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**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF SOCIAL SCIENCE
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL
STUDIES**

**FACTORS INFLUENCING URBAN HOUSEHOLD
FIREWOOD CONSUMPTION AND DEFORESTATION:
SOME INSIGHTS FROM WOREDA 5 OF *GULELE* SUB-
CITY OF ADDIS ABABA**

BY:

BEZAWIT BENEBERU ARERU

MAY 2015

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ADVISOR:

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Contents

Contents.....	i
List of Tables	iii
Acknowledgement.....	iv
Acronyms.....	v
Abstract.....	vi
Chapter One	1
1. Introduction.....	1
1.1. Background of the Study.....	1
1.2. Statement of the Problem	3
1.3. Objective of the Study.....	5
1.3.1. General Objective	5
1.3.2. Specific Objectives	5
1.4. Research Questions.....	5
1.5. Significance of the Study	5
1.6. Limitation and Delimitation of the Study	6
1.7. Organization of the Paper	7
Chapter Two.....	8
2. Review of the Related Literature and Conceptual Framework.....	8
2.1. The Need for Energy and the Energy Access Challenge	8
2.2. Forest Resources and Energy.....	9
2.2.1. Firewood Consumption as a Source of Energy: An Overview.....	10
2.3. Firewood Consumption and Deforestation in Ethiopia: the Linkage	12
2.3.1. Deforestation: Causes and Consequences as a Global Problem	12
2.3.2. Deforestation in Ethiopia.....	15
2.3.3. Causes and Impacts of Deforestation and Forest Depletion in Ethiopia	16
2.3.4. Impacts of Deforestation	18
2.3.5. The Link Between Deforestation and Household Firewood Consumption in Ethiopia: The factors	20
2.4. The Nexus Between Urbanization, Firewood Consumption and Deforestation.....	23
2.5. Urban Household Firewood Consumption in Ethiopia: Implications to the Forest	24

2.6.	The Firewood Consumption Situation: Current Status and Deforestation	28
2.7.	Forest Policy of Ethiopia: A Synopsis	30
2.8.	Factors Determining Household Energy Choices	32
Chapter Three		34
3.	Description of the Study Area and Methods.....	34
3.1.	The Study Area	34
3.1.1.	Geographic Description	34
3.1.2.	Population of the Study Area	35
3.1.3.	Economic Activities in the Study Area.....	35
3.2.	Methodology	36
3.2.1.	Research Design and Methodology	36
3.2.1.1.	Source and Method of Data Collection	36
3.2.1.2.	Sampling Techniques and Sample Population	36
3.2.1.3.	Data Collection Instruments	36
3.2.1.4.	Methods of Data Analysis.....	37
Chapter Four		39
4.	Data Presentation and Analysis	39
4.1.	Socio-Economic Characteristics of Sample Households.....	39
4.2.	Factors Influencing Household Firewood Consumption.....	48
4.2.1.	Household Income.....	49
4.2.2.	Household Family Size.....	53
4.2.3.	Price of Firewood	54
4.2.4.	Tenure Status of Respondents	55
4.2.5.	Holidays and Feasts	57
4.2.6.	Availability and Affordability of Modern Energy Sources	58
4.3.	Urban Household Firewood Consumption and Deforestation.....	59
5.	Conclusion and Recommendations.....	67
References.....		71
Appendix-1		79
Appendix-2		84
Appendix-3		88

List of Tables

Table 4.1. Age structure of the head of households	40
Table 4.2. Gender of head of households	40
Table 4.3. Marital status of the head of households	41
Table 4.4. Family size of households	41
Table 4.5. Monthly Income of Households	42
Table 4.6. Level of education of heads of the households	43
Table 4.7. Tenure Status of the Respondents	43
Table 4.8. Sources of energy the households use for cooking food	45
Table 4.9. Use of Electric Stove by Households	46
Table 4.10. Firewood consumption trend by households and length of stay Cross-tabulation	46
Table 4.11. Trend of firewood consumption	47
Table 4.12. Frequency of Using Firewood in a Week	48
Table 4.13. Purpose of Use of Firewood and Frequency of Use of Firewood Cross-tabulation	49
Table 4.14. Monthly income of households and Reason for choosing firewood Crosstabulation	50
Table 4.15. Monthly income of households and kind of energy the households use for cooking food Crosstabulation	51
Table 4.16. Monthly Income of Households and Frequency of Use of Firewood Cross-tabulation	52
Table 4.17. Frequency of Use of Firewood and Marital Status of the Head of Households Cross-tabulation	53
Table 4.18. Frequency of Use of Firewood and Family Size of the Households Cross-tabulation	53
Table 4.19. Reason for Choosing Firewood	55
Table 4.20. Housing Status and Use of Electric Stove by Households Cross-tabulation	57
Table 4.21. Types of Firewood Households Use	58
Table 4.22. Source of Firewood for Household Consumption	60
Table 4.23. Sources of Firewood	61
Table 4.24. volume of consumption of firewood in Woreda 5 in a week	63
Table 4.25. Urban Household Firewood Consumption and Deforestation Awareness	63
Table 4.26. Solution for Deforestation in Relation to Firewood Consumption	64

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Acronyms

IEA	International Energy Agency
ECA	Economic Commission of Africa
MDGs	Millennium Development Goals
FAO	Food and Agricultural Organization
UNEP	United Nations Environment Program
UN	United Nations
FDRE	Federal Democratic Republic of Ethiopia
EPA	Environment Protection Authority
AACA-ILIC	Addis Ababa City Administration-Integrated Land Information Center

Abstract

In developing countries the major source of energy is biomass fuels and firewood where large proportion of society depends on. In recent years, in Ethiopia one can observe the expansion of electricity. Yet, still there are huge number of people who depends on firewood consumption to meet their energy needs even in urban areas where electricity is believed to be expanding. In this case, the factors influencing urban household firewood consumption and link with deforestation on the surrounding forest areas is given less attention. This study, therefore, aims at identifying the factors that influence household firewood consumption and exploring how it is linked with the process of deforestation. Both qualitative and quantitative research design were used as a mixed approach to answer the research questions. Structured household survey questionnaire, in-depth interview and field observation were used to collect data. Random sampling technique was used to collect the data needed and 150 households were randomly selected from Woreda 5 of Gulele Sub-city of Addis Ababa. Since, much of the firewood comes from the nearby Entoto mountain, the study has established that there is a strong linkage between firewood consumption in the study area and the process of deforestation in and around the Entoto Forest. In general, the study identified that, household income, family size, price of firewood, holidays and feasts, availability and affordability of modern energy sources and housing status are the major factors influencing firewood consumption in Woreda 5.

Key Words:- firewood, energy, urban household, deforestation,

Chapter One

1. Introduction

1.1. Background of the Study

Deforestation as a process of changing forest lands into other land use and deterioration of forests as degradation of forests are major environmental concerns of the contemporary world. One can enumerate a number of causes of deforestation across the world. This includes, increasing population and the ever parallel increase in the demand for agricultural land, industrial sites, and built structures such as housing, forest products, firewood and so on are the major ones. Besides, Brown and Porter (1991) stated that increasing trend for commercial crop production, large scale mechanized logging, mining operation and construction of mega dams are also causes of tropical deforestation.

Deforestation as well as forest degradation has a number of socio-economic, environmental, as well as political consequences. The different consequences, most of the time, reinforce each other. For example, as a process clearing of trees has the environmental consequence of deforestation which may result in lack of rainfall as well as rivers might get dry. This will severely affect societies with rain-fed agriculture. Besides land degradation, soil erosion, and sedimentation mostly are linked with deforestation and forest degradation. This will in turn result in lack of productivity as top soil will be eroded and as a result, agricultural productivity will be negatively impacted which in turn may result in food insecurity. Deforestation, unless preventive measures are taken, will also result in a burden to a government in formulating and implementing expensive countering measures.

Researchers has had observed that “while deforestation has slowed down in the industrialized countries in recent times, it has accelerated in developing countries” (Boahene 1998). This clearly shows that the drivers of deforestation differ from one part of the world to the other based on the level of development that particular society has reached and many other demographic and socio-cultural factors. For instance, one can notice that the contribution of firewood consumption differs comparing the developed societies and the developing ones as the former primarily depends on modern energy sources and the later relies on traditional fuel sources from biomass (Araya 2002). The consumption of firewood in Africa, for instance, has been regarded as one of

the major causes of deforestation with other drivers such as the need for agricultural land and population growth (FAO 2001).

In Sub-Saharan Africa, in both rural and urban areas, firewood is a major source of energy. “While rural households rely more on biomass fuels than those in urban areas, well over half of all urban households in Sub-Saharan Africa rely on fuel wood, charcoal, or wood waste to meet their cooking needs” (IEA 2006 in Alemu and Gunnar 2008). Studies show that the penetration of modern energy sources mainly electricity is low in developing countries and its end use is more or less for lighting. According to the study, 70 percent of people in the developing world rely on wood and its byproducts for cooking (ECA 2013). A biomass fuel, especially wood, is the most important source of fuel in most African countries. As stated by Zenebe et al (2010) “Africa ... is characterized by strong growth in urban consumption of wood fuels.”

Heavy reliance of the urban households on biomass fuels has a devastating impact on environment. Their reliance on the firewood and related products for fuels by the urban people has its impacts on the environment. Most significantly “this dependence of urban centers on surrounding rural lands has aggravated forest devastation and degradation” (Zenebe et al 2010). As firewood and related products “must be collected from the available resource pool, such high dependency is likely to have fundamentally negative impact on the availability of forest resources” (Abebe et al 2012). This impact is more stronger in African and low income countries where modern fuel sources as well as improved stoves are not largely used for cooking.

In Ethiopia, for instance, the use of firewood is one of the most important factors in triggering deforestation. Unsustainable consumption of fuel wood, increasing deforestation and soil erosion are major environmental and economic problems facing African countries such as Ethiopia (Nebiyu 2009). This has linkages with firewood consumption as well. According to Bizzarri (2010) “Ethiopia is the third largest user in the world of traditional fuels for household energy use, with 96% of the population dependent on traditional fuel (e.g. firewood, charcoal, agricultural residue and animal waste) to meet their energy needs.” “In 2005, 108.879 million m³ of timber were harvested for fuel wood (24.5% more than in 2000)” (FAO 2005 cited by Zenebe 2007) which shows the severity of the problem. In Ethiopia household firewood consumption is huge in both rural and urban areas.

In urban Ethiopia, for example, the use of biomass fuel is about 8.2 percent of the total biomass fuel consumption of the country (Dawit 2012). Zeray et al (2013) also noted that “in urban areas, half the households rely on traditional biomass (wood, dung and agricultural residues) for cooking, and in rural areas, virtually all do (except for 0.2% who use kerosene, and 1.2% charcoal).” In Ethiopia, the urban household on an average consumes 1.68 kilo gram of firewood a day per person (Nebiyu 2009). But it should also be noted that the consumption in urban areas shows variations. For example, firewood consumption in Addis Ababa city has been shown increasing and decreasing patterns. “A closer look at traditional fuel consumption trends reveals that in 1995, fuelwood accounted for 74%,... [and] in 2005, [it] declined by 22%, but it continued to supply 56% of the household fuel” (Araya and Yissehak 2012: 5). Nevertheless, the results so far should not be taken for granted and as final since the trend of household firewood consumption in the City should be studied. And above all, understanding the different factors which affect household decision for firewood consumption will help to understand the links between deforestation and household firewood consumption. hence, this research is part of understanding the different factors influencing household firewood consumption in Addis Ababa City and focuses on *Woreda* 5 of Gulele Sub-City and its implication on deforestation.

1.2. Statement of the Problem

Ethiopia is one of the poorest countries on earth. Much of the population lives in rural areas where the primary source of income is agriculture which contributes almost 50 percent of the GDP and 85 percent of the total employment. Energy needs in the country is tremendously satisfied by the use of biomass fuels such as firewood, charcoal, animal dung which accounts almost 90 percent of the energy consumption. Such extreme dependence on traditional fuels has its impact on the natural environment. Especially the heavy dependence on fire wood has multifarious and related problems which have to do with deforestation, land degradation and another circle of fuel wood crisis. In spite of the measures that are being taken at country level in order to rehabilitate the environment, the consumption of biomass fuels has been increasing by 2.5 percent (Alemu 2000).

Addis Ababa as the capital city of Ethiopia and the diplomatic hub of Africa is expected to meet its energy needs from modern fuels such as electricity and fossil fuel. Nonetheless, one can observe across the streets or markets in the suburbs of the city firewood carrying animals or

people which shows the excess use of traditional fuel in the city. According to Araya and Yissehak (2012), 80 percent of the city's fuel source is from traditional fuels and in recent years firewood alone contributes almost 56 percent of the total energy consumption of the city. In the studies conducted so far, for instance, Araya and Yissehak (2012) noted that in a study conducted for ten years from 1995 to 2005 "traditional fuel consumptions in Addis Ababa increased by about 10%." According to the Finance and Economic Development Bureau of the Addis Ababa City (2009), in the same year, the number of population has grown from 2.3 million in 1994 to 2.8 million as far as official statistics is concerned. But there are estimates that the population of the city exceeds 3.5 million (IDRC 2011). Such an increase in population, mainly as a result of rural-urban migration, has an impact on the use of fuel wood in the city.

Alemu and Gunnar (2008) have also argued that the use of fuel wood in major cities like Addis Ababa is increasing. They noted that, "households, even in urban areas—such as those in major cities of Ethiopia—tend to increase the number of fuels they use as their incomes rise instead of completely switching from the consumption of traditional fuels (such as wood) to modern ones (such as kerosene and electricity)" (Alemu and Gunnar, 2008: 17). Zenebe et al (2010) also studied the urban fuel demand and they concluded that "reducing the pressure of urban centers on local forests cannot be seen in isolation from broader development policies aimed at raising the level of education and income of the population."

Most of the studies conducted on urban household fuel consumption are related with factors pertaining to income. What is more, most of the researches are done by economists. And again most of these researches are more or less conducted at macro level. What is clearly known so far is the general trend of firewood consumption in urban areas which is increasing, however, the studies are at macro level. What is more, to the knowledge of the researcher, the link between urban household firewood consumption and deforestation has been given little attention. Yet what is not clearly known is the determining factors affecting urban household firewood consumption at the micro level. Thus, this study strives to understand these factors. Besides, this research strives to explore how the factors are linked to the process of deforestation or vice-versa. Thus, to have a clearer image on the linkage as well as to draw a lesson and input to understand the bigger problem, studies such as this one are important. Furthermore, studying the current household firewood consumption is important to understand past, present and future

patterns in firewood consumption which also received little attention. Hence, the research assesses the problem by looking at household firewood consumption in Addis Ababa by focusing on *Woreda 5 of Gulele Sub-city*.

1.3. Objective of the Study

1.3.1. General Objective

The general objective of this research is to identify the factors that influence household firewood consumption in *Woreda 5 of Gulele Sub-city* of Addis Ababa and to explore how it is linked with the process of deforestation.

1.3.2. Specific Objectives

The specific objectives of this study include:

- to identify the factors influencing household firewood consumption in *Woreda 5 of Gulele Sub-city*
- to understand the link between household firewood consumption and deforestation
- to make recommendations for better future in urban household firewood consumption by identifying the lessons learned.

1.4. Research Questions

The following are the basic questions that this research addressed

1. What are the factors influencing people's decision of consuming firewood in *Woreda 5 of Gulele Sub-city*? Which determining factors are more linked with deforestation and forest degradation?
2. What are the manifestations of the link between household firewood consumption and deforestation?
3. What lessons can be learned? And what are the prospects?

1.5. Significance of the Study

Deforestation is one of the alarming problems that the world has faced with challenging socio-economic as well as political consequences. Hence, understanding its causes and manifestations

in different ways has a vital significance to solve the problem. Besides, household firewood consumption is regarded as one of the major causes of deforestation in the developing world mainly Africa in South of the Sahara where in fact Ethiopia is part of. Studies show that household firewood consumption is one of the major causes of deforestation and the consequent impact on land degradation in Ethiopia. The problem though perceived as big and challenging in rural areas, it is also a feature and a problem in the urban areas such as Addis Ababa. This study is part of understanding the problem of deforestation from the perspective of household firewood consumption in Addis Ababa City by focusing on *Woreda 5* of Gulele Sub-city. This study is, therefore, significant from different angles. Mainly this study will have two interrelated significances. These are;

- It will help to understand the pattern of household firewood consumption. By doing so, it will inform policy makers and researchers the factors that are associated with the patterns of demand for firewood consumption. Thus, it will help to furnish policy makers with badly needed data for the formation of policies.
- It will also help to boost knowledge on the area. It is obvious that research works have a number of academic significance. Hence, the output of this research will add some knowledge on the area and fill some of the gaps in studying household firewood consumption and its linkage with deforestation.

1.6. Limitation and Delimitation of the Study

There are some limitations that this research faced. The two most important limitations are time and finance. Such kind of studies most of the time needs house to house survey and this needs a lot of time and money. Apart from this in the assessments that this researcher conducted, no research is made regarding the issue on the sub-city. Those, which are available are, though, general studies on domestic household fuel choices and related issues at the city level and fails to see the link with deforestation. Besides access to information from different government offices and the study population due to time constraint are some of the challenges that this research faced in its process. Due to the constraints mentioned above this research delimit itself on *Woreda 5 of Gulele* Sub-city and the 150 households to be randomly selected. Another challenge faced by the researcher was the lack of openness from some of the sample population while

filling the survey questionnaires. In this case, much of such a problem was related with pertaining to household income. Hence, the researcher tried to convince the sample population that the purpose of the research is academic so that they could tell their monthly income.

1.7. Organization of the Paper

This thesis is organized under five chapters. Chapter one deals with the introductory part which gives a general background to the research, statement of the problem, objectives, research questions, limitations and significance of the study. Chapter two focuses on the review of the literature. The focus of this chapter is mainly on discussing the different concepts and frameworks about household energy consumption by focusing on firewood consumption and how it is related with deforestation. Then it attempts to explore the different links and factors affecting household's decision of consuming firewood and other related biomass energy sources. Chapter three is about the description of the study area and the details of the research design. Under chapter four the findings of the research are presented and analyzed through the methodology chosen. Chapter five summarizes and concludes on the findings of the research and forwards some recommendations.

Chapter Two

2. Review of the Related Literature and Conceptual Framework

2.1. The Need for Energy and the Energy Access Challenge

The modern world is very much dependent on energy for various purposes. Today life depends on energy. Energy is useful from household utilization through the operation of transportation systems to the functioning of manufacturing industries. Energy in general is the backbone of countries' economies. Research findings also confirm that the attainment of the Millennium Development Goals (MDGs) is highly dependent on access to energy (Modi et al 2005). In other words, "energy services and appropriate energy technologies are essential inputs to economic, social and environmental dimensions of sustainable human development" (Byakola 2009). Yet the energy that is needed-especially modern energy is not as such accessible evenly across the world. Access to modern energy is linked with high economic capacity and technology as the energy sector requires huge investment and resources as well and the know-how to exploit what is available.

In the contemporary world, energy issue has become the agenda of governments as the future of their countries' economies depends on whether they have the capacity to meet their energy needs. In short the energy challenge is what the world has faced (Modi et al 2005, ECA 2013). It could be argued that the challenge to energy access is the agenda of today. This can be related with the so-called energy crisis-which can be defined as the shortage of energy sources such as oil, electricity, or other sources as well as a rise in the price of the energy available. Therefore, the challenge to access energy can be viewed in line with this conceptual understanding where there is minimal access to any energy source be it, solar, wind, hydropower, oil, or biomass. In this regard, the developing world-mainly Sub-Saharan Africa is faced by the energy access challenge.

According to ECA (2013: 2) "globally, over 1.3 billion people lack access to electricity, 2.7 billion people lack clean cooking facilities, concentrated largely (95%) in Africa and developing Asia, particularly (84%) in rural areas." Apart from this, the disparity between urban and rural energy access is one manifestation of the existing energy access challenge. What is available is

also being challenged by factors which are with global concerns, for instance, climate change. According to Athanas (2007), “for both developed and developing countries climate change looms large as a game changing factor.” This is mainly because the different energy sources in one way or another are affected by the climate change and at the same time, the different sources of fuel have their own implication to climate change. In this regard, because the penetration of modern energy sources is very low, developing countries especially from Africa are more relied on biomass fuels mainly wood to meet their energy demands.

2.2. Forest Resources and Energy

Forests are sources of energy from different perspectives. Their direct as well as indirect contribution to energy is very significant. On the one hand, maintaining forests is very crucial to have more rainfall which is vital to fill reservoirs to generate sustainable hydroelectric powers. On the other hand, forests are sources of energy by providing woody fuel sources such as fuelwood, charcoal and other related products. Studies show that “the demand for fuelwood would grow from 3000 million meter cube at the turn of the century to 3500 million meter cube by 2050” (WCSFD 1999 in Arnold et al 2003). According to Kissinger et al (2012: 15) “There have been significant regional shifts in the patterns of fuel wood use globally in the past 15 years, with wood for energy having increased significantly in Africa and Latin America.” The authors further citing Hofstad et al., (2009) stated that, “fuel wood will remain a major source of domestic energy for some time and domestic fuel wood use is expected to remain relatively stable over the next 20 years, while the demand for charcoal is likely to increase due to an expected increase in urbanization, as urban inhabitants use more charcoal than rural ones.” This clearly demonstrates how much forest resources are vital as energy sources.

Unlike the industrialized countries-which have long replaced the use of wood based fuels such as firewood or charcoal by modern energy sources (Arnold et al 2003), due to different economic, technological, political as well as socio-cultural reasons Africa-mainly Sub-Saharan Africa is dependent of traditional fuel sources which include crop wastes, animal dung or woodfuel. As a result of such reliance on traditional fuel sources “Energy access and climate vulnerability are particularly connected in Least Developed Countries (LDCs), where rural communities compete over dwindling natural resources that are being further degraded by climate change (Legros et al.

2009 in Zeray et al 2013).” For instance, “About 70% of the developing countries’ population relies on wood and its by-products as main cooking fuel” (ECA 2013). More particularly, “In sub-Saharan Africa, cooking sources of energy are similarly sourced from wood (69%) and charcoal (11%), with minimal, but slightly higher, shares of kerosene (7%) and electricity (6%)” (ECA 2013). Hence it can be concluded that firewood is the major source of energy in the developing world. This however needs in-depth discussion for better understanding as follows.

2.2.1. Firewood Consumption as a Source of Energy: An Overview

People across the world have developed different sources of energy to meet their demand. For long the world was dependent on the consumption of biomass fuels mainly firewood since time immemorial. That is why, Mathews (2000 cited in Godfrey et al 2010) argued that, the use of the world’s wood for fuel “is a pattern both ancient and modern, and one that is not likely to change in the next several decades.” In fact, “hundreds of millions of people remain completely reliant upon wood for energy and cannot anticipate any rapid transition to other energy sources.” According to “[a] study by FAO in 1981, [it was] estimated that 2000 million people were dependent on fuelwood and other biomass fuel, of which more than 100 million were unable to meet minimum requirements sustainably” (Nash and Cecilia, 2006: 1).

What can be clearly understood is also the distribution of reliance on firewood across the world is highly dependent on different factors and mainly it differs from one region to another and from one country to another country. Among others, the level of development, availability of other energy sources apart from biomass fuels or fuelwood, economic as well as socio-cultural related factors are the major ones. Recent studies show that, “more than 2.4 billion people rely directly on traditional biomass fuels for their cooking and heating, and in poor countries biomass use represents over half of residential energy consumption (International Energy Agency 2005 cited in Machl et al 2007: 3).” What is alarming is, “without new policies, the number of people that rely on biomass fuels is expected to increase to 2.6 billion by 2015, and 2.7 billion by 2030 (about one-third of the world’s population) due to population growth” (IEA-International Energy Agency 2006).

This problem is further aggravated in low income countries such as Africa where tremendous portion of the total population is highly dependent on the consumption of wood for fuel and other

energy related purposes. For instance, as clearly noted by Drigo (2006: 1), “in Africa, wood fuel accounts for over 90 percent of total African wood consumption.” Citing FAO (1999) he further stated that, “in the countries of East Sahelian Africa, Central Africa and Tropical Southern Africa woodfuels contributed from 75 to 86 percent of total primary energy consumption.” Recent studies also show the persistence of such trend in poor counties in Africa (Idiata et al 2013). This clearly shows us that there are still millions who are dependent on firewood to meet their energy demands.

Within Africa itself the use of and reliance on fuelwood consumption varies from one region to the other. According to a research by Idiata et al (2013: 111) in 1994, Nigeria, Ethiopia, South Africa, Tanzania, Congo Democratic Republic, Uganda, Kenya, Sudan, Mozambique and Cote d’Ivoire are ranked the top ten African countries with highest wood fuel consumption and contributed 67.8 percent of total African wood fuel consumption. According to the study the rest 45 African countries contributed one third of the total African wood fuel consumption. Ethiopia for instance contributed 9.1% of the total African consumption only preceded by Nigeria which contributed to 19.1%. Due to a number of factors Ethiopia’s reliance on traditional fuel sources such as animal dung, firewood, charcoal and related sources is very high especially in the rural area. This makes Ethiopia one of the largest consumers of fuelwood in the world. Bizzarri (2010) noted that, “Ethiopia is the third largest user in the world of traditional fuels for household energy use, with 96% of the population dependent on traditional fuel (e.g. firewood, charcoal, agricultural residue and animal waste) to meet their energy needs.”

According to Abebe et al (2012: 1) “Ethiopia is a typical example, where nearly all its rural population depends on biomass energy sources for cooking and other energy requirements.” Among other biomass energy sources in Ethiopia, “fuelwood accounts for around 78 percent of the total energy demand, while animal dung and crop residue account for 12 percent and 9 percent, respectively (WBISPP 2004 cited in Abebe et al 2012).” Araya and Yissehaq (2012: 1) in the last fifty years fuelwood consumption in Ethiopia has increased from forty million to one hundred million cubic meters per annum. This increasing trend has its own impact on the natural environment in general and forest resources in particular. Regardless of the fact that, there are variations in analysis and general assessment on the degree of contribution of use of firewood to

the growth of deforestation, there is a general understanding that firewood and deforestation are linked. The following section highlights the linkage between the two.

2.3. Firewood Consumption and Deforestation in Ethiopia: the Linkage

2.3.1. Deforestation: Causes and Consequences as a Global Problem

Deforestation is the removal of vegetation or a process of de-vegetation. It could be temporary or permanent. But as a process, it involves clearing of tree covers. This is one way of understanding deforestation from the point of land use changes. As stated by FAO/UNEP (1987 cited in Mohammed 2011) “deforestation can be defined as the transformation of forest land to non-forest uses where forest land includes land under agro-forestry and shifting cultivation, and not simply closed canopy primary forests.” Deforestation as a process of clearing of vegetation has become, therefore, a major global concern which tremendously contributes to the overall degradation of the environment. As a matter of fact, deforestation could be caused by either manmade practices or natural disaster but the impact of the former is huge and unparalleled with the later. The global impact of deforestation can be manifested and expressed in terms of a number of factors. Among others, the impact of deforestation might include the increasing deterioration of the earth’s surface-which resulted in soil erosion, land degradation and other related problems and also ever growing and alarming global climate change which knocks the doors of the world’s population indiscriminately (Murry 2008).

The causes of deforestation can be attributed to a number of multifaceted problems. At the same time causes of deforestation can vary from one country to another and from one region to another region based on geographic, demographic, economic as well as socio-cultural determining factors. In the contemporary world deforestation is observed very high in the tropics. Especially in Africa the rate of deforestation is very high. The rate of deforestation in Africa for instance is one of the highest in the world. According to FAO (2012) between 1990 and 2005, Africa’s net forest loss was registered 1.6 million hectares annually only preceded by South America which registered 3.3 million hectares of net forest loss in the same period. Studies further show that the loss of forest in Africa is growing fast especially in Sub-Saharan Africa. The major causes of deforestation in the continent is linked to rapid population growth which resulted in the high demand for agricultural land, logging, fuelwood collection and infrastructure extension (Boahane

1998, Kissinger et al 2012, Idiata et al 2013). Kissinger et al (2012) further noted that besides the above mentioned proximate causes which has to do with “human activities or immediate actions that directly impact forest cover” deforestation is caused by an interrelated “underlying causes” which are “are complex interactions of fundamental social, economic, political, cultural and technological processes that are often distant from their area of impact.”

As mentioned earlier forest degradation and deforestation varies from one region to another region. In the same token, the major causes of deforestation also varies from one region to another due to a number of factors. For example, “commercial timber extraction and selective logging activities are the main drivers of forest degradation in Latin America and (sub) tropical Asia while fuel wood collection and charcoal production are the main forest degradation drivers on the African continent” (Kissinger et al 2012). The lack of modern energy sources in Africa, the level of economic development in the continent as well as socio-cultural and political factors have contributed to Africa’s high dependence on fuelwood which destroys the continent’s forest areas. This is mainly due to the fact that, “African countries rely on wood to meet energy requirements far more heavily than most other developing countries” (Idiata et al 2013).

Within Africa itself the largest consumers of firewood are confined to countries which account 67.8 percent of the total wood fuel consumption of Africa. Nigeria, Ethiopia and South Africa are the top three countries in the group. The first of these two countries are, in fact, the two top populous countries of Africa with rapid population growth which has its own impact on energy and the nature and status of forests and deforestation. For example, in Ethiopia deforestation is a major concern where the country is losing thousands of hectares of forest land each year due to different factors as is discussed in the proceeding sections.

The causes and implication of deforestation also varies across the world. South America, for instance, the leading continent in the world as far as deforestation is concerned, the major cause of deforestation in the region might have to do with logging. “Timber and logging activities account for more than 70% of total degradation in Latin America and Sub-tropical Asia” (Kissinger et al, 2012: 11). Besides expansion of large scale agriculture for commercial purposes have its repercussion on forest areas. “At the global level, agricultural expansion including large-scale commercial activities such as palm oil production, soy production and cattle ranching, have

been the major causes of deforestation. These activities have been, particularly, prominent in countries such as Brazil and Indonesia.” In India, for instance, “the land under cultivation has increased from 118 million hectares to 142 million hectares by 1987” by which 4.5 million hectares of land is a result of diversion of a forest land in to agricultural land (Parikh 2004). But “now these trend is increasingly expanding into lower income countries” such as Democratic Republic of Congo (Laporte 2007 in Mohammed 2011). On the other hand, there are countries and regions which are recovering from devastating deforestation such as Vietnam and China. Countries such as Costa Rica also expand their forest area through successful conversation (Mohammed 2011). On the other hand, Boahene (1998: 249) noted that in Africa deforestation can also be explained in relation to colonialism and its legacies as well as government agencies, wars and the loss of authority of indigenous leaders.

The degree of deforestation, despite varies from one region to another, has a huge impact globally. Increasing desertification, global warming and climate change, floods, poverty, scarcity of fuelwood supply, land degradation and its overall impact on food security are the major ones. Boahene (1998: 251) stated that, “the conversion and burning of forest for farming and the harvest of forest for timber and fuelwood cause a net release of CO₂ from the biota to the atmosphere.” Hence the environmental impact of deforestation has to do with the direct implication to global warming where the mentioned activities “inject about six billion tons of carbon into the atmosphere every year” (Silver and DeFries 1990 in Boahene, 1998: 251). Recent research findings show that “Globally, land use change and forestry are estimated to account for 18.2% of Greenhouse gases emissions.” This shows that deforestation has a direct impact on the increasing global warming and climate change which also increases temperature.

On the other hand, deforestation will result in the loss of carbon storage capacities which would be very essential in maintaining a safe climatic environment. In this regard, it is worth mentioning that forests have a huge potential of mitigating global warming and climate change. Recent studies, for instance, show that 18% of emissions from fossil fuels are currently recaptured by primary forests (Lewis, 2009 in Mohammed 2011). But deforestation will negatively impact this CO₂ capturing potential.

Apart from the forest-climate linkage, deforestation have also tremendous impact on the quantity and quality of water resources. Boahene (1998) referring Proctor (1985) noted that a “major consideration regarding the forest-rainfall relationship is that a sudden upward movement of air (over forest) can trigger the building of cumulus cloud and initiate rain.” This would increase the availability of water which has to do with again the precipitation trapping nature of forests. It is due to such link that most deforested areas experience in declining rainfall. In the same token of water quantity, water quality also is linked with available forest and vegetation resources which could serve as blocking block of soil erosion, sedimentation and siltation which would deteriorate the quality of available water resources. As clearly stated by Boahene (1998: 251) “A, hydrological problem induced by soil erosion is the one relating to increases sediment reaching stream channels.”

Land degradation is also another problem which is related with deforestation which has its repercussions on overall agricultural productivity and food security (Zenebe 2007). Moreover, loss of vegetation and plant species as well as wild-life is also caused by deforestation. Deforestation is regarded as one of the major causes of plant extinctions (Boahene 1998, Zenebe 2007, EPA, 2008). Besides, deforestation also has impact on deterioration of energy sources such as firewood. In general, the global impact of deforestation is huge and a concern. Despite deforestation seems high in a particular region or country, its implication is not specific to the area where particular deforestation occurs. Rather it has a spillover effect to areas and peoples beyond that particular area. One can notice for instance how deforestation affects the policies and programs of both developing and developed countries especially in relation to illegal timber production and logging, as well as issues pertaining to climate change.

2.3.2. Deforestation in Ethiopia

In many ways people depend on forests for their sustenance. This is mainly because, “forests and the benefits they provide in the form of wood, food, income, and watershed protection play a critical role in enabling people to secure a stable and adequate food supply” (Badeg 2001). Forests are important, therefore, to generate income, to meet their energy and food demands. In this regard, Ethiopian forests are significant to the livelihood of both rural and urban population of the country. According to some studies, rural Ethiopia depends on the forest to generate 40

percent of the total household income. More strongly, rural households meet their energy through fuelwood consumption, charcoal and dung among which firewood consumption contributes 78 percent of the total energy consumption (Abebe et al 2012). This shows the high dependence of households on the available forest resource which has a negative repercussion to the overall environment in general and the country's forest stock in particular.

Hence, “forest areas of the country have been reduced from 40% a century ago to an estimated less than 3%” a decade ago (Badeg, 2001). Cheng et al (1998: 199) noted that by the early 1980s the country's forest was deteriorated from 40 percent around 50 million hectares just before the turn of 20th century to 3.6 percent. Studies showed that the country was losing 160,000-200,000 hectares of forest land each year (FAO, 1981; UNEP, 1983, Constable, 1985, Kuru, 1990, Yirdaw, 1996) cited in Badeg 2001). Reusing (2000) also noted that Ethiopia's annual forest lose was about 163,000 hectares. But recent studies show that there is a little decrement in the annual forest lose as compared to years before. According to the study by FAO (2009), Ethiopia loses 141,000 hectares of forest land each year which is less by 20,000 to 60,000 hectares before the down of the 20th century. Nonetheless, the level of economic development of the country and proportion of the population which lives in the rural areas coupled with the rapid population growth still keeps the deterioration of the forest land of the country and makes the recovery work challenging. Thus, discussing the causes and triggering factors will give a better picture to understand the state the forest in Ethiopia and the overall situation of deforestation.

2.3.3. Causes and Impacts of Deforestation and Forest Depletion in Ethiopia

There are a number of factors discussed by different researchers regarding the causes of deforestation in Ethiopia. Some argue that deforestation in Ethiopia goes thousands of years back (Melaku, 1992, 2003; Pankhurst, 1995; Wøien, 1995; Ritler, 1997; McCann, 1995, 1999; Nyssen *et al.*, 2004, 2009 cited in Mulugeta and Tadesse 2010). This might have to do mainly with the long history of agricultural practice in northern and central highlands of Ethiopia. On the other hand, as noted by Mulugeta and Tadesse (2010: 140) deforestation in Ethiopia has accelerated over the last 150 years. Despite we had no the exact data of the old days, the second line of argument goes hand in hand with the available data. In fact, as noted above, Ethiopia has lost largest portion of its forest land which declined from 40 percent to 3 percent of the total area of

the country over a century only. So the question is what are the causes for such a dramatic decline?

Many related the large deforestation with high population growth that the country has been experiencing (Bielli et al 2001, Reusing 1998, Reusing 2000, EPA 2008, Zenebe, 2007). According to Reusing (2000: 1257), “the forest degradation in Ethiopia is closely linked to the ongoing population growth. More people generally lead to an increasing demand on land for living and for agricultural production.” As cited by Tsegaye (2007) “According to FAO (1994), more than 80% of deforestation or forest degradation is attributable to agricultural expansion.” As stated, rapid increase in population creates pressure on the overall environment and the forest land. Some further argue that the reason for the rapid deforestation is not only the increasing population which resulted in high demand for arable land but also increasing commercial activities (Tsegaye 2007). In the same token Zenebe (2007: 30) “The clearing of forests to expand agricultural land and tree cutting for fuel wood, timber and agricultural implements were the causes for the decline in forest cover” in Ethiopia.

In line with the rapid population growth, expansion of towns and cities has their own repercussion on the available forest stock. The need to meet construction materials has had a huge impact on Ethiopia`s forests as trees are cut for housing. It is worth mentioning here that rapid population growth is creating imbalance between demand and supply of forest related products such as timber and other construction materials. The expansion of infrastructure such as roads as well as mega hydraulic infrastructures-for instance the ongoing construction of the Grand Ethiopian Renaissance Dam which will create a huge reservoir has resulted in the clearing of the trees and vegetation cover on the land where the reservoir is to be created.

Some also argue that, governments’ policy has had its impact in increasing deforestation in Ethiopia. One most important reason could be, for instance, Ethiopia for long had no a forestry policy which has its own impact in conserving and maintaining forest areas. Ethiopia`s comprehensive forestry policy was for the first time introduced in 2007 which is a very recent development. In line with this, Ethiopia recently in 2012 established an independent ministry called Ministry of Forest and the Environment whose primary mandate is undertaking activities and formulating and implementing policies and strategies to conserve and implement the

country's forest in particular and the natural environment in general. In line with government policy issues, the resettlement programs have been regarded as one major factor which increases deforestation in Ethiopia. According to Mulugeta and Tadesse (2010: 141) "Although the objective of the resettlement program is to assist food insecure households get access to productive farmlands, the strategy, in most cases, is taking place through the clearing of natural vegetation, particularly forested areas." As explained by Gatzweiler, (2007: 4) "From 1973–87, forest cover" in Ethiopia was "reduced by 11% [as] that period was characterized by resettlement and villageization programs and the expansion of state farm programs." In line with this Mulugeta and Tadesse (2007: 141) explained that "between 2000 and 2004, about 220,000 household heads or 1.2 million people were resettled in the four National Regional States of Amhara, Oromia, SNNP and Tigray." The authors explained that the households resettled in the regions mentioned "carved out cropland and made settlement housing by clearing areas of their natural vegetation and using the woody resources unsustainably."

Besides, deforestation of natural forests in Ethiopia is also linked with land use change due to the conversion of forest into large commercial as well as private farm land. Government policy, in general, on different areas and issues is a crucial factor in determining the pattern and trend of deforestation in the country.

Studies by Dewees (1989 cited in Abebe et al, 2012: 4) "argues that fuel wood scarcity could result in increased deforestation, changes in cooking and eating habits, and the emergence of fuel wood markets." As will be elaborated in the proceeding pages, larger number of population in Ethiopia depends on biomass fuels to meet their energy needs in terms of firewood, charcoal and related purposes. Such heavy reliance on the forest has a vicious implication to the environment as whenever households perceive that they are in short of fuel wood they will search for untouched forest land which has an impact on the further deterioration of the forest.

2.3.4. Impacts of Deforestation

In the preceding part of this review it is clearly stated that there are tremendous factors affecting the forest resource of Ethiopia. In line with this the deferent causes of deforestation are overviewed. Taking the magnitude of the problem and the loses attached, it is easier to enumerate the multifaceted and complex as well as interwoven impacts of deforestation in

Ethiopia. In fact, as the significance of deforestation can be manifested in terms of the country's environmental, economic, socio-cultural as well as political situations, deforestation in one way or another will affect such aspects of life of the country. Deforestation has environmental, social, economic as well as political impacts which are interlinked and one reinforcing the other. As stated by Badeg (2001) "Deforestation and land degradation should be seen as the most important issues threatening the survival of Ethiopia. Floods, drought, desertification, drying of streams, and soil erosion are connected one way or another with the process of forest exploitation and destruction."

Environmentally, "[d]eforestation continues to cause environmental degradation in the form of land and water resources degradation as well as loss of biodiversity" (Demel, 2001 cited in Mohammed 2011). In line with this, deforestation has resulted in the deterioration of biodiversity and also decline in the quality and quantity of water in the country's water resources. For example, the high sedimentation and erosion in the Nile Basin in Ethiopia is linked with deforestation in the country (Woldeamlak 2004, Ahmed 2008, Easton et al 2010). This has its own impact on the storage capacity of different hydraulic infrastructures and reservoirs. Tsegaye (2007) has synthesized the different environmental impacts of deforestation in Ethiopia. In his analysis, Tsegaye stated that "natural calamities and land degradation" are the major environmental impacts with tremendous socio-economic as well as political consequences. In line with this, "Water shortage is another problem caused by deforestation... [as] the absence of a vegetation cover on the catchments, rainfall tends to create run-off instead of replenishing rivers and streams" (Tsegaye, 2007).

The environmental effect of deforestation has a tremendous economic consequence to the country. In this regard, "The disappearance of the forest cover leads to lack of material for soil regeneration and increased soil erosion which results in the reduction of soil fertility and declining agricultural production" (Bielli et al 2001: 1). This has had implications to food security. Besides in Ethiopia the recurrent drought which resulted in shortage of rain fall and the consequent famine which took the lives of hundreds of thousands if not millions Ethiopians is linked with the deterioration of the country's forest resource and deforestation (Boahene 1998, Badeg 2001,). In line with this, deforestation is also creating energy crisis in the country where the shortage of firewood pushes households to use dung and crop residue which has a

tremendous impact on productivity of the agriculture as the residue is turned to biomass fuel. Besides loss of genetic diversity is one of the major impacts that Ethiopia faced from the ongoing deforestation in the country.

It should be clearly noted that unless checked and corrective measures are taken deforestation will create an overall socio-cultural crisis by pushing, for instance, people to migrate when they observe that their land is no more productive and natural resources are dwindling as a result of deforestation. This process will create a congested urban environment which has another circle of economic, social, cultural as well as political consequences. The cumulative effect of deforestation will also create pressure on the political decision makers of the state and again might have implications which could undermine the works of the government. The droughts and consequent famines in the country under the three regimes of Hailesellase I, Derg and the current government are clear illustrations.

In general the impact of deforestation is beyond the destruction of forests and forest resources. It has environmental, socio-cultural, economic as well as political implications. This shows that deforestation as a problem should be solved and measures have to be taken so as to maintain and enhance the forest resources of the country to sustain life. As mentioned earlier, one of the causes and consequences of deforestation is energy crisis in Ethiopia where the majority of its population and almost the entire population in the rural area depends on forest resources such as firewood to meet their energy needs. But this linkage should be clearly reviewed to better understand the overall situation and the magnitude. The following section synthesizes the linkage between household firewood consumption and deforestation in Ethiopia.

2.3.5. The Link Between Deforestation and Household Firewood Consumption in Ethiopia: The factors

As mentioned earlier, one of the major causes of deforestation and forest degradation in Africa in general and in Ethiopia in particular is fuelwood consumption in the country. Despite Ethiopia has the largest potential to produce energy from renewable sources such as water, it is underutilized and the consequence is the heavy reliance on the forest to meet energy demands. Especially, as the majority of Ethiopia's population-some 80 percent of the total-lives in rural

areas, the reliance on biomass fuels is very high. But this does not mean that the urban areas in the country are free from such heavy reliance on forests to meet their energy demand. As clearly noted by Abebe et al (2012) that “Ethiopia is a typical example; nearly all of the rural population depends on biomass energy sources for cooking and other energy requirements.” According to Woody Biomass Inventory and Strategic Planning Project - WBISPP, (2004) fuel wood accounts 78 percent of the total energy demand as the rest 12 percent and 9 percent is covered by animal dung and crop residue respectively. In this context, “Ethiopia is the third largest user in the world of traditional fuels for household energy use, with 96% of the population dependent on traditional fuel (e.g. firewood, charcoal, agricultural residue and animal waste) to meet their energy needs” (Biazzarri 2010).

In 2000, the Ethiopian forests produced some 98 million cubic meter of fuel wood (Mulugeta and Tadesse, 2010: 139) which shows the heavy reliance of people on firewood. Therefore, “the most significant use of wood in Ethiopia in terms of volume is for fuel” (Mulugeta and Tadesse, 2010: 139). It is worth noting that “[w]oody vegetation contributes greatly to the local economy: the fuel wood industry is worth approximately USD 420 million a year” (Forum for Environment, 2010: xviii). From this one can conclude that there are people who depend on fuel wood to generate income and at the same time those who depend on it to meet their energy demands. On the other hand, the imbalance between demand and supply of fuel wood in the country clearly shows how much the country has faced the fuel wood crisis. Studies show that “the demand for fuel wood in 2020 will reach 100 million m³ against a supply projection of only 7.7 million m³” (Tsegaye 2007 citing MONREP 1994). This clearly demonstrates the pressure on the available forest in the country.

Different researches suggest that there is an established link between firewood consumption and deforestation especially in the third world. As stated by Kissinger et al (2012) the major cause of deforestation and forest degradation in Africa is fuel wood collection and charcoal production. This situation is clearer in Sub-Saharan Africa where people have no ample access to alternative energy sources and depend heavily on the forest. In line with this, Ethiopia`s deforestation is also associated with rapid population growth which has a huge impact on the forest by increasing, among other reasons, demands for energy such as firewood.

Household firewood consumption in Ethiopia, as noted above, is very high. Much of the country's population depends on biomass fuels to meet their energy demands. This "Heavy reliance on biomass fuels, particularly woody biomass and dung, contribute to deforestation, forest and land degradation" (Tadesse 2010, Alemu 2000). Similarly, Araya and Yissehak (2012: 8) argued that "Traditional energy use increases the rate of deforestation and land degradation, which in turn can lead to excess soil erosion and loss of soil fertility." Thus it can be concluded that excessive reliance on the forest for firewood is the cause for deforestation in Ethiopia.

On the other hand, the linkage can also be made as deforestation can also result in scarcity of firewood and as a consequence the emergence of energy crisis with far reaching consequences to the environment as well as agricultural productivity. Citing (Deweese 1989 and Heltberg et al 2000) Machl et al (2007: 3) noted that "Deforestation has created a situation of fuelwood scarcity to the point that an impending "fuelwood crisis" looms in many settings." Therefore, the linkage between deforestation and firewood consumption is vicious and one triggers the other. Generally speaking, in Ethiopia where the majority of the population both in rural and urban areas depends on biomass fuels such as firewood to meet their energy demands deforestation is inevitable as it has been seen that the demand outweighs the supply due to forest degradation and deforestation as well as many other related reasons. The question is what are the factors affecting such heavy reliance on firewood consumption in Ethiopia?

Household firewood consumption in Ethiopia is determined by a number of factors. It should be clear that since time immemorial Ethiopians depend on firewood to meet their energy demands. As clearly stated above, the majority of the Ethiopian people-almost 80 percent or above lives in the rural area where there exists low infrastructure development as well as different facilities. In many African countries including Ethiopia the major determining factor that contributes for the heavy reliance on biomass fuels notably firewood is poverty (Zenebe 2007, Alemu 2000). But it is relevant here to make distinction between the rural and urban households.

Rural Ethiopia is characterized by low infrastructural development and limited availability of alternative sources of energy. In fact, in recent years the introduction of improved stoves to the rural areas which are more effective in saving biomass fuel sources has its own impact on the decision of households (Zenebe 2007, Alemu 2000). Besides, level of education, number of

cattle, ownership of vegetation/tree resources, forest endowments as well as policy interventions are other determining factors. In recent years the massive electrification process being undertaken by the government in the future will create much more alternatives. But as much of the firewood is being used for cooking, it can be best argued that, the choice of the rural people is very much limited. In general terms, however, poverty remains the main determining factor for rural households in choosing fuels.

On the other hand, the urban households have plenty of alternative fuel sources where there are different and wide varieties of determining factors as compared to the rural households. For obvious reasons, the price of the available fuel is the determining factor in urban household decisions of fuel choices. This is mainly because urban households are sensitive to prices. As concluded by Zenebe et al (2010: 17) “In addition to prices of related goods household income (expenditure), other household characteristics, such as family size, and age and education of household head, are important variables for explaining a household’s decision to consume a particular fuel.” Besides the availability of other fuel sources such as kerosene and electricity are very crucial in determining the choices of households. In line with this, the preferences and conditions requested by house owners against renters is one determining factor on the decision of households.

2.4. The Nexus Between Urbanization, Firewood Consumption and Deforestation

Urbanization is defined as the process of the growth in the proportion of the population living in urban areas and the further physical expansion of already established urban centers (Samson, 2009; Alaci, 2010 cited in Leulseged et al 2012). For different historical, political, economic and socio-cultural reasons the level of urbanization is very high in developed countries and is very low in developing countries. But recent developments also show that developing countries such as in Africa are showing high rate of urbanization mainly due to rural–urban migration, economic growth and development, technological change, and rapid population growth (Marshall et al., 2009). The expansion of urban centers have both positive and negative impact in socio-cultural, political, economic, technological as well as environmental issues of countries. Mainly, unless managed properly this expansion have an impact on the surrounding environment. At least the expansion of urban centers resulted in a land use change and this has its own consequences on the environment at large as well as on the livelihood of peri-urban

dwellers. Studies in Kolfe Keranyo sub city of Addis Abeba show that the expansion of Addis Ababa mainly the built up areas, for instance, "has shown increasing trends at the expense of 5 agriculture and forestland" (Leulseged et al 2012). Besides this, the expansion of urban centers may also affect the peri-urban forest land mainly due to the need to meet energy sources. According to Barnes et al. (2004 cited in Zenebe et al 2005: 1) "Urban centers have long been dependent on rural areas for their fuel." Thinking of urbanization, the general picture is mainly-pertaining to energy, the primary sources are modern energy sources such as electricity and gas and low dependence on forest resources or biomass fuels.

"Although urbanization and increased per capita income usually result in greater use of modern fuels, such as gas and electricity and a fall in the share of traditional biomass, this has not happened in many African cities including those in Ethiopia" (IEA, 2004, Chambwera and Folmer, 2007 cited in Alem et al 2013). The dependence of urban centers on the surrounding peri-urban as well as rural areas for their fuels, therefore, might create a devastating impact on forest resources unless managed. In fact, "The environmental impact of urban fuel demand in general and the reliance on biofuels in particular—primary sources of forest degradation—are well established (Heltberg 2004; Edwards and Langpap 2005 cited in Zenebe et al 2005: 1). Alemu and Gunnar (2008) also further noted that " Heavy reliance of urban households in sub-Saharan Africa on biomass fuels (such as woody biomass and dung) contribute to deforestation, forest degradation, and land degradation. This is partly because use of these fuels in urban areas is an important source of cash income for people in both urban and rural areas."

2.5. Urban Household Firewood Consumption in Ethiopia: Implications to the Forest

In developing countries, as mentioned above, the major source of energy is more of biofuel as compared to the developed countries. The penetration of modern fuel sources as well as improved stoves in the developing world is low. In fact, the urban areas in the developing world—mainly in Sub-Saharan Africa have access to electricity as compared to the rural areas. Hence there is a wide disparity between the urban and rural areas. According to recent studies, "87% of rural population lack access to electricity, compared with 56% in urban areas in developing countries; and 27% of urban residents have access to modern fuels, compared with 3% of the population in rural areas" (ECA, 2013: 2). As a result there is high dependence on biomass fuels

and mainly wood is the major source of energy. In fact, “about 70% of the developing countries’ population relies on wood and its by-products as main cooking fuel” (ibid).

Despite the penetration of electricity in urban Sub-Saharan Africa its end use is in one way or another limited to lighting. As a result, most of the African countries south of the Sahara depends on biomass fuels for cooking. In Ethiopia, for instance, biomass fuel-which includes firewood, animal dung and crop residue accounts 90 percent of the country’s energy demand out of which 6 percent is the share of the urban areas (Samuel 2002). Thus, although 85.2% of the urban population had access to electricity as of 2011, ... half the households rely on traditional biomass (wood, and agricultural residues) for cooking, and in rural areas, virtually all do (except for 0.2% who use kerosene, and 1.2% charcoal) (Zeray et al, 2013: 4). From this one could argue that the electricity available in urban areas is used for limited services. As stated by Zenebe et al (2010: 9) despite the stated access to electricity in the urban areas of Ethiopia “by and large, lighting is the dominant end use in the domestic sector and the use of electricity for baking is limited to larger towns and to a very limited number of households.” Hence, those households who do not have the opportunity or the luxury to have access to electricity for cooking relies on some other sources mainly biomass fuels.

In urban Ethiopia, like in any urban Sub-Saharan Africa people do rely on biomass fuels mainly firewood for cooking purposes. According to UN (2004: 12) “firewood is widely used for cooking in both rural and urban households. The only slight difference is that urban households purchase their firewood whereas their rural counterparts collect it.” For instance, in the capital city of Ethiopia-Addis Ababa, large numbers of people depend on firewood as energy source. “Cooking, especially that of the traditional bread *injera*, accounts for 85% of household energy use in Addis. 6% is used to heat water and space, and an average of just 1% is used for lighting (Araya and Yissehak, 2012: 3 citing Woody Biomass Inventory and Strategic Planning Project, 2004). In general terms, “approximately one quarter of the population in Addis Ababa depends on fuelwood for their primary fuel, with 8% depending on crop residue and 4.5% depending on charcoal” (Bizzarri 2010: 12). This dependence on firewood has its own implications of different kind.

Throughout history urbanization has a number of socio-economic, cultural, political as well as environmental consequences and implications. As stated by Tadesse (2010) “urbanization does not have only local environmental impacts but it also has a large ‘ecological footprint’ beyond its immediate vicinity. Intensive and extensive exploitation of natural resources to support the urban economy includes use of high amounts of energy resources (including fuel wood), quarrying and excavation of sand, gravel and other building materials on large scales, and over extraction and inefficient delivery and use of water.” Especially when modern energy sources are not the dominant, the heavy reliance of urban centers on firewood to meet their energy needs have a number of environmental consequences. In fact, “with increasing population and urbanization over time, urban household energy is an important issue for developing countries in general, and for poorer developing countries, such as Ethiopia, in particular” (Alemu and Gunnar 2008: 1). In one way or another, the more urban areas depend on firewood or related woody products for their energy need the greater the pressure on forest resources.

Alemu and Gunnar (2008: 1) has clearly synthesized and described the environmental and related impacts of heavy reliance of urban households on biomass fuels. For the authors such reliance “contributes to deforestation, forest degradation, and land degradation. This is partly because use of these fuels in urban areas is an important source of cash income for people in both urban and rural areas" profit making can affect the forest stock. Besides, "use of woody biomass as fuel and as construction material contributes to deforestation and forest degradation." It should also be noted that the reliance of urban households for firewood consumption is a reliance on the rural area and the forest resources there as urban areas lacks the space of cultivating such resources. Hence the reliance is on the rural environment either where the consequence and implication is multifaceted and complex.

So far, relatively a limited number of researchers have studied the issue of firewood as a source urban energy in Ethiopia especially in Addis Ababa. Most studies are confined on rural areas. Tadesse Amara (2010) for instance have discussed the review of the urban environment in 2008 where he also touched up on the issue of urban energy in which, he also discussed its linkage with the natural environment despite not an in-depth one. In the same forum on Ethiopian Environmental Review Hilawe Lakew (2010) have also highlighted Ethiopian energy Sector Review for up to 2008. In his article Hilawe holistically discussed the energy situation in

Ethiopia and the challenges which he concluded that the challenges are manageable. In the Green Forum Conference Proceedings in 2007, energy issue was discussed under different topics related with the environment (Seyoum and Camille, 2007). Abebe et al (2012) while discussing *Coping with Fuel scarcity: Household responses in rural Ethiopia* have also discussed a little the situation of urban energy in the country.

A 2007 Doctoral dissertation by Zenebe Gebreegziabhier titled *Household fuel consumption and resource use in rural-urban Ethiopia* have discussed the issue of energy especially in relation to use of firewood. The 2009 Masters thesis *Domestic Energy Consumption and Deforestation in Harari region: Assessment of Students' Awareness and Views* by Nebiyu Abesha was also another contribution in the discussion on firewood and energy issue. Alemu Mekonnen and Gunnar Köhlin (2007) have published their research on *Determinants of Household Fuel Choice in Major Cities in Ethiopia* by which they give emphasis for different factors on household's decision in choosing fuels. In 2012 Araya and Yissehak published their article on *Sustainable Household Energy for Addis Ababa, Ethiopia* by which they clearly asses the trend of distributions of different energy sources in the city from 1995 to 2005. The authors concluded that in the mentioned years "traditional fuel consumptions in Addis Ababa increased by about 10%. At the same time, modern fuel consumption increased by 50%. The overall trend is positive, but in addition to electricity, other relatively sustainable fuels such as ethanol could still be promoted."

The reviewed studies, however, were with limitations of different kind. But in general, most of the studies were conducted at macro level and the focus was more of from economic points of view except a few like Nebiyu (2009) who tried to see its linkage with deforestation but again focusing on Students' awareness. This current research is one which focuses on studying the issue at a micro-level by focusing on *Woreda 5* of Gulele sub-city in Addis Ababa. This will help to better understand the different factors affecting the decision of households in choosing different fuel sources and their implication to deforestation. This will assist to come up with a specific and targeted policy formulation and implementation in different ways. Firstly, it will help to inform what kind of policy intervention should be taken in that particular study area. secondly, it can be used as a lesson for other areas with similar socio-economic conditions.

2.6. The Firewood Consumption Situation: Current Status and Deforestation

In line with the different socio-economic characteristics of households, the availability of firewood, its price, availability of alternative sources of domestic energy are important variables seen as important factors in affecting household firewood consumption in Woreda 5. To understand the overall fuelwood consumption, in the following sections an attempt is made to discuss the pattern of firewood consumption and different interventions such as the Addis-Bah project and the problems associated with firewood consumption and deforestation.

Like any part of Addis Ababa, for people in and around Gulele area, the sole energy source had been fuelwood and mainly Eucalyptus what is locally known as *Bahir Zaf*. Following the plantation and widespread presence of Eucalyptus forests around the surrounding mountainous areas of Addis Ababa, there was an abundance availability of fuelwood to the city dwellers which makes living in Addis Ababa possible. As stated by Araya and Yissehak (2012: 2) "if it were not for the dramatic success of eucalyptus, Addis Ababa would not have come to exist as the Emperor would have been forced to move elsewhere to look for fuelwood." But with the increasing population of the city and the consequent increase of demand for wood as energy source as well as for construction in the city, the forest in and around the city was subject to consumption which resulted in deforestation and forest degradation (Fekerte 1991).

The late 1970s and 1980s showed a dramatic depletion of the surrounding forest resource of Addis Ababa and mainly the city was confronted with mounting energy crisis. Partially this was due to the nationalization process by which the Entoto Forest lost protection. This made the Forest a public property and there was no real owner who was responsible for its protection and this made the forest vulnerable to different kinds of encroachments on the forest. As a result, people in and around the city was forced to choose for alternative energy sources mainly animal dung, charcoal and crop residue. "Based on a survey conducted at the time, fuelwood production accounted for 38% percent of the total energy production, while charcoal accounted for 5%, crop residue for 24% percent, and cow dung for 23%" (Pohjonen & Pukkala, 1988 cited in Araya and Yissehak 2012: 2). This forced the government's intervention as the problem was alarming. The government, therefore, tried to intervene by focusing on three areas namely; a) supply

augmentation, (b) demand management, and (c) inter-fuel substitution (MGP Ltd, 2002). Taking its importance to the discussion of this thesis the supply augmentation in Addis Ababa city mainly the Addis-Bah Fuelwood Project is discussed below.

The late 1970s and 1980s Ethiopia was characterized by severe urban fuelwood crisis which forced the then government under the Derg to initiate programs across major cities. To this end large scale peri-urban fuelwood plantation was initiated. According to Fekerte (1991), the Government of Ethiopia through the Ministry of Agriculture in collaboration with the World Bank (WB) and Africa Development Fund (ADF) tried to upgrade the eucalyptus plantation in the Addis Ababa region through a project called Addis-Bah Fuelwood Project and an area of 14,637 ha of land was planted between 1984 and 1989.

As a project "Addis-Bah [was] started by rehabilitation of old plantations together with the establishment of new plantations" (FDRE/EPA 1998: 88). The World Bank in its 30 May 1995 report stated that, the Addis-Bah Fuelwood Project, has "succeeded in achieving its broad objectives" and mainly "[f]rom an environmental perspective, the project was moderately successful in arresting degradation of plantations through the protection/rehabilitation of plantations around Addis Ababa" (World Bank, 1995). The 1998 FDRE-Environmental Protection Authority report also stated that, despite problems associated with the selection process of plantation sites by not involving the communities, the fuelwood plantation projects "have increased availability of fuelwood tremendously and these resources are still being used at present" (FDRE/EPA, 1998: 88).

According to a study by MGP Ltd (2002,) the massive afforestation programs of the Derg through projects such as Addis-Bah was important in alleviating the energy crisis of Addis Ababa in the late 1970s and 1980s. Likewise, Fekerte (1991) clearly stated that the Addis-Bah Fuelwood Project did help a lot in making firewood available at reasonable and low price. But the problem in the post-1991 period has shown a downturn of state-led afforestation practices and resulted in high deterioration of the forest around Addis Ababa (Interviewee, MGP Ltd 2002).

The post-1991 period has marked a turning point pertaining to the Addis-Bah project and the fuelwood market in Addis Ababa. This mainly has to do with the liberalization of the market by

the new government following the fall of the *Derg*, and the fuelwood market at the same time was liberalized and becomes subject to the free market ideology. This allowed the proliferation of fuelwood depots and retailers across the different corners of the Addis Ababa city. For instance, in Woreda 5 alone there are 5 fuelwood depots with licenses from the Woreda Trade and Industry Bureau not to mention women fuelwood carriers and fuelwood vendors from the nearby villages.

The free flow of wood harvested from the Entoto Mountain or the nearby villages of Addis Ababa in the post-1991 period for long resulted in the deterioration of the nearby forests. Because of low expansion of alternative sources of energy as well as their expensiveness for the majority of the people make firewood indispensable source of energy for the city dwellers. This was one of the trends observed in the history of firewood consumption in Addis Ababa. According to a study by Araya and Yissehak (2012) for instance in 1995 the contribution of traditional fuel sources including firewood was 82 percent of the primary energy and was reduced to 76 percent in 2005. In the same year of 1995 the contribution of firewood alone was 74 percent of the total energy consumed and in 2005 "it was declined by 22% but it continued to supply 56% of the household fuel" (Araya and Yissehak, 2012: 5-6). The main reason undoubtedly is the expansion of modern fuel sources such as hydropower generated electricity, kerosene and liquid petroleum gas. For instance, "in 2005, however, electricity use increased by an astonishing 2293%" (Araya and Yissehak, 2012: 6). This shows an increasing decline on firewood consumption in the city which was confirmed by the survey conducted for this research.

2.7. Forest Policy of Ethiopia: A Synopsis

The forest policy of Ethiopia of the post-1990s was developed together with the environmental policy of Ethiopia in 1997. The overall objective of the environmental policy is "to improve and enhance the health and quality of life of all Ethiopians, and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole, so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs" (FDRE-EPA, 2004: 9). The policy document under the Forest, Woodland and Tree resources

section states that, one of the policies include: "To encourage all concerned individuals and communities as well as the government to actively involved in the planning and implementation of forestry programmes to ensure sustainability, minimize cost, and forestall conflict."

As stated by Sisay (2008) "the policy presents ideas that address issues such as complementary roles of communities, private entrepreneurs and the state in forestry development; integration of forestry development with land, water resources, energy resources, ecosystem and genetic resources development in addition to crop and livestock production." In 2007 the Government of Ethiopia promulgate a law "to provide for the development, conservation and utilization of forests" under Proclamation 542/2007. Moreover, in April 2007, the Council of Ministers adopted forest development, conservation and utilization policy and strategy. The main goal of the policy is to conserve the forest resources of the country and utilize forest products in a sustainable manner in a way that maintains environmental conservation. The proclamation sets different provisions regarding the conservation, development and utilization of private and state forest resources in a comprehensive manner. In line with developing national forest laws and policies, Ethiopia has also signed a number of international conventions that complements its national policies and programs.

The abovementioned policies are basic in conserving forest resources of Ethiopia. "Existence of environmental policies and strategies: Ethiopia has made admirable efforts in terms of policy and strategy responses to address environmental degradation (Gedion, 2001 cited by Adugnaw 2014: 31). In line with the environment and forest policies, the energy policy of the country, which is based on renewable energy sources is crucial in providing clean, affordable, and sustainable energy for the poor which has a huge positive impact on the conservation of forests in both rural and urban areas (FDRE 2011).

One of the qualities of the forest policy of Ethiopia is that it sets a strategy to increase the land covered by forest from 3.5 percent to 9 percent within five years. The encouragement of private forest development, utilization and conservation is a very strong side of the policy as the government is attempting to give a space for the private sector to involve in the forest sector of the country. Nevertheless, it is difficult to say that urban forestry has got immense attention in the government policies, which is one of its major drawbacks.

2.8. Factors Determining Household Energy Choices

As stated in the previous sections, pertaining to energy choices those in the urban areas are perceived to shift to modern energy sources because of its availability and also due to different socio-economic factors. In the developed countries access to modern energy sources is well established in both rural and urban areas. But in developing countries due to different factors we have less penetration of access to modern energy sources. Especially in Sub-Saharan Africa access to modern energy sources is very much limited. Even in urban areas where penetration of modern energy sources is higher as compared to the rural areas, there are large number of population without access to modern energy sources. These might be related with household's energy choices due to a lot of determining factors.

Different studies in the past using the "the lens of the energy ladder model" tried to show that there is a strong link between household income and the choice of energy sources. The idea is that with the increase in income people may shift to modern energy sources such as kerosene and electricity. "Based on this, most empirical studies tend to agree that income is a key determinant of total energy demand" (Heltberg 2005 cited in Alem et al 2013). The focus of the energy ladder model is therefore the income of households in their energy choices. But this model have faced criticisms who claimed that household income is not the only determining factor of household's energy choices "because fuel use decisions are influenced by several other social and economic factors" (Masera et al., 2000 in Alem et al 2013). Furthermore. "this idea of an energy-demand ladder has also been criticized, since the widespread use of multiple fuels for a particular purpose (such as cooking) has suggested the presence of fuel stacking for a given purpose (Davis 1998; Heltberg 2005 cited in Alemu and Gunnar 2008)." The idea is "multiple fuel use better describes household fuel use" (Alem et al 2013).

Fuel staking or the use of multiple fuels is a result of various reasons and factors. According to IEA (2002 cited in Alem et al 2013) "studies suggest that fuel availability, affordability and cultural preferences are main determinants in the transition from traditional to modern energy use." Zenebe et al (2010) also summarized the determinants of household fuel use and fuel switching analyzed by Heltbrg (2004) which was conducted by comparing the survey data from six developing countries. Hence, the major determinants identified were

- Per capita expenditure positively related to modern fuel use, whereas it related negatively to solid fuels.
- Electrification of the household enhanced modern fuel use, while it decreased use of solid fuels.
- Using a mix of fuels, both solid and non-solid, was related to larger family size.
- Higher levels of education were associated with a greater probability of the household using modern fuels and a lower probability of using solid fuels.
- The availability of tap water inside the house enhanced fuel switching.

From the above findings one can note that income, availability of modern energy sources, higher level of education, larger family size and availability of tap water were identified as determinants of household fuel choices. In this regard, for instance, large family size is associated with the consumption of traditional fuel sources such as firewood (Alem et al 2013). The level of education of households is also emphasized especially in creating awareness on the negative impacts of the use of firewood (Alemu and Gunnar 2008). In this regard Chambwera and Folmer (2007 noted in Alem et al 2013) "note that education can be considered as a long term policy to handle and manage the demand for firewood."

Different studies use different methods such as qualitative, quantitative or econometrics and reach on different conclusions. Their commonality, however, is that there are various factors which determine household fuel choices. And from the above discussion it can be noted that fuel staking or multiple fuel use is becoming more dominant. Hence within the framework an attempt is made to understand the different factors which influence household firewood consumption in Woreda 5 of Gulele Sub-City. This research therefore uses descriptive analysis to understand the nature of the different factors determining the firewood consumption of the study area. Besides tables are used to examine the frequencies, percentages and correlations of the different variables identified.

Chapter Three

3. Description of the Study Area and Methods

3.1. The Study Area

3.1.1. Geographic Description

Gulele Sub-city, which is one of the ten sub-cities of Addis Ababa is located in the northern part of the city. Within the city, it shares borders with four sub-cities. While Addis Ketema and *Arada* sub-cities borders *Gulele* Sub-city to the South-West and South-East respectively, *Kolfe Keranyo* and *Yeka* Sub-cities are to the West and East of this sub-city, respectively. To the north, *Gulele* sub-city shares borders with the Oromia National Regional State. Administratively, according to information from the Addis Ababa City Administration Integrated Land Information Center (AACA-ILIC, 2014: 6) *Gulele* Sub-city is divided into 10 Woredas, 73 Sub-woredas, 200 Sefers and 546 blocks. *Gulele* Sub-city covers 3119.09 hectares (31.19 km²) of land which is 6 percent of the total land area of the city. This makes *Gulele* the sixth largest sub-city in Addis Ababa.

Woreda 5 which to some extent includes the entire area which is commonly called *Kechene* is one of the oldest and the least developed areas in Addis Ababa as compared to other newly developing areas of the city. *Woreda 05* which is the specific study area of this research covers 136.81 hectares of land which is 4.39 percent of the total land area of *Gulele* Sub-city and is placed as the 8th largest *Woreda* in the Sub-city only bigger than *Woreda 03* and *04*. Administratively, *Woreda 05* is divided into 4 Sub-*Woredas*, 13 Sefers and 39 blocks (AACA-ILIC, 2014: 22). *Woreda 05* has an elongated shape which is nearly similar to a queen of a chess piece. *Woreda 05* is situated almost at the center of the Sub-city and is surrounded by *Woreda 06* to the north-east, *Woreda 07* to the West, *Woreda 04* to the South, *Woreda 03* to the south-east and *Arada* Sub-city to the south-west. Except for its northern and southeastern tips, *Woreda 05* is highly characterized by well built areas. While, the northern tip is full of green plantation which is mainly covered by *Tid* (*Junipers procera* and *Cupressus lustanica*) and *Bahrzaf* (*Eucalyptus species*) and is mountainous as part of the chain of the *Entoto* Mountain, the southeastern tip is a graveyard.

3.1.2. Population of the Study Area

According to the 2007 census, it is estimated that, the total population in Gulele-Sub-city was 276,381 during the census year and this accounted for 10 percent of the total population of the city. Gulele is, therefore, the fifth populous sub-city in Addis Ababa. The average population density in the sub-city was at 85.72 persons per hectare. Out of the total population, 129,239 were male and 138,142 were female (AACA-ILIC 2014). This shows the number of female population is a little higher than the male population.

According to the 2007 population census with a total population of 24,484, Woreda 05 accounts 9.16 percent of the total population of the Sub-city. From the total population 12,200 are male and 12,284 are female. Like at the Sub-city level in Woreda 05 it can be observed that there is a slight difference between male and female population as the later is a little bigger than the former. The population density in Woreda 05 is 178.97 population per hectare which makes the Woreda the second densely populated Woreda in the Sub-city only preceded by Woreda 03 which has the population density of 304.35 people per hectare. This makes Woreda 05 the second densely populated Woreda in the Sub-city.

3.1.3. Economic Activities in the Study Area

The source of income in Woreda 05 varies from trade through service provision of any kind to government salaries. Among others, the local economic activities that characterizes *Woreda 5* and its surrounding are weaving and pottery. Retail trade, taxi services, bakery, daily labor, small scale bars and restaurants and the selling of local drinks are among the common economic activities of the area as well. Apart from the aforementioned ones, wood and charcoal trade, flour mills are also common in Woreda 05.

3.2. Methodology

3.2.1. Research Design and Methodology

3.2.1.1.Source and Method of Data Collection

In order to achieve the objective of this study, the research applies primary and secondary data collection methods. The primary data was collected through survey by means of questionnaires, interviews and field observations. Secondary data was collected by reviewing books, journals articles, workshop papers, and internet sources about issues related to deforestation and factors affecting urban household firewood consumption.

3.2.1.2.Sampling Techniques and Sample Population

According to the 2007 census there are 5,457 households in Woreda 5 (CSA, 2007: 165). Taking the mentioned entire household for this research would be difficult taking time, energy and enormous financial cost. Hence, the data for this research is collected through simply random sampling technique by which the households were selected randomly from *Woreda* 5. The total numbers of household randomly selected were 150 households. To make the sampling more representative, the researcher used the 13 *Sefers* and the 39 blocks of Woreda 05. Hence, all the 150 sample households are taken from all the *Sefers* and blocks mentioned which means at least 3.84 persons are taken as samples from each block.

Besides in Woreda 5 according to the surveyed data, there are 5 major fuelwood depots and firewood retailers. All the five were included in the study because their number was manageable.

3.2.1.3.Data Collection Instruments

The research applies both quantitative and qualitative approaches. The use of both methods as a mixed approach helps to understand and explain the factors that influence household decision of consuming firewood. Therefore, the instruments of data collection used were determined by the type of data which was needed for this research. Hence, the following instruments of data collection were used.

Household Survey:- In line with the objective of the research, information was collected from household heads through household surveys. This is mainly because, "A survey design

provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. From sample results, the researcher generalizes or makes claims about the population" (Creswell 2009). To this end, two sets of semi-structured questionnaire was prepared and distributed to the household heads and fuelwood depot owners and retailers.

In-Depth Interview:- In-depth interviews were conducted with key-informants from different government offices in order to gather data regarding government policies on the forest in Entoto and the amount of fuelwood auctioned each year. Hence, one officer from the sub-city Administration and another from the Woreda 5 Administration bureaus were interviewed. Besides, all the heads of the households surveyed were also interviewed about issues pertaining to housing, firewood consumption and access to electricity issues which are not dealt in detail in the questionnaires.

Field Observation:- "Observations, in which the research takes field notes on the behavior and activities of individuals at the research site. In these field notes, the researcher records, in an unstructured or semi-structured (using some prior questions that the inquirer wants to know) way, activities at the research site" (Creswell 2009). Hence, an attempt is made to observe how fuelwood depot owners and retailers deals business with household firewood consumers. Another observation is also made to the Entoto Forest where the researcher observed the installation on infrastructures, real estate development and also collection of already auctioned trees by the government to traders. While undertaking the household surveys and interviews with household heads, attempt is also made to the different fuels used by households such as firewood, charcoal, kerosene and electricity stoves as well as the housing issues.

As clearly seen above the three different data collection instruments were collected concurrently which allows the researcher to better integrate the different data gathered through different techniques.

3.2.1.4.Methods of Data Analysis

The gathered primary and secondary data by means of survey questionnaire and interview is organized and analyzed through descriptive analysis which is instrumental to understand the

nature of the different factors determining the firewood consumption of the study area. Qualitatively data was gathered by means of in-depth interview and field observation. Concerning quantitative data, household sample survey data collected through questionnaires was coded and entered into a computer for analysis, using the SPSS (Statistical Package for Social Science) software. Apart from the descriptive statistics used to analyze the frequencies, means, and percentages of the variables analyzed through the software, tabulation and cross-tabulation techniques were also used to see how variables are correlated.

In other words both quantitative and qualitative strategies of inquiry were used and the data analyzed was integrated . The mixing of data was done through a process what Creswell (2009) called Concurrent Mixed method. According to Creswell (2009) in the concurrent method "the researcher converges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. In this design, the investigator collects both forms of data at the same time during the study and then integrates the information in the interpretation of the overall results." The variables that were observed are socio-economic as well as cultural in nature. Income, family size and marital status, price of firewood, tenure status of respondents, holidays and feasts and availability and affordability of modern energy sources were the variables identified in influencing household firewood consumption in Woreda 5.

Chapter Four

4. Data Presentation and Analysis

As stated in the previous chapter the main objective of this study is "to understand and explore the factors affecting household firewood consumption in *Woreda* 5 of Gulele Sub-city of Addis Ababa and how deforestation is manifested in the process." Together with this, the thesis also attempted to understand the pattern of household firewood consumption in the recent past with the intent of checking whether it is on the rise or declining. To this end an attempt is made to analyze the questionnaires provided for households and firewood depot owners. Thus, analyzing the socio-economic characteristics and situations of the households gives a general picture about the determining factors about household firewood consumption. And in the following section an attempt is made to discuss the socio-economic characteristics of households and developments in relation to substitution of household firewood consumption by other energy sources.

4.1. Socio-Economic Characteristics of Sample Households

A total of 150 households were used as inputs for this study. As stated earlier an attempt is made to make the sample more representative. Hence, all the 13 *Sefers* and 39 blocks are represented by 3.8 persons from each block. In line with this, all firewood depot owners and firewood retailers are included in the study.

The different household characteristics such as household income, housing situation, household size, education and related issues are regarded as important variables in affecting household firewood consumption.

Age

The age distribution varies among the household heads between 17 and 85 years. To make the data from the sample population manageable and easier to analyze, an attempt is made randomly to look into the age distribution by organizing them into seven age groups with eight years of age difference. With frequency of 47, the majority of the respondents fall under the category 26-35 years old (31.3%) followed by 36-45 (24%) and 46-55 years (13.3%). Only 2 percent of head of households are between the age range of 76 and 85.

Table 4.1. Age structure of the head of households

Age range	Frequency	Percent
17-25	18	12.0
26-35	47	31.3
36-45	36	24.0
46-55	20	13.3
56-65	12	8.0
66-75	14	9.3
76-85	3	2.0
Total	150	100.0

Source: field survey

Sex

According to the 2007 census, the total number of population in Woreda 5 is 24,495 of which 12,208 are male and the rest 12,287 are females (CSA 2007: 165). Out of the total 150 sample households, 121 (80.7%) are female household heads and the rest 29 (19.3%) households are headed by males.

Table 4.2. Sex of head of households

Gender	Frequency	Percent
Female	121	80.7
Male	29	19.3
Total	150	100.0

Source: field survey

Marital Status

Regarding marital status 101 respondents (69.2%) responded that they were married while 40 respondents (27.4 %) said that they were single. As will be discussed below there is a link between marital status and firewood consumption as those who are single consume less firewood than those who are married.

Table 4.3. Marital status of the head of households

Marital Status	Frequency	Percent
Single	40	27.4
Married	101	69.2
Divorced	4	2.7
Widowed	1	.7
Total	146	100.0

Source: field survey

Family Size

The family size of households ranges from 1 to 12. As can be seen in the table, 49.7 percent (72 respondents) have a family between 1 to 4 and 38.6 percent (56 respondents) have a family between 5 and 8. Besides, 11.7 percent (17 respondents) said they have a family size between 9 and 12. Hence, the average household size in Woreda 5, according to the information obtained from the survey, is 4.95. Relatively this family size is bigger and its link with firewood consumption is relatively high.

Table 4.4. Family size of households

Range of family member	Frequency	Percent
1-4	72	49.7
5-8	56	38.6
9-12	17	11.7
Total	145	100.0

Source: field survey

Household Income

Household income varies from household to household and the source of that income is also various and includes categories from daily labor through government as well as private employee to self-employed business people-big or small. As can be seen in table 4.5, the family monthly income varies from 250 Ethiopian Birr to more than 5000 Ethiopian birr. The average household income in Woreda 5 based on the survey is 1717.07 Ethiopian Birr. However, the income of 65.9 percent of the sample household is less than 2000 Ethiopian Birr. It is only 12.7 percent who get monthly incomes of more than 3000 Ethiopian Birr.

Table 4.5. Monthly Income of Households

Income	Frequency	Percent
250-650	35	23.3
651-1050	38	25.3
1051-1450	9	6.0
1451-1850	17	11.3
1851-2250	14	9.3
2251-2650	7	4.7
2651-3050	11	7.3
3051-3450	1	.7
3451-3850	3	2.0
3851-4250	6	4.0
4251-4650	3	2.0
4651-5050	1	.7
greater than 5550	5	3.3
Total	150	100.0

Source: field survey

Level of Education of Household Heads

In Woreda 5 the level of education of household heads includes people those who are illiterate to college/university graduates. While 23.5 percent (35 respondents) are unable to read and write 13.4 percent (20 respondents) say they can read and write. 19.5 percent (29 respondents), 25.5 percent (38 respondents) and 18.1 percent (27 respondents) are elementary, high-school and

college/university graduates respectively. If we relate it with age with level of education, 31 of the illiterates out of 35 are above the age 36.

Table 4.6. Level of education of heads of the households

Level of education	Frequency	Percent
Illiterate	35	23.5
Literate	20	13.4
Elementary school	29	19.5
high school	38	25.5
college/university	27	18.1
Total	149	100.0

Source: field survey

Housing Status

Housing shortage has been a serious problem in a fast growing urban areas like Addis Ababa. In general, people are left with three options such as owning their own houses, living in public sector or rental accommodation and renting privately owned houses. All the three are available in Woreda 5 of Gulele. And according to the survey from households private home owners account for 31.3 percent of the 150 respondents (47) and 18 percent of the respondents (27) said they have managed renting a house from private owners. The rest 50.7 percent (76 respondents) have secured public houses from the government. As per firewood consumption, in this research as discussed below, the researcher finds a link with housing status especially pertaining to using electricity and minimizing dependence on firewood.

Table 4.7. Tenure Status of the Respondents

Housing Status		Frequency	Percent
Owner occupiers		47	31.3
Tenants living in	public sector rental units	76	50.7
	Private sector rental units	27	18.0
	Total	150	100.0

Source: field survey

While discussing the different variables in the study area one of the problems identified was the lack of research and census conducted on some of the variables. For instance, according to the information from the Central Statistics Authority (CSA) so far no separate census is conducted at micro level on either Gulele Sub-City or Woreda 5 on the total number of employed population, access to electricity and access to energy saving stoves. The latter two variables are covered in this study by focusing on the sample households.

As can be observed from table 4.8, most of the households use a combination of different energy sources at different time. This shows that people are no more solely dependent on firewood consumption to prepare their meals. Among the use of the combination of energy sources using the mix firewood and charcoal is the most popular one with 20 percent of the respondents consumes the mix of both. This is mainly because of the availability and the lack of other options for the majority of the respondents. It should also be noted that during frequent power interruptions those who also uses electric power also switches to firewood and charcoal. This is further evidenced by the combined use of electricity, charcoal and firewood as illustrated in Table 4.8. The second popular mixes are the use of electricity and charcoal and also the combined use of charcoal, firewood and electricity each with 18.7 percent of the respondents rely on to meet their energy needs. The third popular energy source is the use of electricity by which 12.7 percent of the respondents rely on. Unless it is for the combining use of different energy sources, the single energy source with largest user among the respondents is electricity where 12.7 percent of the respondents said they solely use electricity for cooking. However, it is worth noting that the combination of the different energy sources listed below indicate that the use of such energy sources is for both baking *Injera* and other non-*Injera* cooking activities.

Table 4.8. Sources of energy the households use for cooking food

Source of energy	Frequency	Valid Percent
electric power	19	12.7
fire wood	1	.7
Kerosene	1	.7
Charcoal	1	.7
electricity and firewood	15	10.0
electricity and kerosene	1	.7
electricity and charcoal	28	18.7
firewood and kerosene	2	1.3
firewood and charcoal	30	20.0
kerosene and charcoal	2	1.3
electricity, firewood and kerosene	1	.7
electricity, firewood and charcoal	28	18.7
electricity, kerosene and charcoal	15	10.0
firewood, kerosene and charcoal	6	4.0
Total	150	100.0

Source: field survey

As indicated in Table 4.9., one can also observe the expansion of electricity in Woreda 5 for domestic energy consumption. With the expansion of electric stoves to bake *Injera*-which in Ethiopia is the major consumer of firewood, the reliance on electricity is increasing and the use of firewood is declining. As seen in Table 4.9. about 58 percent of the respondents have electric stoves and they are using it actively. Among the respondents 33.3 percent said that they do not have electric stove to bake *Injera* because they cannot afford to buy the stoves. Here what is important to note is the same percent of people unambiguously stated that the problem is not with the price of electricity but the price of the stoves which is expensive for them to pay the cost

in one cash. And only 6.7 percent of the respondents said they have stoves to bake *Injera* but they are not using it for different reasons.

Table 4.9. Use of Electric Stove by Households

Electric Stove Ownership Status	Frequency	Percent
I have and I'm using it	87	58.0
I have but I'm not using it	10	6.7
I don't have because I can't afford to buy	50	33.3
Total	147	98.0

Source: field survey

Especially those who lived in the area for more than 15 years said there is a dramatic change in the trend especially after the expansion of the use of modern electric stoves and in fact the increased use of energy saving firewood stoves. As Table 4.10 shows, out of the 93 respondents who said the use of firewood is decreasing 80 respondents lived in the area for more than 15 years.

4.10. Firewood consumption trend by households and length of stay Cross-tabulation

Trend of Household Firewood Consumption		length of stay					Total
		1-15	16-30	31-45	46-60	61-75	
firewood consumption trend by households	it is increasing	10	15	8	8	7	48
	it is decreasing	13	36	37	3	4	93
	no change	0	2	2	0	0	4
Total		23	53	47	11	11	145

Source: Field survey

The types of responses provided by heads of households to the question asked regarding the changes, if any, that are taking place in the use of firewood as source of energy for cooking purpose are also evidenced among the firewood retailers and firewood depot owners in Woreda 5. As indicated in Table 4.11, 80 percent of the fuelwood depot owners in Woreda 5 said that the use of firewood is decreasing from time to time. As it is them who have frequent contact with

firewood buyers, they have also noted that there are times where they even do not sell a single bundle of firewood in a day. Asked so how they sustain their involvement in the market, they answered that, their major market these days is the construction industry which needs wood as part of the construction process of buildings. Fuelwood retailers have further noted that, the decreasing reliance of households in recent years has to do with the expansion of electric stoves with relatively affordable purchase price and affordable electricity cost.

Table 4.11. Trend of firewood consumption

Trend of Firewood Consumption	Frequency	Percent
It is increasing	1	20.0
It is decreasing	4	80.0
Total	5	100.0

Source: field survey

Further investigation and analysis on the frequency of using firewood in a week also shows that there is no as such frequent use of firewood or there is a limited daily use of firewood among the sample household surveyed. As shown in Table-4.12., the number of daily firewood users in Woreda 5 are limited to 28 of the sample population which is 29.5 percent. Those who uses firewood 4 times are also limited to 3.2 percent where as those who use firewood twice and once a week are limited to 32.6 percent and 21.1 percent respectively. What is important here to take note of is, 55 respondents or 36.7 percent were unresponsive of this question and a cross-tabulation on SPSS shows that these are people who are either using modern energy sources or those who uses once in a while say in two weeks or more.

Table 4.12. Frequency of Using Firewood in a Week

Days in a week	Frequency	Percent
1	20	21.1
2	31	32.6
3	13	13.7
4	3	3.2
7	28	29.5
Total	95	100.0

Source: field survey

4.2. Factors Influencing Household Firewood Consumption

There are many factors which can influence the firewood consumption in the urban areas of Ethiopia. Some are related with demographic issues such as family size and others are linked with issues related to financial matters and education. In fact, factors such as availability and affordability of other modern energy sources as well as housing and related problems of different kind can also influence firewood consumption. Below an attempt is made to analyze the different factors affecting household firewood consumption in Woreda 5.

But before entering into the details of the factors, it is also worth noting the purpose of firewood in Woreda 5. As seen in table 4.13, the major purpose of firewood in Woreda 5 is for baking of *Injera*. Followed by cooking of *Wot*. In fact there are households who use firewood for both the baking of *Injera* and non-*Injera* cooking activities. Thus the different factors discussed below should be seen in light of the mentioned purposes (See Table 4.13). This is mainly because it is the purpose which mainly affects the fuelwood choice of households.

Table 4.13. Purpose of Use of Firewood and Frequency of Use of Firewood Cross-tabulation

Purpose of Firewood	frequency of use of firewood		Total
	most of the time	sometimes	
To bake <i>Injera</i>	20	15	35
To bake bread	1	2	3
To cook <i>Wot</i>	6	2	8
Other	0	1	1
<i>Injera</i> and bread	1	0	1
<i>Injera</i> and <i>Wot</i>	11	5	16
<i>Injera</i> , bread and <i>Wot</i>	20	5	25
Total	59	30	89

Source: Field survey

4.2.1. Household Income

Household energy consumption and their preferences for different energy sources in most of the cases is linked with their income. In this study, how much income is related with household firewood consumption is analyzed.

The expectation is that, the higher the monthly income of households, the better energy sources they use. On the contrary when household income is lower households may prefer using traditional energy sources such as firewood, animal dung and crop residue. As indicated in Table 4.14. those with low income more or less prefer to depend on biomass fuels such as firewood and charcoal or their combination with electricity. On the other hand, those with higher income more or less prefer using modern energy sources such as electricity and kerosene or the combination of both. Their preference of biomass fuels or their combination with modern energy sources is minimal and is too occasional.

In addition to this one can also observe that those with low household monthly income use firewood most of the time because they have no other options. On the other hand those households with higher household monthly income use firewood occasionally and mainly during frequent electric power interruptions (See Table 4.14). The monthly household income is also linked with the energy source preference of households (See Table 4.15).

Table 4.14. Monthly income of households and Reason for choosing firewood Crosstabulation

Monthly income of households		Reason for choosing firewood				Total
		low price	no option	availability	Frequent power interruption	
250-650	Count	4	19	2	6	31
	% of Total	3.8%	18.3%	1.9%	5.8%	29.8%
651-1050	Count	1	20	2	13	36
	% of Total	1.0%	19.2%	1.9%	12.5%	34.6%
1051-1450	Count	1	3	0	1	5
	% of Total	1.0%	2.9%	0.0%	1.0%	4.8%
1451-1850	Count	0	2	0	6	8
	% of Total	0.0%	1.9%	0.0%	5.8%	7.7%
1851-2250	Count	0	3	2	4	9
	% of Total	0.0%	2.9%	1.9%	3.8%	8.7%
2251-2650	Count	0	2	0	0	2
	% of Total	0.0%	1.9%	0.0%	0.0%	1.9%
2651-3050	Count	0	0	0	4	4
	% of Total	0.0%	0.0%	0.0%	3.8%	3.8%
3451-3850	Count	0	0	1	0	1
	% of Total	0.0%	0.0%	1.0%	0.0%	1.0%
3851-4250	Count	0	1	0	2	3
	% of Total	0.0%	1.0%	0.0%	1.9%	2.9%
4251-4650	Count	0	0	1	0	1
	% of Total	0.0%	0.0%	1.0%	0.0%	1.0%
4651-5050	Count	0	0	0	1	1
	% of Total	0.0%	0.0%	0.0%	1.0%	1.0%
greater than 5000	Count	0	0	0	3	3
	% of Total	0.0%	0.0%	0.0%	2.9%	2.9%
Total	Count	6	50	8	40	104
	% of Total	5.8%	48.1%	7.7%	38.5%	100.0%

Source: field survey

Furthermore, as shown in Table 4.16 the relation between higher income and the frequency of using firewood confirms the above conclusion. The higher the income, the less frequently firewood is used and the lower the income of households the more frequent firewood is used by the household. The cross-tabulation below clearly shows that there are almost 55 non-respondents on how frequently they use firewood indicates those who do not use firewood at all as well as those who occasionally use firewood. This is again related with the monthly income of households and confirms the above conclusion.

Table 4.16. Monthly Income of Households and Frequency of Use of Firewood Cross-tabulation

Monthly Income		frequency of use of firewood		Total
		most of the time	sometimes	
Monthly income of households	250-650	23	8	31
	651-1050	21	10	31
	1051-1450	3	3	6
	1451-1850	3	5	8
	1851-2250	6	2	8
	2251-2650	2	0	2
	2651-3050	1	1	2
	3451-3850	1	0	1
	3851-4250	0	1	1
	4251-4650	0	1	1
	4651-5050	0	1	1
	greater than 5050	0	3	3
Total		60	35	95

Source: field survey

In the extended interview the researcher conducted also, most of the respondents with low income confirmed that their income has to some extent affected their preference of the energy they consume. In the research area through the interview, it is found that the average price of electricity per month is estimated around 250 Birr. Whereas the average cost of firewood per month is about 350 Birr and for charcoal it is around 300 Birr. This shows the monthly average price of electricity is much lower than the prices of firewood and/or charcoal. Apart from this another factor is also observed that what really prevents them from having modern electric stoves to bake *Injera* is mainly the price of the stoves not the cost of electricity. As will be discussed below respondents say in recent years the price of firewood is greater than the price of using

electricity for any purpose. In general, as illustrated above, household income is one of the major factors affecting household firewood consumption.

4.2.2. Household Family Size

Another factor which affects household energy preference is the family size of households. In fact, this can be seen from two perspectives. Firstly, if we look at the marital status of respondents, those who are married consumed more firewood than those who are single. As indicated in Table 4.17. those who are married frequently consumed almost three times as much as the energy normally consumed by singles. This is mainly because those who are married consumes more firewood because most of the time they prepare their meals at home mainly the baking of *Injera* which consumes more firewood. This implies that the higher the family size is the greater the chance for higher consumption of firewood.

Table 4.17. Frequency of Use of Firewood and Marital Status of the Head of Households Cross-tabulation

Frequency of using firewood		marital status of the head of households				Total
		single	married	divorced	widowed	
frequency of use of firewood	most of the time	12	44	2	1	59
	Sometimes	11	22	0	0	33
Total		23	66	2	1	92

Source: field survey

Secondly the family size itself has its own impact on firewood consumption. As indicated in Table 4.18 those who most of the time use firewood are those with bigger family size and their use of firewood is almost twice to those who use firewood sometimes. This is also positively correlated with the frequency of using firewood.

Table 4.18. Frequency of Use of Firewood and Family Size of the Households Cross-tabulation

frequency of use of firewood		Family size of the households			Total
		1-4	5-8	9-12	
	most of the time	27	26	6	59
	Sometimes	14	12	6	32
Total		41	38	12	91

Source: field survey

4.2.3. Price of Firewood

The price of firewood is also another factor which affects whether households prefer a firewood or other energy sources. According to the data from the interview conducted with both household heads and firewood depot owners, the price of firewood tremendously affects consumers' behavior. In this regard, a few years back firewood was cheaper which by now is very expensive and an unaffordable for those with low income.

To give a comparable analysis under Table 4.14 an attempt is made to highlight how the monthly household income is related with household's reason for choosing firewood. As seen in Table 4.19 only household's reason for choosing firewood is highlighted. According to the analyzed data obtained from the surveyed households, it is only 5.8 percent of the respondents who claimed that they prefer firewood because of its low price (See Table 4.19). But the majority of the respondents said they are using firewood only because they have no other options (48.1 percent) and 38.5 percent of the respondents say their main reason for using firewood is frequent electric power interruptions (See Table 4.19). The remaining 7.7 percent are using firewood because of its availability. The general trend, according to the interview conducted, show, however, that these days firewood price is increasing alarmingly and they are switching to electric powered stoves as the cost of energy relatively is lower to the price of their monthly consumption of firewood. The paradox is, however, the rise of the price of firewood is in the face of a huge supply of firewood. Asked whether they have faced firewood scarcity, 95 percent of the households responded that, it is unusual to see firewood scarcity. If there exists a scarcity that is minimal and is seasonal mainly during the three months rainy season where firewood might not be as dry as needed. It is also worth noting, the missing 30.7 percent presented on Table 4.19 are those who are using electricity as their primary energy source.

Table 4.19. Reason for Choosing Firewood

Reason for choosing firewood	Frequency	Percent
low price	6	5.8
no option	50	48.1
Availability	8	7.7
repeated electric power interruption	40	38.5
Total	104	100.0

Source: field study

In line with the firewood user households, according to the interviewed fuelwood depot owners also, talking from the vantage point of their business and profit, they are angered by the rising price of firewood and they blame brokers and high-level fuelwood traders for the problem. For them, they are sandwiched between the firewood consumers households on the one hand and the `big` fuelwood merchants/wholesalers on the other hand. Asked about why the fuelwood wholesalers are problems they answered that, it is because they have the money to compete and set the price of fuelwood during government bids that they are selling the fuelwood in an inflated price. The big fuelwood wholesalers are also blamed for fixing the price of firewood. Retailers and depot owners also accuse the government for favoring these merchants and sidelining retailer small fuelwood depot owners. Hence, they said, what they are losing was their customers who were switching from firewood to modern electric stoves and kerosene. The implication of this development is that there is less consumption of firewood in the study area.

4.2.4. Tenure Status of Respondents

The housing condition of households is another factor which affects firewood consumption in Woreda 5. In Woreda 5, there are 2719 private houses and 2232 public/Kebele houses (AACAILIC, 2014: 51). In terms of area coverage , private houses cover 164,679.11 m² whereas public/Kebele houses cover an area of 75,309.17m² (ibid). This shows that much of the area is occupied by private owners and this has its own impact on the firewood consumption by households. As mentioned at the beginning of this chapter, among the respondents, 31.3 percent of the respondents are the owners of their houses and 50.7 percent are in public houses while the

rest 18 percent rented privately owned houses. This has tremendously affected their energy consumption preferences as those who have private houses have the right to do what they like, such as installing electric power gauges, those who rented private houses do not have the same privilege. On the other hand, what is required from those who are in government houses is just only notifying the local administrative offices, for example, to install electric power gauges.

One important issue to be highlighted here is that Addis Ababa as a city has been experiencing rapid growth of population as rural-urban migration to the city is also contributing hugely to such effect. For obvious reasons, the increase in population always resulted in the increase in demand for energy. Thus, the question is how or to what extent is this demand accommodated or not. It is in fact a question that Woreda 5 also faces as one of the Woredas in a sub-city with a good name of migrant absorbing capacity. This is mainly because, due to high cost of renting houses in the most modernized and central parts of the city such as Arat Kilo, Piassa, Bole, Mekanisa, Cassanchis and so on, people choose places such as Gulele and Kechene areas due to lower costs of rent as compared to other parts of the city. This has its own contribution in creating pressures on the firewood market as well as the firewood consumption pattern.

To give a general picture, detail interview with some of the people who rented houses in the Woreda revealed how they tried to avoid the pressure from the energy demand they would have by switching into less energy demanding foods. They stated that, they need firewood occasionally to bake *Injera* as their *Injera* demand is being supplied by the market with reasonable price. Furthermore, the food consumption is showing shifts also because the whole process of baking *Injera* relatively is time consuming. Hence, people more or less focus on the fast foods such as pasta, rice and other related ones. that they can prepare at home using small scale electric and kerosene stoves.

As can be observed from Table 4.20 a number of people with private houses and public houses have managed to have electric stoves. This does not mean, however, that those who rent private houses do not have electric stoves. Most of them do have electric stoves for both *Injera* baking and non-*Injera* cooking. But the real problem is in most of the cases they are unable to use their stoves due to conflict with the land lords.

Table 4.20. Housing Status and Use of Electric Stove by Households Cross-tabulation

Housing Status		use of electric stove by households			Total
		I have and I'm using it	I have but i'm not using it	I don't have because I can't afford to buy	
the condition of the house you are living in	private home	33	2	11	46
	public house	43	4	29	76
	rent of private house	11	4	10	25
	Total	87	10	50	147

Source: field survey

The real challenge, according to the interviewees, is pertaining to housing and maintaining access to electricity by establishing cordial relations with renters. This is mainly because, in spite of the government's efforts to make electricity accessible, it has become difficult for people to secure the electric power meter because the landlords or landladies have not been happy to allow that gadget to be installed on the walls of their rental accommodations. Besides the lack of rules and regulations that governs both the landlord/landlady and the householder is another problem. As a result most of those who rented private houses are forced to use firewood.

Most of these people with housing problems cited landlords and those who are in public houses on how they are enjoying the fruits of electric powers, they claim. Most importantly, they said, despite with lower monthly income, they could afford the cost of monthly used electric power had they have their own house. These people, however, see a light at the end of the tunnel. For them, the 20-80 as well as 40-60 housing schemes of the Addis Ababa City Administration is the hope that they have and are waiting the long list of registered people until the housing lotto knocks their door.

4.2.5. Holidays and Feasts

One of the major factors that affect household firewood consumption is holidays and feasts. By tradition and culture as well as religious practices, Ethiopians` have a culture of celebrating together. One of the major peculiar features of such celebrations is the culture of feast where hundreds of people would be invited for lunch or dinner. Despite the increasing role taken by big

hotels in hosting ceremonies such as wedding, for many still undertaking the ceremony at home has a paramount cultural importance which necessitates organizing and arranging all the feast at home or a nearby wedding hall. Apart from this during different holidays people may arrange banquets for their beloved ones. This in fact needs a huge consumption of firewood.

According to the response from the interviewees, at least every year one household may have one banquet or feast that they celebrate with their beloved ones. At this time they said, they use more firewood than the normal circumstances as they prepare different food items such as *Injera*, Bread and prepare the local beverage known as *Tella* with larger amount. Especially the preparation of *Tella* needs more firewood as the two major inputs *Tella Bread* or locally known as *Abshilo* and *Roasted Tella Barley* or *Maize* also locally known by the name *Yetella Asharo* needs more firewood in the process. Apart from this, cooking of *Wot* as part of the feast also needs more firewood than usual taking the amount to be prepared into account.

4.2.6. Availability and Affordability of Modern Energy Sources

Availability and affordability of other energy sources is one of the key factors in affecting household firewood consumption. In Woreda 5 one can find both traditional and modern energy sources such as firewood, animal dung, charcoal, kerosene, hydroelectric power and plant residue. All these are available in the market. Leaf and Tree Branches as well as animal dung have been important sources of energy especially to the poor. But recently with rising living standard their price is also increasing. As demonstrated in Table 4.21. the major firewood types that households use are either chopped wood or leaves and branches of trees or a combination of both.

Table 4.21. Types of Firewood Households Use

Types of firewood	Frequency	Percent
chopped wood	31	28.4
Leaves and Branches of Trees	57	52.3
chopped wood and leafs	21	19.3
Total	109	100.0

Source: field survey

But in recent years with the expansion of modern energy sources mainly electricity and energy saving traditional stoves, the use of firewood is declining. For instance, unlike the traditional three stoned stoves the enclosed stoves also known as *Mirt* (Best) Stove has been on the market both in urban and rural Ethiopia. As of Woreda 5, the data analysis shows that most of the households who rely on firewood and charcoal (see Table 4.8) have said that they use energy saving traditional stoves to save energy and time. The government is also promoting the use of energy saving stoves and provide them freely to individuals who can't afford to buy (Interview, Government Officer, 1 June 2015). In addition, the sub-city is giving trainings for cooperatives who needed support to produce energy saving stoves.

As can be observed from Table 4.8. above households in most of the cases use the combination of different modern and traditional energy sources. This can be stated as point of transition for the households from traditional energy sources to modern energy sources. On the other hand, despite increasing expansion of hydropower generated electricity across Addis Ababa, the crucial challenge remains power interruptions and power rationing in the city due to growing demand for energy which is not balanced with the supply. In this context, according the interviewees, households forced to use firewood to meet their energy needs especially to bake *Injera*.

Nonetheless, the growing expansion of energy infrastructure such as the construction of huge dams and wind generated power stations in different parts of the country may contribute to alleviating the demand and supply gap.

4.3. Urban Household Firewood Consumption and Deforestation

In the previous discussions we have seen the different socio-economic characteristics and the different factors affecting household firewood consumption in Woreda 5. What is important is also an attempt to understand the link between urban household firewood consumption and deforestation and how it is manifested. In this sub-topic an attempt is made to highlight such a linkage and its manifestations.

Cutting of trees for any purpose unless different mechanisms of substitution are undertaken has its own negative repercussion on the forest stock in particular and the overall environment in general. One of the major reasons which affect forests is urban household firewood consumption.

Addis Ababa and its surroundings were not free from such process of change as its forest resource has been threatened by urban firewood expansion. According to Eyob (2012: 132) "Fuel wood selling was ... major threat for forest depletion over the forest area of Addis Ababa." Firewood smugglers, women fuelwood carriers and firewood vendors as well as firewood depot owners are on the spotlight in this regard.

Regarding Woreda 5, as indicated in Table 4.22 users get the firewood they want from firewood depots and retailers. About 96.3 percent of the respondents get the firewood from the market while only 1.9 percent manage to collect the firewood they wanted from the nearby forest namely from Entoto Mountain. Another 1.9 percent also meet their energy demands by adjusting themselves either to the market or by collecting fuelwood from Entoto Mountain. In general, almost all women fuelwood carriers of Woreda 5 collect the fuelwood from the nearby Entoto mountain. Firewood vendors also bring the firewood to the market by donkey from the nearby villages. The rest 28.7 percent are those who predominantly depends on electricity or other modern energy sources such as Kerosene. Be that as it may, it is confirmed by the government that, the forest from chain of the Entoto mountains from Gulele to Yeka sub-cities provides almost all the firewood needs of Addis Ababa. Hence, one can say that the Entoto Forest is the firewood source of the entire city.

Table 4.22. Source of Firewood for Household Consumption

Sources of firewood	Frequency	Valid Percent
from nearby forest(eg. Entoto)	2	1.9
from firewood depots and retailers	103	96.3
from nearby forest (eg.Entoto)and from fire wood depots and retailers	2	1.9
Total	107	100.0

Source: field survey

As seen above the majority of households get the firewood they want for consumption from the available market sources mainly firewood depots and retailers. As also discussed in the previous sub-topics the surrounding forest area has been the source of firewood for users. The question is

then where is the origin of the firewood that is made available in the market? There is no any other closer entity to answer this question than firewood depot owners and retailers.

As indicated in Table 4.23 about 40 percent of the firewood depot owners and retailers say, the source of the firewood they sale has its origins from the Entoto Mountains. And other 40 percent retailers stated that they bought much of the firewood they resale from wholesalers who brought the wood from places outside Addis Ababa by trucks and Isuzu mini-trucks. For the rest 20 percent the source of the firewood is government auctions of the nearby forests notably Entoto. In general terms, as shown in Table 4.23 households, who directly collect the firewood for own consumption accounts 40 percent. But according to the information obtained from officials from the Gulele Sub-city Administration the Entoto Forest covers all the firewood demands of the whole Addis Ababa City. The firewood that is all available in the market is mainly sold by the government auctions to wholesalers who in turn resale the firewood to retailers and other firewood consumer organizations such as bakeries.

Table 4.23. Sources of Firewood

Source Areas	Frequency	Percent
from nearby forest (eg. Entoto)	2	40.0
from other whole sellers	1	40.0
from government	2	20.0
Total	5	100.0

Source: field survey

From the above analyzed data one can understand that Entoto Mountain is subject to tremendous firewood production. But the question is, is it not threatened for deforestation and forest degradation? Before answering question highlighting the major plantation in the area will better help to further understand the situation.

The major type of plantation that has been serving as firewood source is the Eucalyptus plantation or locally known as *Bahir Zaf*. The peculiar feature of the Eucalyptus plant is that it can be harvested within a few years of plantation as it does not take a longer period to be ready for consumption. And it is this plantation which dominates the chain of Entoto mountains of Addis Ababa. It is confirmed by the government that in spite of the availability of other tree

species in the Entoto forests it is only Eucalyptus trees which are auctioned by the government. No other tree species is for auction and it is strictly forbidden to cut of these trees (Interview, Government Officer, 1 June 2015). Now the government`s auction of Eucalyptus plantation for firewood and other purposes from Entoto Mountain and its surroundings is not a newly introduced plantation but old plantations both before and during the Addis-Bah Fuelwood Project. In other words, new plantations of the Eucalyptus is not developed tremendously in a way that would be commercialized. This means, replacement of the consumed tree by a new one is rare which means deterioration of the existing forest stock of the area.

The researcher has observed the growing deterioration of the forest in the Entoto mountain from year to year. The clearing of forest in Entoto is increasing especially in the recent years. Apart from the cutting of trees for firewood consumption, the expansion of infrastructure is another reason for the clearing of trees around Entoto mountain. For instance, schools for the nearby residents along rivers is built near the forest which resulted in the clearing of trees. Furthermore, due to the geographic significance of the Entoto mountain towers of Ethiopian Airlines and Ethio Telecom and transmission lines of the Ethiopian Electric Power is erected. This has resulted in the clearing of some amount of trees from the forest stock. Cutting of trees by residents around the forest and illegal expansion to the forest land for housing has been also a challenge to the government`s efforts of protecting the forest (ibid). In line with this, wood smugglers are also cutting trees illegally which is another factor for the depletion of forest resources in the area.

The volume of eucalyptus trees being cut from the Entoto hills also varies from year to year. In fact, according to the government official in the Gulele Sub-city, it is the Entoto forest which is the source of firewood for Addis Ababa does not mean that there is government auction of the Entoto forest every year. Sometimes it is the case and sometimes it is not (Interview, Government Officer, 1 June 2015). Regarding the volume of cut trees being sold, in 2013/2014 the government auctioned 41 hectares of Eucalyptus trees. And in 2014/15 it was 6368m³ Eucalyptus tree from 60 hectares was auctioned which is nearly 106.13m³ per hectare.

Regarding the volume of consumption in the study area, it is observed that the weekly consumption of trees by households varies. It is shown in Table 4.24 that 83.2 percent of the respondents consumes 1 bundle of tree each week. While 12.1 percent say they use 2 bundles of

trees every week, only 1.9 percent say they consume 3 bundles of trees every week. Those who consumes 4 and more than 4 are also limited. It is only 2.8 percent who falls in this category. In general, the mean volume of consumption every week in the study area is 1.24 bundles each week.

Table 4.24. volume of consumption of firewood in Woreda 5 in a week

Volume of consumption	Frequency	Valid Percent
1bunddle	89	83.2
2bunddle	13	12.1
3bunddle	2	1.9
4 and greater than 4	3	2.8
Total	107	100.0
Total	150	

Pertaining to the awareness of people in the study area regarding the link between urban firewood consumption and deforestation, most of the respondents responded what they know. About 87.2 percent of the respondents said "deforestation is linked with urban firewood consumption." While 6.8 percent said, "deforestation is not linked with the use of firewood consumption", the rest 6.1 percent said they do not know whether it is linked or not (See Table 4.25). This shows that urban firewood consumption is one of the causes of deforestation. According to government officials, because of the efforts of the government to create awareness on the link between urban firewood consumption and deforestation positive results have been registered.

Table 4.25. Urban Household Firewood Consumption and Deforestation Awareness

The Link between Firewood Consumption and deforestation	Frequency	Valid Percent
yet it has	129	87.2
no it doesn't	10	6.8
I don't know	9	6.1
Total	148	100.0

Source: field survey

The respondents also propose different solutions to avoid deforestation that might originate due to urban household firewood consumption. As demonstrated in Table 4.26, about 65.2 percent of the respondents propose the use of electric stoves as the best mechanism to mitigate forest depletion due to firewood consumption in the urban areas. Among the respondents 8.3 percent suggested making firewood available and affordable through afforestation and firewood production schemes. remaining 25 percent proposed the combination of different solutions proposed such as expansion of the use of electric stoves, use of kerosene and making firewood available.

Table 4.26. Solution for Deforestation in Relation to Firewood Consumption

Solution proposed	Frequency	Percent
use of electric stove	86	65.2
use of kerosene	2	1.5
increase availability of firewood by afforestation	11	8.3
Use of electric stove and use of kerosene	10	7.6
Use of electric stove, make firewood available through afforestation and firewood production and use of kerosene	13	9.8
Use of electric stove, make firewood available through afforestation and firewood production	10	7.6
Total	132	100.0

Source: field study

According to the respondents the most popular energy source to save the forest is electricity. Despite its availability in the market because of its rising price respondents refrain from advising the use of kerosene as an environmental friendly energy source. It is only 1.5 percent of the respondents who stated the use of kerosene is also an alternative (Table 4.27). About 7.6 percent of the respondents, however, recommended the combined use of electricity and kerosene as a solution to deforestation.

In general, as seen from the analyzed data above, with large family size and low income one can observe households` reliance on firewood. Thus, the pressure on the nearby forests is to be

higher as the demand for fuelwood increases. Another factor which is related with firewood consumption and, in fact, deforestation is housing status of residents. Those who are either in public or private houses are in a better position to secure electric power gauges so that they can use electric power which means a decrease of reliance on firewood. On the other hand householders are facing actual and potential challenges from landlords/landladies when they need to install electric power gauges. Then, they have no choice but to rely on firewood to meet their energy needs. It is worth noting here that with increasing family income people are switching to modern energy sources notably electricity because the cost of electric service is affordable. Taking the price of firewood which is increasing from time to time the availability of clean energy like this will assist efforts of maintaining the forest environment as peoples' reliance on firewood also decreases. Nevertheless, because of lack of access to electricity due to a number of reasons, tremendous number of people still uses firewood to meet energy needs. This needs policy intervention of the government and other stakeholders so as to maintain the health of the environment.

In fact, according to government reports the declining reliance on firewood is encouraging. This is a result of a combination of factors from government policy interventions of expansion of electricity to the introduction and distribution of modified stoves for free. Besides, the government is undertaking reforestation of the Entoto mountains and is protecting the forest area by hiring fulltime guards. But the major factor is the enhanced awareness of the people about the effects of deforestation on the environment which pushes people to switch to modern energy sources.

Looking at the facts on the ground, in the foreseeable future firewood will remain as one of the major sources of energy. Therefore, in order to minimize the effects of firewood on the nearby forests in Entoto massive afforestation deserted forest land as well as the expansion of modern electric stoves is important.

To sum up, the trend of household firewood consumption in Woreda 5 is declining as is also the case in the Addis Ababa City at large. This is empirically evidenced as a result of the surveyed data analyzed and the observation made in Woreda 5. With the declining firewood consumption, one can also observe the use of mixed energy sources by combining both traditional and modern

energy sources due to a number of reasons. Generally speaking, however, it is impossible to avoid urban household firewood consumption due to a number of reasons. What can be done best is minimizing the effect of urban firewood consumption on the surrounding as well as other forest resources by implementing a number of possible solutions that fits the socio-economic conditions of the society.

Chapter Five

5. Conclusion and Recommendations

Conclusion

The general objective of this research is to identify and describe the factors that affect household firewood consumption in *Woreda 5 of Gulele* Sub-city of Addis Ababa and to explore how it is linked with deforestation. To this end an attempt is made to understand the major factors that influence urban household firewood consumption in the study area. After analyzing a surveyed data of 150 households and five fuelwood depot owners and firewood retailers with the literature available on urban household firewood consumption the following conclusions are drawn as findings of this study.

Firstly, there are signs by which people in the study area are switching to modern energy sources. This is mainly due to the availability of modern energy sources such as electricity and kerosene. But what is generally observed is that households' multiple fuel use of energy sources such as electricity, firewood, charcoal and kerosene. While there are people who solely depend on modern energy sources but due to different reasons such as power interruptions and so on they may also use traditional energy sources such as firewood as evidenced in the household energy source combinations observed in this study.

Secondly, despite people are switching to multiple energy sources, still larger amount of firewood is on the market and there are huge number of people using firewood. The most important question is then what are the different factors influencing urban household firewood consumption in *Woreda 5*? This study has found six major factors which influence household firewood consumption. Among others, household income, household family size, housing status, price of firewood, holidays and feasts, and availability and affordability of modern energy sources are the major ones.

As the study shows households with higher household income prefers more modern energy sources and their use of firewood to meet their energy demand is very much limited. On the other hand, people with lower household income opt for traditional energy sources mainly firewood. In line with this, household family size also influence s household firewood consumption. Mainly

those with larger family size use firewood more frequently and in larger amount. Besides, the marital status of households also influences firewood consumption. On the average a married household consumes three fold of the firewood that a single person households consumes.

Among the factors listed, the rising price of firewood in Woreda 5 which according to fuelwood depot owners and retailers is a result of wholesaler price fixing methods and the role of brokers, is pushing people to switch into electricity. According to the analyzed surveyed data in this study, most of the firewood users rely on the forests only because they do not have options despite a rising price. Another interesting finding in line with the factors identified is housing status of households. Woreda 5 which is also called by the name Kechene is known for its role in absorbing many individuals who needs to rent private houses only because they have the perception that the cost of renting house in Woreda 5 is lower as compared to other parts of Addis Ababa. This has its own implication on the demand and supply of energy. In fact, one of the challenges identified is, despite the affordability of electricity individuals faced, problems of installing electric power gauges because of the actual and potential conflict with renters and the lack of rules and regulations that governs both the landlord/landlady and the householder.

Thirdly, the origin of much of the firewood being used in Woreda 5 is traced to the Eucalyptus plantation in the Entoto mountain. This is either secured legally as a result of government auctions or as a result of firewood smugglers and on donkey firewood sellers and women fuelwood carriers. This has its own negative implication on the forest resource of the Entoto mountain. In this regard, it is worth noting here that, when Addis Ababa faced energy crisis in the 1970s and 1980s, the government was forced to design a policy with immediate response which later came out as the Addis-Bah Fuelwood Project. The project was successful in making the Eucalyptus plant available for firewood consumption for Addis Ababa and helped to avoid catastrophic environmental destruction that would happen otherwise. It is the plantation from such project which is still auctioned by the government to meet energy needs to the city.

Fourthly, according to field observation, additional factors such as leasing land from the Entoto mountains on the side of the Oromia National Regional State for real-estate development and also construction of infrastructure in the Gulele Sub-city part of the Entoto hills is the practice that being observed recently. This has its own contribution in clearing the forest in the area. This

process at the same time is also making firewood available to the city dwellers including Woreda 5 which is the major factor behind Entoto`s deforestation.

Fifthly, the lesson that can be learned from the declining trend in firewood consumption is that modern energy sources are penetrating the market despite the doubling of their price in the past few years. This clearly shows that modern energy sources mainly electricity can provide affordable energy to the poor. In the detailed interviews conducted during the study, those who rely on firewood with lower household income stated that, "the monthly cost of electricity is better affordable as compared to the monthly cost of firewood consumption." In this regard it is worth noting that, according to the analysis of the interviews conducted, for most of these firewood users, what is not affordable is the one down payment of electric powered *Injera* stove not the monthly cost of electricity consumption.

Recommendations

The following are some of the recommendations that this study aspires to make.

- Because it is impossible to stop the use of firewood in Woreda 5 in particular and in Addis Ababa city in general, firewood production from the surrounding forest sources of the city will continue due to a number of reasons. Unless policy interventions are taken place the forests from the nearby mountains will be severely depleted. Therefore, plantations of more trees and afforestation of the surrounding mountains of Addis Ababa are necessary so as to maintain environmental protection, at the same time, with the objective to provide sustainable firewood source.
- Expansion of modern energy sources mainly electricity is important in minimizing the effects of firewood consumption. The more affordable electric power is available the lesser people will rely on firewood to meet their energy needs. One of the inputs to make such energy available, is helping people to have their own houses. Therefore, fixing the housing problem will tremendously help alleviate problems associated with energy problems. At least there should be mechanisms or regulations that govern the relation between landlords/landladies and householders
- Despite lack of firewood scarcity as there is a huge supply in Woreda 5, and as confirmed by this research, the price of firewood is rising. This is occurring also while substantial number of households are switching to modern energy sources such as electricity. This development has been affecting the lives of many poor people who cannot afford modern energy sources and those also who are forced to use firewood due to a number of reasons. Hence, the rising price of firewood needs further investigation.
- Most of those respondents with lower household monthly income are not using electric stoves to bake *Injera* because they cannot afford to pay the cost of the stoves in one cash. They have stated that they could afford the monthly cost of electricity service as it is affordable as compared to the price of firewood. Hence, the government shall introduce mechanisms by which these people can buy the electric stoves and pay the costs gradually. This will in turn take off the load on the forest resource which could be subject to firewood consumption.

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Interview

Wondwossen Shiferaw, Coordinator, Natural Resource Development, Utilization and Inspection of Gulele Sub-City, Addis Ababa. Interview held on 1 June 2015, at the interviewee's office at 2:00 Pm in the afternoon.

Appendix-1

**Addis Ababa University
School of Graduate Studies
College of Social Sciences
Department of Geography and Environmental Studies
Structured Household Survey Questionnaire on Urban Household Firewood
Users**

Introduction

Dear all of you willing to fill this questionnaire:- the main aim of this questionnaire is for academic purpose and is designed as an input for research to be conducted in partial fulfillment of the requirement for the degree of masters at School of Graduate Studies of Addis Ababa University. So, I appreciate that you are taking part in this questionnaire and your participation is invaluable. I thank you in advance for giving me your time and for your assistance.

Part A:- General Information

1. Woreda _____ Kebele _____
2. Household Head Age _____
3. Household Head Sex _____
4. Marital Status _____ Family Size _____
5. Level of Education
 - a. Illiterate
 - b. literate
 - c. Elementary school
 - d. high school
 - e. college/university
6. For how long you have lived in Woreda 5? _____
7. The house you are living is, _____
 - a. your own private house
 - b. a public/government house

- c. a private house which you rented
 - d. other, if any, _____
8. Average monthly income of the household is _____

Part II:- Questions in relation to the use of firewood

1. Which of the following energy sources are your primary choices? (tick on any of the items that concerns you).

No.	Type of Energy Source	Mostly Used	Sometimes
1	Electric Power		
2	Firewood		
3	Kerosene/Liquid Petroleum Gas		
4	Charcoal		
5	Other, if any		

2. If your answer to question number-1 is `firewood is the predominant energy source`, for what kind of purpose you use it?
- a. to bake *Injera*
 - b. to bake bread
 - c. to cook *Wot*
 - d. other, if any, _____
3. Which type of firewood you mostly uses?
- a. Chopped wood/Eucalyptus
 - b. tree branches and leaves
 - c. byproducts from timber workshops
 - d. other, if any, _____
4. From where you get the firewood you use?
- a. From the nearby forest/Entoto Mountain
 - b. from the market
 - c. Other, if any, _____

5. if your answer to question No. 4 is `from the market`, what kind of market is it?
 - a. Women Fuelwood Carriers
 - b. fuelwood depots and retailers
 - c. timber workshops
 - d. other, if any, _____
6. how many bundles of firewood you use in a week?
 - a. one
 - b. two
 - c. three
 - d. four and above
7. What is the average cost of a bundle of firewood? _____
8. how much money you spend monthly for firewood? _____
9. how many times you buy firewood within a month? _____
10. how many times you use firewood in a week? _____
11. if firewood is your primary source of energy, what is the main reason?
 - a. because it is cheap
 - b. because I have no options
 - c. because it is abundantly available when I need it
 - d. other, if any, _____
12. for how long you use firewood? _____
13. have you ever faced with firewood scarcity? if yes when and why?

_____.
14. Have you ever bought *Injera* from shops because of scarcity of firewood? In your opinion, is buying *Injera* from shops a good replacement for using firewood to bake *Injera*?

_____.

15. Do you have electric stove for *Injera*?

- a. yes, I have and I am using it
- b. yes, I have but I am not using it
- c. I do not have because I cannot afford buying it
- d. Other, if any, _____

16. In your observation, what is the trend of using firewood in your household and in Woreda 5 at large?

- a. it is increasing
- b. it is decreasing
- c. there is no change
- d. other, if any, _____

17. when you use firewood, do you use energy saving modified stoves?

- a. yes, I use
- b. no, I do not have

18. in your opinion, what are the benefits of using modified stoves?

19. In your opinion is deforestation and forest degradation in the nearby forest lands and beyond is linked with the use of firewood in urban areas such as Woreda 5?

- a. Yes, it has.
- b. no, it has no relation
- c. I do not know
- d. other, if any, _____

20. for your answer to question No. 19, what are the reasons?

21. If your answer to question No. 19, is "yes, deforestation has links with firewood consumption in urban areas", what solutions you suggest?

- a. expansion of electric stoves
- b. use of kerosene and liquid petroleum gas
- c. making firewood available through afforestation and plantation of trees for firewood consumption
- d. other, if any, _____

If you have any comment:-

Date: _____

I Thank You Very Much for Giving Me Your Time and Your Kind Assistance !!!

Appendix-2

**Addis Ababa University
School of Graduate Studies
College of Social Sciences
Department of Geography and Environmental Studies**

Structured Survey Questionnaire on Urban Household Firewood Providers

Introduction

Dear all of you willing to fill this questionnaire:- the main aim of this questionnaire is for academic purpose and is designed as an input for research to be conducted in partial fulfillment of the requirement for the degree of masters at School of Graduate Studies of Addis Ababa University. So, I appreciate that you are taking part in this questionnaire and your participation is invaluable. I thank you in advance for giving me your time and for your assistance.

Part A:- General Information

9. Woreda _____ Kebele _____
10. Household Head Age _____
11. Household Head Sex _____
12. Marital Status _____ Family Size _____
13. Level of Education
 - a. Illiterate
 - b. literate
 - c. Elementary school
 - d. high school
 - e. college/university
14. For how long you have lived in Woreda 5? _____
15. The house you are living is, _____
 - a. your own private house
 - b. a public/government house
 - c. a private house which you rented

- d. other, if any, _____
16. Average monthly income of the household is _____

Part II:- Questions in relation to the market of firewood

22. From where you get the firewood you provide to the market?
- a. From the nearby forest/Entoto Mountain
 - b. from other markets
 - a. government auction
 - b. other, if any, _____
23. In average, how many households could buy firewood from you?
- _____
24. On average, how many bundles of wood you sale a day?
- _____
25. which part of the society mostly purchases firewood from you?
- a. households for domestic use
 - b. business men/women for hotels, Restaurants and local beverage producers
 - c. other, if any, _____
26. on average how many bundles of firewood does a customer household can buy in a week?
- a. one
 - b. two
 - c. three
 - d. four and if above _____
27. What is the price of a bundle of firewood from your depot?
- _____
28. What type of firewood is available in your depot?
- a. Chopped wood/Eucalyptus
 - b. tree branches and leaves
 - c. byproducts from timber workshops
 - d. other, if any, _____
29. why you choose to sale the firewood products you are selling?

- a. because it is abundantly available
 - b. because the profit is high
 - c. there is no other option in this business
 - d. Other, if any, _____
30. can you provide firewood with the needed type and amount?
- a. yes I can provide
 - b. No I cannot provide
31. What is your reason for your answer to question No. 9.
- _____
- _____.
32. if do you think there is firewood scarcity? if it is happening repeatedly what do you think is the reason?
- _____
- _____.
33. for how long you sale firewood? _____
34. In your observation, what is the trend of using firewood in your household and in Woreda 5 at large?
- a. it is increasing
 - b. it is decreasing
 - c. there is no change
 - d. other, if any, _____
35. In your opinion is deforestation and forest degradation in the nearby forest lands and beyond is linked with the use of firewood in urban areas such as Woreda 5?
- a. Yes, it has.
 - b. no, it has no relation
 - c. I do not know
 - d. other, if any, _____
36. for your answer to question No. 19, what are the reasons?

37. If your answer to question No. 19, is "yes, deforestation has links with firewood consumption in urban areas", what solutions you suggest?

- a. expansion of electric stoves
- b. use of kerosene and liquid petroleum gas
- c. making firewood available through afforestation and plantation of trees for firewood consumption
- d. other, if any, _____

If you have any comment:-

Date: _____

I Thank You Very Much for Giving Me Your Time and Your Kind Assistance !!!

Appendix-3

Some Images Showing the Firewood Market, firewood depot owners and retailers as well as women fuelwood carrier in Woreda 5 of Gulele Sub-city of Addis Ababa.







