FUELWOOD CONSUMPTION IN NAMIBIA: (A CASE STUDY ON FUELWOOD CONSUMPTION IN OSHANA REGION)

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May 2004

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2004

being a

DISSERTATION

submitted to

THE UNIVERSITY OF WALES, BANGOR

in partial fulfilment of an

HONOURS DEGREE IN FORESTRY

May 2004

University number 500031335

DECLARATION

I declare that this is the result of my investigation and that it has not been submitted or accepted in whole or part for any degree, nor is it being submitted for any other degree.

Candidate: Helena Mwadina Tulimekondjo Negumbo

Signature: .....

Supervisor:.....

Signature:.....

Abstract

Fuelwood consumption was assessed June and July 2003, in Oshana region, Namibia. Oshakati and Ongwediva towns were selected as the study area. Thirty people were interviewed from each town to find out fuelwood consumed for a period of time and alternatives sources of energy used when fuelwood is not available. Twenty bundles of firewood were weighed for establishing a typical value for the amount of firewood used per family from each town. The finding was that a family with 3 to 10 members of family consumed from 22 bundles per month per family to 29 bundles per month per family. The average weight of each bundle was estimated at 7 kg (weight of fuelwood sold at Oshakati and Ongwediva open market 2003). Fuelwood prices rose N$0.57 and N$ 0.47 in Oshakati and Ongwediva respectively from 1997 to 2003. Fuelwood remains the main source of energy used for cooking in both Oshakati and Ongwediva. Gas, electricity and kerosene were used in both Oshakati and Ongwediva as the alternative sources of energy when fuelwood is not available.

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Dedication

This thesis is dedicated to my husband Richard Simushi Lutombi, to my daughter Pomwene and my son Simushi for the patience during the whole study.

Acknowledgement

Certainly the first acknowledgement is to my supervisor Dr. J.B. Hall for his support, guidance and assistance during the whole phase of this project, thank you.

Sincerest gratitude is extended to the Finland government through Namibia-Finland Forest Program for funding my study. Thanks are to the government of Namibia government for offering me the study leave and all the assistants during my study.

Great appreciation is also expressed to Ongwediva Forestry staffs; whose not only provided the transport during the fieldwork but also help with survey.

Many thanks are to my husband Richard Lutombi and my two kids for their patient. Thanks mum for taking care of my kids during my study, thank you dad for the assistances and encouragement.

Last but not least many thanks are due to my whole family and to my two colleagues Nafele and Walles for all the contribution to this book.

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CHAPTER 1

1. INTRODUCTION

Globally, 2.3 billion people still rely on biomass for their cooking and heating and millions of people make money from selling fuelwood and charcoal. Fuelwood remains the prime sources of energy in developing countries, representing up to 81 percent of the wood harvest (FAO, 2001). In contrast, in the industrialized countries, fuelwood account for less that 10 percent of total fuelwood consumption. Wood fuel consumption in Asia has more or less peaked, but in Africa and Latin America it still growing rapidly (Smith, 1982). Fuelwood dominate the energy economies of virtually of all Africa country, in Sub-Saharan Africa it account for 60-95 percent of total national energy use, with the highest proportion in the poorest countries (Leach and Mearns, 1988).

Fuelwood is the primary source of energy across the Southern Africa region, it is estimated that more than 84 361 million m^3 of fuelwood is used annual in the region (African Development Bank, 2001). According to African Development Bank report (2001), woodfuel is likely to remain the most important source of domestic energy in the region on count of population growth, low incomes and the limited availability and accessibility of alternative energy sources. Even in urban areas, woodfuel will continue to be a major source of energy, especially for low-income households. Natural forests and woodlands (especially under communal ownership) is the most important source of woodfuel, although it is also obtained from woodlots and trees outside forests. In southern Africa some plantations have been established to meet urban woodfuel demand in cities such as Blantyre, Lilongwe, Harare and Gaborone, but they are far from adequate to meet the growing demand (African Development Bank, 2001).

In Namibia Fuelwood remain the main sources of energy for cooking, lighting and heating in the rural and sub-urban areas. Wood is used directly as fuelwood. In 1997 it was estimated that 90 percent of rural people still relay on firewood for cooking and lighting (Wamukonya, 1997).

Much charcoal produced in Namibia are consumed outside the country, it is estimated that 6,000 tons of charcoal is being exported to Europe and South Africa every year (Klaeboe and Omwaami, 1997).

Traditionally people collect firewood from local sources, without putting more effort to do it, and some parts of the country this continues. In other parts, increasing demand for wood from a growing population has contributed to deforestation. The population of Namibia is growing rapidly at a rate of 3%per annum (Census Office, 2002). Rapid population growth translates into increased of human needs and services and thus intensified pressure in limited resources, but with the expansions of rural electrification and the possible development of Kudu Gas Field, the demand of fuelwood in rural areas may go down.

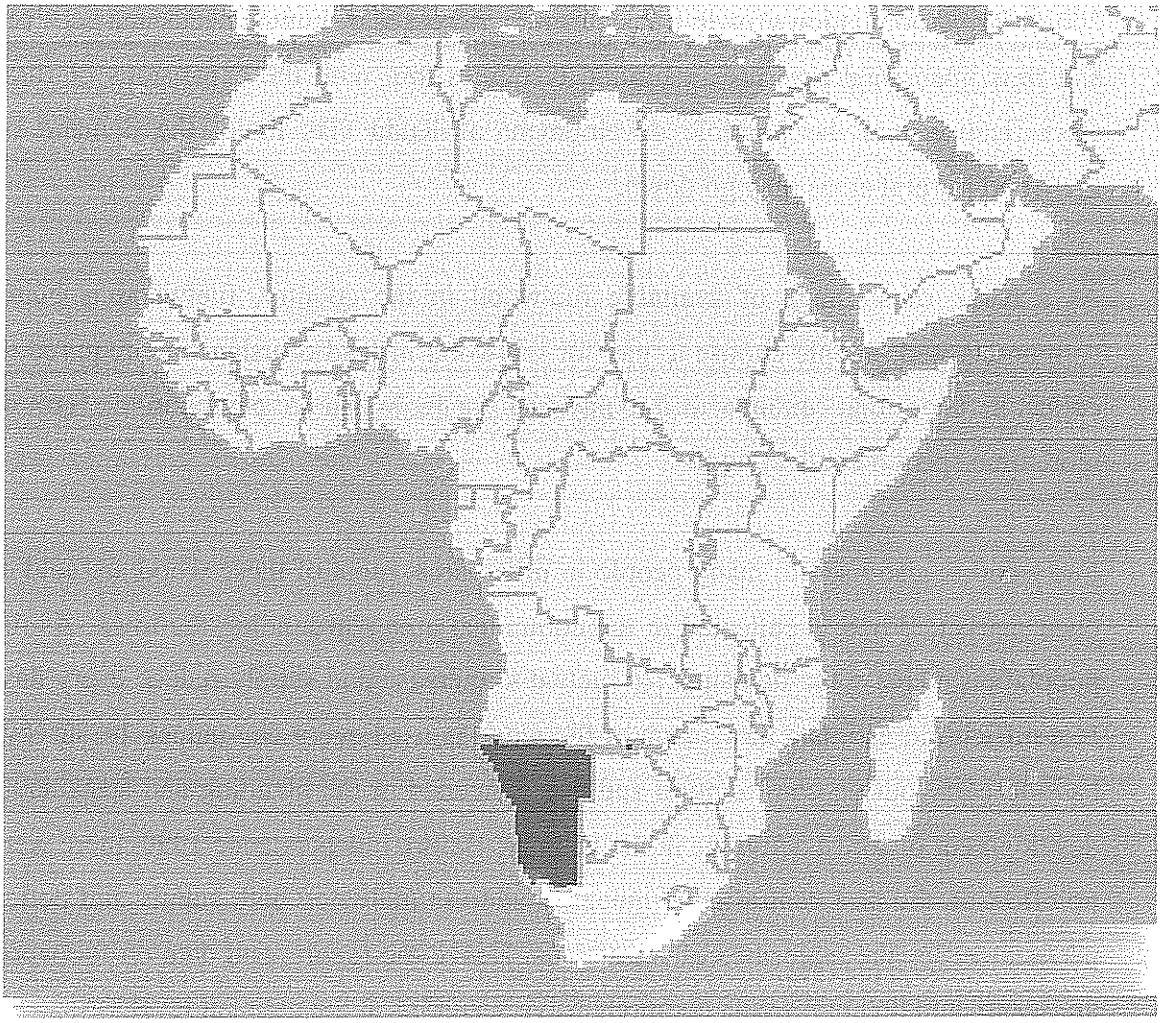
As a result of shortage of available fuelwood in the country, fuelwood is being commercialised. People choose to pay for fuelwood instead of using time required to collect it. Those that cannot afford to pay cash for fuelwood are paying in the form of more time spent on collecting it.

Fuelwood is also used to many people in urban area, most of these wood are sold at open market. Wood is collected in the communal area surrounding the town. As the population increase the demands for fuelwood increase and supply reduce every day. It is difficult to estimate how much of the wood is used every day unless the surveys have to carry out on consumption and this is needed in the planning and sustainable development of forest activities in the country. Before independence 1990, there were no effort on the past central government to address fuelwood both supply and policy perspective for the majorities of Namibians. Hence the reports and data on fuelwood are scanty and do not provide comprehensive scenarios at the national level.

Namibia is located on the southwestern corner of Africa. It is bounded in the north by Angola, Zambia and Zimbabwe, in the east by Botswana, in the south and southeast by the Republic of South Africa, and in the west by the Atlantic Ocean (Fig.1). It cover an area of 82,4 million ha, sq km. The country is large arid, but encompasses broad geographical variation; the scrubby, eastward-sloping central plateau, Kalahari sand along the Botswana and South Africa border and woodland of the northeastern

Kavango and Caprivi regions. The northern border is flush with rivers that provide water to most of Namibia, as there are only few rivers within the country most of which are sporadic.

Figure 1 Africa map shows Namibia in red.



Source: Country report (2003)

1.1 Climate

Namibia has a climate with extremely variable and unpredictable rainfall. The average annual rainfall increases from less than 20 mm on the coast towards the northeast, where Caprivi region receives more than 700 mm. The potential average annual evaporation varies between 3 700 mm in the central-southern area to 2 600 mm in the north. The most arid climate is found in the central Namib where summer daytime

temperature rises to over 40 °C but can fall to below freezing point at night. Daytime temperature in the mountainous and semi-arid plateau is generally lower than in the rest of the country. December is the hottest month everywhere when daily temperature hit an average of 30 ^{0}C. The first rains can be expected in the northern parts of the country in October or November and in the drier southern areas, two months later. The rainfall peaks in January –February in the northern areas and in March in the southern regions. Fog is common on the coast.

1.2 Population

The population is estimated to be 1.8 million, with an average population growth rate 3 % (Census Office, 2002). The average population density in Namibia is only 1.8 inhabitants per km^2, ranging from 5 to 15 per km^2, in the northern regions bordering Angola, too les than 0.3 per km^2 in the south.

1.3 Economy

Namibia economy is heavily dependent on the earnings generated from primary commodity exports in a few vital sectors, including minerals, livestock and fishery. Namibia's economy has been very open, the emphasis being on primary production for export, while the bulk of processed goods required for domestic market have been imported. The majority of the population engages in subsistence agriculture. Namibia's average GDP per capita is relatively high among developing countries but obscures one of the unequal income distributions on the Africa Continent.

1.4 Research Objective

The main problems identified in the urban fuelwood situation in Namibia was that; the fast rate of urbanization has put considerable stress on the existing fuelwood resource and there is lack of knowledge about the current fuelwood use patterns and their environmental impacts on the environment. The increasing unavailability of fuelwood has a potential negative impact on low-income urban households who do

not have the means to either switch to other fuels or collect fuelwood beyond walking distance.

Much have been document in fuelwood consumption and production in Africa and other part of the world, but in Namibia information in fuelwood consumption is very little, it was in this ground that this study was taken.

Project objectives were:

1. To estimate the quantity (volume) of fuelwood consumption per household over a period, through field survey (the primary objective).

2. To compare firewood prices between 1997 and current price (2003)

3. To find out alternatives used when wood is not available.

CHAPTER 2

2. FUELWOOD AS A RURAL ENERGY SOURCE: A BRIEF REVIEW

This chapter reviews literature on fuelwood as a rural energy resource, looking on Africa as a whole, southern Africa as a subregion and, specifically Namibia. It discusses the recognition of fuelwood as a key resource (2.1), and fuelwood demand and supply today in terms of practices and implications (2.2), and prospects (2.3).

2.1 The recognition of fuelwood as a key resource

Tree growing by rural people is nothing new. In many societies, it has been taking place since the beginning of settled agriculture. The extent to which happens varies, however, throughout the developing world. The prediction of a woodfuel crisis in developing countries in the 1980s was based largely on looking at supply and demand from forest plantation and natural forests. The reaction to the expected woodfuel crisis was to plant trees for this purpose, often in the form of traditional plantations. Globally, non-industrial forest plantations in 1995 were estimated to cover about 20 million hectares (FAO, 2001). A significant proportion of these were planted for fuelwood and 98 percent were in developing countries. Three quarters of this plantation were in Asia (excluding Japan), where they account for 60 percent of total plantation production (FAO, 1998).

The successful example of tree growing to produce fuelwood for urban area is from Ethiopia. The program for tree planting has started in late 1890s the emperor Menelik introduced legislation to exempt land planted with trees from taxation and arranged for the distribution of seeding at nominal prices, by 1935 the size of the forest was 4 000 hectares and by 1957 the forest area was covering 10 000 hectares (Foley and Barnard, 1984). This was a response to an extreme scarcity of wood around the new city of Addis Ababa.

Forestry development in Namibia started at the beginning the 20 century when the role of woody vegetations in environmental protection was recognised by the

Germany colonial government (Erkkila, 1992), but this collapse during occupation of South Africa. The national forest policy that was developed emphasised nature conservation, particularly the protection of riverine forests. Although the national forest policy promoted environmental forestry, the dependence of the colonial economy on imported timber, led to the attempts to establish large-scale afforestation programmes based on a combination of exotic and indigenous species. The effort in plantation forestry targeted the areas in the central parts of the country. However, poor results of artificial regeneration and the high cost of establishment made plantations forestry unfeasible forestry development alternative. To cut down public expenditure on tree planting programmes, it was recommended that farmers should be encourage to plant trees on agriculture land (Directorate of Forestry, 1996).

The Namibia Forest Strategy Plan was formulated in 1996 to achieve forestry sector development goals, one of the three broad strategy is; Farmers and communities should be encourage to practice smallholder forestry, management (i.e. farm forestry, agroforestry, community forestry, social forestry, joint forest management) for local economies development. Land tenure (or appropriate property right over forest resources), extension, and marketing incentive should be main instrument used to encourage the adaptation of forestry for local economic development.
Communal areas experiencing population pressure are characterised by the declining forest cover and tight-farmed landscape. In these areas, common property resources management has little potential, as per capital benefit will be extremely low and transaction costs high. The most promising focus for local involvement in forestry is on the creation and maintenance of tree resources on farms. Farm forest will ameliorate the shortage of basic forest product needs, particularly, firewood and fencing materials (Directorate of Forestry, 1996). The starting point of promoting farm forest should be through forestry activities which already form a part of the household land use.

The program were set for the main components of farm forestry which was suppose to be implemented by different stake holder such as DoF, Ministry of Finance, NPC, NGOs, MAWRD and farmers. There are few trees inside the homesteads, mainly fruit trees. Most of the community does not yet know fuelwood production; the problem of

shortage of firewood is not yet addressed either by government or by local people themselves "pers. obs"

2.2 Fuelwood demand and supply today

2.2.1 Supply and demand

The supply of urban woodfuel is almost exclusively on a commercial basis. The mechanisms, by which this happens, vary considerably. In big cities the trade is often organised by the wholesale depots from which smaller retailer obtain their supply.

Many rural areas in parts of Southern Africa are today faced with an energy crisis through rapid depletion of woodfuel resource, which provide principal, and in some cases the only source of fuel.

According to Williams and Shackleto (2002), 80 to 99 percent of rural household in South Africa meets their energy requirement with fuelwood. The bulk of this is supplied by domestic collection from indigenous savannas.

In Namibia, fuelwood supplies come from different places; in the north central fuelwood is obtained mostly from communal area and also from private farm in the central both directly from natural forest just to the reason that they are no plantations in Namibia. Sometimes the owner of the farm are the one involve in the business, they instruct their labourer to cut the wood and then loading in the truck to go and sell to the small retailer in the cities. In some case, people go to these private farm and ask the owner the permission to harvest firewood of course they have to buy it, but maybe at low cost because they have to do harvesting themselves.

In towns, the supply of fuelwood tends to be formal compare to rural supply. Rural supplier sometimes transport fuel to the towns, using bicycle, donkey or bull carts, carrying it on buses, or bring it in by headloads. Some sell to the dealer while others trade directly in the market place.

In Oshakati and Ongwediva town, fuelwood comes largely form communal land; the dealers obtain a harvesting and transporting permit from forestry offices and then, sell the wood to the retailer in town. Most retailers cannot afford to bring fuelwood themselves to town due to the distance where firewood still available and the cost of petrol. It is reported that most of the fuelwood sold at open market (Oshakati and Ongwediva) are harvested communal area more than 100 kilometres, away from this town. And it was noted that the most people involve in the business of fuelwood at these places are Angolan national especial at Oshakati open market.

The fuelwood in market are well organized. The dealers have enough fuelwood and it sorted in different price classes, depending on the size of the bundle. The sorting is done visually not by weighing but the bundle look of the same size. During the 1997 the bundle of fuelwood at Oshakati and Ongwediva were sorted in price classes from N$1 to N$2.50, and in Windhoek from N$2 to N$6 (Klaeboe and Omwami, 1997).

The price for fuelwood in the supper market is high compare to the price in the open market. In the supermarkets a bag of 5 kilogram can cost N$15 –20 while a buddle of 6.35 kg in the open market can cost N$6.55. This cost is too high especial to poor people, when compared to the amount of firewood need per day per family. High cost of firewood can only reduced by increasing the supply, and the only long-term benefit is through planting woodlots or plantations for fuelwood production.

Illegal tree cutting provides additional sources of supply in many countries. Sometimes this is done by individuals removing small quantities of wood for sale in the town ((Foley and Barnard, 1984).

According to an assessment of the energy of the traditional energy (firewood, cow dung and crop residual) consumed in third world countries, 79 percent is as firewood, 17 percent as crop residual and 4 percent as dung (Bernbridge and Tarlton, 1990). The consumptions of fuelwood per capita per annum is estimated at the average of 1.0 m^3 and account for 58 % of total energy used in Africa.

Most cities in the developing countries rely on wood or charcoal to supply a significant part of their domestic fuel needs. Very few reliable estimates of urban fuelwood consumption are available, at either individual or aggregate level (Williams and Shackleton, 2002).

It is estimated that more than 13 millions m^3 of fuelwood are used annually in South Africa the quantities of fuelwood used per households per annum vary greatly and these depend on a number of factors, including household size, availability of resource and labour to collect it. Figures are raging from 0.6 to 7.7 tonnes per family per annum (Williams and Shackleton, 2002).

Commercial exploitation facilitated by localised shortages and peri-urban demand has led to conflict as entrepreneurs harvest fuelwood from communal areas without approval of local institutions or residences. This is typical of the situation in many other African countries. In Namibia this led to the process of issuing harvesting and marketing permit by the directorate of Forestry to change. Currently the forestry officers need a letter for agreement from the local headmen where the woods suppose to be harvested before you issued with the final permit.

In Rural area people spent many hours searching for firewood and often have to walk long distance to obtain their daily requirement. As a result many people in the rural community gathers cow dung and crop residue for cooking. First people have to gather and carry firewood from further and further away, this tiresome and difficult task falls mainly in women and children. Secondly more and more of the small cash income that rural people have, has to spent on fuel, leaving less for other essentials such as food. In some areas the shortage of firewood is so great that it has affected the number of cooked meals has had to be reduced and the crops people grow have had to be changed to concentrate on those that can be can be eaten raw or with very little cooking (Arnold, 1978).

How much fuelwood is used tend to be determined by the availability of wood, where forest resources are still plentiful and easily accessible large quantities of fuelwood are commonly consumed. In the areas of wood scarcity the amount are generally much low. Study by Klaeboe and Omwami estimates annual consumption of

fuelwood per person in Namibia to be ranging from 328.5 kg per person in Windhoek, 346.75 kg per person in Owambo and 562.1 kg in Rundu (Klaeboe and Omwami, 1997).

Other influences on consumption level include climate, the type of food cooked, the method of cooking, type of stove used and the availability of alternative sources of light other than cooking fire. In many places there is also seasonal variation, with consumption increasing in the period after harvesting when labour is readily available and wood is easy to obtain, and dropping during the monsoon when collecting is difficult and people are heavily occupied with farming (Foley and Barnard, 1984).

Fuelwood scarcity in Namibia varies from region to region, Caprivi and Kavango region where the population still low there is still enough fuelwood remaining but how long it will last depend on the sustainability of use. Oshana region and other region where the population is high and deforestation is also high there is a shortage of fuelwood, some village are now using cow dugs, *Sclerocarya birrea* stone, *Hyphaene petercian* fruit and crop residua to cook food. The story of women and children working long distance to gather firewood is no more a story in some of the community because there is no such long distance where firewood is available, the point is there is no wood available in far. The situation is getting worse the government through Directorate of Forestry have to speed up the program of tree planting if these community have to continue cooking food.

The total commercial of fuelwood in Namibia including charcoal production, is estimated at 152 864 tons per year and the substance consumption in the rural and urban areas was estimated at 519 467 tons per year (Klaeboe and Omwami, 1997).

According to Forestry outlook study for Africa (FOSA), report fuelwood consumption in Namibia is estimated at 872 m^3 per year in 2000 that is likely to increase to1 011 m^3 per year by 2020 (African Development Bank, 2003). These are low compare to other countries in Southern Africa (Table 1).

Table 1 Woodfuel consumption in southern Africa projected from 2000 to 2020

Country	2000 (000 m^3)	2010 (000 m^3)	2020 (000 m^3)
Angola	3 740	4 835	6 113
Botswana	745	818	840
Lesotho	2 754	2 993	3 211
Malawi	6 131	6 864	7 884
Mozambique	31 278	41 649	54 379
Namibia	**872**	**941**	**1 011**
South Africa	21 183	20 734	19 710
Zambia	8 773	10 351	11 908
Zimbabwe	7 894	8 709	9 424

Source: African Development Bank (2003).

2.2.2 Energy alternatives

India and China are well known for using biogas technology as an alternative source of energy for cooking. According to Moulic (1985) courted by Skutsch (1983), the main raw materials in India are cow dung, and in China, are pig dung, cow dung, and night soil.

In Namibia, one limitation for introducing biogas technology may be lack of reliable sources of the raw materials and the capital outlay. Namibia has, however, great potentials for new and renewable sources of energy, such as solar, wind and ocean waves. These energy sources are virtually untapped. At present the capital and technology needed for utilizing these resources are so prohibitively expensive that these energy sources may be beyond the means of Namibia "pers. obs".

In the developed world, a shift away from woodfuel to modern fuels occurred almost concomitant with economic growth. Access to dependable supplies of modern fuels and adequate income to invest in the technologies to use them are the major driving forces of modern fuel substitution.

Namibia is planning a second hydroelectric power plant on the Kunene River on its northwest border with Angola. This will increase power supplies to the densely

populated northern part of the country and help in industrialization. Namibia is also undertaking feasibility studies on wind energy along its western coastal with the power generated to be fed into the national grid. The largest natural gas field in the subregion has been discovered in southern Namibia and its exploitation is expected to become a reality in the next two decades (African Development Bank, 2003). Rural electrification is also the government policy some of villages already supplied with electricity and more still waiting to get it, even not all the people can afford to buy and use electricity due to it high cost, at least those who will afford are will reduce the pressure on the forest.

2.2.3. Fuelwood production

2.2.3.1 Species selection

Whatever other form of energy are made available to the rural community, no alternatives energy will replace fuelwood to a major extend in the long term. The main reason for this is the cost of alternative sources. If the problems of fuelwood shortage are to be overcome, it is essential that fuelwood be used more economically and that additional fuel resources be created.

The appropriate choice of a species for fuelwood production is very important for successful fuelwood production. Local people knowledge must be used in the species selection because they are familiar with the species in their environment. Indigenous species must be given the first priority provided that they have desirable characteristic for fuelwood production. Fuelwood production will be only effective if the local people are fully involved in the decision-making and management of the tree and if it is solving their problems. Kamwi (2000) stress that the key to successful fuelwood production is through discovering what the local community would like the project to do and what attractive to them. He also mentions the importance of the local preferences or perjures towards certain species. For example if *Faidabia albida* is highly thought of locally and be grown on the site (i.e. it meets the environmental constraints), and it serves the project's purposes well, then it is a good choice of species: everyone takes better care of something that is highly valued. It is also depend on government and NGOs support, through supplying seed and incentive for tree planting.

Good knowledge of the locality requirement of a particular species to be planted in a certain places is need in the selection of the species to overcome the problem of the time between establishmed and production. Species with many-braches, sometimes short-lived species may better meet requirement for small-scale village use (National Academy of Science, 1980). High yield and quick growth are the some of the characters to be considered during species selection, apart of these there are also other important characteristic to be considered, such as; multipurpose plants that have additional uses apart from firewood production, plants that adapt well to different sites establishment, easily and require little care, plant that thrive in problem environment such as low nutrient arid zone, drought resistance, plant that have characteristic such as nitrogen fixing ability, ability to coppice and capable of regenerating naturally, should yield wood with good burning properties. And most important species must meet the demands and preferences of the local people.

According to National Academy of Sciences the following species are worth testing in arid and semiarid regions, which Namibia is apart of arid zone some of the species is already existing in Namibia and most of the species are indigenous to Namibia: mopane (*Colophospermum mopane*), *Acacia nilotica*, *Acacia saligna*, *Acacia senegal*, *Acacia tortilis*, and *Eucalyptus camaldulensis*. These species have shown the capacity to survive where the rainfall is 500 mm or less or where rainfall is extremely variable (National Academy of Sciences, 1983). The adaptive mechanism includes deep root system that penetrate to subsoil, small leave blades or needle-like to reduce transpiration during drought by slowing evaporation through the leaves and unpalatability or thorniness that discourage grazing animals from eating it.

2.3. Prospects

2.3.1. Land tenure and land use

Conditions of land tenure differ from country to country. The most favourable position for tree growing is where land is privately owned and individuals hold a secure title to the holding the farm.

Obtaining land for tree growing is undoubtedly one of the major stumbling blocks in the program of plantation establishment (Foley and Barnard, 1984). Community land is frequently scarce, or is being used for a variety of other purposes. To avoid competition for land between growing trees and crops, trees can be planted on field boundaries, roadsides, around houses and other small areas of otherwise unused area. Another solution could be intercropping of trees with agricultural crop, e.g. the intercropping of acacia Senegal with agriculture crop in Tanzania (Foley and Barnard, 1984).

Land tenure in Namibia has influenced the manner in which woodland and savannas have been managed in the past and will continue to do so in the near future. Traditional tenure is highly complex and diverse (Marsh, 1996) for example, in central north Namibia, variation within traditional tenure systems occurs between clans and perhaps even within clans. Thus user right to land and to trees are not uniforms throughout the regions.

In Namibia, the government owns most of the land, apart from minority rich private farmer owners, but in communal land people have right to the land where they are settled. A piece of land is allocated to a family mostly husband by the headmen and that family have right to stay in that piece of land until the end. In case the owner of the house pass away the farm is given to one of the families remembers. Trees can therefore be grown with full assurance that the benefits will be obtained by the persons who planted them, or by their children.

2.3.2. Timing of operation

In dry areas tree planting should be done at the beginning of the rain season so that, at the time the end of rain season seedling will already established. Since starting of the rain season is also the time when people start to cultivate their field for food production tree planting can be done afternoon to avoid labour competitions. Shortage of labour at the appropriate time has been noted as a constraint on tree planting program in Kenya: "tree planting always coincides with agricultural activities. And naturally the latter get priority. Moreover, the women who are the fuelwood managers are also much involved in other activities that they have little time to devote to tree planting" (Karekezi and Mackenzie, 1995).

In the study of Energy in Developing countries Series Why People Don't Plant Trees by Skutsch, found that shortages and competition for labour with agricultural work was the main reason for some people not to participate in the program of tree planting in Tanzania (Skutsch, 1983).

2.3.3. Management of fuelwood plantations

Trees need protection and must well managed in order to obtain higher yield at the harvesting of final crop. Where plantation is established it is good to fence off the area to keep away the animals from brushing the plants. Management start immediately after fencing, site preparation and planting in woodlots. The planting time is critical as transplanting need protection and good handling during planting. In the area were the rainfall is the limiting factor, tree planting must be done at the starting of rain season, to allow seedling to establish where soil still wet. Due to the land shortage if any land is given for woodlots or plantation it is very important to take advantage of plantation site potential. The participation by the villager in the management of woodlots promotes the recognition of the local people as they feel part of the plantation because they are getting involved in the management activities. It is reported that many plantations or woodlots established for fuelwood production failed because villagers were not involve in the management.

Trees in the plantation should be harvested after they reached the required size. Selective felling is advisable at the beginning of the first plantation harvest program. However, clear felling is can be done if the objective is to use coppicing. The best

time for harvesting plantation is in the dry season. Care should be done to taken to ensure that remaining trees are not damaged. It is very important to discuss the distribution of the production from the plantation before the end of the rotation, because this can bring conflict among the community. In Gujarat, India the few plantations that reached maturity created a debate over whether the harvest should be shared locally or sold for a profit (Pandey and Jain, 1991).

CHAPTER 3

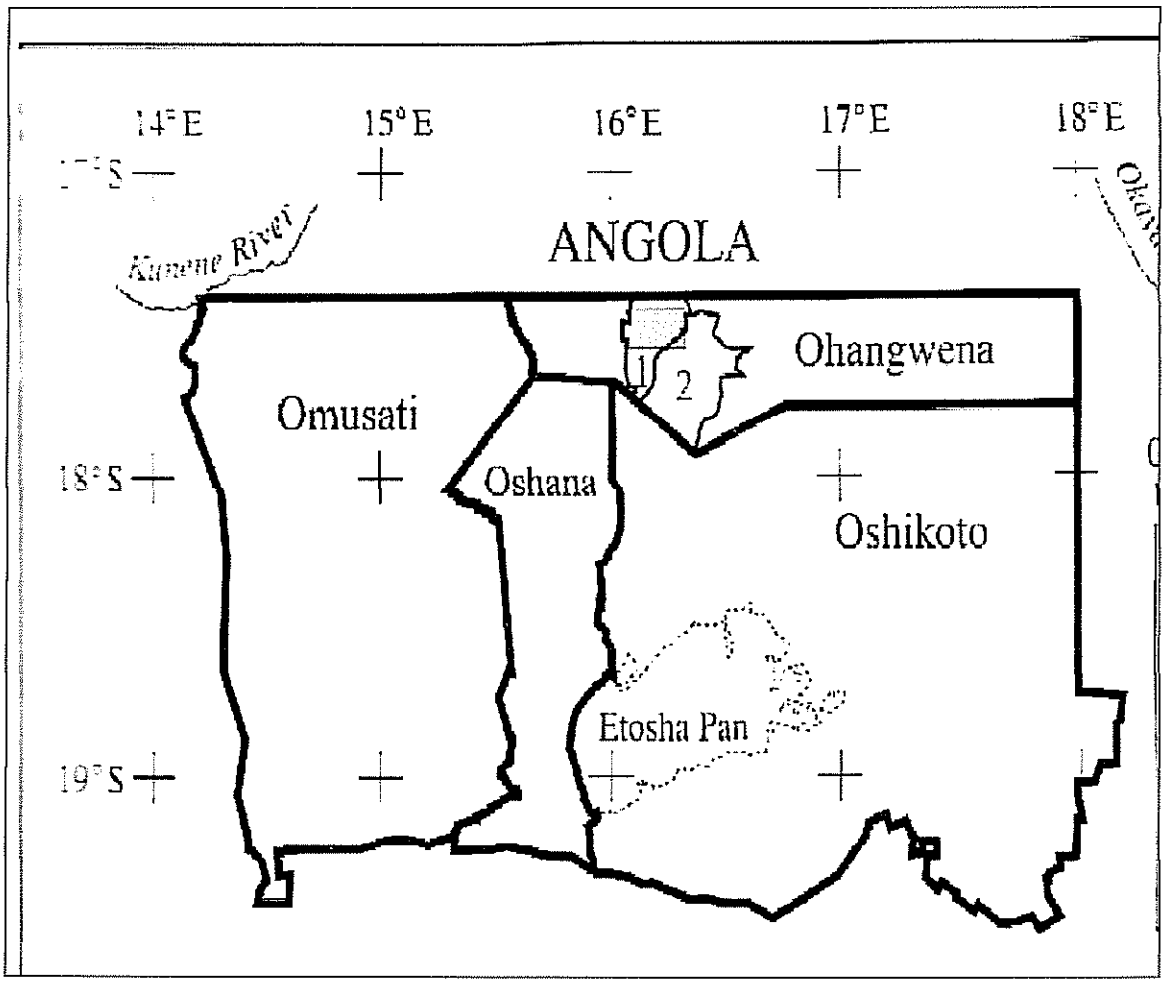
3. MATERIALS AND METHODS

In this chapter, the study areas are described in section (3.1), fieldwork considering sampling methods (3.2) and data processing (3.3).

3.1 Study area

Oshana region lies between 15° 30'E and 16° 00'E (Fig. 2). It is about 50 kilometres long and 165 kilometres wide covering an area of 8678 km^2. The study area, Oshakati and Ongwediva are located in the north of Oshana region. The distance between these two towns is about 6 kilometres.

Figure 2 The location of Oshana region, Namibia



Source: Modified from Erkkila (2001)

3.1.1 Oshakati

Oshakati is located in Oshana Region of northern Namibia lies between –17. 7833333 to 15. 6833333. It is the second largest urban area in the country after the capital, Windhoek (Census Office, 2001). As such it is the economic capital of the north central area of Namibia. The town was established in 1966 by the apartheid regime as the administrative centre of the 'homeland' of the then Owamboland. In 2001, according to Preliminary Census data, the population of Oshakati was 42,649 individuals, making it the second populated town in Namibia (after Windhoek). It is estimated that the population at the town has been growing at a rate of 5.76% per annum since independence (Geo Business Solutions, 2002).

Oshakati has a small formal residential area and much larger informal areas in which close to two-thirds of its residents live. The latter exhibit signs of extremely rapid growth and the town are viewed as an area of first settlement for those from the villages seeking urban job and economic opportunities. Recently arrived migrants tend to gravitate to the informal areas, as evidenced by the rapid growth of new housing (Geo Business Solutions, 2002).

Very limited data on the socio-economic status of the town's residents are available. However, it appears that the majority of its residents are relatively recent migrants. It is likely that younger males predominate, and that these groups of residents are both poorer and less well educated than the norm.

No data have been found on household income for the formal settlement. However, in the informal settlement areas average household income ranges from N$836 to N$1,666 per month (Geo Business Solutions, 2002). Between 25% and 45% of households in these informal areas are self-employed, presumably in informal activities, while for those who are employed, most (approximately 25%) work for government. Oshakati, as the region's capital, provides many public and private sector services to the population of Oshana Region and surrounding areas.

3.1.2 Ongwediva

Ongwediva is situated in northern Namibia, in Oshana Region, less than six kilometres away from Oshakati. It was originally started as a residential and institutional settlement in the 1920s under the colonial government, mainly to accommodate South African administrative and military personnel. It became a town on the dissolution of the South African dispensation in 1990, with its Town Council operating under an agency agreement with the Ministry of Regional and Local Government and Housing until 1998. The town covers an area of about 4104, 2896 hectares. It has an overall population of 27 396 people of which 3 500 live in the informal settlements and most of them are lower income people or unemployment. The rest of population live in formal areas.

Ongwediva is mostly a residential place, with very few business compare to Oshakati. The town got electricity services but due to the high cost of these services, it make it difficult to people living in informal settlement to use electricity for cooking even sometimes for lighting. Only few number of people live in informal settlements use electricity and this put more constraint in natural resources surrounding this town. Unemployment is very high (39 %) in both two town and most of people are rely on selling cooked food, and fuelwood at open market, especial women.

The two towns were selected due to easy access, big firewood markets and also a study on firewood consumption was conducted five years ago, this will give a picture to what is the situation of the firewood demand from that time to today.

3.2 Fieldwork

The main data collection technique used was interviewing, involving questionnaires. All the interviews were contacted in Oshiwambo. Thirty people were interviewed from each town randomly sampled among passer-by. The criteria for selecting a sampling spot was that it should not be close to a firewood market and that one would expect all kinds of people to pass it. Prospective interviewees were identified random, but interview only proceeded if they confirmed that they lived in the town being surveyed. The entire interviews were conducted morning and afternoon because it is

the time when most of people walk to and from work and also due to the higher temperature in the area. The authors with the help form Ongwediva forestry staffs did the fieldwork.

Twenty bundles of firewood were weighed from each town for establishing a typical value for the amount of firewood used per family and to determine prices per kilograms, since the question to how much used is related to the firewood bundle sold in these two towns. Fuelwood at these markets are not sold in kilograms or by volume, but they are just weighed by physical looking and determine the prices. All the bundles of fuelwood look almost same size (plate 1 & 2). The price of firewood was also noted in the process of weighing the wood.

Respondents were in two groups: Group 1 for main firewood users (people who use firewood every day); Group 2 for occasional firewood users (people who use firewood occasionally). Several sellers of firewood were approached and co-operated in allowing the weighing of firewood. Other information on firewood sales and supply were communicated by the firewood retailers and supplemented with direct observation.

3.3 Data processing

The main data collected are; sources of energy used, alternative of fuel used when fuelwood is not available, number of bundle of fuelwood used per family, weight of fuelwood and species preferences (Appendix I).

The main reason for collecting the data was to estimate fuelwood consumption for the reason the data has been analyse using descriptive data analysis. Mean and median have been calculated. Most of the data analysed are lopsided with the mean being higher than the median, reflecting some very high answers. The median being the number in the middle of the sample has been used in this case.

The quantity of fuelwood used was calculated using the information collected in question 3. The assumption was made that all the firewood used were weighing the same as the firewood sold at open market, which is having the average of 7 kilograms

per bundle, so the bundles of fuelwood used per month or per day were multiply by the weight of the bundle, which was estimated to be seven average and then divided by the number of people to give the quantity of fuelwood used per person per month in kilograms. Firewood prices were calculated and compared with the prices of firewood in 1997.

Chart wizard were plotted to show the proportion of the data on main sources of energy and also in alternative sources of energy used. Histograms were plotted features of the data on the bundles of fuelwood recorded per family. Statistic analyse were performed to give descriptive summary and also to determine the significant difference among the fuelwood users.

3.4. Hypotheses

The following two hypotheses were developed after reviewing selected literature on the objective under study.

1. Fuelwood were still major cooking fuel used by the majority of the urban household.

2. Fuelwood consumption is directly correlated to household size.

These propositions were examined to find out if they are consistent with the fuelwood situations in Oshakati and Ongwediva town. To judge their validity, propositions hypothesis one was examined by applying descriptive analyses, whereas hypothesis number two was tested using statistic model.

Plate 1 Firewood sold at the Open Market Oshakati, Namibia

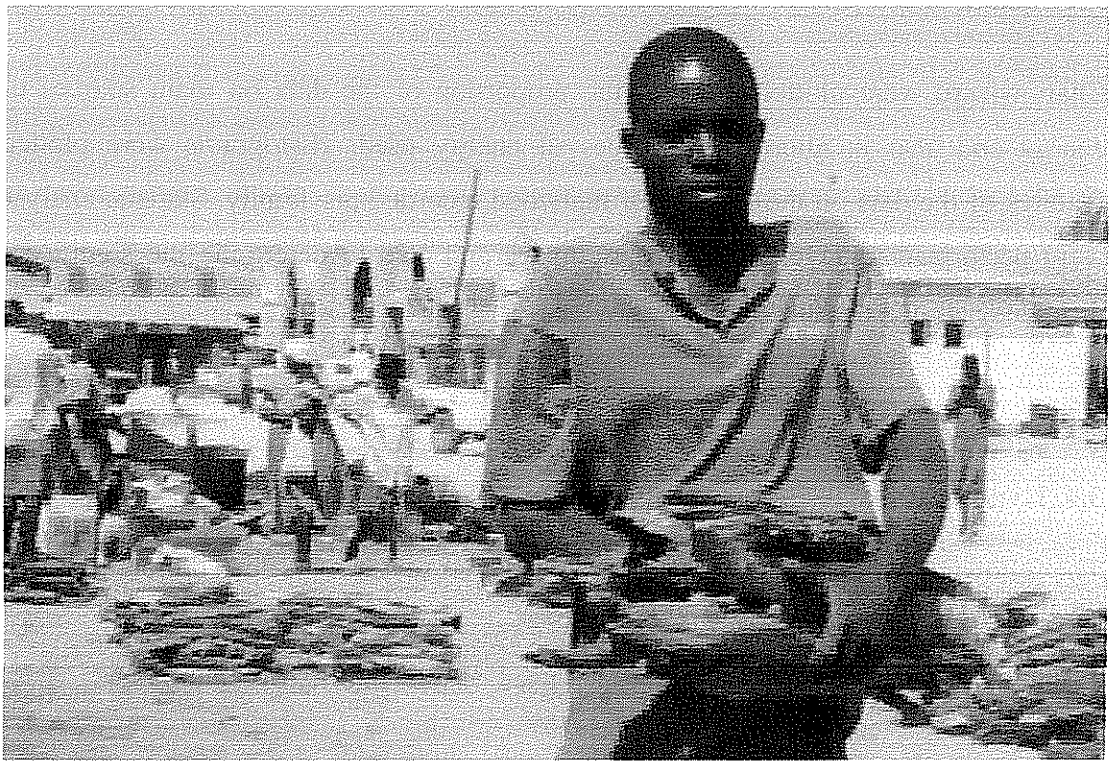


Plate 2 Firewood a waiting splitting, Open market Oshakati, Namibia

CHAPTER 4

4. RESULTS

In this chapter, section 4.1 is concerned with the data set, section 4.2 relates to fuelwood sale and purchase and section 4.3 reports of the household context.

4.1. Data set

Tables 2 and 3 summarise the data collected. In both towns most people indicated that they used fuelwood as their main source of energy. Main users consumed more wood than occasional users. *Colophospermum mopane* was only species mentioned as "preferred" in these towns. Gas, electricity and kerosene are used in both two towns as sources of energy when fuelwood is not available. In Ongwediva a proportion of respondents reported continual access to fuelwood (Table 3).

Table 2 Oshakati, Namibia: peri-urban perceptions of fuelwood context.

Respondents	Main source of energy used	Whether ever use firewood or not	How often firewood used	Bundle used	Cost/bundle	Number of people in a family	Distance from the market (km)	Species preferences		Alternative energy
1	Firewood		Main user	24	7	5	<1	Yes	COLM	Gas
2	Electricity	Yes	Occasionally user	2	7	4	1-5	Yes	COLM	
3	Firewood		Main user	29	7	9	<1	No		Kerosene
4	Electricity	Yes	Occasionally user	4	7	7	4-5	Yes	COLM	
5	Firewood		Main user	26	7	8	<1	Yes	COLM	Kerosene
6	Firewood		Main user	23	7	5	>1	Yes	COLM	Electricity
7	Firewood		Main user	25	7	4	2	Yes	COLM	Gas
8	Gas	Yes	Occasionally user	3	7	11	<2	Yes	COLM	
9	Firewood		Main user	26	7	6	<1	Yes	COLM	Gas
10	Firewood		Main user	25	7	6	<1	Yes	COLM	Gas
11	Gas	Yes	Occasionally user	2	7	3	>2	Yes	COLM	
12	Firewood		Main user	28	7	10	<1	Yes	COLM	Electricity
13	Firewood		Main user	25	7	5	>2	Yes	COLM	Kerosene
14	Gas	Yes	Occasionally user	4	7	6	<1	Yes	COLM	
15	Gas	Yes	Occasionally user	2	7	7	<1	Yes	COLM	
16	Firewood		Main user	25	7	8	1-5	Yes	COLM	Gas
17	Firewood		Main user	26	7	8	<1	No		Gas
18	Firewood		Main user	26	7	6	1-5	No		Electricity
19	Firewood		Main user	23	7	3	1-5	Yes	COLM	Gas
20	Firewood		Main user	25	7	4	<1	Yes	COLM	Gas
21	Firewood		Main user	24	7	6	<1	Yes	COLM	Gas
22	Firewood		Main user	28	7	6	<1	No		Kerosene
23	Gas	Yes	Occasionally user	5	7	4	1-5	Yes	COLM	
24	Electricity	Yes	Occasionally user	3	7	6	<1	Yes	COLM	
25	Electricity	Yes	Occasionally user	6	7	5	1-5	Yes	COLM	
26	Firewood		Main user	26	7	3	>2	No		Gas
27	Firewood		Main user	27	7	9	<1	Yes	COLM	Gas
28	Firewood		Main user	28	7	5	<1	No		Electricity
29	Firewood		Main user	25	7	6	<1	Yes	COLM	Gas
30	Firewood		Main user	22	7	3	<1	No		Kerosene

Table 3 Ongwediva, Namibia: peri-urban perceptions of fuelwood context.

Respondents	Main source of energy used	Whether ever use fuelwood or not	How often firewood used	Bundle used	Cost of firewood (per bundle)	Number of people in the household	Distance from the market (km)	Species preferences		Alternative energy
1	Firewood		Main user	27	6	8	<1	Yes	COLM	Kerosene
2	Firewood		Main user	25	6	7	<1	No		Others
3	Gas	Yes	Occasionally user	3	5	5	1-5	Yes	COLM	
4	Firewood		Main user	25	6	5	<1	Yes	COLM	Gas
5	Firewood		Main user	28	6	6	<1	No		Others
6	Firewood		Main user	26	5	5	<1	Yes	COLM	Gas
7	Firewood		Main user	24	7	5	>1	Yes	COLM	Gas
8	Firewood		Main user	23	5	4	<0.5	No		Kerosene
9	Firewood		Main user	25	6	7	2	Yes	COLM	Gas
10	Firewood		Main user	25	6	5	<2	No		Gas
11	Firewood		Main user	27	6	6	<1	Yes	COLM	Kerosene
12	Firewood		Main user	28	6	7	<2	No		Others
13	Electricity	Yes	Occasionally user	2	6	6	<1	Yes	COLM	
14	Firewood		Main user	25	5	5	<1	Yes	COLM	Kerosene
15	Firewood		Main user	23	5	6	>2	No		Others
16	Firewood		Main user	28	6	9	>2	No		Kerosene
17	Gas	Yes	Occasionally user	4	6	5	<0.5	No		
18	Electricity	Yes	Occasionally user	3	6	4	<1	Yes	COLM	
19	Firewood		Main user	24	6	6	>2	Yes	COLM	Kerosene
20	Firewood		Main user	27	6	6	1-5	Yes	COLM	Others
21	Firewood		Main user	25	5	3	>1	Yes	COLM	Electricity
22	Gas	Yes	Occasionally user	2	7	8	1-5	Yes	COLM	
23	Firewood		Main user	26	6	5	>1	Yes	COLM	Gas
24	Firewood		Main user	23	7	5	<0.5	No		Others
25	Firewood		Main user	28	6	9	<1	Yes	COLM	Electricity
26	Firewood		Main user	23	6	6	<1	No		Others
27	Firewood		Main user	27	6	6	<1	No		Kerosene
28	Firewood		Main user	24	5	4	<0.51	No		Electricity
29	Firewood		Main user	28	6	7	<1	Yes	COLM	Others
30	Firewood		Main user	25	5	7	<0.5	Yes	COLM	Electricity

Keys to table 2 and 3, column 11: COLMO = *Colophospermum mopane*

Figures 3 and 4 summarize the energy distribution in Oshakati and Ongwediva. In Oshakati 21 (70 %) respondents out of 30 used fuelwood as their main source of energy (Fig. 3), while in Ongwediva 25 (83 %) respondents out of 30 used fuelwood as main source of energy (Fig.4).

Figure 3 Oshakati, Namibia proportion of respondents declaring different sources of energy as the main one used.

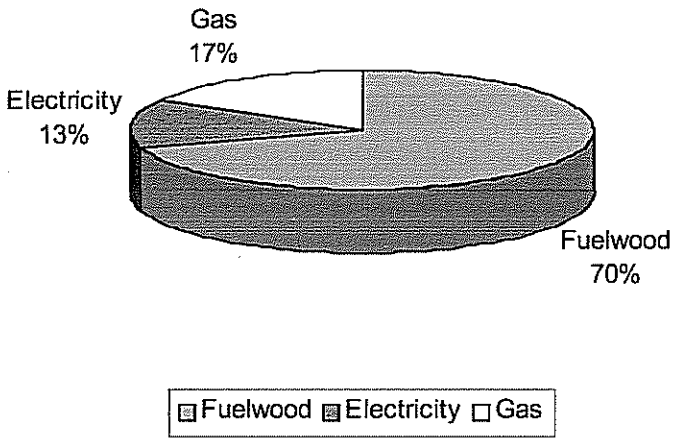
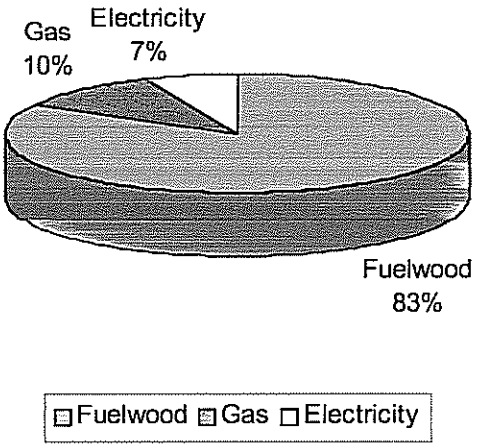


Figure 4 Ongwediva, Namibia proportion of respondents declaring different sources of energy as the main one used.



4.2 Units of fuelwood sale and purchase

The frequency histograms (Figs. 5 &6) are based on 40 bundles of fuelwood weighed at each of Oshakati and Ongwediva towns. Consideration of bundle weights was undertaken in relation to five weight classes: 4.5-5.5 kg, 5.6-6.5 kg, 6.6-7.5 kg, 7.6-8.5 kg and 8.6-9.5 kg.

Figure 5 Frequency, by weight category of bundles of fuelwood weighed in Oshakati, Namibia.

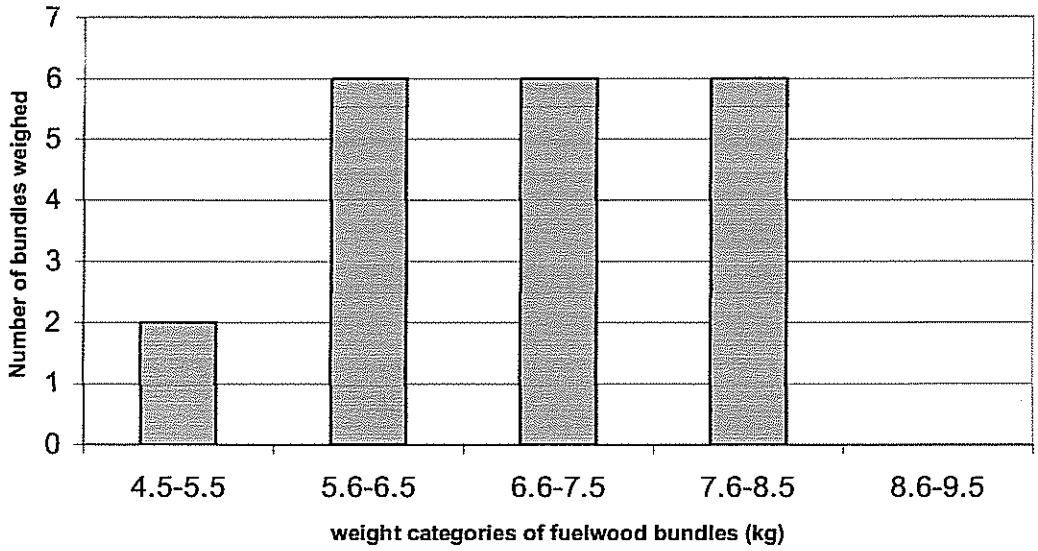
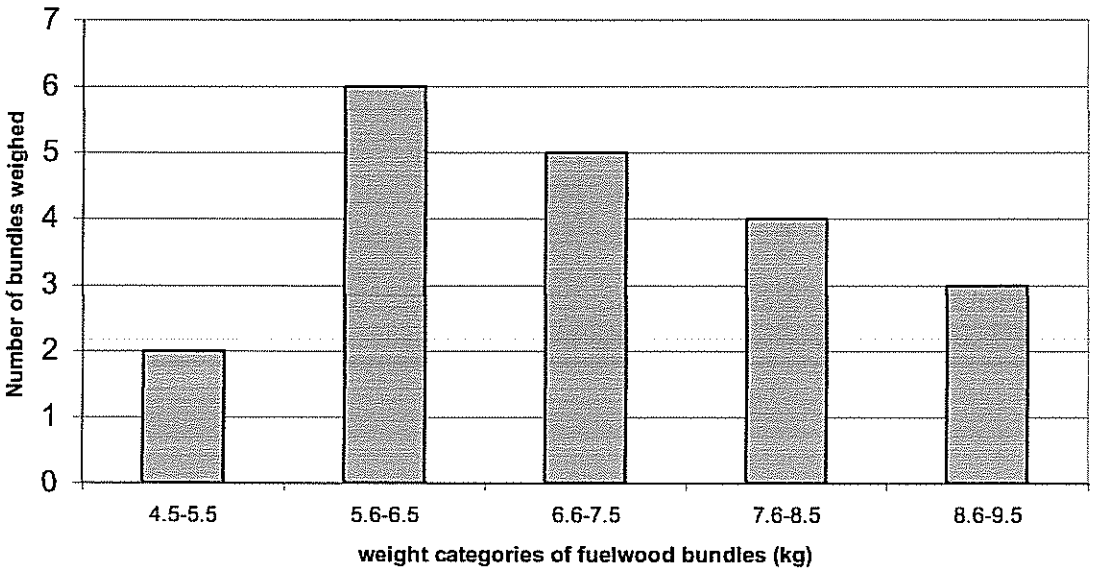


Figure 6 Frequency, by weight category of bundles of fuelwood weighed in Ongwediva, Namibia.



Tables 4 and 5 shows statistic summarize by bundles monthly use of fuelwood in Oshakati and Ongwediva. The lowest number of bundles used by the main fuelwood users is 22 and the highest is 25. Occasional users reported values of 4 to 8 bundles per month.

Table 4 Oshakati and Ongwediva, Namibia: descriptive statistics for fuelwood use by main users, in bundles.

Oshakati		*Ongwediva*	
Mean	25.5	Mean	25.6
Standard Error	0.39	Standard Error	0.35
Median	25	Median	25
Mode	25	Mode	25
Lowest value	22	Lowest value	23
Highest value	29	Highest value	28
Count	21	Count	25

Table 5 Oshakati and Ongwediva, Namibia: descriptive statistics for fuelwood use by occasional users, in bundles.

Oshakati		*Ongwediva*	
Mean	3	Mean	6
Standard Error	0.47	Standard Error	0.68
Median	3	Median	5
Mode	2	Mode	5
Lowest value	2	Lowest value	4
Highest value	6	Highest value	8
Count	9	Count	5

Fuelwood at Oshakati and Ongwediva was weighed establish a reference value for the amount and cost of firewood used per family. In Oshakati bundles of firewood were sorted into bundles costing six Namibian Dollars (N$6) and bundles costing seven Namibian Dollars (N$7). All bundles of fuelwood weighed at Ongwediva cost the same amount (N$ 6), but the weight of the bundle varied. The average weight of a fuelwood bundle at Oshakati was 6.9 kg and at Ongwediva it was 7 kg (Table 6).

Table 6 Weights and cost of fuelwood bundles at Oshakati and Ongwediva, Namibia.

	Town			
	Oshakati		Ongwediva	
Sample	**Weight (kg)**	**Cost (N$)**	**Weight (kg)**	**Cost (N$)**
1	8.2	7	7.4	6
2	7.3	7	6.6	6
3	8	7	8.6	6
4	5.5	7	8.3	6
5	6.7	7	6.3	6
6	7.8	7	7.4	6
7	8	6	7	6
8	6.4	6	4.9	6
9	5.8	6	8	6
10	6.2	6	7	6
11	6.4	6	5.6	6
12	8.1	7	4.5	6
13	7.5	7	6.3	6
14	8	7	9	6
15	6.3	7	8.1	6
16	6	7	6.2	6
17	5.4	6	5.6	6
18	7.1	6	7.6	6
19	7.3	6	6.4	6
20	6.9	6	8.6	6
Average	**6.9**	**6.6**	**7**	**6**

Fuelwood consumption per month per family in Oshakati by main users is estimated at 176 kilograms, while at Ongwediva main users consume 179.2 kilograms per family per month. Occasional users consume very little compared with main users (Table 7).

Table 7 Prices and consumption of bundles of fuelwood in Oshakati and Ongwediva.

Type of user	Town	Average number of people/family	Average bundles/month	kg/bundle	Consumption kg/family	Consumption kg/per person/day	Price/bundle (N$)	Price (N$)/kg
Main users	Oshakati	6	25.5	6.9	176.0	0.98	6.6	0.96
	Ongwediva	6	25.6	7	179.2	1.00	6	0.86
Occasionally users	Oshakati	6	3	6.9	20.7	3.45	0.12	0.96
	Ongwediva	6	6	7	42.00	7	0.23	0.86

4.3. Application to the family situation

The bundles of fuelwood recorded as used per family were multiplied by the average weight of the bundles weighed to give the amount fuelwood used per month in kilograms (Figs. 7,8,9 and 10) shows the relationship between the number of people in a family and fuelwood used monthly and daily. Figures 7 and 8 show that family with few members consumed kilograms of fuelwood compare to the family with large family members.

Figure 7 Relationship between the number of people in the family and firewood consumed per day in Oshakati, Namibia.

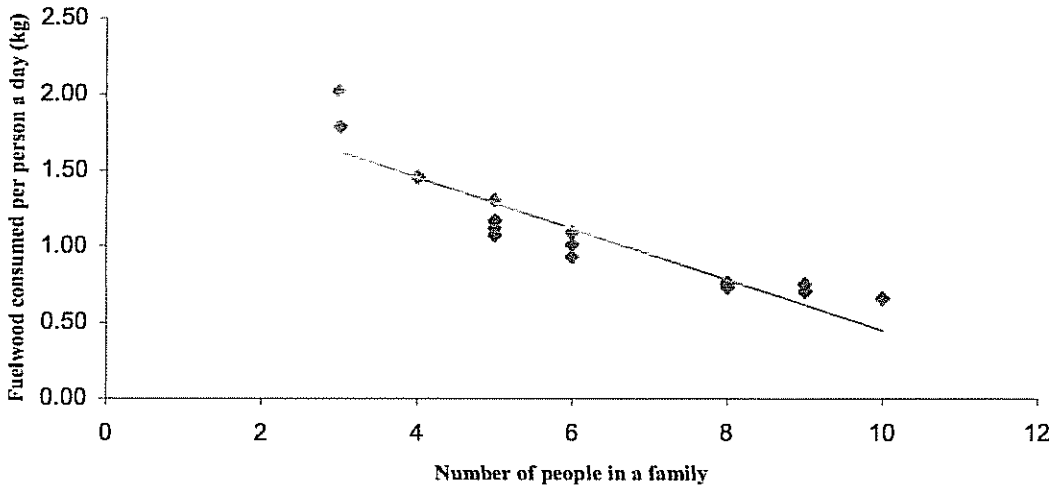


Figure 8 Relationship between the number of people in the family and firewood consumed per day in Ongwediva, Namibia.

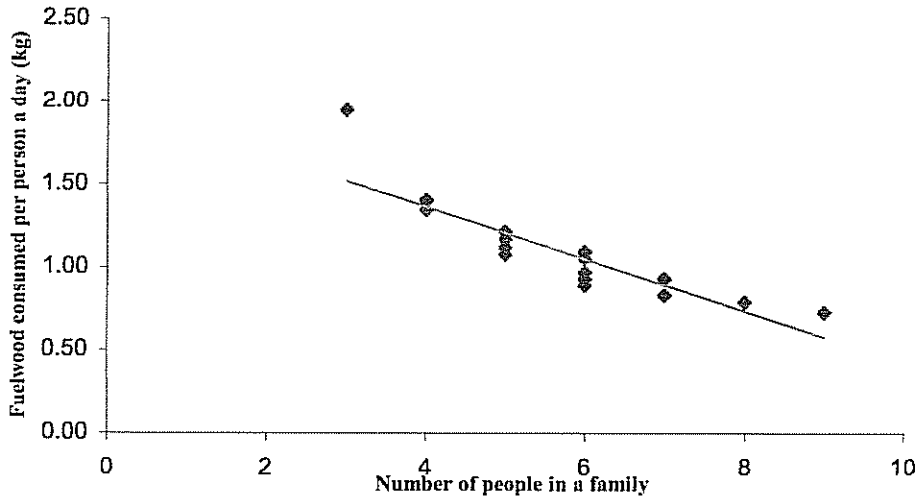


Figure 9 Relationship between the number of people in the family and firewood consumed monthly in Oshakati, Namibia.

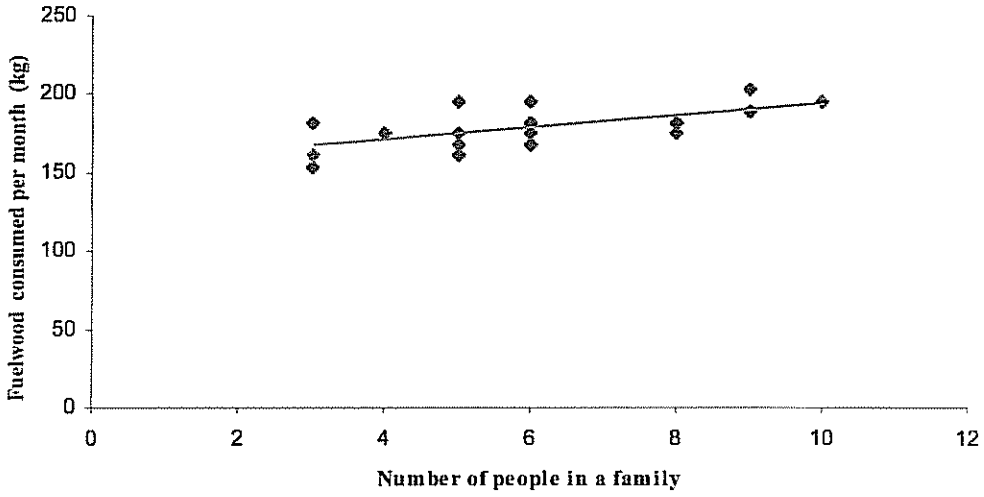
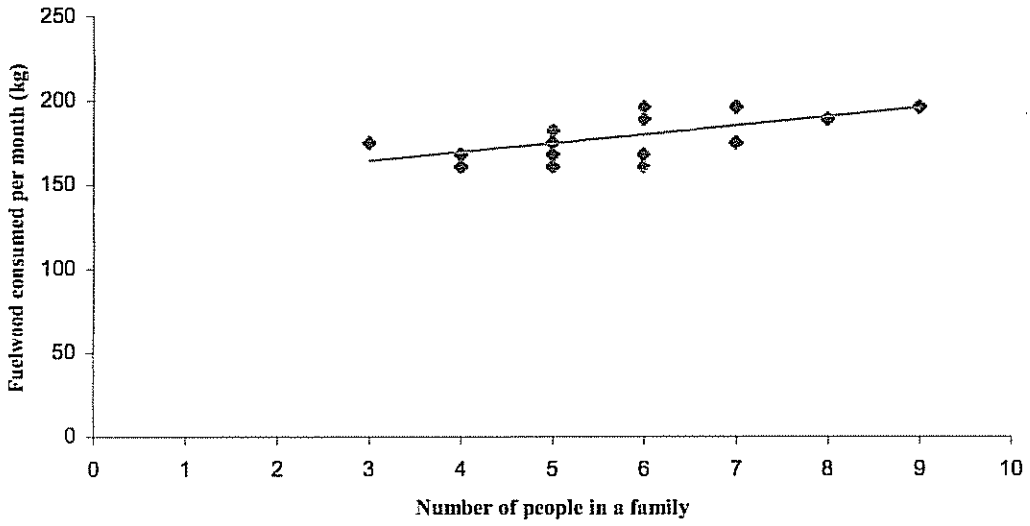


Figure 10 Relationship between the number of people in the family and firewood consumed monthly in Ongwediva, Namibia.



Gas is the popular (57%) source of energy used in Oshakati when fuelwood is not available (Fig. 11). In Ongwediva, 8 (32%) respondents out of 25 indicated that they did not use any other source of energy to cook in their house and always had access to fuelwood this groups is indicated by "others" (Fig. 12), there was no such group represented in Oshakati.

Figure 11 Alternative sources of energy used in Oshakati, Namibia, when firewood is not available.

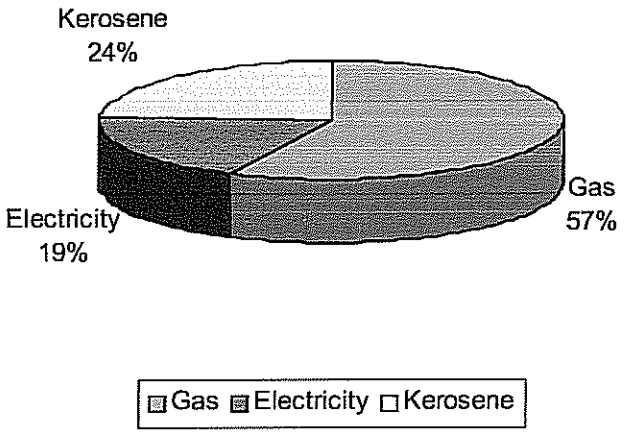
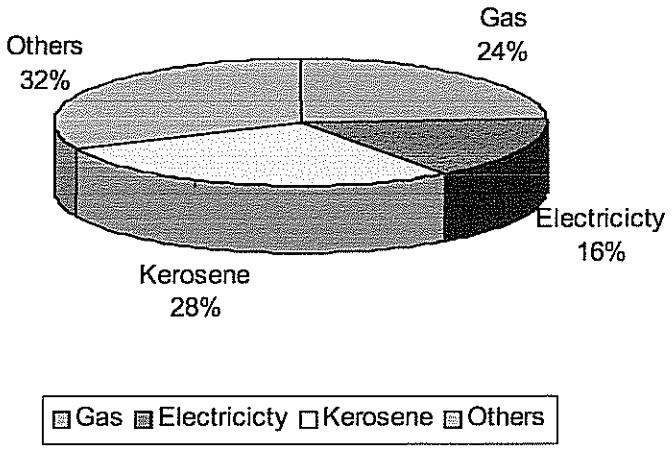


Figure 12 Alternative sources of energy used in Ongwediva, Namibia, when firewood is not available.



There was no significant difference between Oshakati and Ongwediva main fuelwood users in the number of bundles of fuelwood used monthly (Table 8). There was significant difference, between Oshakati and Ongwediva in the number of bundles of fuelwood used by occasional fuelwood users (Table 9).

Table 8 ANOVA output to test significant difference in fuelwood used by main fuelwood users in Oshakati and Ongwediva, Namibia.

ANOVA: Single Factor

SUMMARY

Towns	*Count*	*Sum*	*Average*	*Variance*
Ongwediva	25	639	25.56	3.09
Oshakati	21	536	25.52	3.26

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F*
Between towns	0.0149	1	0.0149	0.00	0.946	4.062
Within towns	139.3981	44	3.1681			
Total	139.4130	45				

Table 9 ANOVA output to test significant difference in bundles used by occasional users in *Oshakati* and Ongwediva, Namibia.

ANOVA: Single Factor

SUMMARY

Towns	*Count*	*Sum*	*Average*	*Variance*
Oshakati	9	31	3.44	2.03
Ongwediva	5	28	5.6	2.3

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F*
Between towns	14.9349	1	14.9349	7.05	0.021	4.747
Within towns	25.4222	12	2.1185			
Total	40.3571	13				

CHAPTER 5

5. DISCUSSION

5.1. Fuelwood consumption

The purpose of this special project was to estimate fuelwood consumption per household in Oshakati and Ongwediva, Namibia. All the people interviewed in this study used fuelwood in their houses. Consumption varies dramatically among families because some people use more than one sources of energy. Oshakati main fuelwood users use on average 25.5 bundles/month and occasional users use, on average 3 bundles/month, equivalent to 176 and 21 kilograms per month respectively. Ongwediva use proved higher for occasional fuelwood users (6 bundles/month) equivalent to 42 kilograms/month. The observations on main users are in agreement with those of Omwami and Klaeboe (1997) Directorate of Forestry. In their study fuelwood consumption was estimated to be 0.95 kg per person per day (main user). The observations for occasional users in current study are much lower 0.12 and 0.23 kg per person/day compare to 0.56 kg/person per day for Omwami and Klaeboe (1997). However, the Namibia Institute for Social and Economic Research (1992) and Wamukonaya (1997) recorded only 0.57 and 0.59 kg per person per day, respectively main users.

The three studies (Klaeboe & Omwami 1997; Namibia Institute for Social and Economic Research 1992; Wamukonda 1997) used structured questionnaires during data collection. It can be assumed that some differences stem from different sampling intensities, the number of people interviewed and the season when the study was conducted. In the study by Wamukonya (1997) only 100 households were covered in 8 regions of Namibia. The study by Omwami and Klaeboe, (1997) interviewed 970 people compare to the current study that interviewed 60 people, in one region. Number of people interviewed in the study by Namibia Institute for Social and Economic Research (1992) is not given.

In this study it was found that smaller family units, use more fuelwood per person per day than larger family units, finding in agreement with those of Bembridge and

Tarlton (1990). Bembridge and Tarlton found that smaller families use more firewood per capita than the larger family units. This finding are not really surprising but could be explained on the basis of women with small families being better able to cook meals, three times a day, increasing the daily fuelwood, requirement.

The current study was limited by time, and hence the number of people interviewed was also limited. If the study could have taken place door to door rather than in the market and by population stratification according to income, the results might be different.

The other factor which may explain differences between the current study and studies done previously is the method used to translate the bundles of fuelwood used to the kilograms of the firewood currently sold at the open market, because usually wood weight differs with its moisture content species.

5.2 Prices of fuelwood

Prices of fuelwood rise up from N$ 0.39 to N$ 0.96 and N$ 0.86 in Oshakati and Ongwediva respectively since from 1997 to 2003. The study by Klaeboe and Omwami 1997 found that fuelwood prices were N$0.38 in Oshakati and Ongwediva; bundles of fuelwood sold at the market were sorted in price classes N$ 1 to N$ 2 (Klaeboe and Omwami, 1997).

5.3 Alternative sources of energy

Overall, gas is preferred for cooking as an alternative fuel when fuelwood is not available. This can be explained by the fact that gas is generally cheaper than electricity and require simple equipment such as hand gas cylinders. Kerosene is also used by the higher number of people, in both two towns, this could be explain by the reason that the materials used in using kerosene are cheaper (affordable) to obtain and available everywhere.

5.3. Suggestions for further study

Much has been written on fuelwood supply and demand in Africa, but very little reports and data regarding fuelwood production and consumption are available in Namibia therefore further study is required to gather more data on fuelwood.

Three research areas are recognised as important:

1. Species suitable for fuelwood production and suitable to Namibia condition. In order to increase the supply for fuelwood production through tree planting one has to understand the silviculture and yield production for species.

2. More investigation is needed to acquire information regarding cost of fuelwood compare to other energy sources, such as electricity, gas and kerosene, to be able to understand the motivations for people in urban area to use fuelwood if there are other means of energy that they can use.

3. Data is needed on fuelwood used both for commercial and household level through out the country.

CHAPTER 6

6. CONCLUTIONS AND RECOMENTATIONS

6.1 Conclusions

Fuelwood is still the main sources of energy used for cooking in the household, in Oshakati and Ongwediva, Namibia. The consumption of firewood did not change much since 1997. Gas, kerosene and electricity are used to many people as the alternative to fuelwood. Fuelwood are scarce, according to the information from fuelwood dealers in Oshakati and Ongwediva, most of the wood sold at these market are harvested more than 100 kilometres, most from different region. So fuelwood plantations or woodlots are needed immediately to reduce the shortage of fuelwood.

6.2 Recommendations

After this study and review of the literature in fuelwood use inside Namibia and in Southern Africa the following recommendations where made:

1. Because there is no sign of reduction on fuelwood consumption in towns, the Directorate of Forestry should explore the possibility of facilitating the establishment of urban community woodlots using local authorities and NGOs. This strategy seeks to curtail the dependence on rural areas for urban fuelwood supply by exploring actions that could improve fuelwood availability within the vicinity of the urban areas. The following actions could be useful:

2. Incentives are needed to encourage people to plant more trees, and other alternatives such as gas and electricity should be promoted to reduce the pressure on natural resources.

3. All educational institutions should be encouraged to undertake some tree-planting programmers.

4. General awareness campaigns would be helpful in sensitising the urban population on the importance of tree planting.

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APPENDICES I

Information from urban area (Oshakati and Ongwediva)

Enumerator----------

Name of interviewee----------

Date	Geographical area	Community (Town)	Sample number

1. What is your main source of energy for cooking at home?

Fuelwood	(1)	
Charcoal	(2)	
Kerosene	(3)	
Electricity	(4)	
Gas	(5)	
Others	(6)	

2. Do you ever use firewood in your household? Only answered by respondent whose main sources of energy is not firewood.

YES	
NO	

3. How often do you buy fuelwood and how much do you buy?

How often	Number (how many)	Local unit for fuelwood
Every ----------days		

(Daily = every day, weekly = every 7 days, monthly =every 30 days)

4. How much does fuelwood cost?

Prices N$	Local unit for fuelwood

5. Number of people in the house

6. What is the distance from your house to the sources of firewood?

< 0.5 km	
< 1 km	
1-5 km	
5-10 km	

7. Do you have species preferences?

YES ☐

NO ☐

If yes which one (s)?

Colophospermum mopane	
Compretum spp	
Terminalia sericea	
Acacia spp	
Burkea africana	
Pterocarpus angolensis	
Baikiaea plurijuga	
Others	

8. What are the alternative sources of energy when firewood is not available?

Charcoal 2 ☐

Paraffin 3 ☐

Electricity 5 ☐

Gas 4 ☐

Others---------- ☐

THANK YOU

END OF QUESTIONNAIRE