

Wood Fuel Usage and Its Marketing-Distribution Channels in Eritrea: A Case Study

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ABSTRACT

The use of wood (fuel wood, charcoal and black liquor) as a fuel source for heating and cooking is the major source of energy in developing countries. It accounts for 90-98% of residential energy consumption in most sub-Saharan Africa. Assessment of the actual magnitude of wood fuel use, and its distribution, marketing channels, have consequently been difficult to determine, and have been the subject of considerable debate among the policymaker and administrator in Eritrea. There is heavy reliance on forest to meet domestic cooking-fuel requirement. Most of the cooking biomass energy either collected from neighborhood or purchased from unauthorized wood-fuel trader. In this research paper researchers have tried to examine the use of wood-fuel, household energy requirement, nature and types of wood collection and their marketing channels in the highlands of Eritrea.

Keywords

Wood fuel, Energy, Environmental effects, Socio-economic, alternative source of energy

INTRODUCTION

Wood fuel gathered from forested areas, farms and hill escarpment are the most important source of domestic energy in the developing countries (Cecelski et al., 1979; Heltberg et al., 2000, WEA 2001). Developing countries still heavily relied on wood fuel to meet their basic cooking energy needs. An estimated average 60-85% of Africans uses wood fuel as their primary source. In Tanzania, 90% of the total energy consumption (biomass, petroleum, electricity, coal) is wood fuel for household requirement. Moreover, wood fuel use accounts for 90 to 98 % of residential energy consumption in most of sub-Saharan Africa (Idiata et al 2013). Here, in most of the rural households, women are the main stakeholders to collect the wood, crop residue etc., for cooking requirement (FAO, 1995).

Wood fuel in the form of wood and charcoal are remains the dominate energy source for over two billion people world wide (UN Population Fund). Charcoal is often favoured by users since its heat stays rather constant and the fire doesn't have to be tended as much. It takes 10 kg of wood to make 1kg of charcoal. In some areas not even these fuels are available and dry grass or cow dung is burned instead. Household air pollution from cooking fires kills more people each year than AIDS or malaria (World Bank, 1989, 1992).

In Eritrea many households in the urban centres and almost all-households in rural areas depended on wood collected from forests and farms as their main cooking-energy source. Due to constant unchecked forest exploitation for household requirement, war for independence and the lack of clean-alternative and affordable energy is a significant factor that contributes rapid depletion of forest in the country.

Nationwide wood fuel contributes more than 85% of the national household cooking energy needs (Department of Energy 1997). Generally wood fuel is the dominant form of cooking-energy in the nation, both in the rural and urban areas. The scarcity of wood fuel has become almost as equally concerning as food shortage in the country. The fast depletion of forest cover is a major contributor of environmental and health problems.

The increasing scarcity of biomass wood fuel in rural areas of Eritrea is believed to have made life difficult. A generation ago, in rural Eritrean people have to walk all most 30 minutes to collect sufficient wood fuel of good quantity to meet their household energy needs for two weeks; today nearly a day is required to collect the same amount (NEMPE, 1995). Lack of clean, alternative and affordable energy is a significant factor for the Eritrean people to rely on wood fuel energy.

Wood fuel consumption differs greatly from place to place in the country, depending on the availability, price, income and shortages of modern cooking energy. The remote

villages, which have a better access to forests with adequate dead wood trees and bushes, tend to consume more than villages which have no or little access to forests and therefore had to buy at higher prices from trader. Since energy is basic to life, meeting this basic need and maintaining the sustainability of the national resources is the order of the day.

Due to heavy dependence on wood fuel for household cooking energy, our environments are affected by depletion of forest, increasing aridity and excessive soil erosion. There is an acute shortage of data pertaining to wood-fuel collection and marketing channels that can guide to reduce unauthorized forest removal. In this research paper researchers have tried to examine the wood as a major cooking energy sources and their marketing channels in the highlands of Eritrea.

OBJECTIVES OF THE STUDY

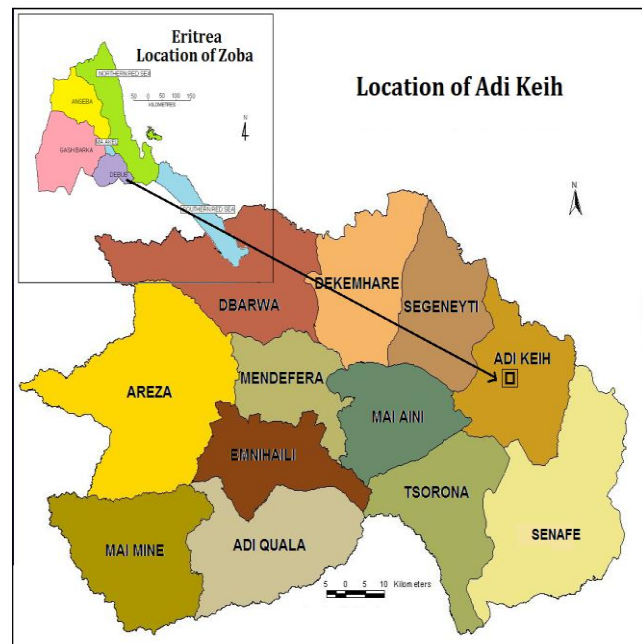
Following are the objectives of the study

- (i) To assess the type of energy use and their preferences in household cooking energy requirement.
- (ii) To examine wood collection and marketing-distribution channels of wood fuel in study region.
- (iii) To outline the consumption pattern of wood fuel in different sectors of societies in the study region.

STUDY REGION

Constant supply of fuel energy for cooking purpose is the major challenges facing almost every households of this country including the residents of Adi Keih town. It's difficult to investigate whole country and examine the nature and characteristics of fuel use and their associated problems. Therefore to narrow down the region for the rational investigation, Adi Keih town and its command area have been selected for intensive study. The reason for the selection of study region is keeping in the mind of real fuel crisis for cooking and lighting purpose in the household. Not only there is absence of minimum forest cover in the region, but there are also interruptions in the supply of modern alternative fuel such as electricity, LPG and Kerosene. Consequent to this, the remnant forest cover has been severally affected since last two decades.

Adi Keih town is located on 14°50' North latitude and 39°22' East longitude situated about 110 km south of Asmara and about 20 km north of Senafe along the Asmara-Senafe



Map- 1

road. It (Adi Keih town) is divided in to four administrative zones, known as Hishmele, Hadamu, Unabur, and Hayneba. The town stretches along both sides of the road and extends widely on the top of high and very flat plateau. Besides plateaus there are some hills separated each other by valleys known as Ruba Bur, Ruba Adi-Wegera, Ruba Geradef etc. The total area of Adi-Keih town is 350 hectare. Adi-Keih town is located at an altitude of 2470 meters above sea level. This is among the highest elevated towns of the country. Because of its location on high altitude, it has low temperature. Daily temperature ranges varies from 12 degree centigrade to 20 degree centigrade. The town receives an annual average rainfall of 494 mm and enjoys a fine weather throughout the year.

Total number of population estimated to be around 24,177 in number and distributed in 4770 households with average 5 members of people per household.

MATERIAL AND METHODS

The study is based on primary and secondary sources of information. Primary data have been collected from three different layers of the study region: First layer of interview were conducted with the administrations pertaining to supply of cooking fuel to the household of the town such as LPG, Kerosene and power supply. Their number is less, therefore, focussed open discussion interview have been conducted with them.

Second layer of interview were conducted with the consumers residing in four municipal administrative wards taking into the consideration of income level. It is hypothesized that higher the income level, lower will be the use of fuel wood for cooking purpose and vice versa. Twenty household from each administrative wards with the help of random stratified sampling techniques have been selected. It means total number of 80 fuel wood consumers have been selected. Interviews have been conducted using close and open ended question in questionnaire taking into the consideration of its significance.

Third layer of interview were conducted with the fuel wood collector (both trader and consumer). The trading of fuel wood is ban in the country. Therefore, identifying and recognizing them is difficult. Keeping into the consideration of nature and character of trader who are always hiding and avoiding, researchers have identified total 20 traders who have been involved in fuel-wood and charcoal trading in the study region.

Secondary data have been generated from published and unpublished materials from library, archives, internet and various administrative sub zone and branch of Ministry of Agriculture offices. Collected data were tabulated and analysed with the help of quantification and qualification. Simple percentage and graphic chart have been developed to understand the marketing-distribution channels, nature and characteristics of fuel wood consumptions. With the help of remotely sensed images and GIS techniques, the most vulnerable area of forest cover have been identified to understand the affected areas in the absence of alternative fuel shortages.

RESULTS AND DISCUSSION

The use of wood as a fuel source for lighting, heating and cooking is as old as civilization itself. Wood fuel is wood used as fuel. The burning of wood is currently the largest use of energy derived from a solid fuel biomass. Wood fuel may be available as firewood, charcoal, chips, sheets, and pellets etc. The particular form and their use are depends upon factors such as source, quantity, quality, availability and application (Campbell et al., 2003; Davis, 1998; Heltberg et al., 2000; Ouedraogo, 2006). Majority of the residents in study area depends on wood fuel to meet basic cooking energy need. At aggregate level, wood fuel use accounts for 75 % of residential cooking energy consumption in the study region.

Generally, in the household, an ideal fuel preference ladder with fuels at the bottom and kerosene and electric at

the top exists (Leach 1992). Preferences to these fuels are based on presumed rank built on physical characteristics of cleanliness, ease of use, and cooking speed. The households transition up and down the fuel ladder with the rise and fall of the household income, the improved distribution and availability of fuels, or the increasing scarcity of a fuel source (Horst & Hovorka 2008). Household energy surveys have found that income is the major determinant of the energy transition (Alam et al., 1998; Campbell et al., 2003; Davis, 1998; Ouedraogo, 2006). However, in the study area the preference of fuel wood, charcoal and other biomass as a source of energy is apart from income level, lack of other alternative source of energy is the prime factor for the use of fuel wood. Therefore, most of the households are highly relied upon the wood fuel as a major source of energy in combination of other biomass fuel energy.

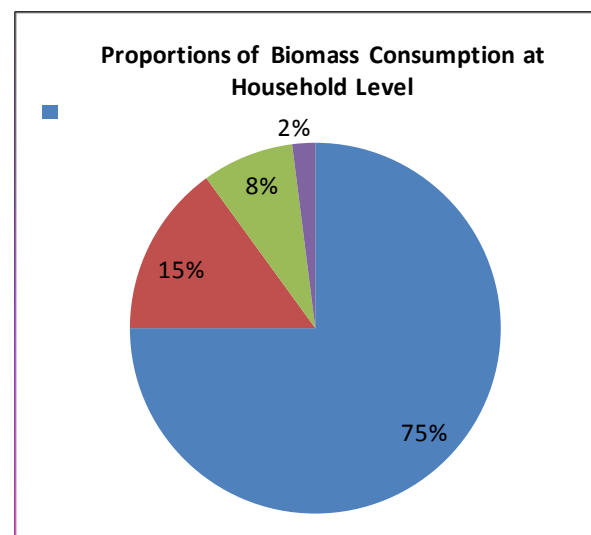


Fig 1

Preferred household fuel consumptions

The fuel preference ladder is broken down into 3 categories in the study region: biomass fuels, transition fuels, and modern fuels. The biomass fuels are divided into two categories: dung and crop residue, and fuel wood. Dung and crop residue reside below fuel wood and are used when fuel wood is scarce. Biomass lies at the bottom of the ladder. On the next tier are transition fuels of charcoal and coal. The top tier consists of kerosene, electric, liquefied propane gas (LPG), solar, and wind.

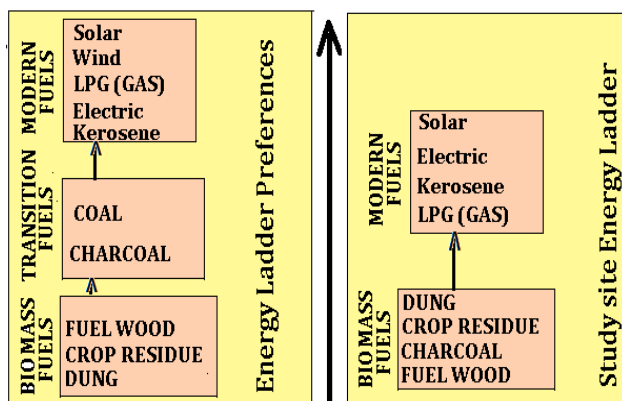


Fig 2 Energy ladder preference

Since there are shortages of other alternative energies people using fuel wood as their first choice to run their household cooking-energy demand. Fire wood is mostly used for preparation of daily meals. Secondly, most used fuel wood energy is charcoal. Though charcoal is mostly preferred for coffee and tea preparation, nowadays it uses for stew, soup, sauce, fricassee, etc. preparation. In the case of Adi-Keih town, the main sources of energy used by households are wood and charcoal. In addition to these, agricultural residue, animal dung and scrap are also used by those residents who can't afford the cost of wood and charcoal. Almost 75% of the residents of the town are using fuel wood.

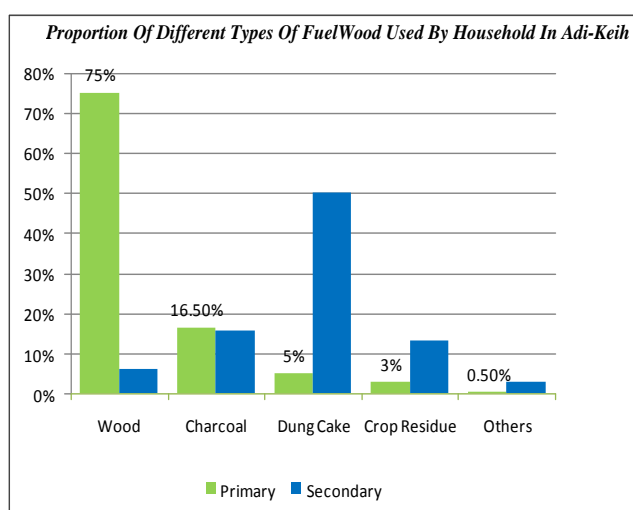


Fig-3

(Source: Based on Field Survey)

But they are not using all kind of biomass alone but in combination with other sources of energy, such as LPG, electricity. There are also only selective peoples who are using electricity and gas. Supplies of modern fuels are not

regular and sufficient according to requirement in the study area. That is why majority of the people depends on fuel wood, charcoal, dung etc. 75% of our interviewers depend on wood as their primary source of energy in household and 6.2% as their secondary source. The 16.5% depend on charcoal as their primary source and 15.8% as their secondary source. Dung cake is used as primary and secondary source respectively as 5% and 50%. Crop residue used 3% as their primary source and 13.5% as their secondary source. Dung cakes and crop residue are mostly used by the poor and needy consumer of the society as their primary source. The modern energy source like electricity, gas and kerosene are used hardly as the primary source because they are not sufficient and comprise merely 0.5% as primary and 3% as secondary source.

Wood fuel catchment area

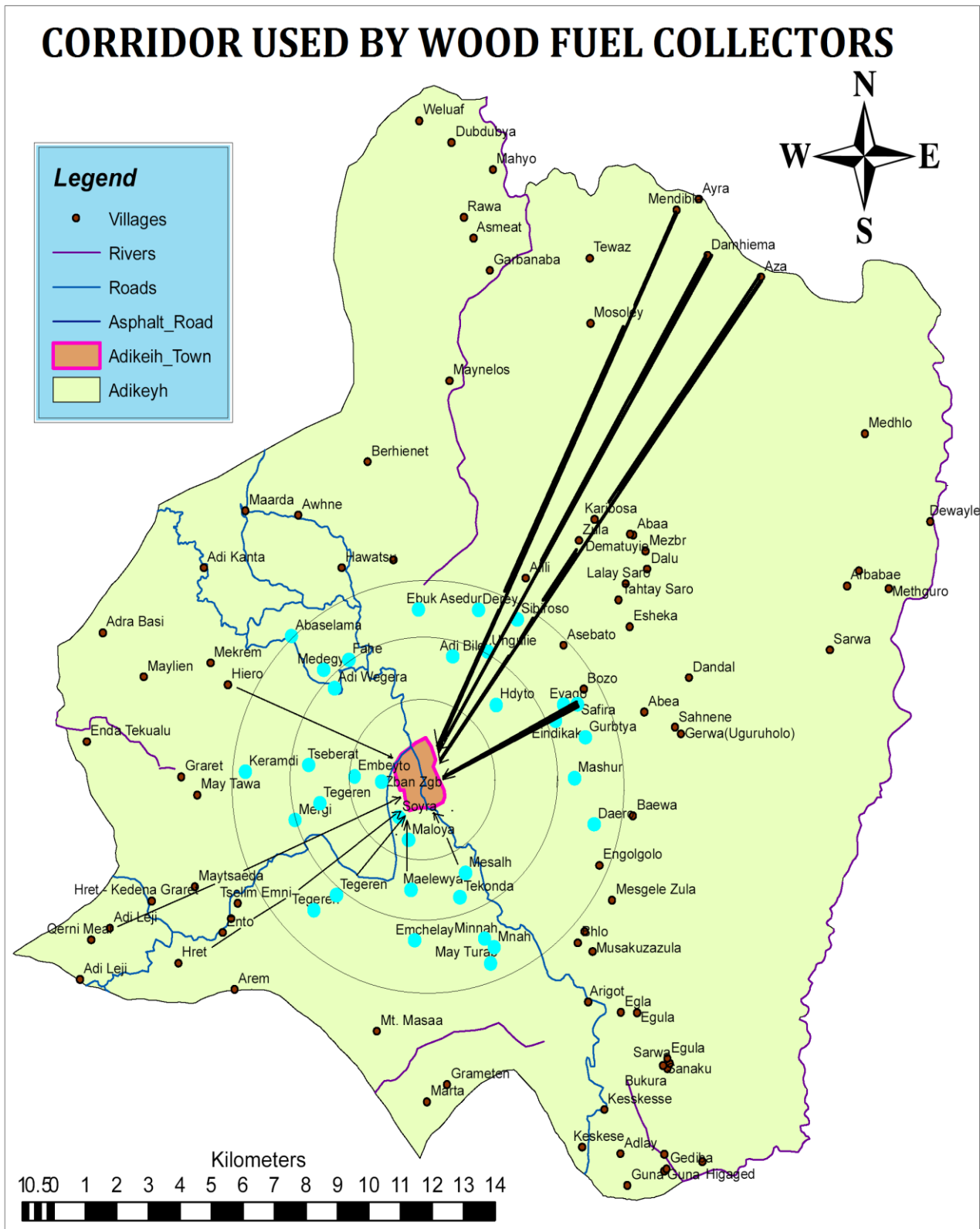
The main sources of fuel wood energy in study area are fulfilled from immediate neighbouring region as well as far off from the surrounding localities or villages. Consumers who belong to lower economic strata generally gathering fuel wood from immediate surrounding localities. While traders apart from surrounding regions most of them are collecting it from far off localities. Broadly we can categorize into two broad regions (Eastern and Western corridor) from where most of the fire wood collectors (consumers and traders) are collecting fuel wood.

North-Eastern corridor:- Comprises villages like Ruba-Hadas, demhina, kohaito, Dahanlo, Goradaf, Meager, Guragur, Safira, Karibosa etc. These areas are the main sources for the Adi-keih town fuel energy.

South-Western corridor:- comprises villages like Hret, Hakoita, Hiro, Madiegeya, Mai feres, Enda Umaro, Qerni maer, Qaetit, Dbar, Qonteftefe, Fullho etc. there are sub channels like Wonkeb ,Berkito, Endiheish, Mai Seraw, etc. located to the northwest.

Preferred wood fuel species

There are various types of woods species that grow in the subzone of Adi-Keih and its vicinity. Use of wood depends upon their types of requirement and their availability in the region. The table below shows that all the woods that grow in sub-zone are both indigenous and exotic. Most of the indigenous types are now endangered as being substituted by others species like Eucalyptus Camaldulensis, and Cupressus Lusitanica to great amount in the process of reforestation and afforestation in the region.



Map 2 Corridor for Wood Fuel collection

Table 1 Plant Species in Adi Keih Sub Zone

S. No	Local name	Botanical name	Indi- genous	Exotic
1	Tshdi	Juniperus Procera	✓	
2	Awlii'e	Olea Africana	✓	
3	Tahses	Dodinala Augustifolia	✓	
4	Sagla	Ficus Sycamorus	✓	
5	Dae'ro	Ficus Thoningi	✓	
6	Mebte'	Carissa Schimper	✓	
7	Gaba	Ziziphus Spina- Christi	✓	
8	Meqi'e	Balanites Aegyptiaca	✓	
9	Seraw	Acacia Etbaica	✓	
10	U'buk		✓	
11	Qelamitos	Eucalyptus Camaldulensis		✓
12	Beles	Ficus Capreaefolia/Carica	✓	
13	Alakhit		✓	
14	Mesegod		✓	
15	A'la	Acacia raddiana(tortilis)	✓	
16	Grawa	Veronia Amygasalina		✓
17	Tabeb		✓	
18	E're	Aloe Megalacanth	✓	
19	Tshdi Ferengi	Cupressus Lusitanica		✓
20	Momona	Acacia Albida	✓	
21	Atat	Maytenus Undata	✓	
22	Htsawuts	Calpurina Aurea	✓	
23	Metheguf		✓	
24	Nim	Azandrachta Indica		✓
25	Sye	Phoenix Dactylifera		✓

(Source: Ministry of Agriculture, Adi Keih)

Fuel wood is used for mainly household purposes, such as cooking and heating. Moreover, some proportions are also used for commercial and ritual practice. Users of fuel wood usually prefer it according to the fire intensity and their duration of fire longevity. Not only that, their market value is also depends upon their heat intensity and its duration. Consequent to this some of the species have had to be exhausted very rapidly from the region. The following list of forests species are arranged in the order of their high demand for firewood in the study area. The list of most preferred firewood species have been prepared according to the choice of its user. More than 80 percent of the respondents prefer the species below in table 2 as their first choice. In fact, it's simple for the users to select best type of fuel wood based upon their own experience.

Table 2 Best wood fuel species in Adi Keih

S. No	Local Name	Botanical Name
01	Seraw	Acacia Etbaica
02	Awlie	Olea Africana
03	Kiliaw	Euclea Shimper
04	Tshdi	Juniperus Procera
05	U'buk	
06	Qelamitos	Eucalyptus Camaldulensis
07	Qolqal	Euphorbia Abyssinica
08	E're	Aloe Megalacanth

(Source: MOA and Field survey)

Nature of Wood fuel Collectors

Wood fuel is one of the important sources of fuel in the study region. Most of the lower economic class people residing in the region depend upon the wood fuel collection from nearby localities. While higher class residents depends upon wood fuel and charcoal from sellers, who are engaged in collection and their selling in the town. Both traders and consumers collect fuel-wood from the region depends upon their objectives and accessibility. Though, theoretically collection of wood fuel from restricted areas is prohibited. However, lack of regulation and alternative source of energy affects their decision and exploitation. On their nature broadly there are two broad categories of fuel-wood collectors:

- ❖ First consumers-colleting wood fuel for their self consumptions mostly from fringe of the town and immediate nearby localities.
- ❖ Second sellers/traders (Both authorized licence holder and Unauthorized) – There are two broad categories of traders: licensed traders and unauthorized traders. Licensed trader (their number is only two) is inactive in the study area. Food fuel supplied by licensed traders is inferior in quality as well as relatively higher in costs. Second kind of trader is unauthorized traders and they contribute the entire share in wood fuel trade.

In many localities of study region wood fuel are gathered freely from the local environment of fringe area of town, and the main costs of wood fuel use is the time to collect the fuel (Agarwal 1994). Wood fuel beyond a certain distance will take too much time to collect. It depends upon the nature of wood fuel collectors and their objectives. Moreover, time required to collect wood fuel is also influenced by nature of the terrain such as hills, rivers, and gullies. Steep slopes, rugged terrain, and watercourses (dry channel) add significantly to the collection time. Locational constraints on access can be calculated in relation to the benefits accrued for the time and effort taken. Whether people are willing to pay this price

depends on the available alternatives to wood, the users' income, and the opportunity cost of the collectors' labour time.

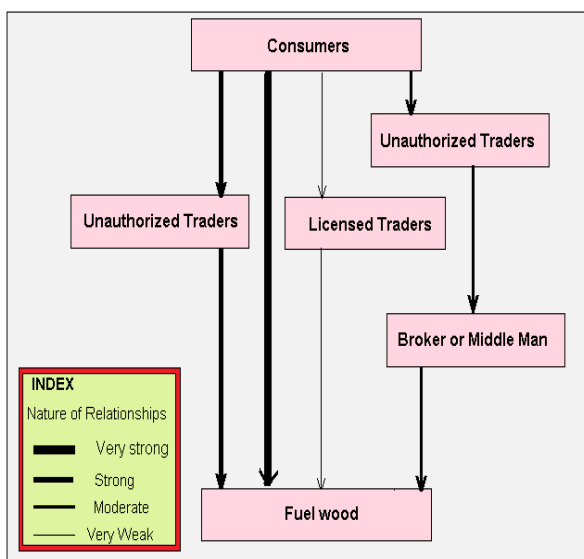


Figure 4 Channels of Fuel Wood Consumptions

Fuel wood Consumers

There is an acute shortage of alternative fuel energy in the study region. So, most of the residents are depends upon wood fuel. Consumer who can't afford it, they are collecting from the immediate-localities. Fuel provision is frequently the women's responsibility in the household. Collection fuel wood is physically hard and time-consuming work, an arduous burden on women who typically are also responsible for all household work in the study region. As pressures on the local resource base develop, the distances travelled, collection times, and other demands on women also increases. This is what happening in this part of country too. Most of the wood-fuel collection is women's job (Agarwal, 1994). More than 75% of female in the Adi Keih town are collecting fuel wood fuel as compared to their male counterpart. Male proportions in the collection of wood fuel are quite less accounting for almost 12%, while children also contributes similar proportion as par with male as far as wood fuel collection is concerned.

Table 3 Nature of Fire wood Consumers

Characteristics	Percentage	Distance
Male (Adult)	12	7 kilometres
Female (Adult)	77	5 kilometres
Children (Below 14 years)	11	2 kilometres
Total/Average	100	4.66

Source: Field Survey

As far as distance is concerned a single consumer travel almost average 4.66 kilometres for the fire wood collection. But it varies according to the nature of fuel wood collectors. Mostly female and children are collecting wood fuel from nearby localities. Female are travelling distance up to 5 kilometres of radius, for fuel wood collection, while children travels average 2 kilometres of distance for the wood fuel collection.

Table 4 Time spent and Frequency in fire wood collection

Time spend	Percentage %	Frequency	Percentage%
Less than 4 hours	34.4	Daily	60
4 and 8 hours	54.4	3 times in month	23.8
More than 8 hours	11.2	Twice in month	11.2
Total	100	Once in month	5

Source: Field Survey

Demand for fuel wood and charcoal can have a devastating impact on the surrounding areas. Consumers often consume wood fuel without any attempt to conserve the resource base from the surrounding areas of this town. Thus time taken in its collection is constantly increasing from less than 15 minutes (in 1960) to presently almost 4 hours per trip. More than 55 percent of wood fuel collectors spend almost 4 to 8 hours in its collection per trip. Almost 90% of the consumers are collecting wood fuel from just 5 kilometres of radius of the town in which major proportions (60%) they collect from south and south west of the town. It includes the villages such as Maloya, Mesalh, Tokonda, Maelewy, Tegeren etc.

Size of the family decides the frequency of trip for the fire wood collection (Liu et al., 2003). Average size of the family member is five people per house in the study region. But some of the family size is extensive. Almost 60 percent of fire wood collectors usually visit daily for the collection of fire wood and other biomass energy to meet their requirement. Only 5 per cent of the fuel wood collectors visit once in month for the collection of fire wood.

Thus, here we can conclude that in the study area consumers who are collecting fuel wood for their self consumptions are mostly female and travelling average 5 kilometres daily and spend almost 4 to 8 hours in firewood collection. Fuel wood consumer, however, do not use any means of transportation rather they are carrying wood bundle on their heads.

Wood fuel traders and trade

Recent studies (Leach and Mearns 1988) suggests that even in cities where wood fuel is more expensive than the modern alternatives, people prefer wood fuel because the supply is more secure; the wood fuel is available in small, affordable quantities in local markets; and wood fuel requires no expensive initial investment in cooking stoves. Therefore, to understand urban wood fuel problems, it is essential to understand the structure of urban fuel markets. The cost of wood fuel to urban consumers (especially the poor) can be significant, and there is some (though patchy) evidence that in many places the cost is increasing. A more general problem is access to fuel markets for many non-wood fuels are typically poorly developed, particularly in peripheral neighbourhoods where many poor people live. Governments often restrict imports and

the internal distribution of commercial fuels. This situation contrasts markedly with wood fuel markets, which usually reach all corners of the Adi Keih town.

Almost 50 per cent of the households are purchasing wood fuel and charcoal in different amounts. In spite of the ban imposed by the administration to sell and purchase of wood fuel by illegal traders, charcoal trade is common in the study area. Wood fuel trade is typical and tedious because of bulky nature of commodities. In the trade and business most of the male are engaged. More than 90% of the traders are male. Proportion of female in wood fuel trade is insignificant in the study region. Females are mostly engaged in wood fuel collection while male counterparts engaged in their sell. Traders are travelling almost up to average 50 kilometres and spend about 2 days in wood fuel collection.

Table 5 Nature of Wood fuel traders

Sellers or Traders			Modes of Transportation in %			
Characteristics	Percentage	Distance (Kms)	Camel	Donkey	Automobile	On head
Male (Adult)	90.	45 kilometres	80	15	5	-
Female (Adult)	10	5 kilometres	-	-	-	100
Children (Below 14 years)	000	00	-	-	-	-

Source: Field Survey

They are collecting wood fuel from far distance of remote inaccessible undulating topography. Therefore, their preference mode of transport to carry wood bundle is camel. Camel is common mode of transport to carry wood fuel from the point of collection to the point of sell/consumption. More than 75% of traders are using camel as major mode of transport to carry wood fuel. Proportion of automobile is insignificant as mode of transport for wood fuel traders. It is because of unavailability of automobile, inaccessible terrain and as well as regulation imposed by the governments where they cannot carry through roads.

Traders who are engaged in business of wood fuel in the town follow different modes of sale. The only expenditure spend by the trader is the time-costs in wood fuel collection. So, the price is not uniform and fixed. It depends upon the demand and supply as well as agreement between trader and consumers. However, average price of wood fuel per quintal varies between 1000 to 1200 NKF per quintal. There are also other mode of sale such as donkey load, camel load, and bundle load. Their price in NKF 400, 1300, and 150 for donkey load, camel load and bundle load respectively.

Table 6 Price index of Wood fuel

Modes of Sale	Price in NKF	Purchase by consumers %
Per Quintal	1200	7
Donkey load	400	30
Camel Load	1300	55
Bundle Load	150	8

Source: Field Survey

Moreover, proportion of purchase is high among the higher class of households in Adi Keih town. Lower economical class people rarely purchase wood fuel. Hence, it has clear effects on the modes of sale. Majority of purchaser prefer to purchase camel load, followed by donkey load and bundle load. The reasons for highest proportion of camel load purchase by consumers are due to two important reasons: first camel traders bring wood fuel of special kind from far off places; second the quantity of wood fuel is relatively higher in camel load. Thus affects the proportion of sale through camel load in the study region.

Consumptions of Wood fuel

Fuel wood consumption for cooking purpose is very high in the study area. Use of modern fuel is selective only for

baking *injera* and *himbasha*, which requires the highest energy consumption rate in cooking. Kerosene is slowly being introduced in the study region for cooking but too has interrupted-limited supply. Dung and agricultural residue, though, they cannot replace fuel wood (because of their weak energy output), could mentioned as an energy alternative in households where household rears livestock and cultivate farmlands.

Households Consumptions

The level and amount of wood as a fuel source varies from house to house in the study area. Level of wood fuel use varies according to level of income, requirement and supply, however, due to shortage of alternative fuel source almost all the residents of this town remain using wood as a fuel at various level.

The family who buys wood fuel from the market are focussing on selecting those wood fuels which can produce best quality of charcoal with little smoke and having high duration of burning. Lower income group family select mainly *Eucalyptus Camaldulensis* (*Qelamitos*) and acacia segal (Tseada Chea) due to its lower market costs and easily available in the neighbourhood. Production and marketing of charcoal is officially banned in the country, however, their supply is remain in the market.

Institutional and Commercial consumptions

In addition to the households wood fuel consumption, the governmental institutions including hospitals, concentration camp, police station, military camp, ...etc. locating inside Adi-Keih town consume huge amount of wood fuel. Besides, there are commercial enterprises - such as restaurant, and snack bar also using wood fuel for their energy requirement. Moreover, traditional food enterprise also using wood fuel for their commercial activities.

Wood fuel Consumption and Afforestation

The amount of wood fuel consumed in Adi-Keih town could comprehend for different purposes. Wood fuel consumed for different purposes like, household requirement, marriage, mourning, baptism, annual rituals and other related activities. Generally, the different consumptions being held by the society could give some implications about the impacts on the environment by comparing with that of afforestation efforts conducted in the town. As the data collected from the survey suggested the rate of wood fuel consumption exceeds the rate of afforestation, this town is in the risk of wood fuel scarcity for future unless remedial actions has to be taken to regenerate trees or alternative cooking-energy sources.

Table- 7 Wood fuel consumptions and Afforestation

Wood fuel consumption sector	Total consumption Quintals	Tree planted yearly	
		People	
Household	57240	145,910	
Government institutions	1680	19,456	
Commercial enterprise	144	total	165366
Marriages	17280		
Mourning	4320		
Annual Rituals	14400		
Baptism	4320		
Others	360		
Total	99,744		

CONCLUSION

Wood fuel is the dominant sources of cooking energy in the study area. The heavy dependence of wood fuel is likely to be continued for the foreseeable future as long as suitable alternatives fuels are not in place to substitute wood fuel perfectly. Almost 75 per cent of the household are using wood fuel for cooking their food in combination with other mode of fuels. The high dependency of wood as a fuel is due to unavailability or interrupted supply of alternative source of energy in the town. The main local sources of wood fuel in Adi Keih town are from eastern and western channels of the town margin. Almost 70 percent of lower economic class people collecting their fuel from 5 kilometres radius of town. Among them mostly females who are collecting wood fuel daily, spending 8 hours a day in wood-fuel collection from the vicinity.

It is widely believed that if household income increases, people tend to diversify and switch from wood fuel and charcoal to modern fuels. But in the study region in spite of high income people prefer to use wood fuel because the supply is more secure. The difference here as far as economic structure of household is concerned, higher income strata people usually purchase wood fuel from the trader. Transaction and business exchange of wood and charcoal is theoretically banned in the country. Therefore, business associated with wood fuel or charcoal is usually hidden and most of the traders prefer their transaction either during late evening or early morning. They are collecting wood from average 50 kilometres of radius from the town.

Traders who are engaged in trading, they are earning almost 3000 to 4000 NKF per month. As far as they have not to spend any amount of money in its collection, so,

their investment is in the form of time. Lack of alternative source of income derives them to be engaged in such business. They usually follow unusual route to carry wood. Camel is one of the important modes of transport for them taking into the consideration of landscape of the region.

Use and level wood fuel consumptions vary from sector to sector. There are almost eight different sectors have been identified, where wood as a fuel is consumed at different scale. Among them household consume more than 50 % of total consumption of wood fuel in the town, followed by marriage and annual rituals consuming almost 30% of total wood fuel consumption in the study region.

As wood is the only reliable sources of cooking fuel in the study region, so its use and collection has sever implications on the supply and local environment. The clear visible impact fuel wood consumption is in the form of sharp decrease in the supply of wood, increase in the amount of time for its collection. Moreover, exposure of land due to removal of covers reducing the capability of land and intensifying the erosion. Thus overall, it's affecting the carrying capacity and capability of the land and environment in the region.

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