmental degradation having higher population density. Rather, large population size and growth is being absorbed within rural system. For instance, Ivan Living Stone cited in Gould (1992) has written on the process of absorption of population growth in Eastern and Central Africa, particularly in Kenya and argues that this has occurred with least apparent difficulty and fewest adverse environmental effects in the area of existing high population density.

In a historical study of population growth, agricultural productivity, and land degradation in Machakos District in Kenya, Mortimore and Tiffen (1992) and English (1992) saw positive relationship between population growth and environmental management and improved food production. Moreover, the study evidences available from the Kissidoughou, in Guinea and the Kisi District in Kenya reveal positive correlation between population and environment

In Ethiopian case, Muluneh's study (2003) conducted in west Guragheland of Ethiopia also supports the positive relationship between population and environment. The result of the household survey he made in six Kebeles indicates that 99 percent of the respondents took part in planting trees either on communal land or private holding or both.

These positive relationships, however, need certain preconditions like good peace and security for trade and investment and right tenure system in which economic benefits are shared by many, rather than monopolized by few (Mortimore and Tiffen, 1995). Demographic factors have adverse impact on environment when combined with poverty.

In regard to this, Singh and Gilman (2000) wrote the following:

> *The link between poverty and the environment is uncritically characterized as a "vicious circle" or a downward spiral". Population growth and inadequate resources are supposed to lead to the migration of the poor to ever more fragile lands or more hazardous living sites, forcing poor people to overuse environmental resources. In turn, the degradation of these resources further impoverishes them. These interactions offer us a plan to reverse the down ward spiral.*

However, while poverty and environmental degradation may be positively correlated, correlation does not imply causation. Land tenure system, cultural and institutional factors and market failures are key variables conditioning the poverty-environmental degradation nexus. In some places, in Africa, ownership rights are acquired simply by clearing land. In other places, farmers who let their land lies fallow risk losing their ownership rights. In still other places, incentives for high fertility are provided by systems in which the allocation of land is a function of family size. In all these instances, land tenure systems are not functioning effectively to preserve land resources for future generation (World Bank, 1990).

The most vivid example is Mortimore's (1993) careful analysis of environmental change in north Nigeria. Mortimore has taken extensive samples of soil quality in a densely settled agrarian zone of rapid population growth in 1977 and 1990. He finds no evidence of soil deterioration during the period. Furthermore, the soil quality is equivalent to that in an uncultivated area with comparable ecological features.

He concludes that "population growth and high population density are well-matched with sustainable resource management by smaller holder" (Mortimore, 1993:62). Where soil preservation is less successful, he suggests incentives must be found for small holders to invest in it, above all by providing secure ownership right.

The World Bank's (1990) review of population/environment / and agricultural linkage in Sub-Sahara Africa also lists a huge array of obstacles to expanded food production and better environmental management. These include credit systems, biased agricultural prices and exchange rates, adverse tax policies, weak agricultural extension services, excessive government control, and civil wars. According to the bank, these problems have the effect of compelling growing population to exploit ever more extensively the resources available.

Because of its multiple origins, it would be foolhardy to think that the problems of food production and resource management can be solved by population policy alone. Problems of poverty and resource degradation have multiple sources and require to multiple forms of interventions (Preston, 1994:90).

3.2. Determinants of Involvement in Charcoal Production

3.2.1. Global Perspective

Poverty and environmental problems are closely linked in a nexus of mutually reinforcing causality chains. People living in poverty are forced to overuse environmental resources for their daily survival and further impoverished by the resulting degradation (Daniel, 2005). Much of the environment is being destroyed in response to short-term economic interest. Poor people often destroy their own environment –not because they are ignorant but to survive (Ramphal, 1987:10; Terefe, 2001).

Asset poor households are more reliant on forest compared with the better-off households (Fisher, 2002). For the poor people, firewood collection and charcoal selling are important and simple means of earning cash income; in the production area, this income is more important than incomes from other alternative sources such as agriculture. In Malawi, Fisher's (2002) study indicates that households that are poor in land per capita, education, and goat holdings are more reliant on Low Return Forest Activities (LRFA[3]). This is consistent with studies of income diversification in Africa which show that asset poverty compels diversification into low-return activities (Barrett *et al.*, 2001; Dercon, 1998). Stoffle (1993) argued that in Dominica Republic the people of Buen Hombre produce charcoal for cash income. Over half of the farmers interviewed, 54 percent are engaged in charcoal production, while 37 percent of fishermen interviewed engage in charcoal production to earn cash income. Likewise, during the 1997 and 2002, the charcoal production increased tenfold in Somaliland Capital, Hergeisa, from around 100 to over 1000 metric tones far beyond sustainable level, because rural communities have used charcoal production as an option of income sources in the absence of sustainable livelihoods. Moreover, urban population growth and charcoal export to Gulf State increased the demand for charcoal (Afro News, 2006). Whitney (1987) also studied that in the Sudan an overall increase in

[3] Low Return Forest Activities include firewood collection, small scale charcoal production, etc.

population and urban growth followed by an increase in per capita consumption of energy are the major contributing factor for an increase in charcoal production.

Moreover, charcoal trade is a part of life in most of Africa and other developing countries; it is linked to culture. This means, the proportion of biofuel energy consumed by households is related with cooking habit. Lack of effective controls in place to protect the environment from deforestation and rapid population growth has been exacerbating the problem of charcoal trade in Africa. In regard to this, Misana (1996) wrote charcoal production as a commercial activity in most countries is largely unregulated and outside the control of governments.

3.2.2. National Perspective

Arsi Zone Environmental Protection Department (EPD, 1995) in its study on "Impact of Human Activities on Environment" investigated that poor income households are involved in charcoal production for cash to purchase grains. They rationally choose to depreciate tree resources when survival is at hazard, especially during summer[4] .In Dugda Bora area, about 30 percent of the farmers interviewed responded that they supplement their income from the sale of forest product. The demand for charcoal and fuel wood by the urban population made production of these items very profitable. Some peasants whose settlements are accessible and close to the major roads almost bonded their farms and totally engage in charcoal production (Assamenech, 1999; Bekure, 1996).

Asset possession[5] determines the decision that the household has on the environmental management. Households who have been in a position to accumulate asset over several years are better in coping during special moment of hardship. As a result, they can attain food security on a sustainable basis. On the other hand, the members in the community that have no better access to asset are unable to attain food security on sustainable basis (Degefa, 2005). Such households have no other option, because they are poor in asset holding such as land, livestock and the like. As a result, they rely on direct extraction of land resources particularly the natural vegetation for fuel wood and charcoal indicates negative relationship between asset possession and charcoal production.

[4] Summer is the time when most of the peasants have shortage of seeds, food and medicine.
[5] Farm land holding size and livestock holding size.

On the other hand, what Daniel (2005) studied in Dugda Bora of East Shewa Zone of Oromia Regional State is different from this. He reported that, opposed to the past currently, farmers involved in charcoal production not only for cash for purchasing of grains, but also for participation in traditional socio-economic institutions like'ekub' and 'idire'. When the settlers occupied the area, charcoal production was under taken only during special moments of hardship.

Some studies also indicate that individuals at different levels (officials and investors), not only the poor, have taken part in the charcoal business. Such problem may be emanated from lack of strong policy related to forest use and effective control of environment from deforestation. In regard to this AAU School of Graduate in Journalism and Communication (2004) reported:

> *Charcoal production in Ethiopia is 'illegal', yet facilitated and aggravated by officials and investors who show only pretentious concerns on the people. Not only the poor, but also officials at different levels and investors well aware of the impacts are directly or indirectly the protagonist in the charcoal business. This attitudes changing even Afars' grand traditional trees. We respect the red traffic, but have tended to run blind to the reddish flames of the dark charcoal".*

Age of the household heads also have profound effect on charcoal production. According to the study, there is positive relationship between age and involvement in charcoal production. Younger farmers used to dominate the activity. Young farmers are those who have no access to the land. Subsequently, all segment of the rural population including females are actively involved in activity .Wives usually 'steel' small amount of charcoal from what has been produced by their husbands and sell it in town (Daniel, 2005)

Being other things kept constant, large size household are food insecure in most case. To secure food for their households, they rush into other income generating activities (Chalachew, 2004). Such income generating activities can be fuelwood collection and charcoal production. Therefore, household size has positive relationship with involvement in charcoal production.

The issue of the land is crucial to the whole operation of improved management of environment. The question of ownership and titles to the land is of paramount important to the farmers' decision on environmental management .Terefe's (2001) study on the relationships between land tenure and environmental degradation also showed that peasants are forced to undermine long-term use of land resources and concentrate on short-term benefits. This particular study

conducted in two districts of Kersa and Kondaltiti, Central Oromia indicates that the vast majority of his respondents (nearly 82 percent) do not feel secure about the existing land holdings due to lack of defined land property ownership.

AAU (2004) report also indicates that absence of forest policy and ownership has hampered forest management, conservation and utilization, because there are no defined ownership and use rights. People do not consider communal property as their properties. This exemplifies and expands Hardin's "*Tragedy of the commons*"

Moreover, lack of cross-sector coordination in implementing policy, lack of complimentary between environment policy and energy policy and poor or incomplete demarcation of forest are some of the major causes for unsustainable exploitation of forest resources.

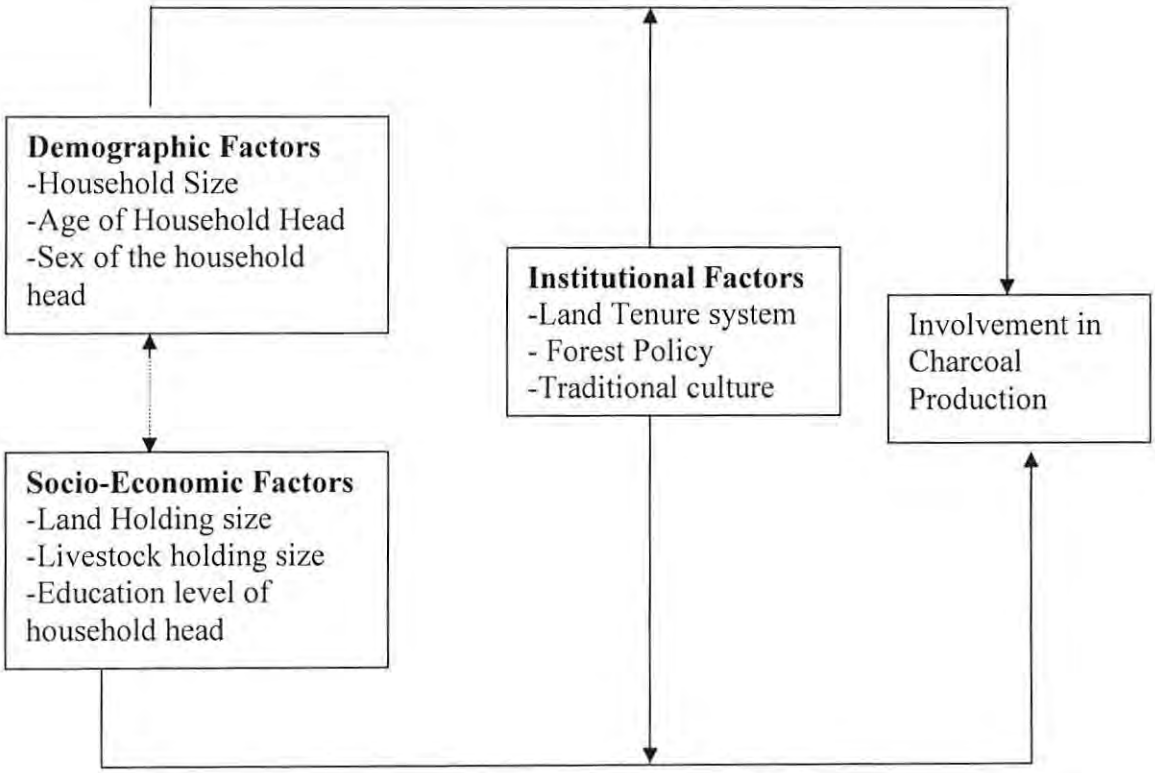
3.3. Analytical Framework

Analytical framework developed to explain demographic and socio-economic determinants of household's involvement in charcoal production as depicted in figure 1. In the framework, households' involvement in charcoal production is a function of the components of household socio-economic characteristics and external conditioning factors (policies, land tenure system, traditional values and environmental factors).

Demographic factors include the demographic characteristics of the households, which take into account household size, sex and age of the household heads. On the other hand, socio-economic characteristics of the household in the model is used to indicate variation of rural households in terms of income, farmland holding sizes, and livestock holding size, education level, etc, which in turn indicates variation of the households' capability in accessing means of subsistence on sustainable basis. Farm households that have no farmland, livestock resources and alternative opportunities are obviously unable to attain their food on sustainable basis. Hence, they are forced to search for alternative sources of income. One of such sources of income can be from local wood resources, charcoal production.

Institutional and environmental factors are external factors. Institutional factors are the rules and regulations under which the communities are using the local resources. Institutional factors condition the adverse effect of demographic and socio-economic forces on local wood resources.

Fig 1: Analytical Framework on Demographic and Socio-Economic Determinants of Households Involvement in Charcoal Production



Source: Developed by Author on the basis of Literature Review.

Note: ◄·····► Path not investigated

3.4. Definition of key terms

Charcoal – Traditional energy source, which is produced by the rural households from natural vegetation, especially from Acacia trees to earn income.

Involvement in Charcoal production- is making traditional bio-fuel energy (charcoal) from natural vegetation (Acacia tree) by any members of household, to supplement income. **Household size-** A group of persons who live together and make common provisions for food and other essentials of living.

Demographic factors- certain type of demographic characteristics possessed by rural households, which include household size, age and sex of the household heads.

Socio-economic factors- are self-explanatory, which indicates rural households' category in asset position and consequently variation in their coping mechanism during special moment of hardship. Special moment of hard ship refers to during shortage of food and shortage of income to cover households' domestic basic requirement. These socio-economic factors include: Land holding size, livestock holding size and educational status of household heads.

Landholding size-total land size possessed by household comprises land under cultivation, fallow land, grazing land and under settlement.

Livestock holding- Total livestock possessed by household comprises cattle, goats, sheep, horse, and donkey.

Educational Level-the highest grade level that the household heads completed

Institutional factors- external factors, which may condition or hinder a given activity. They are the rules and regulations under which the rural households use their environmental factors. These rules and regulations include: Land tenure system, traditional culture and forest policy.

Land Tenure System- The rules and regulations under which rural households use land. The land tenure systems can be private, common, public and open access.

Traditional culture- Rules and regulations the traditional communities use to avoid an over use or misuse of the common resources.

CHAPTER FOUR

BACKGROUND OF THE STUDY WEREDA

In Chapter three, we tried to review related literatures to population-environmental nexus, demographic and socio-economic determinants of households' involvement in charcoal production and conceptual framework scheme. In this chapter, we are going to take up the physical and socio-economic profiles of the study Wereda. These factors help to understand the general physical, demographic and socio-economic characteristics of the wereda in general and study area in particular.

4.1 Physical Conditions

4.1.1. Location and Area

Administratively, Ziway Dugda Wereda is located in Western part of Arsi Zone, Oromiya Regional State. It is one of the 26 Weredas found in the Zone. The area shares boundary lines with East Shewa Zone in the Western and Northern part, Hetosa Wereda in the North -East part, Tiyo Wereda in the Eastern part, Munesa Wereda in the Southern part and Dodota Wereda in the Northern. Ziway Dugda Wereda also shares Lake Ziway with East Shewa Zone.

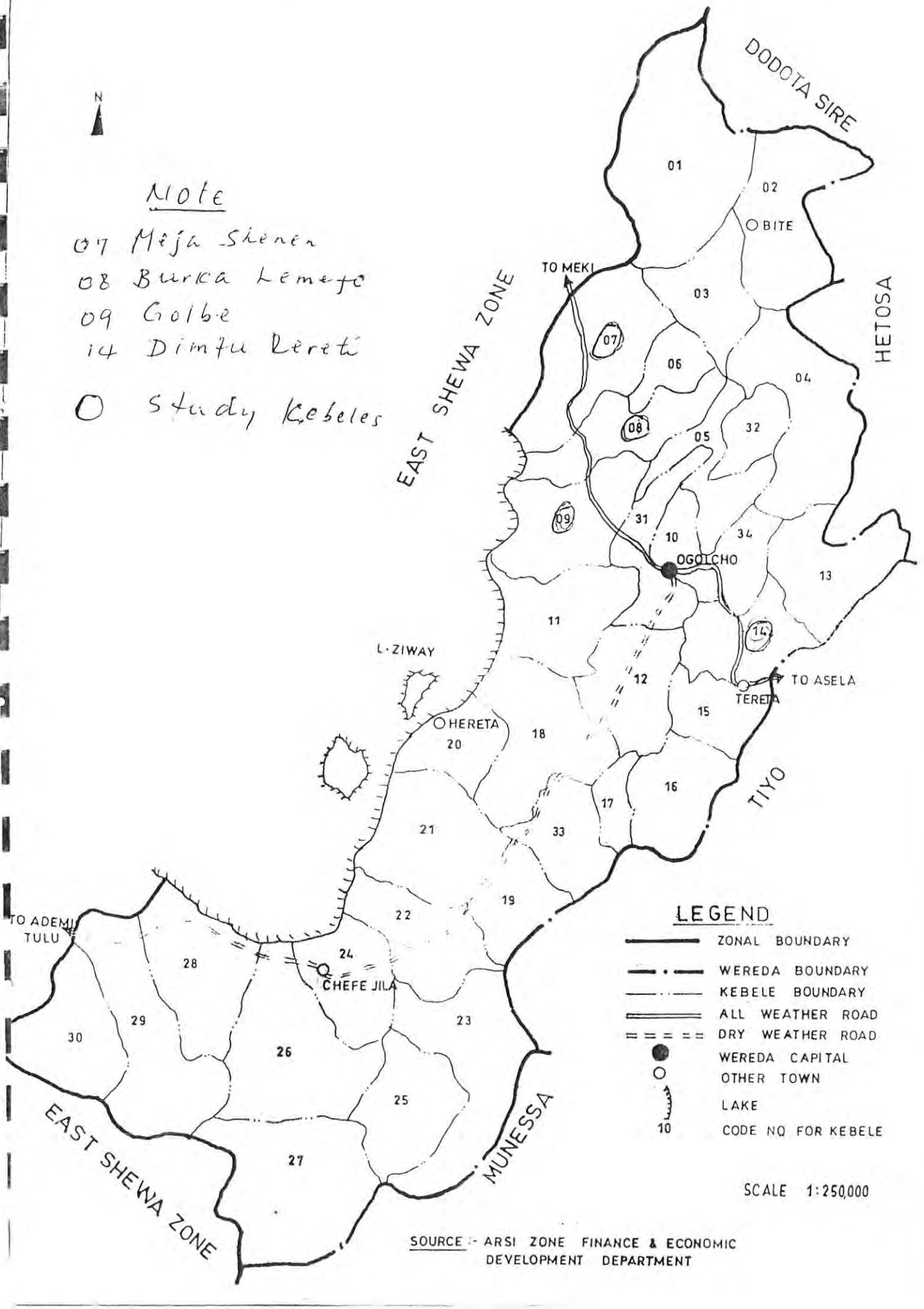
The capita of the wereda, Ogolcho town placed on all weather roads from Asela-Meki. It is located at 168 km South West of Addis Ababa and about 40 km West of Asela town, capital of Arsi Zone (see map).

Regarding the area, the wereda has 1247 km^2 accounting for about 5.2 percent of the total area of Arsi Zone. It is sub divided into 35 Kebele Administrative units of which 34 are rural Kebeles and one is urban Kebele (Ziway Dugda Wereda FEDO, 2005).

4.1.2. Relief

The wereda is located in the Rift Valley Region. The land escape of the wereda is characterized by mountains, hills, and undulating plain topography and degraded land. The general altitude of the wereda ranges from 1500-2500 meters above sea level and its elevation decreases from Eastern periphery of Tiyo and Hetosa Weredas towards the West to Lake Ziway area (Tesema, 1997).

THE ADMINISTRATIVE DIVISION OF Z/DUGDA DISTRICT



SOURCE :- ARSI ZONE FINANCE & ECONOMIC DEVELOPMENT DEPARTMENT

4.1.3. Drainage

All parts of the wereda are found in the Lake Ziway drainage system. Kater River, which covers the length of about 30 km within the wereda is the only river found in the wereda. The local communities are using the river for traditional irrigation, for cattle and domestic consumption. Lake Ziway is also another water body that is found in the wereda.

Lake Ziway covers about 434 km with an average of 15 meters depth and found at 1846 meters above sea level. It is the home of different types of wildlife like hippopotamus, fish and birds. Hence, Lake Ziway has a high potential for fishery and recreation development. The Islands and peaks located in the lake are Mountain Gudo, Fudiro and Tedecha that highly tourist attractive places. Other places like Habura and Sengo Natural Caves are also interesting tourist attraction sites. However, due to worsening environment in its drainage basins, Lake Ziway is retreating fast and the people are using such receding areas for irrigation and grazing purposes (Ziway Dugda FEDO, 2005).

4.1.4. Climate

Climate is a major resource, which can affect all human activities. As a result, climatic information is an important input for short, medium and long term socio- economic development planning. However, due to adverse human interventions, climatic conditions have been changing.

Lying between 1500-2500 meters above sea level, almost all parts of the wereda are located within Wiena Dega[6] (Sub-Tropical) agro-climatic zone. It receives mean annual rainfall ranging from 800-900 mm, which is erratic in pattern. There is a high coefficient of variation with regard to amount, on set and cessation of rainfall. The mean annual temperature ranges from 15^0c-20^0c (FEDO, 2003) of Ziway Dugda Wereda. The area has the shortest growing periods that range from 120-180 days. The time of planting (sowing) starts in the middle of April and continues up to August. The main rainfall occurs in summer season that extends from June to September. The area also receives small rain from March to May.

[6] The traditional agro-ecological Zone for areas lying between 1500m and 2300 m above sea level. In Afaan Oromo, the local community call it "Badda Daree"

4.1.5. Vegetation

According to some literatures and oral tells four decades ago most parts of Arsi Zone including Ziway Dugda Wereda had been covered with dense indigenous forest. At the present, however, those forests have been removed due to an increase of new demands for crop land, woods for construction, firewood as a result of population growth. The wereda has undergone extensive deforestation and other forms of adverse human interventions. Currently, only about 9.5 percent of the total area of the wereda is covered by forest (Ziway Dugda Wereda FEDO, 2003). According to the local community, the deforestation process was begun in the form of selective clearing during the reign of Emperor Haile Sillasie. The once densely populated acacia trees have been dropped to a present density of about 10-15 trees per hectare (Arsi Zone Natural Resource Department, 1995) of Arsi Zone.

The natural tree species found in the study area include Boswellia papyrifera, Acacia sega, Acaciz Senegal, Acacianilotica, Zyzyphus spp, Diospyros mesqiliforms, Exytenanthera abyssinica, Balantines aegyptica (EPA, 1998). These acacia trees that constituted the original vegetation cover have considerably been deforested mainly for the purpose of fire wood and to producing charcoal.

As one mechanism of conserving patches of the remaining natural vegetation, the Kebele Administrations in the study wereda is attempting to stop deforestation. However, as far as the selling of firewood and charcoal remain important off-farm activities and coping mechanism for food deficit for the people of the wereda, the efforts made by Kebeles are not effective. Currently, some of the protected vegetation that has probably undergone little disturbance in the wereda is located in area known as Aluto.

4. 2. Socio-Economic Profile

4.2.1 Population

Human population and development is inseparable. Any development activities are carried out by people and are meant for the improvement of welfare of people. Therefore, having reliable information of the characteristic (size, growth, composition, density, etc) of the population is of paramount important for effective development planning.

Population Size and Density –Based on the 1994 Population and Housing Census Report on Oromia Regional State, the estimated total population of Ziway Dugda Wereda is 116602 in 2006, making up about 4 percent of the population of Arsi Zone. The number of male and female population was 57974 and 58628 respectively; giving a sex ratio of 99 males to 100 females. The absolute increase of the wereda's population between 1994 and 2006 was 29911 with an average annual increase of 2493 people and a rate of 2.88 percent per year, indicating a rapid rate of population growth in the wereda. The majority of the people, which account about 96.8 percent, are inhabitants of rural area.

The total population of the wereda is distributed over an area of 1247 km^2. This gives an average Crude Density Rate[7] (CDR) of 83 people per km^2, which is below the Zonal average 110 person per km^2. Comparing the wereda with other weredas, it is one of the areas with low population concentration followed by Seru (39), Amigna (49) and Gololcha (80) among the rural areas of the Zone. Agricultural Density Rate[8] (AD), which relates size of rural population to cultivated area, refined indicator used to measure the degree of population pressure on land resource. The agricultural density for the Ziway Dugda Wereda is 112 persons per hectare of cultivated land, which appears to be the small.

Household Size- another indicator of population resource relationship at household level is average household size. Unlike population density, Ziway Dugda Wereda records the highest level in person per household. According to the 1994 population and housing census Report on Oromia Regional State, the average household size for the wereda is 5.2. The average household size is 5.2 people per household for rural area while it is 4.6 people per household for urban areas.

[7] Is calculated by dividing total population of an area (both rural and urban) by its total land area (includes cultivable and uncultivable).

[8] As its name indicates is calculated by dividing rural inhabitant by cultivated land. Hence, it is a more refined indicator than crude density.

Table. 4.1: Population Size, Sex Distribution and Place of Residence by Year

Place of Residence	1994 *		2006**		Changes per year [9]	
	Number	Percent	Number	Percent	Number	Percent
Rural	**84267**	**100.00**	**118713**	**100.00**	**2870**	**3.41**
Male	41899	49.72	58654	49.41	1396	3.33
Female	42368	50.28	60059	50.59	1474	3.48
Urban	**2424**	**100.00**	**4545**	**100.0**	**177**	**7.30**
Male	1204	49.67	2326	51.18	94	7.81
Female	1220	50.33	2219	48.8	83	6.80
Total	**86691**	**100.00**	**123258**	**100.0**	**3047**	**3.51**
Male	43103	49.72	60980	49.47	1490	3.46
Female	43588	50.28	62278	50.53	1557	3.57

Source: * CSA, 1996

** CSA, 2007

Age-Sex Structure-Age-sex structure are crucial demographic data in examining population characteristics. These demographic variables have direct implications for several issues related to socio-economic aspects of populations such as trends in population growth, food supply, size of school age population for school construction, labor force, and female population in their reproductive age. It also indicates the potential of future population growth of an area. Therefore, in the process of any socio-economic development planning, one should have to take into account the age-sex structure of the population.

Dependency ratio- The over all dependency ratios for the Ziway Dugda Wereda are found to be 105.73, which would mean for every 100 economically active persons, there are 106 economically inactive persons. Of course, young dependents constituted the largest ratio (over 95 percent). The data in table 4.3 indicates a disparity between places of residence, which is 105.97 for rural and 97.72 for urban areas. Surprisingly, the old age dependency ratio for urban area was relatively high, which may be due to longer life expectancy.

[9] Calculated by Author

Table 4. 2: Age Dependency Ratio of Ziway Dugda Wereda by Place of Residence

Place of Residence	Young Age Dependency ratio[10] (per 100 active person)	Old Age Dependency ratio[11] (per 100 active person)	Over all Age Dependency ratio[12] (per 100 active person)
Rural	100.6	5.2	105.97
Urban	93.7	4.0	97.72
Total (Wereda)	100.4	5.3	105.73
Arsi Zone	103.37	6.81	110.18

Source: CSA, 1996

Ethnicity, language and religion –The major Ethnic Groups in the wereda are Oromo, Amhara and Sodo-Gurage, which constitute 94.48 percent, 1.43 percent and 0.7 percent, respectively. Other ethnic groups account for 2.97 percent (see table 4.3). Regarding the religious composition, Muslim and Orthodox are accounting for 89.46 and 10.17 percent, respectively and the rest account for 0.26 percent (CSA, 1994). Hence, the wereda is predominantly inhabited by Muslim population (See table 4.5).

Table. 4. 3: Percentage Distribution of Major Ethnic Groups of Ziway Dugda Wereda

Major Ethnic Groups	Number	Percent
Oromo	82220	94.84
Amhara	1236	1.43
Gurage	664	0.7
Others	2571	2.97
Total	**86691**	**100.00**

Source: CSA, 1996

[10] Young age dependency ratio of the population is calculated by dividing population age 0-14 by economically active population (15-65)

[11] Old age dependency ratio of the population is calculated by dividing population age 65+ by economically active population (15-65)

[12] An overall dependency ratio of a given population is calculated by dividing the sum of young age (0-14) and old age (65+) population by economically active population (age 15-64)

Table.4.4: Percentage Distribution of Major Religious Groups of Ziway Dugda Wereda

Religious Group	Number	Percent
Orthodox	8813	10.17
Muslim	77642	89.56
Others	236	0.26
Total	**86691**	**100.00**

Source: CSA, 1996

4.2. 2. Agriculture

Ziway Dugda Wereda is characterized by subsistence mixed farming system. Almost all population of the wereda gets their livelihood by cultivating different type of crops and rearing livestock simultaneously.

Crop production and Food Supply Situation-Even though it is subsistence in character, agriculture is the sole source of livelihood for the population of the wereda as elsewhere in the zone. It is the major source of cash income and dominant sector to generate employment opportunity. In the wereda mixed farming is experienced, i.e., livestock rearing is as a main activity next to crop production. Rain fed crop production is the major agricultural activity. In the wereda unlike other weredas of the zone, crop production is mainly during Meher season, account for more than 95 percent of the total crops produced.

According to the CSA (2003) Agricultural Sample Survey, the farmers of the wereda cultivate about 20 types of crops. Of these, cereals are the dominant crops accounting for about 92.65 percent of the croplands and 94.75 percent of the total crop harvest in 2001/02. Among the cereals, maize, wheat, teff, barley and sorghum are the major ones. These crops cover 45.23, 24.50, 13.40, 6.65 and 2.77 percent of the total cropland. In terms of production out put, these crops comprise 65.96, 18.12, 4.69, 3.86, and 2.08 percent of the total harvest, respectively (CSA, 2003). The other annual crops grown in the wereda are horse bean, field Pease, haricot beans, and lentils from pulses, Neug, and linseed from oilseed crops and Tomatoes and Ethiopian Cabbage from vegetables.

Table 4.6 shows the variation of the various crops productivity during the years 1999/2000 to 2002/03. For example, the yield of cereal crops declined from 9.29 quintals/hectare in the year 1999/2000 to 2.42 in the year 2002/03. Likewise the pulses were declined from 4.84 quintals/hectares in 1999/2000 to 2.42 in 2002/003 (Agriculture and Rural Development Office, 2003) of Ziway Dugda Wereda. The variation could be attributed to rainfall fluctuations or decline which has been characteristic of the wereda. Other factors such as socio-economic factors may also explain the fluctuation in crop production and productivity, which of course calls for a detail investigation.

Table 4. 5: Productivity (yield) of Major Crops for Private Peasant Holdings (Meher Season)

	Yield (in quintals/Hectare)			
Type of Crop	**1999/2002**	**2000/001**	**2001/2**	**2002**
Total	**8.63**	**4.42**	**13.82**	**2.42**
cereals	**9.29**	**4.95**	**15.02**	**2.42**
Wheat	9.50	6.10	13.95	2.83
Teff	5.00	3.83	7.34	2.85
Barley	7.84	3.61	14.00	4.50
Maize	9.97	4.45	17.43	1.65
Sorghum	8.00	4.00	10.00	0.85
Pulses	**4.84**	**1.64**	**5.98**	**2.42**
Horse beans	6.00	0.77	4.00	0.00
Field peas	4.00	1.34	5.00	0.00
Lentils	3.00	0.61	3.00	0.00
Haricot bean	5.00	1.69	6.07	2.48

Source: - Ziway Dugda Wereda Agriculture and Rural Development Office, 2005

As a result, the wereda is not food self-sufficient. Of the total population of the wereda, about 30190 (34.82 percent) have chronic food shortage (Ziway Dudga Wereda DPPC, 2002/3). During the indicated year, about 167 livestock were died of the drought. Currently, the Wereda is assisted by safety-net program.

Land Tenure System and Land Holding Size-Land is the most important asset on which different socio-economic activities are carried out. The ownership and titles to the land is of paramount important to the farmers' decision on environmental management. Per capita land holding size is relatively better in Ziway Dugda Wereda. An average land holding size of the

wereda is 2.0 hectare per household. This is above the zonal average, which is 0.6 per household. However, due to absence of land redistribution in recent years most of the young generations do not have their own land. Most of the land is owned by old generation. From the total household, about 40 percent do not have their own land (Ziway Dugda Wereda Agriculture and Rural Development Office, 2005).

Livestock and Farm Ox Possession-Animal husbandry is another important source of livelihood for the study wereda, like other parts of Ethiopia. Slight variations of livestock were observed in the wereda in their number and distribution by year and type. In the year 2006/07, the total number is 374120 heads, which is equivalent to 133242.35 Tropical Livestock Units (TLUs), giving an average of 19.87 heads (7.07 TLU[13]) per farm household. As the area is mixed farming, the figure appears large and the farmers can generally be regarded as being better in livestock resource.

Similarly, for the farmers who entirely rely on traditional farming method, farm oxen possession would be a critical production factor. The data obtained from Ziway Dugda Wereda Agricultural and Rural Development Office (ARDO, 2003) show that about 29 percent of the households are without farm ox. On the other hand, about 33 percent of the farmers own only one ox. From the figure, it is not difficult to deduce that crop production in the Wereda is partly constrained by lack of farm oxen.

[13] Tropical Livestock Units

Table. 4. 6: Distribution of Livestock Population by Type

Type of Livestock	No	Livestock Density per km^2	TLU	No per HH	TLU per HH
Cattle	137024	109.53	109331	7.28	5.81
Sheep	54523	43.58	4863.45	2.89	0.26
Goats	168250	134.49	11777.5	8.94	0.63
Donkey	11530	9.22	4033.5	0.61	0.21
Horse	1473	1.18	1914.9	0.08	0.10
Mule	1320	1.06	41320	0.07	0.07
Total	**374120**	**299.06**	**133,242.35**	**19.87**	**7.07**

Source: Arsi Zone FEDO, 2007

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

CHAPTER FIVE

DESCRIPTION OF THE STUDY POPULATION

The Rural Kebeles included in the study have 2526 households, account for about 13.8 percent of the total households of Ziway Dugda Wereda. Meja Shene Kebele Administration with 767 households share 30 percent of the total households of sampled Kebeles, followed by Burka Lemefo Kebele Administration (29 percent). From Golbe and Dimtu Rereti Kebeles, 80 households (20 percent) and 83 households (21 percent) were sampled, respectively. These Kebeles were selected based on consultation made with Ziway Dugda Wereda Agriculture and Rural Development experts.

Table 5.1: Total Number and Sampled Households by Study Kebeles

Name of Study Kebele	Total Number of HHs*	Sampled Households**	
		Number	percent
Meja Shene	767	122	30
Burka Lemefo	736	117	29
Golbe	501	80	20
Dimtu Rereti	522	84	21
Total	**2526**	**403**	**100**

Source: * from Ziway Dugda Wereda Agriculture and Rural Development Office.

** Computed by Author based on Sample size.

Demographic and socio-economic characteristics of the respondents to be discussed here are closely associated with households' intention to involve or not in charcoal production. There is convincing evidence that households who belong to a certain socio-economic group and who possess certain demographic characteristics are more likely to rely on environmental resources such as charcoal production and firewood collection. Hence, it is indispensable to discuss the background characteristics of the sampled population in this study before any in depth analysis is to be done.

Some of the most important socio-economic characteristics of the households to be discussed in this chapter are categorized into demographic and socio-economic characteristics. The

demographic characteristics include household size, age and sex of the household head, while socio-economic characteristics are education, landholding size, livestock holding size, households' employment in off-farm activities and access to modern farm inputs. Moreover, the external factors such as land tenure system, traditional values and environmental factors, which play significant role in conditioning or hindering households' involvement in charcoal production, are also widely discussed.

5.1 Demographic Characteristics

5.1.1. Household Size

Household size is one of the important demographic indicators to show person -resource ratio at households' level. In large households, percapita landholdings diminish, because the families share the available land. Moreover, large family size may reduce households saving capacity as consumption in terms of feeding, clothing, and health care increases.

During the field survey, household heads were asked to report lists of their families' members. Accordingly, of all the respondents, households with one to three members make up 18.6 percent, households with four to six members constitute 45.7 percent while households with greater than six make up 35.7 percent. This implies that in the study area many households (45.7 percent) have at least four to six household members. As indicated in table 5.2 shows, 74.7, 48.9 and 36.8 percent of the household with one to three, four to six and greater than six members are involved in charcoal production, respectively.

Table. 5.2. Percentage Distribution of Respondents by Household Size and involvement in charcoal production

			Involvement in charcoal production	
Household Size	**Frequency**	**Percent**	**Frequency**	**Percent**
1-3	75	18.6	56	74.7
4-6	184	45.7	90	48.9
>6	144	35.7	53	36.8
Total	**403**	**100.00**	**199**	**49.4**

Source: Filed Survey, 2007

5.1.2. Age Structure

Age-sex structure refers to population distribution according to their age and sex. Having knowledge about age- sex characteristics of a population is very fundamental to understand the potential of population has for growth, dependency burden, demand for education and heath care, etc. Age-sex structure is very important input to plan a sound socio-economic development.

The age sex composition of the sampled population is presented in table 5.3. According to the table, respondents with age 15-29 constitute 30.1 percent while those with age 30-39 account for 32.8 percent. On the other hand, about 37.2 percent of respondents are greater than age 39. Households headed by 15-29 and greater than 39 age household heads are more dependent on forest resources. Regarding involvement in charcoal production, about 52.9 and 55.3 percent of the households of the study population involve in the activity, respectively.

Table 5.3: Percentage Distribution of the Respondents by Age and Households involvement in charcoal production.

			Involvement in charcoal production	
Age group	**Number**	**Percent**	**Number**	**Percent**
15-29	121	30.0	64	52.9
30-39	132	32.8	52	39.4
>39	150	37.2	83	55.3
Total	**403**	**100.0**	**199**	**49.4**

Source: Field Survey, 2007

5.1.3. Marital Status

In addition to being one of the important proximate determinants of fertility, marriage has economic and social implication. Generally, marriage is basic to family formation. In countries like Ethiopia, where subsistence agriculture is the mainstay, families play central role in the production processes, income maintenance, economic status (CSA, 2003).

Based on data collected from field survey, the respondents' marital status is calculated and presented in table 5.4. According to the data, about 3.7 percent of the sampled households are found to be polygamous type of marriage, which is widely practiced in Muslim dominant areas. Widespread practice of Polygamous marriage in turn gives us hint on fertility and sex ratio situation of an area. In areas where polygamous marriage is common, other things being constant, the female population out number the male. Currently married sampled households account for 79.9 percent while never married are 8.4 percent. Widowed and divorced respondents constitute 5.7 and 2.2 percent, respectively. From data analysis, it was found that about 80 percent of the households with polygamous type of marriage are involved in charcoal production followed by currently married households (52.2 percent). This implies that large labor available to participate in charcoal production is a characteristic of polygamous type of marriage household.

Table 5.4: Percentage Distribution of Respondents by Marital Status and Involvement in charcoal production

Marital Status	Number	Percent	Involve in charcoal production	
			Number	Percent
Never married	34	8.4	14	41.2
Currently married	322	79.9	168	52.2
Divorced	9	2.2	4	44.4
Widowed	23	5.7	1	4.3
polygamous	15	3.7	12	80.0
Total	**403**	**100**	**199**	**49.4**

Source: Field Survey, 2007

5.2 Socio-Economic Characteristics

5.2.1 Literacy Status

Literacy status is an important factor that affects the well-being of individuals or societies in general. Level of education is associated with the participation as well as productivity of

agriculture. Education improves knowledge and use of agricultural practices and applied technology in agricultural operations (CSA, 2003). Education has also intense influence on the peasants' general awareness about the adverse effects of environmental degradation (Shibru, 2002). A person with a better education has more probability to engage in high-income generating activities. Hence, literate household heads play important roles in improving the welfare of his families. However, the data presented in table 5.5 indicates that 45.5 percent of the households headed by illiterate are involved in charcoal production. On the other hand, 61.5 and 42.4 percent households headed by primary (1-8) and secondary (9-12) education level household heads are involved in charcoal production, respectively.

According to the data collected through field survey, about 45.2 percent of the respondents attended primary school (grade 1-8). On the other hand, the respondents who attended secondary school account for 14.6 percent while who are illiterate constitute 24.6 percent of the total respondents. Sex wise distribution of literacy status indicates that female respondents are more illiterate (71.9 percent). See table 5.5.

Table 5.5: Percentage Distribution of Respondents by Education Level and involvement in charcoal production

			Involve in charcoal production	
Education Level	**Frequency**	**Percent**	**Frequency**	**Percent**
Illiterate	99	24.6	45	45.5
Read and Write	63	15.6	17	27.0
Primary (1-8)	182	45.2	112	61.5
Secondary (9-12)	59	14.6	25	42.4
Total	**403**	**100.0**	**199**	**49.4**

Source: Field Survey, 2007

5.2.2. Occupation

The population of the study area has different types of livelihood. However, subsistence mixed farming system is the major activity. Accordingly, about 65.1 percent of the respondents' means

of livelihood is based on both crop production and livestock rearing simultaneously, while 25 and 4.2 percent are based on crop production and livestock rearing, respectively (see table 5.6).

Table 5.6: Distribution of the Respondents by Occupation

Occupation	Number	Percent
Only crop production	101	25.0
Only Livestock Rearing	17	4.2
Both Crop and Livestock	262	65.1
Others	23	5.7
Total	**403**	**100.0**

Source: Field Survey, 2007

5.2.3. Landholding Size

Land is very important asset and means to sustain livelihood. It is a key resource base for any human development activity. Landholding size is considered as a critical factor that determines the type of crops grown and size of crops harvest, especially in developing countries like Ethiopia. Accordingly, about 80 percent of agricultural out put in Africa has been attained through the expansion of agricultural land. Moreover, availability of pastureland is an important issue for livestock rearing (Degefa, 2002; Chalachew, 2004). Under the subsistence agriculture, where modern farm inputs utilization has been yet under developed, like in the area under consideration, land size plays a significant role in influencing farm households' income and food security. In study area, like other parts of the country, land distribution is not even. Large proportion of the land is concentrated in the hands of older age groups. Mostly, the younger are landless. Unequal distribution of the most important resource base, land, among the community implies inequality in access to asset and exposure to the problem of food insecurity.

Table 5.7 presents six types of land holding size categories and the proportion of farmers that fall under each group and the total size of land occupied by the respective categories. Accordingly, about 49.1 percent of the respondents own 0.51-2.0 hectares while 30.5 percent own <.50 hectares of land. On the other hand, only 20.4 percent of the respondents possess greater than 2 hectares of land, indicating unequal distribution of land in the study area. According to the above

table, 74, 40.4 and 34.1 percent of the households with less or equal to 0.5, 0.51-2.0 and greater than 2 hectares of land are involved in charcoal production respectively, indicates decline of involvement as land size increases.

Table 5.7: Distribution of Respondents by Land holding size[14] and Households Involvement in charcoal production

			Involve in charcoal production	
Farm size category(Hac)	**Frequency**	**Percent**	**Frequency**	**Percent**
<0.50	123	30.5	91	74.0
0.51-2.00	198	49.1	80	40.4
>2.0	82	20.4	28	34.1
Total	**403**	**100.0**	**199**	**49.4**

Source: Field Survey, 2007

NHH=Number of Household, Cum. =Cumulative

Regarding to the problem of land shortage, about 76.6 percent of the respondents reported that the current landholding size is not enough to support their family. As indicated in table 5.8, the reasons for the problem of shortage of land are in order of their importance, infertility of the land (54.6 percent), small in size (48.6 percent) and large families (41.7 percent).

Table 5.8: Percentage Distribution of Respondents by Reason for Shortage of Farmland

Reasons	**Number**	**Percent[15]**
Small in Size	196	48.6
Large Family Size	168	41.7
Infertility of Farm Land	220	54.6
Others	17	4.2
Total	**664**	

Source: Field Survey, 2007

[14] Holding type comprises land under cultivation, fallow land, grazing land and land under settlement.
[15] If added, the percentage is above 100 due to multiple reasons. Hereafter, if the percentage is not added and the respondents' summation is above 403, it indicates multiple reasons.

5.2.4. Off-farm Activities

Employment of households in off-farm and non-agricultural activities has a paramount significance to diversify the source of farm households' livelihood. It enables farmers to modernize their production by providing an opportunity for applying the necessary inputs and reduces the risk of food shortage during unexpected crop failure. Employment in off-farm activities could create alternative sources of employment for high population concentration areas, which help to reduce the over utilization of land resources. It also reduces the wastage of working human power (Degefa, 1996).

Accordingly, in the study area people are participating in various types of activities to secure the livelihood of their families. Of the total respondents, 48 percent have off-farm employment. The most important off-farm employments in order of their importance are selling fire wood and charcoal, daily laborer and petty trading. The most important source for daily laborer employment is "safety-net program" as the area is food insecure (see table 5.9).

Table 5.9: Distribution of Respondents by Type of Off-farm Employment

Type of Off-farm	Number	Percent
Daily laborer	131	65.8
Sewing clothes	7	3.5
Petty trading	45	22.6
Selling firewood and charcoal	199	99.5
Others	33	16.6

Source: Filed Survey, 2007

Although off-farm employment opportunities play a great role in improving the livelihood of the households under consideration, larger proportions of them are not engaged in the activities. When the reason asked for not engaging in the off-farm activities, farmers identified one or a combination of various reasons given in table 5.10. Of the reasons given, lack of opportunity (37.2 percent) and lack of skills (32.5 percent) were identified as the main reasons (see table 5.10).

Table. 5.10: Households Reasons for not Engaging in off-farm Activities

Reasons	Number	Percent
Lack of spare time	40	20.9
Lack of skill	62	32.5
Lack of opportunity	71	37.2
Health problem	19	9.9
Lack of interest	17	8.9
Others	8	4.2

Source: Field Survey, 2007

5.2.5. Livestock Size and Farm Ox Possession

Rural households benefit from their livestock in different ways; i.e., as a source of draft power, source of cash income, source of supplementary food and means of transport. Besides, livestock are considered as means of security and coping mechanism during crop failure and other natural calamities. Under such conditions, livestock play a significant role in maintaining and enhancing households' food security situation on a sustainable basis. This is the rationale why it is assumed that farm households that have large livestock number do no directly rely on environmental resource to meet their daily needs. The farmers that have large livestock have better capacity to cope with the problem of crop failure. More over, they are in a position to meet their households' basic domestic needs such as clothing, health care, education cost, etc.

As indicated in table 5.11, about 35 percent of the respondents owned less than two TLUs (Tropical Livestock Units) while 31.3 percent owned two to four TLUs. On the other hand, 33.6 percent of the respondents have own above four TLUs.

Table 5.11: Percentage Distribution of Households by Ownership of TLU

TLU Category	Frequency	Percent	Involve in charcoal production	
			Number	Percent
<2.0	141	35.0	86	61.0
2.0 -4.0	126	31.3	62	49.2
>4.0	136	33.8	51	37.5
Total	**403**	**100.0**	**199**	**49.4**

Source: Field Survey, 2007

It is obvious that, in areas where farmers entirely depend on traditional method of farming, farm oxen possession would be a critical production factor. The household sample survey result indicates that about 46.5 percent of the households do not have farm oxen. On the other hand, about 29.5 percent of the farmers own only one ox. Only about 24.1 percent of the farm households of the study area own greater than 2 farm oxen. Cross-tabulation with involvement in charcoal production indicates that 53.5 percent of the respondents who possess no farm ox are involved in charcoal production. On the other hand, 61.3 and only 26.8 percent of the respondents who possess one and greater or equal to two farm oxen involves in activity, respectively (see table 5.12).

Table 5.12: Percentage Distribution of the Respondents by Number of Farm Oxen Possessed

Number Of Ox	Frequency	Percent	Involve in charcoal production	
			Frequency	Percent
0	187	46.5	100	53.5
1	119	29.5	73	61.3
≥2	97	24.1	26	26.8
Total	**403**	**100.0**	**199**	**49.4**

Source: field survey, 2007

5.2.6. Modern Farm Inputs

In areas where landholding size is small and the fertility status of the soil is deteriorated, agricultural inputs such as fertilizers, improved seeds and irrigation play a significant role in improving households' crop production and income cash, which in turn contributes towards attaining household food security and domestic basic requirement of the household. Thanks to the CADU/ARDU extension packages, there is little problem in adoption of modern farm inputs among the farmers of Arsi Zone (Degefa, 1996; Dagnachew, 1999). Accordingly, households' interview indicates that about 156 (38.7 percent) and 133 (33 percent) of the respondents use chemical fertilizers and improved seeds, respectively. On the other hand, only 70 (17.4 percent) and seven (1.7 percent) have used irrigation and pesticides, respectively. Similarly, of the total respondents, about 36 percent of the respondents received credit.

During the focus group discussion, farmers complained lack of irrigation, off-farm income, credit services (especially for females), shortage of improved seeds and high price of fertilizer for their living under poverty. In the study area, farmers said if they get government and non-governmental organizations assistance in the area of irrigation development, farm credit supply and off-farm employment, they can improve their lives. Adoption of modern farm inputs also reduces over utilization of natural resource.

Table. 5.13. Percentage Distribution of Farmers by Modern Farm Input Utilization

Name of Modern Farm Inputs	**Frequency**	**Percent**
Chemical Fertilizers	156	38.7
Improved seeds	133	33.0
irrigation	70	17.4
Farm Credit	145	36.0
Pesticides	7	1.7
Total	**371**	

Source: Field Survey, 2007

5.3. Perceived Determinants of Involvement in Charcoal Production and its Environmental Impact

The data inputs incorporated in this section are collected through household survey, focus group discussions and key informants. Moreover, during the same phase of field work, in-depth informal discussions were made with different parts of the community. The data collected from focus group discussions and key informants interviews are used to substantiate the results of quantitative data collected through household survey. For the sake of simplicity, the opinions of various communities related to determinants of involvements in charcoal production are categorized into economic, institutional, demographic and environmental factors.

5.3.1. Economic Factors

Farmers deeply felt that lack of better options or alternative sources of income, forced them to involve in charcoal production as fast income generation to purchase food grain. Here what one respondent said is:

> *Previously, the area was covered by dense forest. When the rain dropped, there was no surface run off and erosion. Our soil was fertile. We used to produce enough crops from small amount of land. We had enough number of livestock and we used to drink milk, eat meat and honey. Hence, we didn't know hunger. However, today due to lack of enough means of subsistence, forest becomes our source of food, income and daily survival. If a person has better option, why he filthy himself with charcoal and ash. Why he goes after donkey here and there.*

From this statement, it is clear that the farmers have the knowledge of the impact of deforestation on environment. However, their poor economic conditions compel them to depend on forest resources. This is in consistency with studies of poor in land per capita and goat holdings are more reliant on Low Return Forest Activities (Fisher, 2002). Kebele Chairman and Development Agents also supported this idea. Burka Lemefo Kebele Chairman believed that basically, involvement in charcoal production is strongly intertwined with poverty. According to him, individuals who involve in charcoal production are poor who have no other options and enough means of survival. However, taking this as a full advantage, some business men from East Shewa

town like Meki and Alem Tena go to rural villages and persuade poor farmers to cut down the remnant Acacia trees available in farmstead.

Household's interviews also support the above views. According to the filed survey result, of the total households interviewed, 86.8 percent are food insecure. About 81.1 percent of the food insecure households overcome the problem through the purchase of grains. Although the sources of cash income to buy grains are different, large proportion of the respondents, 57.4 percent identified selling of firewood and charcoal while only 23.2 percent said selling of livestock. About 32.7 percent identified daily laborer as the principal ways of getting access to cash income (see table 5.15). This indicates that food insecure households are more dependent on forest resources.

The reason asked the household heads why they failed to meet families' annual food requirements. They identified environmental, demographic and socio-economic factors. From economic factors, shortage of farm ox was identified as a major problem by 86.4 percent of the respondents. Similarly, about 83.1 and 81.1 percents of the respondents relating the problem of their household food shortage with shortage of modern farm inputs and producing once in a year, respectively (see table 5.17). Focus group discussions and key informants interviews also confirmed that most of the farmers who engage in the activity are poor, who have no/ enough land, livestock and farm ox. Only 27.6 percent of the respondents replied that, they involved in charcoal production to generate additional income.

Table 5.14: Households Coping Mechanisms In the Face of Food Shortage

Mechanism	Number	percent
Purchasing grains from Market	284	81.1
Borrowing Grain from farmers	25	7.1
Borrowing from Idir	4	1.1
Reducing Consumptions	96	27.4
Receiving Relief aid	85	24.3
Others	21	6.0
Total	**515**	

Source: Field Survey, 2007

Meja Shenen Development Agent[16] explained that involvement in charcoal production is a consequence of high demand from urban centers and increased price on one hand and poverty in rural areas on the other. As a result, charcoal business becomes profitable for the rural households since the cost being incurred is time and power spent on production. He bitterly complained weak support from the concerned authorities in controlling the activity. This motivated even the richer farmers and the Kebele Officials to engage in the activity. Currently, the farmers who have grain mills engage in the activity by hiring other people.

Table 5.15: Sources of Cash Income to Purchase Grains from Market

Type of sources of Income	Number	Percent
Borrowing from other	36	12.7
Selling livestock	66	23.2
Working as laborer	93	32.7
Selling firewood and charcoal	163	57.4
0thers	65	22.9
Total	**458**	

Source: Field Survey, 2007

Table 5.16: Percentage Distribution of Respondents by Reason for Engaging in Charcoal Production

Reasons	Number	Percent
To generate additional income for household	55	27.6
To cover education costs of family	40	20.1
To pay debt	16	8.0
For domestic consumption as fuel	70	35.2
To purchase food (salt, food Oil, fuel, and others)	163	81.4
Others	8	4.0
Total	**317**	

Source: Field survey, 2007

[16] Abamela Wendimu

Mostly charcoal production is undertaken during summer season to full fill seasonal food gap. The respondents correspond this period with shortage of seed and food. Wereda Natural Resource Conservation Team[17] also confirmed the seasonality of engagement in charcoal production. This finding goes in line with results obtained by Daniel (2005) that volume of charcoal inflow to towns is high during summer season. Regarding this, about 75 percent of his respondents confirmed that, during the summer season, the majority of peasants exhaust their food and cash resources. They are liable to have short time preference.

Table 5.17: Perceived Factors Inducing Seasonal Food Shortages

Lists of Problems	Major Problem		Minor problem		Not a Problem	
	Number	Percent	Number	Percent	Number	Percent
Producing one in a year	327	81.1	51	12.6	25	6.4
Shortage of farm ox	349	86.6	40	9.9	14	3.7
Shortage of rain fall	376	93.3	27	6.7	0	0
Shortage of modern input	335	83.1	44	10.9	24	6.0
Soil infertility	237	58.8	128	31.8	39	9.6

Source: Field Survey, 2007

5.3.2. Institutional Factors.

In Oromo traditional culture, forest especially big trees have a respect. In relation to this, one peasant, Gemo Ede'o told the old traditional say "*Gowwaan namaa muka addunyaaa hin se'u,*" which literally means "a foolish man does not consider tree as a property." According to Gemo, this indicates that whenever there is forest resources, there is every thing; no hunger. There is rainfall, honey, water, food and other forest related resources. He argues that forest depletion not only affects climatic conditions, cause erosion, cause famine and drought but will also adversely affect the needs of future generation. Forest has both spiritual and economic values in Oromo society. Workneh's observation supports this view. "The green environment has special

[17] Ato Tariku Bayu, Ziway Dugda Wereda Natural Resource Conservation Department Team Leader.

significance to the Oromo people. It is the symbol and prestige of fertility (germination) and of all good things" (Workneh, 2001: 44)

According to the local community, cutting trees is not their culture; it is foreign culture. The people said to come from the "north" around 1964-65 eroded their grand traditional forest management system and introduced charcoal production from trees and forest into the area. According to their ideas, the actions of previous governments also affect their attitude, because they took some of their land and demarcated for other purposes. It is interesting to note that, during the fieldwork, the researcher observed a big Acacia trees on private farm lands (see fig 2). The common lands, however, covered with scant remnants of Acacia trees (see fig 1). This finding result supports Hardin's disadvantage of common resources. Every body sees the common resources from his own benefit point of view.

Figure 1: Remnants of Acacia trees left after deforestation. It is the most preferred tree for charcoal production (Photograph by author, 2007 from common land in Dimtu Rereti Kebele).

Some focus group members also mention the issue of land (the legal perspective) as one of the major problem for deforestation. By the 1975 land law, all land in Ethiopia was nationalized. As state authority lacked capacities to manage and control the nationalized land, this legislation (of making the land state property) made the land open-access type of property-right regime (FSS,

2003). Common resources such as forest, which is free and open for all tend to be vulnerable to depletion due to overuse and misuse, this commonly referred to as *'the tragedy of commons'* (Hardin, 1968). Wereda Natural Resource Department team also confirmed that undefined land ownership right intensified the problem of over use and misuse of the local forest. According to the Department, forest areas which the charcoal burner first targeted are public forestlands. Currently, the targeted public forest in Meja Shenen and Burka Lemmefo Kebele Administrations is Sukayi public forest. In open access property exploitation, what the charcoal burners pay is only power and time. Then they are used to selling one quintal of charcoal up to 40-60 birr.

Figure 2: These are big acacia trees found in private farmstead or homestead (Photograph by author, 2007).

Different parts of the community also related the problem with weak government institutions. Weak controlling systems intensified the problem. For a long time, charcoal market used to operate openly. Now days, however, it is under taken secretly. By principle, charcoal and wood production and distribution are illegal. However, the control system is sporadic and the focus is after the tree is being cut. In regard to this, Wereda Natural Resource Department said that the current controlling system is only to illustrate that charcoaling is an illegal. The intention is not to

stop it totally. The researcher observed charcoals confiscated at Wereda Agricultural Development Office (see Fig 3).

In both Kebeles, forest access was somewhat unrestricted or open access. Wereda Agriculture and Rural Development Office is unable to prevent people from extracting charcoal at a level exceeding sustainable yield due to lack of defined ownership and use rights. Lack of cross-sector coordination, lack of complimentary between environment policy and energy policy and incomplete demarcation of forest are some of the major causes for unsustainable exploitation of forest resources.

Figure 3: Some of charcoal and firewood confiscated at Ziway Dugda Wereda Agriculture and Rural Development Office (Photograph by author, 2007).

According to Dimtu Rereti development worker[18] ,some farmers chop the wood used for charcoal during day time and burn during the night. Some farmers again take the woods used for charcoal to home and burn in compound. His idea is also confirmed by Wereda Natural Resource Department Teams. He expressed that from a single acacia tree about 3-4 sacks of charcoal could be produced. Now days, due to the depletion of acacia trees, people have started to use every type

[18] Husen Geleto, Dimtu Rereti Kebele Development Agent.

of natural vegetation, which used to be inferior for charcoal production. Charcoal is made from traditional kilns or earth moulds (see fig 4).

Figure 4: One of the traditional charcoal kilns observed in Dimtu Rereti Kebele made of soil and tree branches, Photograph by author, 2007.

The idea of key informants and focus group discussions are also substantiated by opinion of the respondents. Although there are some divergent views, most of the respondents support charcoal production control in the locality. Accordingly, about 92.1 percent of the households accept a ban of charcoal production while only 7.9 percent do not support. About 72.9 percent of the respondents answered that the government is not effective in controlling the activity and they condemn the government weakness. About 95.4 percent of the respondents believed that if the livelihood of the people improved charcoal production in the locality would decline. From this finding, it is not difficult to deduce that to reduce unsustainable charcoal production and consequent degradation of the environment, intervention in area of poverty is unquestionably important.

Responding to questionnaires to know patterns of volume of charcoal production, price of charcoal and number of charcoal trader from time to time, about 63.7 percent of the respondents believed that from time to time, the number of individuals engaged in charcoal production has decreased in the locality.

Table 5.18: Percentage Distribution of the Opinion of the Respondents on Charcoal Control

Type of opinion	Yes	No
Should charcoal production to continue?	7.9	92.1
Is government control enough to stop charcoal business?	26.9	72.9
If the livelihood improved, would charcoal production decline?	95.4	4.6

Source: Field Survey, 2007

The reasons given were decline in forest resource (53.7 percent) and fear of control (41.6 percent). About 89.2 percent of the respondents believed that the price of charcoal has increased. Moreover, during discussion, the community expresses fear of firewood and construction materials shortage in near future if the current trend continues.

Table 5.19: Perception of Respondents on Temporal Aspects of Charcoal Production

Time to time pattern in the:	Increased	Decreased	Constant	Total
Volume of charcoal production	32.0	63.7	4.4	100.00
Price of charcoal	89.2	10.8	0	100.00
Number of charcoal traders	79.4	20.6	0	100.00

Source: Field Survey, 2007

5.3.3. Environmental Factors

As the study is carried out in predominantly rain fed agricultural environment, any deviation of environmental elements from the normal situation could adversely affect farmer's livelihood. During focus group discussion, the farmers also explained that environmental factors are the major constraint to improve their lives. Of all the environmental factors, drought and erratic rainfall patterns are the most influential. Moreover, the dominance of sandy soil in the area is reducing the water holding capacity of the land and therefore making it susceptible to crop failure. The soil is highly erodeable. These characteristics expose the area under consideration to, a higher risk of food crop failure and recurrent drought and famine. It also reduces the productivity and prices of their livestock on market. Field survey result also shows that about

93.1 and 58.7 percent of the household attributed the major problem of food insecurity to shortage of rain fall and soil infertility, respectively.

5.3.4. Demographic Factors

Population increases, and subsequent fragmentation of land and over cultivation are major demographic factors for over utilization of the forest resources. Regarding the role of women in charcoal business, focus group discussion revealed that small number of women is involved in burning few sacks of charcoal to cover basic expenses of their families. Women are mostly involved in retailing trade of charcoal. They mostly collect the branches of dry trees. Household survey data also indicates that of the total interviewed female headed households only 22 percent are participated in charcoal production as opposed to 53.5 percent for male headed households. Focus group discussion also indicates that in charcoal production younger farmers from age 15 to 30 used to dominate the activity. The reason given by the participants is that the problem of shortage of land is more common among the younger farmers. As they have no land, they are forced to find other means of survival.

5.3.5. Impact of Charcoal Production on Environment

Several factors are responsible for the massive deforestation that has been currently under taken in the study area (table 5.21). From the household interviews, it was evident that charcoal production is one of the causes of deforestation. Accordingly, almost 78.6 percent of the respondents identified it as a cause of deforestation followed by the expansion for agriculture (72.4 percent), fire wood (56.6 percent). Charcoal production involves mass deforestation of indigenous trees which have both medical and spiritual values, resulting in soil erosion, loss of habitat for plant and animal species, and reduced availability of wood. It is an action which destroys the common national capital.

Table 5.20: Perceived Causes of Deforestation (Multiple Responses)

Causes	Frequency	Percent
Charcoal production	276	78.6
Firewood collection	198	56.4
Timber Production and construction	69	19.7
Land clearing for expansion of agriculture	254	72.4
Grazing	46	13.1
Others	12	3.4

Source: Field Survey, 2007

The data inputs collected from household interviews and discussion made with different parts of the community indicates that people have awareness about the negative impact of charcoal production to the livelihood of the community and environment. Accordingly, about 92.7 percent of the respondents attributed it to climatic change. This perception is further strengthened by reduction in rainfall (83.0 percent), soil erosion (85.9 percent) and loss of wildlife (73.3 percent) resources. The Focus group discussion and key informants also outlined that the rainfall failures, severe soil erosion, and loss of wildlife were attributed to the dwindling tree covers in the area. The volume of Lake Ziway has been decreased and receded from its original place due to sedimentation by the soil eroded from farm and degraded lands. According to the farmers the flooding started from the bare steep highlands destroys their farm land during main rainy season. The livestock has been suffered from drought and shortage of food. For instance, in 2003 there was severe drought and many livestock died. Milk productivity of the livestock even their size and weight has significantly decreased. Formerly, the time interval of drought is very long. Currently, however, the time interval is reduced to 4-6 years. The incidence of food insecurity has been increased. Deforestation also created shortage of construction materials. Some focus group mentioned that some people started to use soil as construction materials in stead of woods. The symptom of shortage of firewood has also been seen in the area. Some people started to use roots of trees.

Environmental degradation and subsequent climatic change led to the spread of diseases, especially malaria. It is the most widespread disease, causing a several deaths in the Ziway Dugda. Many of the respondents have witnessed visible ecological change during their life time and they labeled the trend as alarming.

Table 5.21: Perceived Impact of Charcoal Production on Environment (% of respondents)

Charcoal making induces impact on:	Frequency	Yes	No
Soil Erosion	329	85.9	14.1
Loss of wild life	269	73.3	26.7
Rain fall decrease	318	83.0	17.0
Climatic change	355	92.7	7.3
Social conflict on resource	160	41.8	58.2

Source: Field Survey, 2007

CHAPTER SIX

STATISTICAL ANALYSIS OF DETERMINANTS OF INVOLVEMENT IN CHARCOAL PRODUCTION

Respondents were identified as involved in charcoal production if they were performing the activity during the last twelve months prior to the survey. Based on the data collected from the household heads aged 15 and above, in this part quantitative statistical methods were employed to analyze the relationship between the demographic and socio-economic characteristics of the rural households and involvement in charcoal production. The main objective is to identify and quantify quantitatively what factors are important in determining households' involvement in charcoal production.

Congruent with this, the logistic regression model and the chi-square test are used. The chi-square test is used to explain whether or not attributes are associated (Kothari, 1986:317). It does not indicate the type or the direction of the relationship that exists between the dependent and a set of independent variables. It indicates whether or not the two variables have association. On the other hand, logistic regression is used to identify and quantify the contributions of several factors in explaining households' involvement in charcoal production. Unlike the chi-square test, logistic regression indicates the type or the direction and strength of the relationship (whether positive, negative or no relationship) between the dependent and independent variables.

Hosmer and Lemeshow Goodness of fit are used to check whether or not the model chosen well fit to the data. When the model is well fitted to the data, the Hosmer and Lemeshow Goodness of fit, should be $P>0.05$. Accordingly, the Hosmer and Lemeshow Test significance of the data is found to be p-value=.157 indicating that the model fits to the data. The method used for analysis is *Enter*.

The independent variables used are household size, age and sex of household heads, landholding size, livestock size (TLU) and educational status of household heads. The dependent variable is household involvement in charcoal production. Since it is dichotomous such as *not involved* and *involved*, No=0 and Yes=1, respectively. As a result, Logistic Regression Model is an appropriate model with dichotomous dependent variable.

6.1. Household size versus Involvement in Charcoal Production

Household size is the most important demographic variable that is used to indicate population-resource ratios at household level. Other things being constant, most of the time larger households are food insecure. In large households, since available resources are shared among families, percapita resources are dwindled. Under such condition, larger family size households are forced to rush into alternative sources of income to satisfy their families' basic domestic needs. This is the basic premises why it is assumed that "households' size and involvement in charcoal production is positively correlated".

When cross-tabulated with dependent variable, 74.7, 48.4 and 36.8 percent of the respondents with household members less or equal to three, four to six and greater than six were involved in charcoal production, respectively.

The chi-square of independence (x^2=28.310) at P value=.000 show highly significant association between households size and involvement in charcoal production (see table 6.2). The results of the logistic regression also confirmed this significance. According to the logistic regression result, the probability of involvement in charcoal production is declined by 72.5 percent for households with greater than six members as compared to the reference category (less or equal to three). In other wards, as households' size increases, the probabilities of households involvement in charcoal production decreases indicating negative relationship between household size and involvement in charcoal production. As a result, the hypothesis that says "households with small family size are less likely to engage in charcoal production activity" is not accepted. Though it does not support the literature at hand, other things being constant, the effect of large family size on environment is obvious.

6.2. Livestock Holding Size versus Involvement in Charcoal Production

Livestock is an important source of income, draft power and means of transport for rural households. Besides, livestock and their products are considered as a means of security and coping mechanism during crop failure.

Cross-tabulation with dependent variable indicates that about 55.4 percent of the respondents who possess less or equal to four TLUs are involved in charcoal production. On the other hand, only 37.5 percent of the respondents who possess greater than four TLUs involve in charcoal

production (see table 6.2). The chi-square independence test (X^2=11.590) at P-value=.001 shows a highly significant association between households livestock (TLUs) possession and involvement in charcoal production. The results of logistic regression also supported this. This means, the probability of involvement in charcoal production decreases as livestock size of the households increase. The odd of involvement in charcoal production for the households with greater than four TLU is declined by 50 percent (EXPB=.447) as compared to reference category (see table 6.3). Put in other wards, as the size of households' livestock increases, involvement in charcoal production decreases. As a result, hypothesis number two which says "Household with large livestock holding size is less likely to engage in charcoal production activity is accepted". This result supports the findings of Degefa (2005) and Fisher (2003). According to these findings, households who are in better position to accumulate asset over several years are better in coping during special moment of hardship. As livestock acquisition remains a key form of wealth accumulation in rural Ethiopia, households with large livestock may not rely on direct extraction of land resources particularly the natural vegetation for fuel woods and charcoals. However, in asset poor households, since other options are limited they engage in charcoal business.

6.3. Land Holding Size versus Involvement in Charcoal Production

Land is very important asset and a means to sustain livelihood. It is the key and finite resource base for most human activities including agriculture, industry, forestry, energy production, settlement, recreation, water catchments and storage. The size of farmlands is expected to influence peasant perception of the rational use of the land resource (Chalachew, 2004).

Compared to other areas of the Zone, the land holding size of the study wereda in general and the study area in particular seem larger. However, under the current condition, such size of land seems not enough to support households' current family size with out modern farm inputs. When cross-tabulated with dependent variable, about 53.3 and 45.9 percent of the respondents with less or equal to two hectares, and greater than two hectares of land are involved in charcoal production, respectively (see table 6.1).

The result of chi-square of independence test (x^2=11.590) at P-value=0.001 in table 6.2 shows highly significant association between landholding size and involvement in charcoal production,

which was also corroborated by the result of logistic regression. As indicated in table 6.3, the probability of involvement in charcoal production is declined by 66.2 (EXP B=.338) percent for households who own land greater than two hectares as compared to reference category. Hence, the hypothesis that says "landholding size of the households and involvement in charcoal production is negatively correlated" is accepted. This finding also supports the result of Bekure (1996).

Households with large land size have high probability to diversify their crop to reduce the risk of crop failure. Households with large land size may own large livestock as land size could be a factor for livestock possession. As a result, they may not face the problem of food insecurity. Moreover, farm size per household resident should provide a good indication of availability of excess labor to employ off-farm and the households food security.

6.4. Age of Household Heads versus Involvement in Charcoal Production

Age of the household head may show the economic position of the household. Degefa's (2002) study indicates that household food availability increases with an increase in the age of household head. The higher the age of the household heads, the more stable the economy of the farm household. Older people have relatively richer experiences of the social and physical environment. Moreover, older heads are expected to have better access to land than the younger heads. The young generations who have no access to land and have better options are forced to involve in alternative income source activities. One of such activities is charcoal production. This is the reason behind why it is assumed that young households are more likely to involve in charcoal production.

When cross-tabulated with the dependent variable, 52.9, 39.4 and 55.3 percent of households headed by 15-29, 30-39 and more or equal to 40 age household heads were involved in charcoal production, respectively (see table 6.2). The result of chi-square of independence (x^2=7.910) at P-value=0.018 shows significant association between age of the household heads and involvement in charcoal production. The result of logistic regression established insignificance for age group 30-39. However, for age group greater or equal to 40 the results of logistic regression show a significant relationship at p value=.007. Accordingly, the probability of households' involvement

in charcoal production would increases by 2.477 for age greater than or equal to 40, however, in contrary to what is expected.

Higher involvement of households headed by old older household heads in the activity might be attributed to the fact that households headed by older household heads may have larger family size and high dependency ratio. As charcoal is labor intensive and requires power, large family size implies cheap labor available to participate in charcoal production, especially in households where male number out weights female number.

6.5. Sex of the Household Head versus Involvement in Charcoal Production

In line with involvement in charcoal production, male-headed households are greater than female headed-households. As indicated in table 6.2 when cross-tabulated with the dependent variable, about 21.1 percent of female-headed households and 54 percent of male-headed household respondents were involved in charcoal production.

The chi-square test of independence (x^2=21.312) at p-value =0.000 in table 6.2 show highly significant association between sex of household-head and involvement in charcoal production. The logistic regression model also confirmed this significance. As indicated in table 6.3 the odd of involvement in charcoal production is declined by 70.6 percent (EXP B=.294) for female headed households as compared to reference category (male-headed households).

The obtained result implies that the hypothesis number five that says 'male-headed households are more likely to engage in charcoal production activity than female-headed households' is accepted. The result supports Daniel's (2005) and Miasna's (1996) findings. Misan's finding indicates that mostly, the females collect the branches of dead tree from the forest. They do not cut big trees to produce charcoal as it requires power and labor intensive. In male headed households, the number of male population may out number the female number.

6.6. Education of Household Head versus Involvement in Charcoal Production

It was expected that household per capita food availability increases with an increase in the education level of household heads. The impact of education on households' food production might be through promoting awareness on the possible advantage of modernizing agriculture through technological inputs and by diversifying household incomes, which in turn enhances

food security (Degefa, 2002). Moreover, literate people have higher opportunities to be employed in economic sectors that can generate relatively better income. In other wards, educated household heads have chances to diversify their livelihoods to higher return economic activities. Hence, as expected the literate people's involvement in charcoal production is less than illiterate respondents.

The result of chi-square of independence (x^2=13.372) at p-value=0.000 in table 6.2 show a significant association between the educational level of the respondents and households involvement in charcoal production, which was further confirmed by the result of logistic regression. The correlation between educational level of the household heads and households involvement in charcoal production is therefore statistically significant. However, in contrary to what was expected. As indicated in table 6.3 the odds of involvement in charcoal production increases by 2.233 for literate households' heads as compared to reference category (illiterate-headed households).

The possible reasons for high involvement of households headed by literate in the activity could be due to contact of Kebele officials with the activity, the involvement of male household heads due to drop out from primary and secondary schools and male students to cover education cost.

Table 6.1: The Result of chi-square of Independence by Background Characteristics of Respondents

Background Characteristic	Involvement in Charcoal Production							
	Yes		No		Total			
	Number	Percent	Number	Percent	Number	Percent	X^2	P-Value
Household size								
≤3	56	74.7	19	25.3	75	100		
4-6	90	48.9	94	51.1	184	100	28.310	0.000
>6	53	36.8	91	63.2	144	100		
Age of the HH Heads								
15-29	64	52.9	57	47.1	121	100		
30-39	52	39.4	80	60.6	132	100	7.910	.018
≥40	83	55.3	67	44.7	150	100		
Land Holding Size								
≤2	171	53.3	150	46.7	321	100	9.557	
>2	28	34.1	54	65.9	82	100		0.000
Livestock Holding Size /TLU								
≤4	148	55.4	119	44.6	267	100	11.590	
>4	51	37.5	85	62.5	136	100		0.000
Sex Of the HH heads								
Male	187	54.0	159	46.0	346	100	21.312	
Female	12	21.1	45	78.9	57	100		0.000
Literacy Status of HH Heads								
Illiterate	62	38.3	100	61.7	162	100		
Literate	137	56.8	104	43.2	241	100	13.372	0.001

Source: Field Survey, 2007

Table 6.2: Results of Binary Logistic Regression for Socio-economic and Demographic Determinants of involvement in charcoal Production

Variables	B	S.E	EXP(B)	Sig
Household size				
≤3 (RC)				
4-6	-.899	.326	.407	.006
>6	-1.291	.357	.275	.002
Age of the HH Heads				
15-29 (RC)				
30-39	.266	.306	1.305	.384
≥40	.840	.310	2.315	.007
Land Holding Size				
≤2 (RC)				
>2	-.947	.305	.388	.002
Livestock Holding Size /TLU				
≤4 (RC)				
>4	-.712	.235	.491	.002
Sex Of the HH heads				
Male (RC)				
Female	-1.225	.357	.294	.001
Literacy Status of HH Heads				
Illiterate (RC)				
Literate	.803	.251	2.233	.001

Source: Filed Survey, 2007

Note: B=Coefficient

SE=Standard Error

EXP (B) =Exponential Beta

Sig =Significance Level

RC=Reference Category

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1. Summary

This study was conducted in Ziway Dugda Wereda of Arsi Zone. The area is ecologically sensitive as it is found in the Rift Valley Region. It is an area where deforestation is the major problem due to inefficiently inherent production of charcoal, fire wood collection, expansion of farming land, etc. However, it contains Lake Ziway, which is important for the economy and environment of the Zone in particular and the country in general. Therefore, unsustainable use of forest resources increases loss of biodiversity, soil erosion and sedimentation of the lake. These are the rationale behind study in this problem in this particular.

The findings of these study have both applied and basic purposes. The basic purpose of the findings of the study is that it improves our understanding on how various socio-economic shape the attitudes and activities of the rural households towards the environment. The applied purpose is its contribution for intervention and formulation of policy in areas of poverty, energy and environment linkage. The basic data used were generated from household survey, Focus Group Discussions and key Informant interviews. The total sampled households were 403.

Statistical Packages for Social Science (SPSS) Soft Ware was used for data analysis. Different methods were used to analyze the data. These methods range from simple percentage distribution to chi-square test of independence and logistic regression model. Chi-square test was used to identify associations that exist between the dependent variable (involvement in charcoal production in this case) and independent variable (demographic and socio-economic characteristics of households).

The demographic and socio-economic attributes of the study population, which were expected to determine households' involvement in charcoal production, were presented quantitatively. Data collected through focus group discussions and key informant interviews were systematically incorporated into the text to substantiate quantitative data. The largest proportions of the respondents (85 percents) are below age 39. About 86 percent of the sampled households were male. With regard to the marital status, about 79.9 are currently married. Illiterate and literate peoples constituted about 40.2 and 59.8 percent of the total respondents, respectively. Of total

respondents, households with four to six members constitute 45.8 percent while those with greater than six accounts for 35.7. About 49.4 percent of the sampled households are involved in charcoal production, which is 54.4 and 21.1 percent for male and female, respectively.

About 49.1 percent of the respondents own 0.51-2.0 hectares while 30.5 percent own <.50 hectares indicating unequal distribution of land in the area. In regard to shortage of land, about 76.6 percent of the respondents reported that the current land holding size is not enough to support their family. The reasons given for the problem are in order of importance, infertility of the land (54.7 percent), small in size (48.5 percent) and large families (41.6 percent).

With regard to livestock holding, about 66.3 and 33.7 percent of the respondents own less or equal to four and greater than four TLUs. Of the total respondents, 38.7, 36 and 33 percents use chemical fertilizers, credit services and improved seeds respectively.

According to the sampled households and focus group discussions, poverty is the major determinants of households' involvement in charcoal production. Most of the respondents attributed the problem of involvement in charcoal production to shortage of farm ox, shortage of land, modern inputs, irrigation, etc.

Mostly charcoal production is undertaken during summer season to full-fill seasonal food gap. The respondents correspond this period with shortage of seed and food. Three major causes of deforestations were identified as perceived by the sampled household heads. These were charcoal production (78.6 percent), clearing and expansion of agriculture (72 percent) and firewood collection (56 percent). Moreover, lack of defined property ownership exacerbates the problem. In turn, as perceived by the respondents the major problems of deforestation on environment are climatic changes, soil erosion and reduction in rainfall, loss of wildlife, etc. As a result, the larger proportion of the respondents (92.1 percent) supports the control of charcoal production.

Household's involvement in charcoal production is positively correlated with age and education level of household heads and family size. On the other hand, landholding and livestock holding sizes of households and involvement in charcoal production are negatively correlated. Similarly, male-headed household heads are more likely to involve in charcoal production.

7.2 Conclusions

The interaction between population and the environment is a complex and explained by many factors. No single causation can be spelt out. Many people also argue that population growth and size alone may not explain the current natural resource base depletion at local level. According to these authors, it is simple generalization to relate the problem with population size alone. The catastrophic impact occurs due to specific circumstances of underdevelopment. Therefore, it is found that, the interaction among many factors such as demographic and socio-economic characteristics of the households on the one hand, institutional factors (declining of former resource management system (geda system in Oromo case) at faster rate, poverty, ineffective controlling system, lack of policy in the rational utilization of common property, etc,) on the other are playing a significant role in determining the extents of natural resources exploitation. The result of this study also confirmed that these factors have contributed very much for resource degradation at the study area as depicted by analytical framework in chapter three.

Since the problem has multiple sources, it requires multiple sources and integrated forms of intervention. Multiple and integrated sources of interventions include population policy, forest policy, household poverty alleviation policy, energy policy, education and socio-cultural change policy. These multi facets forms of interventions have to be under taken simultaneously.

Before four decades the native people did not engage in charcoal business. But as the poverty incidence become deep rooted coupled with population increase and lack of better option (alternative income sources), the local community started to depend on forest resource to which they have free and easy access.

The study confirmed that the demographic and socio-economic characteristics of households are the major determinants of households involvement in charcoal production in the study area. According to the conclusions drawn from statistical analysis, households that are poor in some assets such as landholding and livestock holding size are more involved in charcoal production. Likewise, female-headed households are less involved in charcoal production as compared to male-headed households not because they are better in asset possession than male headed households but female-headed households are less involved in charcoal production might be due to the fact that females mostly collect the branches of dead tree from the forest. The females do not cut big trees to produce charcoal as it requires power.

On the other hand, as household heads age increase, household involvement in charcoal production increases. The factors that might attribute are an increase of household size and dependency ratio as age of household increases which implies cheap labor available to participate in the activity as charcoal requires labor intensive. Household-headed by literate also more engage in charcoal production. This could be due to participation of some Kebele officials. Moreover, drop out of male household heads from primary and secondary schools might be attributed to high involvement of literate headed households in the activity. Moreover, absence of defined land and forest ownership property has hamper management and proper utilization of forest resources.

Currently, charcoal production is extensively under taken in the study area. It was found that about 49.4 percent of the households are involved in the activity of which male accounts for 54 percent while female constitutes only 21.1 percent. Mostly, the production is undertaken during summer season to full-fill seasonal food gap.

High prevalence of poverty in rural areas on one hand and high demand from urban centers on the other encourage rural households to involve in charcoal production. In the study area, like other parts of the country, since the forest resources is open access and unrestricted the only cost spent being incurred is time and power in charcoal production.

It was found that charcoal and wood production and distribution is illegal. The activities are under taken in hidden ways. However, the control system is sporadic and the focus is after the tree is being cut. It was found out that the acts of controlling are not to stop the activity, but to illustrate that charcoaling is an illegal activity. Most of the farm households in the study area are aware of the negative implications of inefficient production of charcoal on the environment. This could be drawn from the changes they observed in their local environment over time.

7.3. Recommendations

Based on the conclusions made and problems identified through analysis of data collected from household survey, focus group discussion and key informant interviews, the following recommendations are forwarded.

1) Statistical analysis confirmed that households with less land and livestock are found to be more dependent on forest resources. They have low capabilities to engage in and create better income generating activities. Hence, to improve the economic status of these groups, attempts should be made to create alternative sources of income through diversification and creation of off-farm economic activities. Such economic activities could be poultry production, petty trading, bee keeping, etc. Moreover, interventions in the delivery of micro-finance services are vital especially for females.

2) Study confirmed that large proportion of the farm households depend on forest resources due to lack access to land. Under the prevailing conditions, it seems difficult to expand farmlands and make the farm households food self-sufficient without modern farm inputs. Therefore, special attention has to be given to the supply of modern farm inputs and also for irrigation development. Moreover, the current farm-get prices of chemical fertilizers need to be assessed and checked in line with the total cost of peasant production and return.

3) Large family reduces households saving capacity as percapita expenditure increases. In large households, since available resources are shared among families, percapita resources are dwindled. As a result, they are forced to depend on environmental resources to satisfy their basic needs. Therefore, the current fertility rate has to be reduced through strengthening provision of family planning services.

4) The country is endowed with tremendous potential of renewable energy sources. Therefore, alternative energy sources such as bio-fuels (biogas, bricket sustainable charcoal), hydropower, solar energy and wind energy, which can be used to minimize the pressure on plants should be given special attention.

5) Taking into account the seasonal cycle of involvement in charcoal production and food shortage in rural areas, as a short-term solution, well-timed system of food aid supply system has to be designed and implemented.

6) Given the contribution of inefficient energy use for the exacerbation of deforestation, the policy makers and different NGOs recognized the importance of energy saving stoves (eg *Lackech*) in addressing the problem. Each *Lackech* stove saves an average 75 kg of charcoal per household per year Daniel (2005). Household monthly energy budget is estimated at birr 53 when charcoal is used with traditional stove and birr 43 when it is used with an improved *Lackech*, where budget goes up to birr 90 for using liquid petroleum. Hence, besides the promotion of use and production, the costs of energy saving stoves in urban and rural areas should be seriously considered. Moreover, both government and Non-government organizations has to strengthen the production and distribution of energy saving stoves to the community.

7) The proportion of biofuel energy consumed by households is related with cooking habit. Terefe's (1989) result indicates that greater proportion of fuel is devoted to baking *Injera*, preparing *Watt* and *coffee* making. According to Terefe, *Injera* might be baked once every three days while *watt* is prepared once or twice a day and served warm. Similarly, the ceremonial coffee making is daily ritual activity and lasts more than an hour during which time the fire is kept burning. Moreover, there are many traditional holidays during which fuel consumption is higher than normal times. Combined with inefficient energy utilization system, the above mentioned energy use habits exacerbates deforestation. Therefore, our habit of energy use has to be modified through an introduction of instant machines and fuel saving stove for cooking and coffee making.

8) It was found that absence of land and forest ownership has hampered forest management and proper utilization, because people do not feel common and open forest as their property. Moreover, the peasants do not feel security to plant trees and manage land. Therefore, the government has to ensure land and tree security for the peasant.

9) Finally the author calls for further studies in other charcoal producing areas to validate the results obtained in this study. The number of adult males in the household and distance from main roads determine households involvement in charcoal production. Therefore, the author also calls for further investigation in these areas too.

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Appendix

PART ONE

Household Survey Questionnaires

The main objective of this questionnaire is to collect the demographic and socio-economic data that determinates households involvement in charcoal production in Ziway Dugda Wereda of Arsi Zone. The study is conveyed for academic purpose. Hence, the response from respondents is confidential and cannot be traced to the persons who provided them.

I. Identification

1. Enumerators Code _____
2. Region- Oromia
3. Zone - Arsi
4. Wereda- Ziway Dugda
5. Name of the village _____
6. Household identification number _____
7. Name of the Household head_____
9. Age_____
10. Sex_____
11. Education level: 1) illiterate 2) read and write 3) primary (1-8) 4) senior secondary (9-12) 5) Tertiary
12. Marriage status: 1) married 2) single 3) widowed 4) divorced 5) polygamous
13. Ethnicity: 1) Oromo 2) Amhara 3) others
14. Occupation: 1) Only farming 2) Only cattle rearing 3) both

15. Family data:

S. No	Name	Sex	Age (In complete year)	Relation to House hold head
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

II Off-farm income and credit service

1. During the last twelve months did you or any member of your household member

Participate in off-farm activity? 1) Yes 2) No

Name of off-farm	Name of the household member participated	Amount of income (Birr/ year)

2. If your answer for question No 1 is *yes,* specify the type of activity in the following table

4. If you do not have any off-farm activity, what are the reasons? 1) Lack of spare Time 2) lack of skill 3) Lack of opportunity 4) health problem 5) lack of interest 6) if any others, specify

5. Did you or any member of your family get credit service? 1) Yes 2) No

6. If *yes* who is the source? 1) Government 2) NGO 3) private 4) others, specify___

IV. Landholding

1. Did you have land? 1) Yes 2) No

2. If yes, fill in the following table all lands you possess.

Description	**Grazing land**	**For cultivation**	**construction land**	**Forest**	**Others**
Area (timad)					

3. Do you think that your land enough to support your family? 1) yes 2) No

4. If ***No,*** what are the reasons? 1) small in size 2) large family size 3) infertility of land 4) others_____

V Agriculture Part

1. Did you use any modern farm inputs? 1) yes 2) no

2. If ***yes***, fill the type of inputs did you use in the following table- year 1998/99

Name of input	**Amount kg**	**Price (Birr)**

3. Does the crop you produce enough to support your family? 1) yes 2) No

4. If ***No***, how do you support your family? 1) Buying from market 2) Borrowing from idir, 3) Borrowing from other farmers, 4) Asking aid 5) Reducing consumption during food shortage 6) others, specify_____

5. If by *buying from market*, what is the source of your money? ') Selling charcoal/ firewood 2) selling livestock 3) Borrowing from other farmers 4) others, specify_____

6. During which seasons of the year your family faces food shortage (put x)?

Name of Months	**Put (X)**	**Name of Months**	**Put(x)**	**Name of Months**	**Put(x)**
June		October		February	
July		November		March	
August		December		April	
September		January		May	

7. According to your opinion, which factors induce seasonal food shortage?

Lists of Problems	**Major Problem**	**Minor Problems**	**Not a problem**
Shortage of farm land			
Producing once in a year			
Shortage of farm land			
Shortage of rain fall			
Shortage of modern farm inputs			
others			

8. Do you have Livestock? 1. Yes 2. No

9. If *Yes* for question No 9, give us the size of your livestock in the following table.

Type of livestock	**Size of livestock**
cow	
Ox	
Sheep	
Goats	
Donkey	
Horse	
Mule	
Total	
others	

VI. Involvement in Charcoal Production

1. Did you or any member of your family participate in charcoal production during the last 12 months? 1) Yes 2). No

2. If ***yes***, for question No1, for what purpose? 1) To get additional income 2) To cover education cost 3) To pay debit 4) To buy food grain and other domestic requirements

   5) If any others, specify_____

3. During which months of the year do you or your family mostly engage in charcoal production? (put x)

Name of Months	**Put(x)**	**Name of Months**	**Put (x)**	**Name of Months**	Put(x)
June		October		February	
July		November		March	
August		December		April	
September		January		May	

4. According to your opinion, volume of charcoal production, charcoal price and charcoal traders increase, decrease or no change?

Opinion	Increases	Decrease	No change
Volume of production			
Charcoal price			
Charcoal traders			

5. In the future, do you want to involve in charcoal production? 1) Yes 2) No

6. If No for question No 5, what is your reason? 1) Depletion of forest 2) Fear of control 3) Want to create other job 4) Others, specify_____

7. According to your opinion, if charcoal production ban, who is more victim? 1) Charcoal Producers 2) All urban residents 3) Urban poor 4) Charcoal traders 5) Others, specify_____

8. Regarding charcoal control, give your opinion in the following table

Opinion	1. Yes	2. No	3. I don't know
Should charcoal production have to stop?			
Does government control enough?			
If the live improve, would charcoal production stop?			

VII. Impact of unsustainable charcoal production on Environment

1. Is there deforestation in your area? 1) Yes 2) No

2. If *yes*, what are the causes? 1) Fire wood 2) Charcoal production 3) Expansion of agriculture land 4) Timber production 5) Expansion of grazing land 6) Others, specify_____

3. What are the impacts of deforestation on environment? 1) Soil erosion 2) Decline of water 3) Loss of wild life 4) Weather change 5) Shortage of rain fall 6) others, specify_____

4. From whom did you hear about the impact of deforestation on environment? 1) Development agents 2) Agriculture expert 3) Non- Government organization 4) From other farmers 5) Others, specify_____

PART TWO

Questions to be answered by Focus Group Discussions and key informants.

1. Is there the problem of food shortage in your area?
2. What are the major causes of food insecurity?
4. During which months of the year do most of the people face food insecurity problem?
5. How do the communities over come the problem of food shortage?
6. Is there problem of food shortage increasing or decreasing? Why?
7. Are there deforestations in your area?
8. If yes, what are the major causes?
9. Is there the problem of charcoal production in your area?
10. Why do people involve in charcoal production?
11. When did charcoal production start in your area?
12. Does involvement in charcoal production increase or decrease over time?
13. Which parts of the community mostly involve in charcoal production? Why?
14. Do you support a ban of charcoaling?
15. Does government control to stop involvement in charcoal enough?
16. What are the impacts of charcoal on the environment?
17. Which environmental changes is more problem in your area? a) Loss of wild life, b) deforestation, c) soil erosion, d) decline in surface water, e) increase in temperature, and f) reduction in rainfall.

DECLARATION

The thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

Name _____

Signature _____

Date _____

This thesis has been submitted for examination with my approval as university advisor.

Tenfe Degefa		20 Aug. 2007
Advisor	Signature	Date