THE RURAL ENERGY PROBLEM: A CASE STUDY OF WOODFUEL IN SHISWA SUB-LOCATION, KAKAMEGA DISTRICT

BY

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D E C L A R A T I O N

This thesis is my original work and has not been presented for a degree in any other university.

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This thesis has been presented for examination with my approval as university supervisor.

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DEDICATION

This work is dedicated to

Faith and Sandra

my nieces

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I am greatly indebted to a host of persons who in one way or the other contributed to the realization of this piece of work. Indeed I am thankful to all members of the Department of Urban and Regional Planning, both the staff and fellow students for their constructive criticisms which helped me, to a reasonable extent to shape the piece of work to what it is now. Special thanks to my supervisor Mr. George Ngugi.

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ABSTRACT

The study drew inspiration from the current concern for rural areas, conveniently termed Rural Development. The specific aspect of Rural Development, Energy was singled out owing to even greater concern for the energy crisis in the developing countries in terms of rapidly diminishing traditional energy resources and astronomic increases in fossil fuel prices. In reaction to these inescapable realities many governments in the developing world have attempted to come up with diverse policies, strategies and programmes aimed at alleviating the problem, if not eliminating it altogether.

However well intended these policies and strategies may be, their effectiveness will, to a reasonable extent, depend on the realities at the grassroot level. Therefore before translating these policies into actual action programmes greater understanding of the energy problem is a prerequisite, especially from the perspective of the grassroots. The study aimed at contributing to such understanding.

The central arguement of the study is that the energy problem in the rural areas should not be looked at in isolation but as intricate aspect of the process of rural underdevelopment. The approach to its alleviation should therefore be a package deal aimed at

eliminating rural poverty.

Data analysis revealed a weak farm household economic base as reflected in the income levels, occupation structure and agricultural practices. This has tended to limit the ability of the farm households to afford alternative energy resources so that there is over-dependence on fuelwood. This was also reflected in the energy use technology which was on the lower side of effeciency. Further, given the skewed nature of distribution of farm household resources in terms of land, income, etc., some households were experiencing the problem of energy more severely than others. Finally, certain socio-cultural arrangements contributed to the energy problem. That is the decision making structure within which the household was a limiting factor to the female folks accessibility to energy resources.

Thus while advocating for adoption of energy saving technologies and supply enhancing programmes like agroforestry, provision for local communities to have accessibility to government resources (among others); the study sees the long-term solution of the energy problem as lying in integrated programmes aimed at raising the productivity and income levels of the farm households.

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CHAPTER 1

INTRODUCTION

In this chapter, an overview of the study problem is presented. First the statement of the problem is made, then a justification of the same made. Secondly, the theoretical framework and literature review are provided. These are followed by the study objectives, research methodology, study assumptions and scope and finally the operational definitions and study limitations.

1.1 STATEMENT OF THE PROBLEM

In reaction to the realization that there is an energy supply problem/crisis, the Government of Kenya had its energy development objectives as:

(a) rationalizing the use of imported petroleum;

(b) developing indigenous energy resources; and

(c) lessening dependence on imported fuel.

(Development Plan 1979-1983)

In the current Development Plan (1984-88), energy strategies and policies are spelled out and they include:

(a) encouragement of agro-forestry;

(b) establishment of peri-urban plantations;

(c) rural afforestation and soil conservation programme;

(d) energy conservation, among others.

To a large extent the formulation of these policies was provoked by the oil crisis (escalation in price of fossil fuels) of 1973 and 1979 - 81 periods. This had serious foreign exchange implications. In 1973, for example, the govenment was forced to spend 35% of its foreign exchange earnings on the importation of fossil fuels and in the early 1980s 63% of Kenya's export earnings was spend on the importation of petroleum (Timber lake, 1985) - this implies that only 37% of the export earning was available for the importation of critical production inputs in the industrial, agricultural and other sectors of the economy. It is a fact, therefore that energy supply is a crucial aspect of the general economic development of the Kenyan economy and deserves considerable attention. Further, this demonstrates how valnerable the Kenyan economy is to world fossil fuel price fluctuations due to over dependence on external sources of energy.

The above mentioned energy policies indicate the desire of the government to break away from this unfavourable situation of dependence on external sources of energy and instead be more inward looking by mobilising the domestic energy resources. However, these policies and strategies represent the macro view of the energy supply problem, that is, they are broad guidelines as to the direction of action desired to alleviate or completely eradicate the said problem.

These are to be or are being translated into specific programmes for implementation. The success of these programmes to a large extent will depend on grassroot support for them and this will in turn be determined by; the perception of the problem by the beneficiaries (local community); their ability in terms of resorces available to them - land, appropriate knowledge or information and technology to implement these programmes; the level of involvement of the said in the initiation, planning, implementation and sustenance of such programmes; the willingness and completence of the change agents/government officers especially the frontline staff to guide the rural masses to understand, accept, implement and sustain such programmes; among other factors. That is, there has to be a thorough understanding and preparedness of the grassroot to be able to accommodate these programmes.

Quite often than not action is taken before the problem is really understood. In the period 1978-83, for example, the world Bank and various agencies spent £500 million in aid to community forestry in less developed countries with unimpressive results (Timberlake, 1986). When such programmes fail, their failure is blamed on the rural masses who are stereotyped as being lazy, resistant to innovations or is blamed on the frontline staff for not doing their work. One of the main setbacks in addressing the energy issue

is lack of sufficient data to provide a basis for action. Where an attempt has been made to gather data, such data, quite often than not is biased in terms of covering economic, geographic or ecological considerations to the neglect of the cultural and social aspects of the problem under consideration. In other cases where data appears to address all these aspects, they may fail to address the most critical components of these aspects. It has been argued, for example, that the rural energy crisis is a women crisis (wisher, 1980). Such arguements misdirect action - that is, they focus on women as key players in the energy crisis yet ignoring that invisible but critical rule of the man as the owner and controller of the household resources (including trees as a source of woodfuel). In other instances, the energy problem is addressed as if it is an issue separate from the general process of rural development - yet such programmes as indicated above have resourced use competion implication.

With increasing privatization of what used to be communal land and the restriction on the government forests, the farm will become a critical source of rural domestic energy. Yet it is the same farm that must accommodate increased planned cash and food crops production and settlement for the ever increasing population. This means that there are competing uses of

the farm which must be harmonised in some way to yield optimal results/output. As it were, most of the above strategies have farm requirement implications. The critical questions are: how apropriate is the farm as a source of woodfuel for the farm-household in the study area or will the rural household farm holding adequately accommodate the said competing landuses? How have the rural households reacted and adjusted to this dilemma or how do they perceive the energy problem? What are some of the social - cultural factors that explain the supply of woodfuel on the farm or accessibility and use of woodfuel within the farm household?

The study aims at assessing the energy supply situation (with special references to woodfuel) in shiswa sub-location, Kakamega District and from which appropriate interventionist approaches to alleviate the energy supply problem can be made. Further, it aims at contributing to the better understanding of the energy problem, that is, to supplement the existing knowledge of the same.

1.2 THEORITICAL FRAME WORK/LITERATURE REVIEW

One of the current thinking in regard to the woodfuel crisis is that, the woodfuel crisis is not of energy perse but it has its roots in the dynamics of the process of under development and poverty. To quote

Wane,(1986):

"For people with secure and adequate landholdings or a resonable level of income, woodfuel is rarely a serious problem. They can afford to pay for alternatives. It is the poor and landless who are the greatest sufferers from woodfuel scarcities, and it is the poor who can do least about it. No simple technical measure can change this basic fact.

Poverty is also the connecting link between wood cutting and environmental degradation. The land less poor stripping the woodlands to supply the urban market do so because they see no alternative way of earning a living. The squetter families clearing the trees from mountain slopes are there because they can find nowhere else to farm; their land is eroded and degraded about them because they can not afford the investments needed to protect it and make it productive in the long term.

At times, the woodfuel crisis has been expressed in simple demographic terms. Increasing woodfuel consumption and the pressure on land resources is blamed on rising populations with implication that stringent birth control measures would make the problem disappear. It is clear however, that the woodfuel crisis is much more complex than this.

Though population growth is undoubtedly one of the driving forces behind the depletion of tree resources, it is poverty, inequality, and lack of apportunities that are as much to blame. Until these fundemental problems are tackled, the woodfuel crisis will never be permanently cured." (wane, 1986, p. 87-88).

Eckholm(1979) in line with this thinking argues that the real issues in deforestation (and therefore woodfuel problem) are: agricultual stagnation, grossly unequal land tenure, rising unemployment, rapid population growth among other factors. Foley(1986) extends the arguement further to suggest that contrary to the belief that the rural populace or communities' perception of the woodfuel crisis was limited to the extent that they indiscriminately cut down trees and were wastefull in the use of woodfuel, they (the rural people) have actually tried to adjust to the prolem in a very rational manner. He argues for example that the habit of economy in regard to the use of wood and charcoal has already been institutionalized in the communities where there exists scarcity of woodfuel. The main contributary factor to the woodfuel supply problem, he argues, is the need for additional land for growing food. Due to either population growth, or migration or war or drought people extend farming to lands which were formerly areas where fuelwood was

collected, and trees are cut down to make way for cropping and in due course are no longer available for fuelwood supply. Furthermore, woodfuel crisis is not limited to the rural areas but rather is accelerated by the presence of urban market for woodfuel. The commercialization of woodfuel means that even if the existing stock of woodfuel would havew been sufficient to meet rural domestic energy needs, there has emerged a competetive demand for it. And since the farmer is striving to generate some income or liveliwood he will rise to the occassion and size the opportunity. To the extent that although fuelwood collection was areserve of the female, the male sex are now involved in fuelwood collection for commercial purposes. He therefore concluded that the woodfuel problem should not be addressed in isolation but as an integral part of the development process.

Timberlake et al (1984) see the emergence of the woodfuel crisis in the rural areas as concommitant to the structaral changes experienced in society over time or as part of the societal growth process. Thus a society moves from a position of self-sufficiency in fuelwood supply to a situation where there is a deficit. First, in a situation where the population densities in a given local area are low, the household fuelwood requirements are met without any damage being caused to the standing stock of trees. And those who

own land are able to grow their own trees. And where local custom permits, the local people collect fuelwood from their neighbours farms and very little time is spend in fuelwood gathering. But as the population in the local community grows there is a higher demand for fuelwood which cannot be satisfied from the immediate area and as a result the fuelwood collection area is extended - a consequence of which is the increased number of hours spend in the said exercise that are not available for other productive work. By and by distance to the source of fuelwood becomes prohibitive and people turn to the standing tree stock which becomes depleted. There is then a shift to use of inferior alternatives like crop residues, dung and other combastible materials. Secondly, a set of structural changes, privatization of land ownership and the emergence of commercial wood markets, reinforce the emerging fuelwood crisis. Privatization of land ownereship restrictis the accessibility to traditional communal sources of woodfuel which affects the poor, who are not able to provide for themselves from their farms, more severely. And the emergence of commercial wood markets provide an incentive to the people to engage more in wood harvesting either from their own farms or communal areas and nearby forest reserves. The land owners find it more profitable to sell excess wood for money rather than allow the poor to collect it for fire.

O'keefe et al (1986) looking at the woodfuel crisis as it affects the urban areas argue that the overdependence of many urban residents on woodfuel is tied up with the question of affordebility. They abserve that the current market prices are far below the cost of producing wood and the prices only reflect the cost of transporting it to the areas of consumption. They argue therefore that the aproach to the crisis is to address the issue of development in both the urban and rural areas. They thus observe:

> " ..... the urban fuel problem is one of low incomes; poverty is the trap which forces people into dependdence upon wood resources which are being depleted far faster than they are being renewed..... The only longterm answer is economic development to raise urban and rural incomes so that the rural poor are not forced to strip their land of one of the most precious assets, and the urban poor are able tompay the price of a sustainable fuel supply" (O'Keefe, et al, 1986)

Hosier (1985) basing his study on the three broad agro-ecologies zones in Kenya (High potential, medium potential and semi-arid zones) categorised the rural farmers into five groups: the non-surplus farmers, the surplus farmers, cash-surplus farmers, the cash crop farmers and the wage workers. These categories represented the various income brackets and were aimed

at demonstrating how the economic status affected the use of fuelwood energy. He found out that the wage workers had a lower level of reliance on and consumption of woodfuel. The surplus farmers (those engaged in small holder agriculture of about 1.5 hectares) who had the smallest average farm holdings had the lowest average fuelwood and paraffin consumption levels; the cash surplus (mixed farmers) had the largest average farmholdings and the highest energy consumption levels. He thus concluded that the level of household income and accessibility to land has a positive relationship with the level of energy consumption. Further by calculating the income levels of these categories of farmers, he found out that for the surplus farmer category, wood consumption increased with income and as such it appeared to be viewed as a normal economic good. Whereas in the wage workers category, wood consumption decreases as income increase. The other household categories did not show any consistent pattern of fuelwood consumption. Hosier further, found out that other factors which influenced the level of energy consumption were: the cost, (in terms of time for collecting fuelwood) as fuelwood becomes scarce its consumption also decreases as household requirements are checked either through conservation or substitution; the household size also influenced the amount of domestic energy requirement, as the household size increases so did the fuelwood

consumption. However the larger families had more effecient energy use on a per capita basis. Finally the dietary patterns of the household also influenced the level of energy life.

Several other studies have been undertaken to contribute to the understanding of the energy situation in Kenya. The most critical of which is the study done by the Beijer Institute expressly intended to constribute to the processof timely energy planning in Kenya. This was a national level study and it assessed the current and future commercial and non-commercial energy demand and suply situation. The study revealed the crucial role played by woodfuel in the economy and that in the absence of appropriate intervention this resource will continue to be depleted as to lead to severe stress on the economy. It came up with recommendetions as to how to alleviate the energy shortage problem, some of which are being implemented by the government. (O'keefe, Raskin and Bernow, 1984).

Western, D and Ssemakula, J. (1979) carrsied out a study which examined the consumption of woodfuel in the various sectors - large and small firms, rurall and urban domestic consumption. The study provided estimates of the contribution of woodfuel to the total energy consumption in Kenya, examined consumption patterns by region and came upwith projections of demand to the next two decades. Sweveral other studies

have been done which evaluate the potential supply and demand for charcoal in Kenya Arnold et.al, 1962; Chlala, 1972; Uhart, 1975, Kabagambe, 1976). But these studies have tended to assess the demand in urban areas only. However, other studies have been undertaken to assess the per capita consumption of wood in the rural areas in Kenya and other parts of East Africa (Arnold et.al 1962, oppenshaw, 1976).

All the above mentioned studies have tended to be at a macro level. Several other studies have been undertaken focusing on smaller geographical areas: such include that done by castro, A. (1983) on tree planting and fuel use in Kirinyaga District, this study stressed the factors effecting access to wood and other fuel supplies; Brokensha and Riley (1983) investigeted the impact of deforestation among the Mbere; Wanjama (1985) examined the nature and extent of woodfuel crisis in Kikuyu Division in Kiambu District. This study identified the factors contributing to woodfuel shortage in the Division as: rapid population growth, deforestation small land sizes and low energy conversion effeciency methods. This study sees the solution to the woodfuel problem as being the conservation of energy, diversification of energy and supply enhencement through tree planting. Wainaina (1985) also examined the energy situation in Gaichanjiru location in Muranga District and found out that the most

critical aspects of woodfuel acquisition were accessibility, availability, quantities and quality of woodfuel and location of sources of woodfuel. The study further establishes that the woodfuell problem is an integral part of agricultural stagnation in the location, that the use of agricultural residues, for example, as fuel ahs contributed to the low fertility of the farms leading to low levels of agricultural production. It identifies population pressure on land as being one of main contributary factors to the said problem.

This study is based on a much smaller geographic unit with a view to gaining a more detailed understanding of the rural energy problem. It focusses on a sub-location which is the lowest level of decision making in the District Focus for Rural Development strategy and findings here will reveal grassroots perception of the energy problem. The study aims at supplementing the other studies in providing data to increase the understanding of the woodfuel problem in the rural areas.

1.3 NEED FOR THE STUDY

Woodfuel constitutes a critical energy resource in the Kenyan economy, 75% of the energy resources are from woodfuel as compared to electricity which constitutes 1.2%, oil 21.4%, and coal 0.3%. Further, in the rural areas woodfuel constitutes 95% of the energy

consumption of which 69%is in the form of fuelwood and 29% in the form of burned charcoal. (o'keefe at.al. 1984). It is indeed government policy to promote rural development and woodfuel supply is an important aspect of rural development and as such deserves further study. Bearing in mind the above facts and that the supply of wood resources fall short of the demand for the same - in 1980 demand was 20.41 million tonnes against supply of 20.33 million tonnes, a shorfall of 0.08 million tonnes; in 1985 demand was 26.42 million tonnes, supply 20.35 million tonnes, ashortfall of 6.07 million tonnes, and if this trend continues unchecked, by 1990 demand will be 32.37 million tonnes, supply 21.57 million tonnes, a shortfall of 10.80 million tones, a study which will contribute to the better understanding of the problem is only but most appropriate.

Secondly, as indicated in section 1.1, the Kenya Government policies and strategies on energy show a bies for the development of indigenous sources of energy; such that although oil and wood together comprise the most important forms of energy-in 1980, for example, 95% of primary energy requirements were met by oil and wood supplies (o'keefe, Raskin and Bernow, 1984) - woodfuel will increasingly become the most favoured since it is an indigenous form/source of energy, while oil is imported.

Thirdly, the study area, Shiswa sub-location lies in the hinterland of Kakamega town and has been a source of charcoal to the town dwellers and as such, by gaining an understanding of the woodfuel situation here, it is possible to predict the possible implications to the town. Further, studies reveal that 50% of the urban household energy requirements are met from charcoal, therefore findings from the study area will be of regional or national application. Furthermore the study area falls in the agricultural high potential zone and lessons learned here can be applied in similar areas.

Fourthly, the study area borders the Kakamega forest which has been an important source of woodfuel for the sub-location until the government imposed some restrictions. An understanding of the present situation will throw some light on how a community adjusts to such changes and form a good basis for favourably intentioned interventions. Finally it is government policy to not only encourage but also actively participate rural development and energy supply is indeed a crucial aspect of rural development.

1.4 STUDY OBJECTIVES

1. To examine the energy production, supply and consumption patterns in shiswa sub-location.

2. Investigate the possibility of the study area to accommodate the energy supply programmes formulated at the centre.

3. To gain an insight into the local communities perception of the energy shortage problem as a basis for planning the said programmes.

4. Make recommendations for appropriate intervention approaches to alleviate the energy shortage problem.

1.5 RESEARCH METHODOLOGY

To be able to achieve the above mentioned objectives the farm-household was the unit of investigation and the following methods of data collection were employed:

(a) a household questionaire was administered to a total of 105 household which constituted about 2% of the total population. This was done by first dividing the area into clusters based on the existing villages - a village is the lowest level administrative unit under a headman (Liguru) and is composed of people from one lineage and therefore to a large extent it is a humogeneous unit in regard to socio-cultural aspects - that is each village constituted a cluster out of which a sample of 15 households chosen at random were interviewed.

(b) Unscheduled interviews were held with a selected number of elderly members of the community. These were aimed at unearthing the socio-cultural factors that contribute to the energy situation in the study area and also drawing from their long experience as members of the local community to trace the historical development of the forementioned problem.

(c) Discussions were held with the District forest officer and the Deputy provincial officer for Western Province. These discussions yielded information on the forestry resorces, forest planning and use in Kakamega District and in addition information on tree nursery distribution and extension services related to Rural Afforestation. Further unplanned discussions were held with the Distric officer in charge of Ikolomani Disrict which centred around matters of general development of the area.

(d) Finally, through direct observation information on aspects like road network, means of transporting woodfuel, alternative energy resources, various landuses etc was collected. This was supplemented by photographs taken during the field survey.

The questionaire administered to farmers was

designed in such a way as to capture such aspects as: the socio-economic background of the households like the employment patterns, income levels, the family size and age distribution, the landuse patterns and farm size; energy specific questions as, the type of energy used in heating, cooking and lighting, sources of fuel-wood, aspects of tree planting and use, decision making within the household; and finally the issue of the community's perception of the energy was addressed through problem identification and solution suggestions by the respondents.

As regards data analysis and presentation, basing the analysis on questionaire responses a descriptive method of analysis has been used. This includes use of measures of central tendancy and dispersion, in addition simple percentages were used. In presenting the data use has been made of tables, pie charts and photographs.

1.6 THE STUDY ASSUMPTIONS

The study makes certain assumptions:

(a) that the perception of the problem of energy shortage by the local community in the study area is very minimal. As such they have not attempted to take appropriate measures to alleviate the energy supply problem.

(b) The current patterns of energy supply are not

appropriate for meeting present and future energy requirements in Shiswa sub-location. And within this supply patterns and land use patterns the energy supply programmes formulated at the centre (by the central government) cannot be adequately accommodated.

(c) That the socio-cultural environment in Shiswa sub-location contributes to the energy supply problem.

1.7 SCOPE AND LIMITS OF THE STUDY

The study focussed on the analysis of household energy in Shiswa sub-location, its production, distribution and uitilization with special reference to wood-fuel. Certain aspcets such as: the sources of wood fuel; on farm wood production - purpose for planting trees, who plants, where planted, sources of seedlings and problems associated with their production; utilization of the various forms of energy within the household.

This information was appreciated against the socio-cultural, economic and ecological background of the study area. That is, it was done with due consideration of various aspects of rural development. It therefore included an appraisal of the Geo-physical aspects, like, climate, vegetation, soils and size; the Economic base - employment patterns, agricultural/land-use patterns; socio-cultural environment - population

structure and distribution, decision - making at the household level, values and beliefs.

All the above were examined within the framework of government policy on energy and rural development (chapter 2). Finally, the spatial scope of the study was a sub-location, this was so because; the sub-location is the lowest decision making level in the district focus for rural development strategy and findings here will represent grassroot perception of the problem under consideration and given the time and financial constraints it was not possible to handle a larger area. In addition, the said sub-location has unique characterestics which need to be captured by specifically focussing attention to it.

1.8 OPERATIONAL DEFINITIONS

In this study a number of terms have been used which need to be taken in context and have thus been defined:

(a) woodfuel - as used in this study means fuelwood or firewood and charcoal.

(b) sub-location - Is the lowest level administrative unit within Kenya's provincial Administration structure. It comprises of a number of villages which are composed of a group of people of the same lineage or clan led by a headman

(Liguru).

(c) The farm-household - This connotes a group of people, related by blood or otherwise who live together and derive all or part of their live hood on a farm.

(d) Woodlot - A form of landuse where land is dedicated to monocroping of trees and involves removal of land form agricultural production and its alienation form other landuses. (Hosier, 1985)

(e) Agroforestry - Connotes many forms of landuse in which tree and shrub cultivation is combined with the production of agricultural or horticultural corps on the same piece of land. Livestock production can also be an integral part of othe system.

1.9 STUDY LIMITATIONS

Like other studies, this study was not without its own limitations. These limitations were the inevitable consiguenees of the setting of the study area; the survey instruments employed; and the nature of the

topic of study, amony others. First the study area is in a rural setting where many households operate at the level of subsistence economies or as economies in transition from subsitence production to monetary production. As a result a substantialm proportioon of transactions take place outsie the fromall exchange channels and record keeping in terms of income earned from sale of farm produce, amount of fuelwood conumed per given period of time; the land under a given farm enterprise or even the total land area by the household, is also at very low levels. To this extent most of the responses to these vanables were mainly fair estimates, such that a certain level of accuracy was lost in this way. This was also a constraint in achieving the second study objective of investigating the obility of the study area to accommodate the energy programmes formulated by the government.

Secondly, the main instrument of data collection employed in the survey was a structured household questionnaire which was administered with the help of research assistants. And as prewitt (1975) rightly observes, "The more interviewers there are the more difficult it is for the researcher to maintain control over the research." This was more so the case where need arose for the interviewer touse his own fidgement in estimating, for example, the land areaunder a woodlot or other farm enterprise like maize. There was

thus room for either averestimation or under estimation and also aspects that required probing were not captured, as well as the researcher would have wished. Further since this method involved direct interaction between the interviewers and the respondents one can not rule out the possibility of this setting influencing the reaction of the respondent to questions posed to him/her. (Ibid, p.45).

Finally, energy consumption and supply patterns to some extend vary from one season of the year to the other. To be able to capture this kind of information would require more time than was available for the study. Furthermore, to be able ot collect fairly accurate data on the amount of fuelwood requirements or used one requires ot have weighing equipment which was not available to the research.

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CHAPTER II

AN OVERVIEW OF THE ENERGY POLICY IN KENYA

The study problem having been defined in the preceding chapter, one, in the current chapter an attempt is made to evaluate the government policy on energy with a view to presenting the macro-level view of the energy problem to enhance the understanding of the study. This is supplemented by a brief look at the government policy on rural development. The rationale being that the study area is in a rural setting and whatever the nature of development in the said, it has a bearing on the issue under study, energy. In the first section (2.1), the importance of energy in the Kenyan economy is demonstrated; in the second section the development of the government policy on energy is traced and evaluated - this is preceded by an outline of the main energy policy considerations; the government policy on rural development is presented in the third section (2.3) and finally conclusions are drawn.

2.1 ENERGY AND THE KENYAN ECONOMY

"The energy requirements of developing countries may be expected to continue to grow as development spreads to all segments of these countries. With the industrialization of their economies, commercial energy requirements will rise substantially

above the present level. The modernisation of agriculture will also absorb an increasing amount of commercial energy and will stimulate the substitution of commercial for non-commercial energy for domestic and other uses in the rural areas. The rural populations need for non-commercial energy will continue to grow". (Unctad, 1980, p.6)

In Kenya the economy is expected to grow at the rate of 5.6% per annum to the year 2000 and the manufacturing sector alone is expected to grow at a rate of over 7% per annum over the same period. To achieve these rates of growth, the energy requirements will grow as shown in Table 2.1.

TABLE 2.1: ENERGY REQUIREMENTS, 1985-2000
('000 TONNES EXCEPT FOR ELECTRICITY)

	1985	2000	GROWTH RATE 1985-2000 (% p.a.)
Fuelwood	14,972	23,480	3.0
Wood for Charcoal	8,754	17,513	4.7
Commercial wood	1,077	2,588	6.0
Biomass	1,112	2,177	4.5
Petroleum	2,080	3,821	4.1
Coal/coke	97	180	4.2
Electricity:			
- Kilowatt hours	2,480	6.077	6.2
- Capacity megawatts	586	991	3.6

Source: Sessional Paper No.1, 1986

It is evident from Table 2.1 that, with only two exceptions, the growth rates per annum by source of energy are well over the current population growth rate of 4.0% per annum. There are several implications of these growth rates: First, for the case of the imported energy sources, petroleum and coal, more and more of the export earnings will have to be directed to meeting the import bill for these fuels. As a result very little of the export earnings will be available for the importation of capital, technology and other intermediate inputs required to achieve the intended rate of economic growth and in this way may stand in the way of such desirable goals. From Table 2.2, for example, energy imports as a percentage of merchandise exports grew from a mere 18% in 1960 to 63% in 1981, that is only 37% of the export earnings were available for importation of other inputs in the development process.

In the selected African countries, Table 2.2, Kenya was one of the worst hit, with Senegal and Upper Volta having to commit as much as 77% and 71% of their export merchandise to the importation of energy resources. This astronomic increase in oil import bill should be appreciated with due regard to the impact it had on the domestic economy. In the period prior to the oil price increase, 1962 to 1972, the annual growth rate of GDP was 6.2%, falling to 4.3% in the period

Table 2.2: ENERGY IMPORTS AS A PERCENTAGE OF MERCHANDISE EXPORTS IN SELECTED AFRICAN COUNTRIES, 1960 & 1981

	1960	1981
Upper Volta	38	71
Tanzania	n.a.	50
Niger	6	23
Kenya	18	63
Sudan	8	44
Senegal	8	77
Ethiopia	11	44
Ivory Coast	5	21

Source: World Bank Development Report, 1984

after the oil price increase 1972 to 1982 (Table 2.3). The growth in per capita income concomitantly fell from 3.0% per annum to a very low 0.7%. The worst hit was government services whose average annual growth rate fell from a desirable 10.2% in 1964 - 72 period to a mere 4.5% in the 1972 - 82 period; industry was also greatly affected with the average annual growth rate falling from 8.8 in the 1964 - 72 period to 5.3% in the 1972 - 82 period. Thus, apart from the other services sector which experienced a steady average annual growth rate of 5.2% in the periods under consideration, there was a declining trend in annual average growth rates.

This undesirable turn of events was also reflected in the average rate of inflation which was less than 2.6% per annum in the period 1964-72, but rose to 11.4%

per annum in the period 1972-82, after oil price increases (Ruigu, 1985). As a matter of policy, emphasis should be on the development of indigenous energy resources.

TABLE 2.3: AVERAGE ANNUAL GROWTH RATE OF GDP (%)

SECTOR	1964-82	1964-72	1972-82
Traditional Economy	3.7	4.0	3.4
Agriculture and allied sectors	3.8	4.7	4.4
Industry	6.8	8.8	5.3
Government Services	7.8	10.2	4.5
Other Services	5.2	5.2	5.2
Total GDP at factor cost	5.1	6.2	4.3
Per capita GDP	1.7	3.0	0.7

Source: Kenya Official Handbook 1963-1983, p.62

Secondly, to be able to meet the growth rates in fuelwood, wood for charcoal and commercial wood (Table 2.1) more land resources will have to be committed to the production of energy in competition with the other productive activities (like food and cash crops) which have land requirements. This should be appreciated in the light of the diminishing availability of agricultural land (Table 2.3) against the increasing population. This is more so the case with the high potential districts like Kiambu, Kisii, and Kakamega

TABLE 2.4: ESTIMATED AVAILABILITY OF GOOD AGRICULTURAL LAND PER PERSON, PER DISTRICT, 1969, 1979 AND 1989.

DISTRICT	HACTARES	HACTARES PER PERSON		
		1969	1799	1989
Kiambu	170	0.36	0.25	0.18
Kisii	220	0.33	0.25	0.20
Machakos	284	0.40	0.28	0.20
Kakamega	325	0.42	0.31	0.25
Nyeri	160	0.44	0.33	0.25
Taita	50	0.45	0.34	0.26
Nakuru	301	1.03	0.58	0.34

Source: Rural Development, Employment and incomes in Kenya, Livingstone, I. (1986)

which are also areas of population concentration. In Kiambu Districts, for example, by the year 1989, the availability of good agricultural land per person will have fallen to 0.18 hectares from 0.36 hectares in 1969, a decrease of about 50%. For Kisii District the decrease will be about 40% from 0.33 hectares per person to 0.20 per person in 1989. This trend is similar in the other districts as it is clear from Table 2.3. As a matter of policy therefore, emphasis should be on agroforestry which will make it possible to accommodate the competing land-uses, rather than woodlots which will exacerbate the competition among the said land-uses. The next section is committed to examining government energy policy given these facts.

2.2.0 ENERGY POLICY CONSIDERATIONS.

In essence, any energy policy is an attempt to strike a balance between the demand for and supply of energy resources in the context of the present and future working of the economy so that a desirable trend is established whereby shortages are done away with and instead there is a steady and assured supply of energy running ahead of the demand for it. That is moving towards a situation of self sufficiency in energy supply. There are therefore two broad policy approaches, one from the demand side and the other from the supply side, that is demand management or energy conservation and supply enhancement respectively. Both approaches are complementary.

(a) Demand management/energy conservation.

This policy approach focuses on the end-use or consumption of energy, emphasising effeciency in its use - that is minimization of wasteful or inefficient utilization of energy. It offers a number of advantages:

(i) It has positive effects on the natural environment diminishing the social costs associated with increased air, water and other forms of pollution.

(ii) Due to shorter lead times, it has the effect of

lowering energy imports more rapidly than increased production of indigenous energy.

(iii) Since it leads to a reduction in the amount of energy demand, it contributes to prolonging the life of depletable energy resources, and thus buying more time to develop other energy alternatives.

(iv) Success in energy conservation will tend to exert a downward pressure on energy prices, thus contributing to the fight against inflation. (OECD, 1974 and Miller, 1979)

To realise these advantages there are two main policy tools: energy prices and energy taxes. Through energy price manipulation, it is possible to discourage the consumption of a given energy form and also indirectly force the consumers to exercise economy and take energy conservation more seriously. At least prices of primary energy supplies to the end-user should be at world market levels. Also substantial energy taxes should be imposed on selected fuels to reinforce the effects of market prices. These, however, should be accompanied by a comprehensive public education program on energy conservation backed by skilled manpower and proportionate financial outlay. Further, in applying these policy tools consideration should be given to the likely effects of the price regime on the

performance of the economy and the distribution of the tax burden among the different income groups in society. (World Bank, 1979)

This approach could, however, be a constraint mainly by the fact that "final consumption of energy is so diffuse and decentralised that conventional policy instruments are powerless". (World Bank, 1986) Also, especially in the developing countries, the non-commercial energy supplies which constitute a significant proportion of energy consumed in the economy may not be easily influenced by the manipulation of market prices. While this tends to limit the choice of policy instruments in the energy sector it does give an indication to the importance of the need to have a package which will take care of these diverse conditions.

The other likely constraint, is the existing state of technology, especially in the shortrun. This is especially in the developing countries where it would be difficult to implement certain strageties that require a minimum level of technological capability, such that in the short and medium term the measures are likely to be merely cosmetic.

(b) Supply Enhancement.

This approach emphasises the need to boost current supply of energy while ensuring a reliable, adequate

and affordable future supply of energy proportionate to demand. This is achieved through diversification and acceleration of supply of energy resources, especially the indigenous ones. Therefore the extend to which this strategy can be successful will depend on the availability of indigenous energy resources besides the appropriate technology and the attendant financial and manpower resources. It offers the advantage of leading to reduction in the price level in the energy sector and given the fact that energy constitutes an important item of expenditure in low income family budget this will contribute raising the real income of this bracket in the longrun.

In the light of all these, an energy policy should:

(i) Integrate the energy plans and strategies with the other national development goals. For example to be able to achieve any meaningful level of energy conservation, it would require certain structural changes in the production processes in the industrial sector, new standards for more effecient autos in the transport sector, modification in residential and commercial buildings and many others. This will need to have been incorporated in the policies of the other sectors in the economy.

(ii) Have short, medium and long-term energy develop-

ment strategies. The long-term strategy should provide the broad guidelines for major decisions which will effect the more distant future; the medium term strategy which should be formulated in the light of the long-term strategy and a more detailed strategic plan. It ought to be long enough to provide a basis for investment planning and also to achieve significant fuel savings through demand management policies. And finally the short-term policies which should be part of a regular planning process dealing with temporary and acute problems (Cook and Survey, 1977).

(iii) Incorporate both the supply enhancement strategy and the demand management strategy. The supply enhancement strategy should emphasise the development of indigenous energy sources. On the other hand, the demand management strategy, while making use of the conventional policy instruments, should of necessity institute a massive education programme of the population providing clear energy conservation guidelines.

All these should be backed by the necessary institutional framework for their implementation besides proportionate financial and manpower committment by the central government and other development agencies. With this we turn to Kenya's case.

2.2.1 THE KENYAN ENERGY POLICY FRAMEWORK.

The Kenya Government policy on energy is reflected in the National Development Plans and has developed over the years from mere broad declarations of intent to more focussed programmes of action. In the first development plan 1966-70, basically one form of energy, electricity, is mentioned and programmes to enhance its supply spelt out. The main objective during the said plan period was to increase the distribution of electricity to meet anticipated growth in demand. And in keeping with the then national goal such improvements were intended to "facilitate the industrialisation process". (Development Plan, 1966-70)

Similar intentions are echoed in the second Development Plan, but in addition alternative sources of energy including sun, wind and tides, nuclear and geothermal energy are indicated as possibilities. But, apart from geothermal, no specific programmes were forthcoming to develop them. During the first two plan periods therefore, emphasis was on electricity and the supply enhancement aspect of it (electricity) to the neglect of demand management component and other energy resources. There were no long term and medium term energy plans, neither was there any attempt to integrate the energy programmes or plans into the broad development national goals. This lack of serious attention directed to the energy sector could be forgiven on

account that these plan periods preceded the first oil crisis of 1973 during which period the need for an energy policy was not yet apparent given the low and affordable oil prices that prevailed.

In the 3rd five-year Development Plan, 1974-1978, the importance of electricity is emphasised but the benefits of development in this sub-sector were to be spread to benefit the rural areas also. It is stated in the Plan:

> "The demand for electrical energy in the urban areas will be met in full but it is also the government objective to extent the availability of electrical energy more widely in the rural areas. An accelerated rural electrification programme is to be implemented during the plan period." (Development Plan, 1974078)

It is in this plan that the importance of fuelwood begins to be noticed. The main strategy was to encourage farm woodlots on private land through the Rural Afforestation Programme. However, the budgetary allocations of the Ministry of energy revealed a bias for the electrical energy resource development. In the 1981/82 financial year, for example, 73.2% of the Net Approved Expenditure was directed to electric power development; Non-conventional energy sources (including woodfuel), 11.7% and petroleum and other fissil fuels

6.3%. In the next financial year the situation had changed only slightly, of the Ministry's total vote of K£2,302,550, in 1982/83, 55.6% was allocated to electric power development, Non-conventional energy sources, 6.5%, and 21.7% for petroleum and other fossil fuels.

It is in the 5th Development Plan, 1983-88, that more detailed and specific energy strategies are spelt out. There is also an attempt to incorporate the demand management and supply enhancing strategies and also an element of distributive justice by encouraging rural electrification. In the electricity sub-sector, for example, programmes include:

(a) acceleration of exploration of geothermal resources to determine the total commercially viable potential.

(b) acceleration of the exploitation of proven commercially viable geothermal wells to meet projected power demand growth.

(c) stepping up of Rural Electrification Programme arrived at providing greater source of lighting energy to the rural population and stimulate industrial and agricultural development in the rural areas.

In the wood fuel subsector, there is also an

apparent bias for the supply enhancing strategies. programmes in this sub-sector include: agroforestry peri-urban plantations and rural afforestation and soil conservation. In the petroleum sub-sector, the strategy seems more or less demand management one of the strategies stated in the plan is:

> "to continue to use the price mechanism to discourage wasteful consumption and thereby stimulate conservation. Gasoline will continue to bear heavier taxes than other petroleum products since it is used for private transportation". (Development Plan, 1983-88)

It is in the petroleum sub-sector that use is to be made of the price mechanism to influence energy substitution. It is stated that "in order to encourage industries to shift from oil to coal, a progressive tax on fuel will be considered. In addition the import duty on coal will be reviewed".

The plan does recognise, also, the need for both the public and private sectors to cooperate in order to achieve the stated energy conservation measures. An indication of the roles both sectors are to play is given, with the government providing policy advice and incentives whereas the private sector implements improvements in products and energy use practices.

In sum, there are a number of observations that

one would make: First, although policy pronouncements indicate the desire of the government to diversify the energy sources, budgetary allocations reflect a clear bias in favour of electricity as opposed to the renewable energy resources. In the 1985/86 financial year, for example, of the Department of Energy's Net Approved expenditure of K£11,868,208, 51.1% was directed to electric power development as opposed to renewable energy development which received only 3.3% and petroleum exploration and substitution 42.1%. The allocations are not proportionate to the importance of each of these energy resources in the economy. Woodfuel, for example, (as indicated in chapter one) accounts for over 75% of the energy resources supplied in the country, but received only 3.3% of the financial resources. While electricity which accounts for only 1.2% of the energy supplied, received 51%.

Although this bias for electricity could be justified by the fact that it offers the advantages fo being environmentally safe, has minimal land requirement and is an indigenous source, it has a high import content in terms of technology. Also in the short term and medium term it will continue to be out of reach to many of the citizens in terms of financial capability. By 1980, for example, only 36% of the urban households could afford electricity.

Secondly, policy rhetoric indicate the governments

desire to pursue both supply enhancement and energy conservation measures but very minimal resources are committed to energy conservation. In the 1986/87 financial year less than 0.5% of the net expenditure in the Department of Energy was committed to energy conservation. Furthermore, there are no clear and articulate guidelines for the various sectors of the economy on energy conservation. Finally, most of the strategies are more or less short term and medium term, there is no long term strategy. Also there is minimal attempt to incorporate the energy plan into the other sectors' plans.

2.3 GOVERNMENT POLICY ON RURAL DEVELOPMENT

With an estimated 84.7% of the Kenyan Population living in the rural areas (Sessional paper No.1, 1986), the government recognizes the need to give special attention to the rural areas. It was therefore stated in the 3rd Development Plan that there was need to direct a greater proportion of the national resources to the rural areas. This was in recognition of the fact that:

> "The major primary resources of Kenya are land and the people. The substitution of higher for lower uses of land through intensive commercial farming, the diversification of agricultural enterprises, and the development of trade and rural industries

are major means of utilizing these resources . . ." (Development Plan, 1970-74)

To this extent, therefore, the government strategy to rural development emphasizes: the promotion of agricultural development; stimulation of off-farm economic activities; and greater participation of the local communities in decision making and implementation of development programmes.

In respect to agricultural development, the approach has been to provide a package of supportive infrastructure. These include: extension and credit facilities; rural access roads to facilitate the flow of farm inputs and output to and from the market; development of appropriate technologies for small farm activities; improved pricing of agricultural products; improving accessibility to consumer and social services, like water and power. However, the government does recognize the constraint of diminishing land resource availability given the high population growth rate (as demonstrated in section 2.1). Therefore, stimulation of off-farm economic activities to provide vent for surplus labour is another area of emphasis. This has taken the form of provision of incentives for the dispersion of industry and encouragement of non-farm informal activities, which are labour-intensive. These will not only contribute employment and income generation but will also enable the tapping of local

resources like entrepreneurship, capital and raw materials. In addition, by providing such opportunities in the rural areas, this will go a long way in checking the process of rural-urban migration.

Finally, greater participation in planning process by the grassroot, through the strategy of District Focus for Rural Development, it is believed, will lead to improved plan implementation. Also local resources will best be mobilised for development and make the process of rural development self-sustaining.

With respect to the development of the energy sector there are several positive aspects inherent in the government policy on rural development: First, provision of extension services in the agricultural sector could be extended to include dissemination of information on proper techniques of woody biomass production (especially agro-forestry). Use should be made of the existing agricultural frontline staff instead of employing extension staff specific to afforestation and agroforest. This will not only save on financial resources but will also help in eliminating contradiction in innovations passed on to the farmer and lead to more harmonious land-use practices. Secondly, the encouragement of the informal non-farm small-scale industrial activities could be utilised in developing appropriate energy saving implements like the ceramic jikos, at affordable prices. Finally, through agricul-

tural development, it is possible to increase the range of alternative energy resources available to the farm household. This is both in terms of increased purchasing power provided by income generated from the sale of farm produce, and availability of biogas raw materials (by keeping livestock).

In conclusion, it has been demonstrated in this chapter that energy is an important sector in the economy as shown by the effects of oil crisis which led to a fall in the average growth rate of the GDP, increase in the average rate of inflation and increase in the oil import bill. It has also been shown that recognizing the importance of energy the government of Kenya has over the years tried to come up with strategies to strengthen the said sector.

It is government policy to use both supply enhancement and demand management (energy conservation) to alleviate the energy problem. In the supply enhancement approach emphasis is on mobilisation of the locally available energy resources whereas in the demand management strategy the government aims at improving the efficiency of the utilization of both locally available energy resources and the imported ones.

However, it was also indicated that policy statements in a number of cases were at variance with actual

practice. Budgetary allocations revealed a clear bias for supply enhancement approach at the expense of the demand management approach. Also electricity subsector was favoured in terms of financial resource allocations relative to other energy sub-sectors, although in terms of its contribution to total energy supplied in the economy it is not so significant. Finally, the policy on energy conservation is still largely inadequate because it lacks clear and articulate guidelines for its implementation. This leads us to the next chapter, study area.

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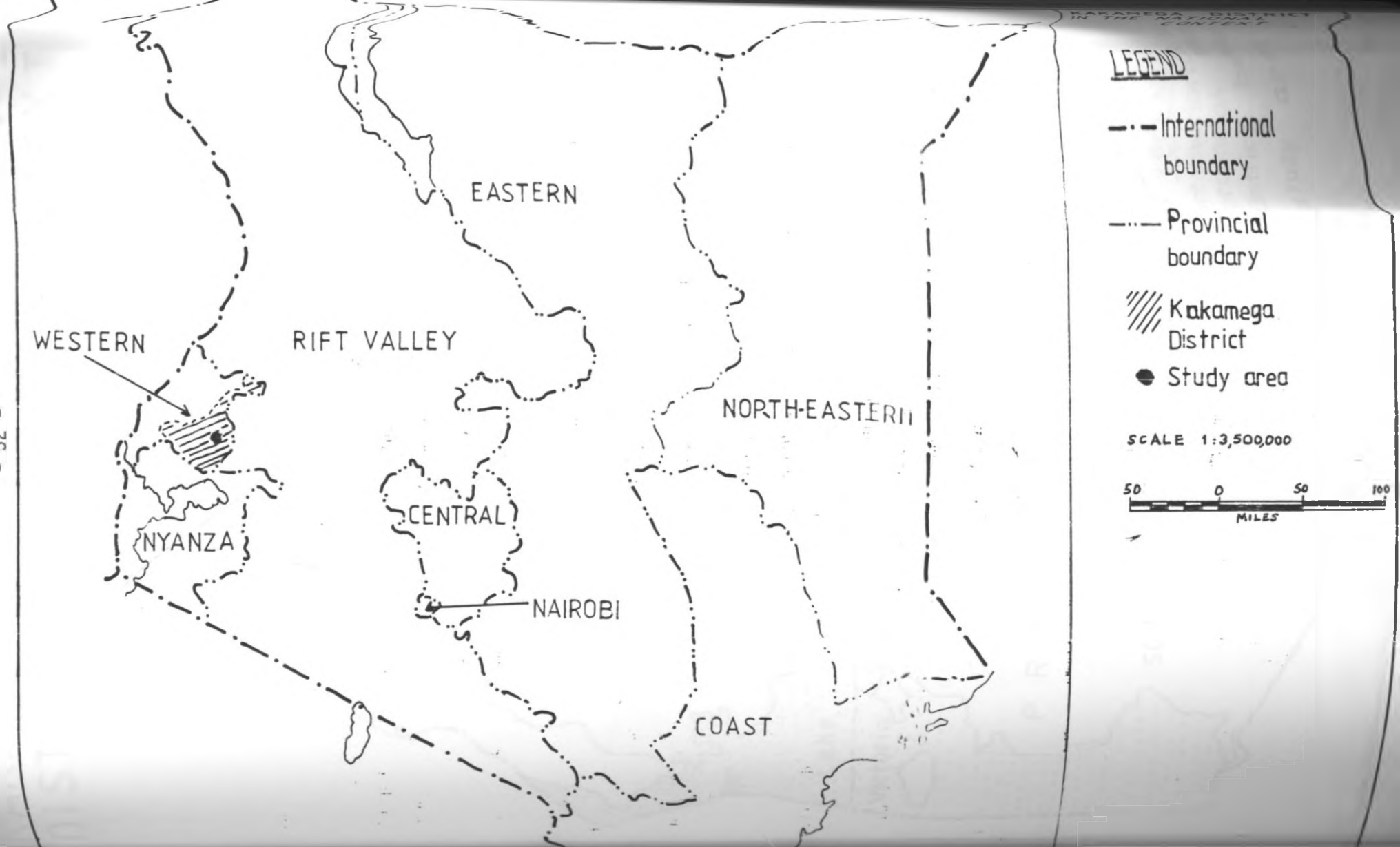
CHAPTER III

THE STUDY AREA.

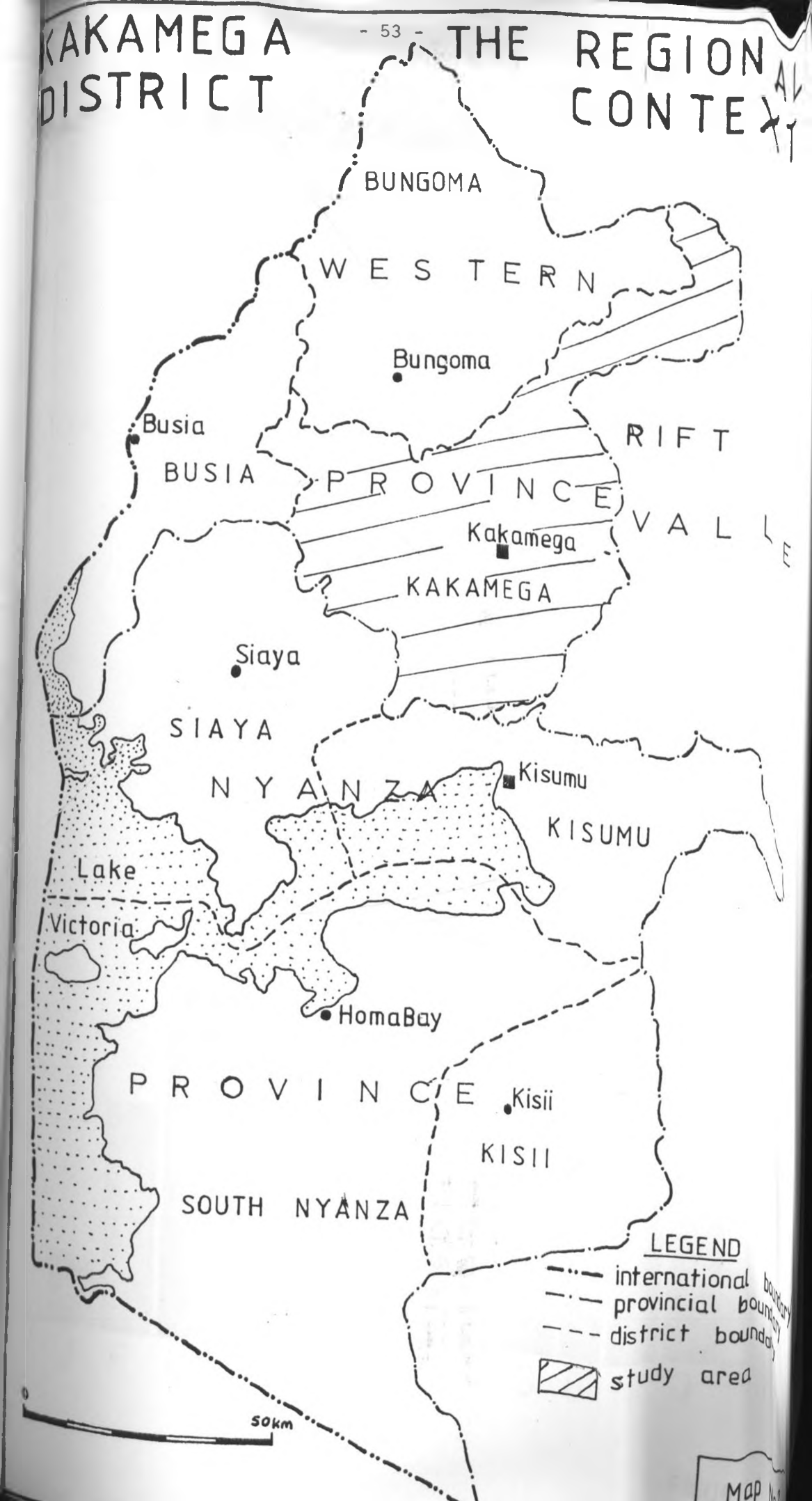
In chapter one the study problem was identified and in chapter two the problem was put in the policy context. This chapter moves a step further to pay attention to the geographic and socio-economic background of the study area. It is divided into two main sections: the first section presents a brief profile of the Kakamega District's resource base with special reference to woodfuel. The main aim of this section is to establish the alternatives available in the immediate neighbourhood of the study area; the second section on the other hand presents a more detailed profile of the specific study area, Shiswa sub-location. This section provides a spring board from which the superceding discussions, the data analysis and policy recommendations, are undertaken.

3.1.0 KAKAMEGA DISTRICT, A GEO-PHYSICAL AND ECONOMIC PROFILE.

In this section the aspects considered include: the location and size, climate, agro-ecological zones and soils, biomas resources of the study District, Kakamega.


LEGEND
International boundary
Provincial boundary
Kakamega District
Study area
SCALE 1:3,500,000
50 0 50 100
MILES
WESTERN
RIFT VALLEY
EASTERN
NORTH-EASTERN
CENTRAL
NYANZA
NAIROBI
COAST

KAKAMEGA DISTRICT IN THE REGIONAL CONTEXT



MEAN MONTHLY RAINFALL
KAKAMEGA DISTRICT

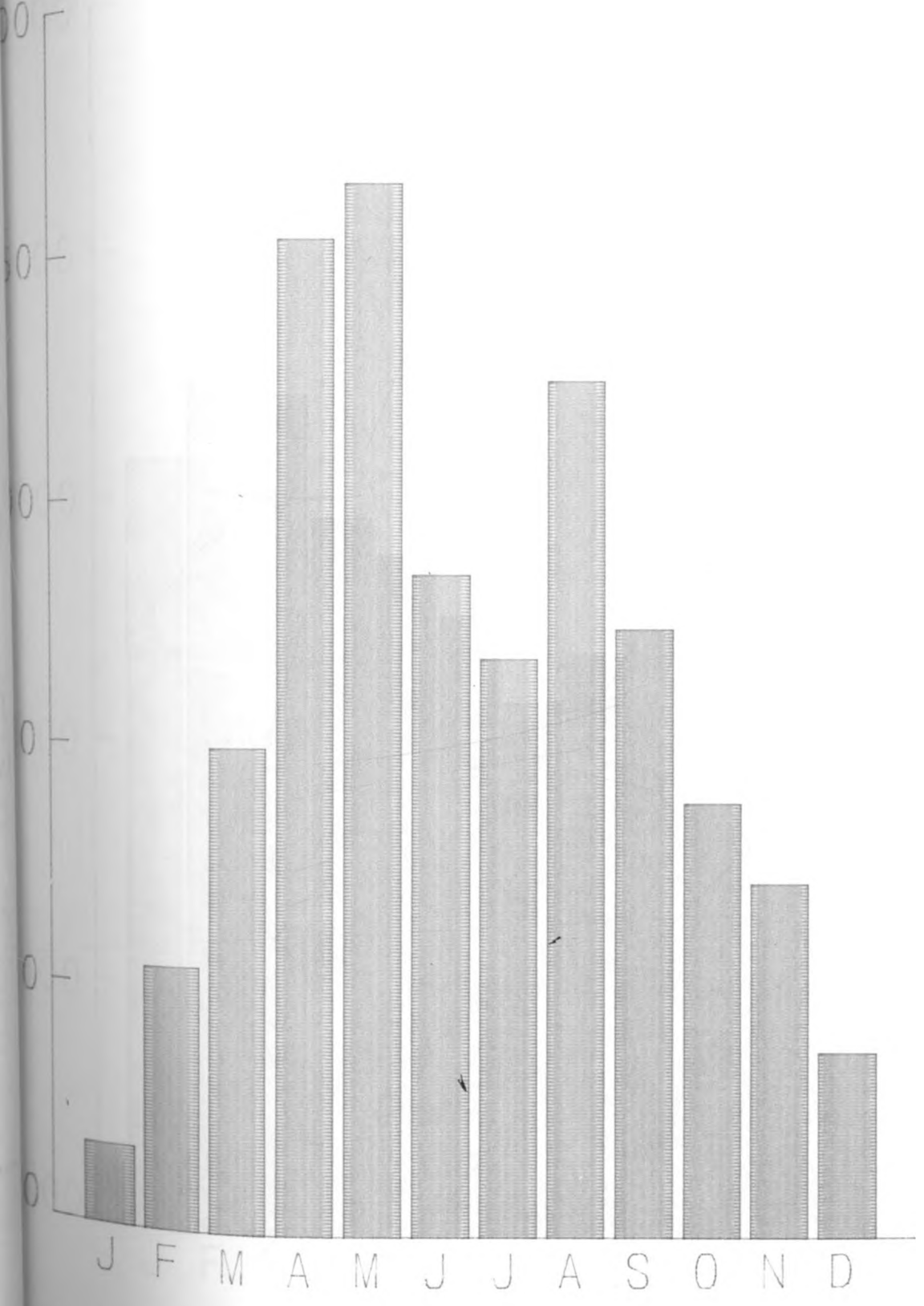


FIGURE 1

EVAPORATION (MM) – JULY 1979–1983
KAKAMEGA DISTRICT

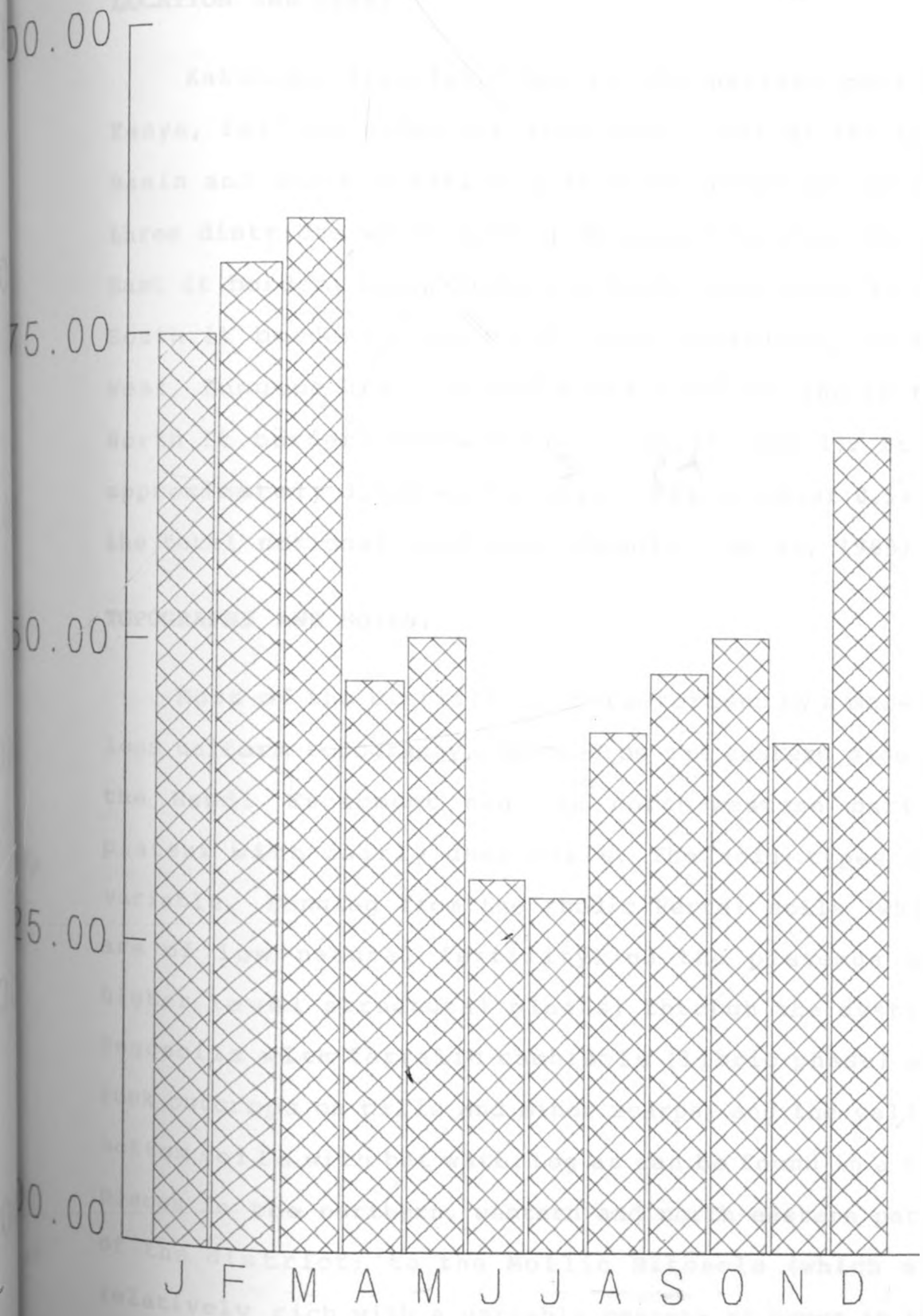


FIGURE 3

3.1.1 THE PHYSICAL BACKGROUND.

LOCATION AND SIZE:

Kakamega district lies in the Western part of Kenya, falling under the geographic unit of the Lake Basin and administratively it constitutes one of the three districts which make up Western Province. To the East it borders Uasin Gishu and Nandi Districts, to the South it borders Kisumu and Siaya Districts, to the West, Bungoma District and Busia District and to the North it borders Trans Nzoia District (map 1). It is approximately 3,500 km^2 in size, that is about 0.5% of the total national land mass. (Bradley, et al, 1985)

TOPOGRAPHY AND SOILS:

Most of the District is characterised by a more or less uniform topography, flanked on the eastern side by the Nandi Escapment and the north-western part a plateux with fairly deep soils. The soil types are variable, ranging from the rhodic Ferrel soils (which are of low natural fertility) on the plateaus and higher level structural plains; through the dystric regosoils with ferralic cambisols (libric phase) and rock outcrops on hills and minor scarps; and the valley bottom soils with bat waterlog as can be found in a few places in the northern, western and north-eastern parts of the district; to the Mollic Mitosols (which are relatively rich with a variable content of humus in the

top soil) in the upper middle level uplands and lower middle-level uplands. (Jaetzold, 1982)

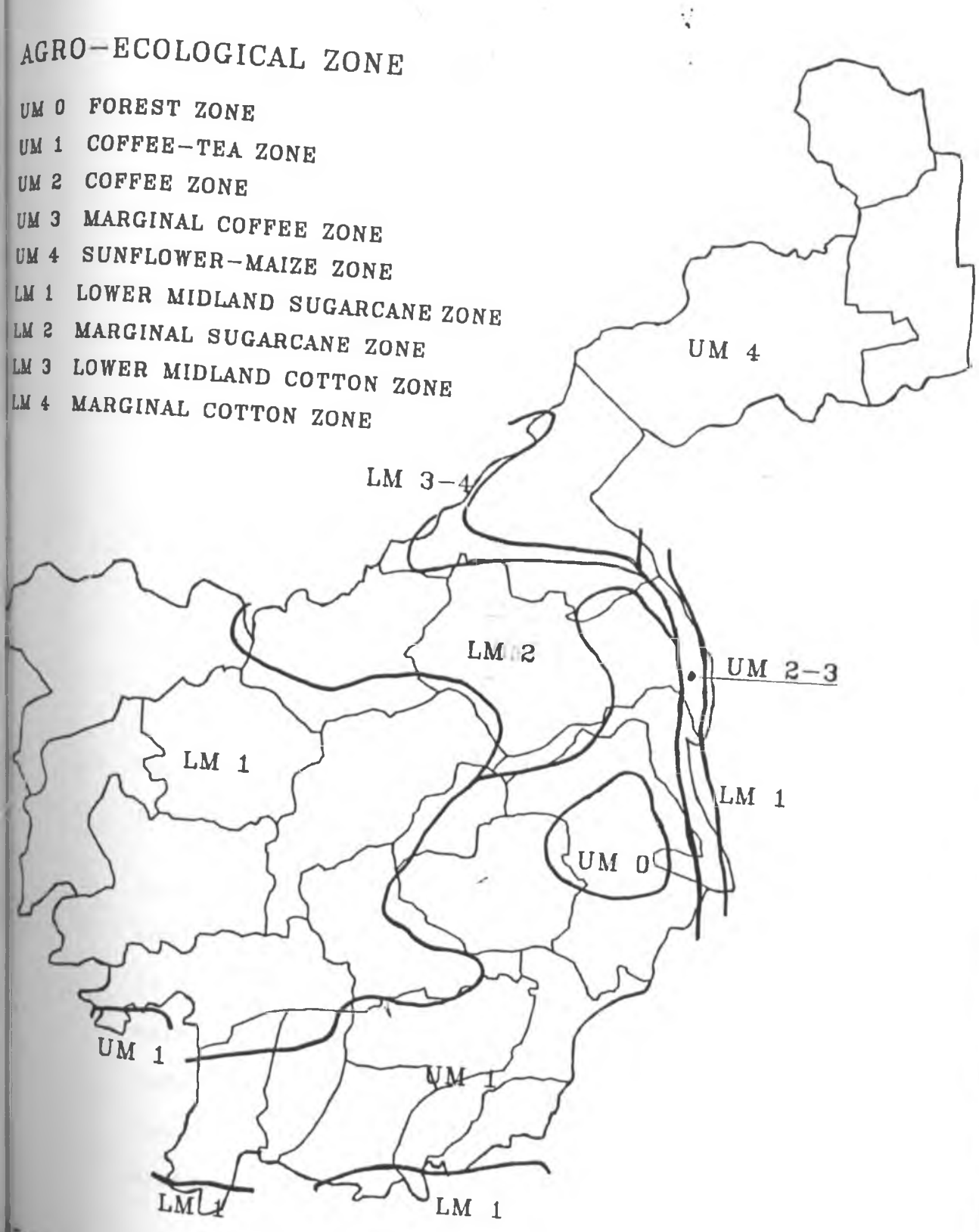
CLIMATE.

Kakamega District enjoys some of the highest amount of rainfall in the country, 1000 mm to over 2000 mm per annum. Rainfall expectation is also high, 500 - 1100 mm during the 1st rain and 450 - 850 mm during the 2nd rain, that is in 6 out of 10 years. This varies from one agro-ecological zone to the other, such that whereas in the upper midland one zone the 60% reliability of length of growing period is 365 days in the upper midland four it is about 230 days. (Ibid (see map 2 and figure 1). The mean annual temperatures are fairly high ranging from 18°c to 20.5°c and above. Given the heavy rains the evaporation levels are not so high, ranging between 1600 mm to 1800 mm per year. (see figure 2 and 3)

AGRO-ECOLOGICAL ZONES.

Against the background established from the aspects considered above, the district (Kakamega) can be divided into 9 Agro-ecological zones which to a very large extent reflect the pattern of land-use in the district. Specifically, they have a bearing to the woody biomass availability and potential, that will be discussed in section 4.1.3. These zones include:

AGRO–ECOLOGICAL ZONES, KAKAMEGA



source: jätzold '81

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MUSOGA, HERBERT
MA 1987/88

MAP NO. 2 3.

1. The upper midland zone (0) - this constitutes the Kakamega Forest which is considered too wet for good yields of most of the crops and can best be used for forestry purposes.
2. The upper midlands (1) zone or the coffee-tea zone - this zone has permanent cropping possibilities and is dividable in two to three variable cropping seasons. The main crops grown are tea, coffee, maize and a wide variety of horticultural crops. Due to favourable attributes the area comprising this zone constitutes a high density settlement area.

3. The upper midland (2) or coffee zone - this is a small and transitional zone in the eastern part of the district similar to the tea-coffee zone but has lower yelds owing to less favourable soils.

4. Upper midland (3) or marginal coffee zone - this zone is quite similar to the previous one.

5. Upper midland (4) or sunflower-maize zone - this zone has a long to very long cropping season, that is dividable in two variable cropping seasons - the main crops are maize and sunflower and beans. This zone constitutes the settlement aea and has much lower population density than the rest of the district.

6. Lower midland sugar-cane zone (1) - has permanent cropping possibilities and constitutes the main sugar-cane growing area in the district.

7. Lower midland (2) or marginal sugar-cane zone - it has a long cropping season followed by a (weak) medium to short one and intermediate rains.

8. Lower midland (3) and cotton zone; and

9. Lower midland cotton zone. (After Jaetzold and Schmidt, 1982) - (map 3)

3.1.2 LAND-USE AND WOODY BIOMASS RESOURCES.

Agriculture constitutes the dominant land-use in Kakamega District. (Table 3.1.2) In 1984 the area occupied by agricultural landuses constituted 75% of the land area of which 65% was under subsistence and grazing, while the remaining 10% was under cash crops. Forests, woodlots and hedges occupied 20% of the land, while the other 5% was under structures and other land uses. By 1987, however, the proportion of land under agricultural use had increased to 82% (as compared to 75% in 1984) of which subsistence and grazing occupied 70%, and cash crops occupied 12%. But the area under forests, woodlots and hedges decreased to only 10% of the total land area. Roads and other land-uses occupied the remaining 8%.

The data in Table 3.1.2 reveals the emerging competition among the various land uses, with the woody Biomass loosing in to agriculture. Over a space of three years 1984 - 1987, the proportion of land under forests fell by about 2% (from 9.70% in 1984 to 7.80% in 1987); that under woodlots fell by about 0.24%. This should be appreciated in the light of the dynamics of the man-land resource relationship especially as dictated by increasing population relative to the more or less inelastic supply of land. Whereas the district constitutes only 0.5% of the total land area of the country, it supports about 6.5% of the population of Kenya. The inevitable population pressure on land is revealed by the diminishing land per capita as shown in Table 3.1.2(b). In Kakamega District, which constitutes 44% of the total high potential agricultural land, over the ten year period, 1969-1979, the population increased by about 250,000 persons that is about 32% increase. As a result of which the land per capita fell by 0.11 hactares, that is approximately 26%. By 1989 the population will have increased by 291,000 persons (28 %) from the year 1979 and the agricultural land per capita fallen by 0.06 ha (19% decrease) to only 0.25 hactares per person.

These statistics point to a number of policy issues: one that to be able to support the population in terms of food availability and income generation

TABLE 3.1.2a: LAND-USES TYPE AS A PERCENTAGE OF TOTAL LAND AREA SELECTED YEARS (1984 AND 1987), KAKAMEGA DISTRICT

	1984	1987
SUBSISTENCE CROPS		
Maize	1.73*	34.50
Cassava	0.45	-
Potatoes	0.49	-
CASH CROPS		
Sugar-cane	9.38	12.28
Coffee	1.16	0.03
Tea	0.36	0.29
WOODY BIOMASS		
Hedges	1.74	1.31
Woodlots	0.72	0.48
Bush	6.70	-
Forest	9.76	7.80
OTHERS		
Grazing fallow	47.58	37.90
Ploughed/bare	16.60	1.42
Structures	1.15	1.60
Roads	2.39	2.29
Others	0.69	0.70

Note: *The percentage of land under maize in 1984 was so low owing to the fact that by the time the data was collected it was during land preparation season.

Source: Ministry of Planning and National Development, Technical report No.92, 1987.

from the growing of cash crops, more land will have to be brought under cultivation. But as indicated in Table 4.1.2 (a) there is very little expansive capacity and therefore, as already is happening there will have to be trade-offs among the land-uses. As mentioned above the woodlots will continue to loose in to agriculture which in the absence of intervention in terms of

provision of alternative energy resources, will lead to even more serious woodfuel shortages, in addition environment degradation in terms of soil erosion resulting from diminishing tree cover; Two, that the high population densities could be accommodated by intensive agricultural production techniques, which also in the absence of proper farm management discipline and capability in terms of the presence of the purchasing power for inputs, will lead to soil exhaustion and erosion that will get the population into a viscious circle of disadvantages.

Currently most of the agricultural land (70%) is under subsistence and grazing and only about 12% is under cash crops (some of which like tea and coffee are actually declining in terms of hactarage committed to

Table 3.1.2(b): ESTIMATED AVAILABILITY OF GOOD AGRICULTURAL LAND PER DISTRICT (WESTERN PROVINCE), 1969, 1979 AND 1989 - HACTARES OF HIGH POTENTIAL LAND EQUIVALENTS.

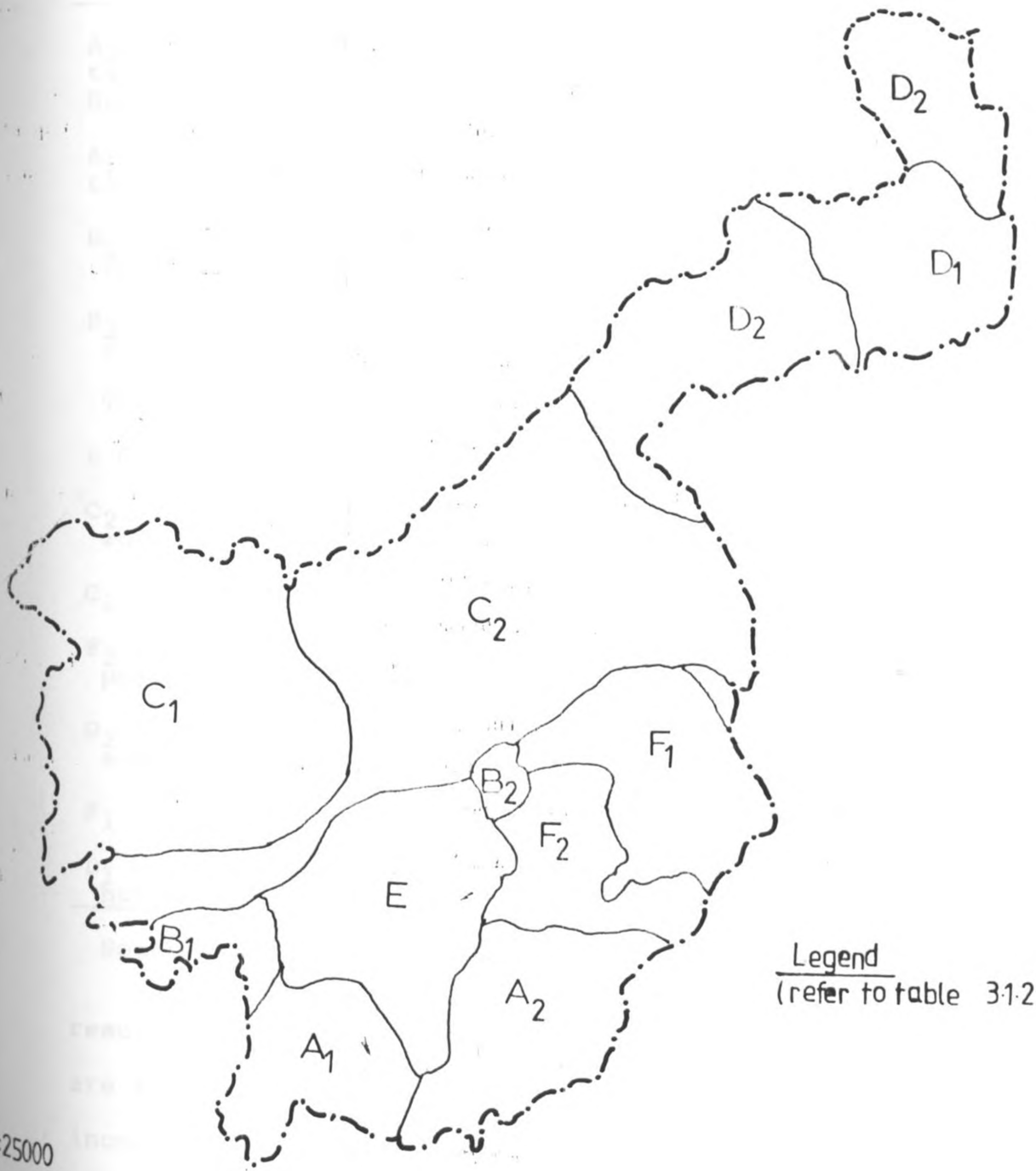
DISTRICT	POPULATION (000) 1969	1979	1989	HA. (000)	HACTARES PER PERSON 1969	1979	1989
Kakamega	783	1033	1324	325	0.42	0.31	0.25
Bungoma	345	503	710	253	0.73	0.50	0.36
Busia	200	300	431	163	0.82	0.54	0.38

Source: Rural Development, Employment and Incomes in Kenya, Livingstone, I. (1986)

them). Therefore in terms of the ability to purchase alternative forms of energy like bottled gas, or electricity, the case seems to be weak, if we assume that most of the people in Kakamega District depend on agriculture for income generation. All these point to the fact that the energy issue is closely tied with the whole process of rural development especially agriculture and income generating activities and therefore to effectively address it, it will require that it be treated as an entegral part of the package for rural development.

This would be best appreciated by considering the population distribution factor against the pattern of planted woody biomass. As can be seen from table 4.1.2 (c) there is a positive relationship between the population density and the level of planted woody biomass. In the very high population density sub-region of Vihiga/Hamisi, for example the area under planted woody biomass as a proportion of cover is 16.0% as compared to the Kakamega/Forest periphery - which has relatively low population density of about 74 rural homes per km^2 - having only 4.2% cover of planted woody bio-mass. This could be attributed to the fact that with diminishing land resources due to population increase there is very little, if any, land left for bushes from where fuelwood could be collected. As a

WOODY-BIOMASS SUB-REGIONS (IN RELATION TO POPULATION DISTRIBUTION): KAKAMEGA



Legend
(refer to table 3.1.2)

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	Map no. 4

source: Ambio vol.14 no.4-5

TABLE 3.1.2(c): DISTRIBUTION OF PLANTED WOODY BIOMAS IN KAKAMEGA DISTRICT

Sub-Region	No.of Rural homes per km^2	Farm size (ha)	Corn % Cover	Planted Woody bio- % cover
A_2 Very high population density - Vihiga/ Hamisi	195	0.49	21	16.0
A_1 Very high population density - Emuhaya	185	0.53	27	12.7
B_1 High population density - Butere	176	0.56	13	14.2
B_2 High population density - Kakamega	160	0.57	10	12.3
Town Hinterland				
E Central Kakamega	112	0.87	14	9.4
C_2 Peripheral Sugar zone	80	1.16	10	5.7
C_1 Core sugar belt	78	1.22	3	4.2
F_2 Kakamega Forest periphery	74	1.12	14	4.2
D_2 Peripheral Northern sub-humid zone	54	1.70	31	2.7
F_1 Kakamega Forest	22	1.70	7	2.2
D_1 Core Northern sub-humid zone	16	3.33	26	1.8

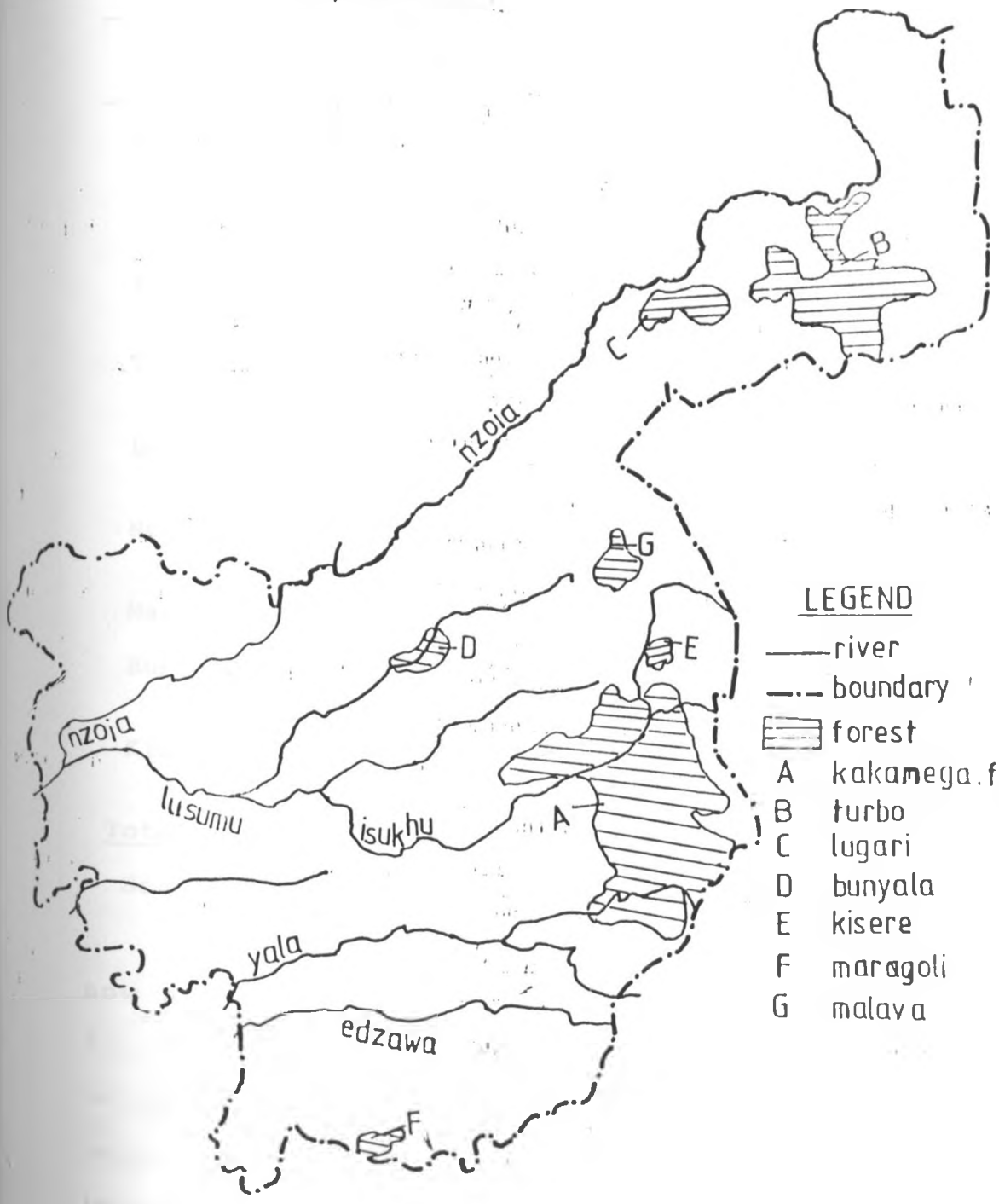
Source: Ambio, A Journal of the Human Environment.

result many people in the high density population areas are forced to turn to on-farm fuelwood sources and thus incorporate tree planting in the farm budget. However, as indicated in Table 3.1.2(b), the area under planted woodlots actually declines as increasingly more of the land area is demanded for agricultural production.

Again, this apparent competition between the said landuses is clear from the statistics presented in Table 3.1.2(c), where the proportion of land under corn is very close to the proportion of land under planted woody biomass. In the very high population density zone of Vihiga/Hamisi for example, the proportion of cover under corn is 21% against the planted woody biomass which comprises 16% of cover; the same is also true in the peripheral sugar zone where corn constitutes 10% of cover whereas the planted woody biomass constitutes 5.7% of total cover. Again this points to the need for a high level of farm practices to be able to accommodate these competing landuses in the absence of which the necessity to look outwards for supplies of woodfuel, that is the forests, which subject is the next.

The area under gazetted forests in Kakamega District comprise about 7.7% of the total land area (Table 3.1.2{d}) of which about 62% is indigenous (in Kakamega and Kisere forests), the remaining 38% is plantation or exotic. A number of factors make it difficult for these forests to be a good alternative to on-farm woodfuel resources. First, is the distribution aspect whereby the forests form only pockets in a few areas of the District (see map) such that only those in the immediate neighbourhood of the forest can make use of them. Second, there are restrictions to the use of the forest especially Kakamega Forest part of which is

FOREST RESOURCES AND DRAINAGE KAKAMEGA



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Map no. 5

TABLE 3.1.2 (d): FOREST RESOURCES IN KAKAMEGA DISTRICT.

FOREST	AREA (Ha)	TREE SPECIES
Kakamega: (a) Natural	20,534.7	Pinus, africana, maesopsis enini, Bischojia jovonica, Markania, Cordia
(b) Plantation	3,475.7	Cypress, Pinus Patula, Eucalyptus, Saligna
Turbo Forest	2,255.4	Cypress, Pinus patula, Eucalyptus, Saligna
Lugari Forest	1,580.0	Cypress, Pinus patula, Eucalyptus Saligna
Nzoia Forest	4,507.4	Cypress, Pinus patula, Eucalyptus Saligna
Maragoli Forest	469.5	Cypress, pinus patula
Bunyala Forest	825.6	Cypress, Pinus patula
Kisere	484.0	Pinus Africana, maesopsis Bischojia, Markhamia, Cordia
Total	34,123.3	

Source: District Forest Office, Kakamega.

now a National park and as can be seen from table 3.1.2(d) the plantation forests are meant to supply pulpwood and sawwood and woodfuel is only a subsidiary aspect. A policy indication follows the need to incorporate the supply of woodfuel in the planning of forest resources in Kakamega District.

3.2 SHISWA SUB-LOCATION IN KAKAMEGA DISTRICT

Within the broad framework established in the proceeding section (3.1) the discussion currently presents an appreciation, further, of the study area on a more localised basis, shiswa sublocation. Since most of the aspects of the physical background have been addressed at the broader level, this section lays more emphasis on the socio-cultural profile of the study area that could not be addressed at the District level. This emphasis on the socio-cultural background is necessary because it has a bearing quite important to the energy supply situation in the study area. Thus, other aspects are addressed only briefly.

3.2.1 LOCATION AND SIZE.

Shiswa sub-location is one of the several administrative units that make up Shinyalu Division in Kakamega District. It covers an area of about 12 km^2 and by the 1979 census it accommodated about 5203 persons with a population density of approximately 425 persons per square kilometre. Currently, it is estimated that it accommodates over 6400 persons with a density of over 500 persons per square kilometre.

It is located in the central part of the district (Kakamega) in the immediate hinterland of Kakamega town bordering the Kakamega Forest to the north (see map).

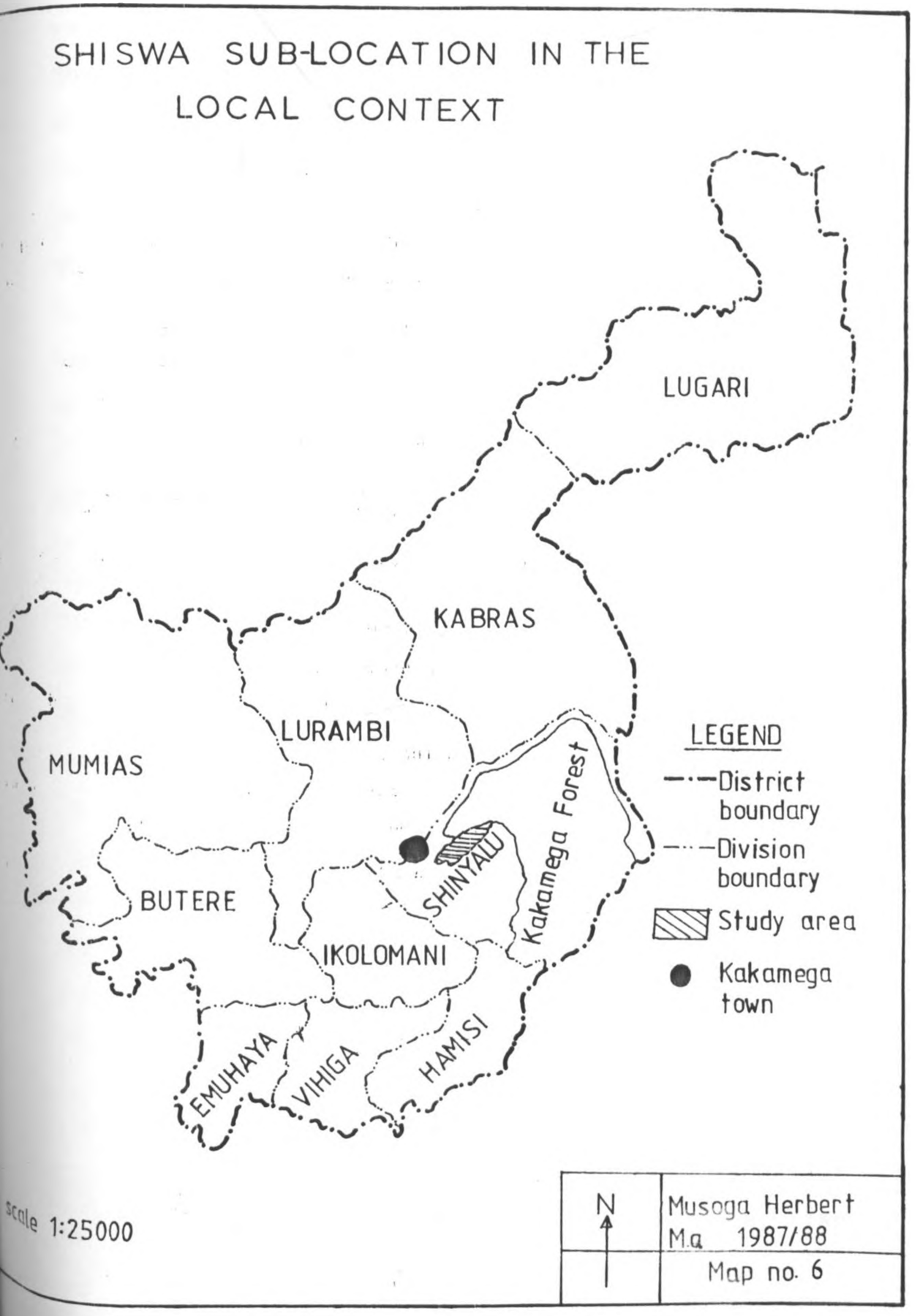
3.2.2 CLIMATE AND ECOLOGY.

The study area lies in the upper midland one (UM_1) agro-ecological zone (as discussed briefly under section 3.1) at an altitude of between 1500 - 1800 metres. Annual mean temperature ranges between 20.4 to 18.1 ^{o}C. It enjoys an annual average rainfall of 1800 - 7200 mm at 60% reliability with the first rains being between 800 mm and 1100 mm and the second rains being between 700 and 800 mm. Further, it is advantaged by a 60% reliability of growing period with 150 or more days during the first rains and 210 to 215 days during the second rains.

The soils are to a large extent well drained, very deep, dusky red to yellowish red, fiable to firm, clay loams to clay and in some places with acid humic topsoil - ferralo - chromic or thin terisols (Jaetzold and Schmidt, 1982). For the purposes of provision of woodfuel the climate and ecology present a good environment that allow trees to grow very fast and with good planning it could be possible to provide sufficient food and cash crops and woodfuel.

3.2.3 THE SOCIO-CULTURAL PROFILE

Like in many other African societies, the family is the basic unit of social interaction among the Isukha (a sub-tribe of the Luhyia tribe of Western Kenya), the natives of the study area, Shiswa sub-


SHISWA SUB-LOCATION IN THE LOCAL CONTEXT
LUGARI
KABRAS
LURAMBI
MUMIAS
BUTERE
IKOLOMANI
SHINYALU
Kakamega Forest
EMUHAYA
VIHIGA
HAMISI
LEGEND
District boundary
Division boundary
Study area
Kakamega town
N
Musoga Herbert
M.a 1987/88
Map no. 6
scale 1:25000

location. It is within the family that an individual receives the preliminaries of the socialization process through which norms, values and beliefs of the society are passed on to the said. To a great extent this will influence his (the individual's) outlook to life or rather the definition of reality, ceteris peribus. In the study area the accessibility to fuelwood resources to an extend is determined by the socio-cultural considerations. It is in appreciation of this that the discussion in this section is devoted to the socio-cultural profile of the study, in detail and the unit of analysis in chapter 4 is the farm household.

The Isukha are largely a patrilineal society, that is the individual traces his lineage from the father's side rather than the mother's side and the children and wife are seen to belong to the man's family or clan. Consequently, this is also a patrilocal society, that is, on marriage the spouses reside in the male spouse's home. To a large extent this kind of arrangement has tended to influence the pattern of resource ownership and control or accessibility, role definition and decision making within the farm household. Thus, the man, as the undisputed head of the household is the crucial decision maker especially in regard to decisions affecting the use of land, which is generally seen to be a critical resource in society and other resources which denote some form of permanence, like

trees. Ideally women do not own land, but may hold it in trust for the male children in the event of the husband passing away. (Mbithi, 1974)

In the same context division of labour was basically along gender lines, with the man taking up what was seen as more challenging and "field-oriented" tasks, while the women undertook the more "domestic-oriented" tasks, which according to the men were too trivial to deserve male attention. The kitchen for example was seen as the wife's territory and all that went on in the kitchen, basically cooking, was left to the descretion of the women. Consequently, the task of fuelwood collection was left to the wife and the female children. It is no wonder that on marriage a girl is said to have tone to "cook" in the place she is married. This kind of social arrangement did not pose any particular problems while the abundance of fuelwood prevailed, but sadly enough this "macho" attitute by men still lingers even in the face of fuelwood scarcity. The men still regard the issue of fuelwood procurement as a women affair and as such so trivial as not to deserve the attention of men. No wonder that in most homes there exists the paradox of "scarcity amid plenty", whereby there may be plenty of trees on the farm but the kitchen department experiences the problem of inadequate fuelwood because the tree is seen in terms of being a source of building materials and

income earner rather than as a source of fuelwood.

To guard the division of labour arrangement within the household, there are certain social control mechanisms, central of which is the belief system. As regards the issue of tree planting, it was believed that:

(a) If women planted trees, then they would become barren. And since child bearing according to customs was the only guarantee to stability in marriage and because of the high value placed on marriage in society, no woman ever attempted to plant a tree, lest she becomes barren.

(b) If a woman planted a tree, the husband would die, and since the life of widows was a very miserable one, no woman would dare take action that would result in the possible threat to her husband's life.

(c) If a woman plants a tree, she would be directly challenging her husband's supremacy in the household and this could result in a divorce. (Charangi, 1984)

These beliefs had their origin in the purpose for which trees were planted. The major purpose for which trees were planted were: first and foremost for

sacrificial purposes - as the alters at which the sacrifices were undertaken - which was an activity that was a monopoly of men; secondly, as land marks for boundaries between farms. By planting a tree in a particular place one was claiming ownership of the particular piece of land/ground and since women were not entitled to own land they had no business planting trees. As time went on these beliefs were extended to all kinds of trees indiscriminately. Although this particular aspect seems to be disadvantageous in regard to restricting the accessibility to the tree as a source of fuelwood, it should be considered in context. One positive point about it is that it is a kind of socially determined resource exploitation control mechanism. This is so because while the need for cutting down a tree for the purpose of either selling or building is occassionally, the need for cutting down a tree for fuelwood is quite a frequent one so that in the absence of such socially determined checks in the exploitation of the tree resource, deforestation could have set in much faster. It should also be considered as a good starting point for any intervention by the government in attempt to alleviate the fuelwood shortage problem. Whoever is intervening should aim at manipulating the existing social arrangements to facilitate the adoption of the measures to alleviate the aforementioned problem.

Closely tied up with the cultural arrangement is farming which constitutes the mainstay of the community currently in question, the main enterprises being cattle keeping and crop husbandry. This has greatly influenced the importance they attach to land and cattle. Cattle are kept both for social and economic purposes: economically, they are seen as a means of storing wealth; socially they are used for marriage exchange, paying dowry. (Uchendu and Anthony, 1974) Further the community has a certain attachment to land enshrined within the value system. Land is valued not just as a means of subsistence to the farm-household but: first it is seen to provide one with a base for identity and association with one's kin; secondly it is a measure of wealth and whoever possesses it has a certain level of dignity that is self-fulfilling; and finally land is seen to provide continuity between generations, by occupying a piece of land inherited from the forefathers one keeps in tough with his ancestral spirits in the spiritual realm. (Mbithi, 1974) Thus, land that is inherited from ones father is highly valued, consequently land sub-division is the rule rather than the exception.

It is undeniable that this socio-cultural arrangement is undergoing changes and modifications as the said society gives in to modern education and religion. But the process of change is painfully slow

as some of the values linger on, albeit in disguise. Intervention approaches should to a fair extend facilitate this change.

In conclusion, we have established that although the study district has quite a favourable geo-physical environment for woody biomass development, due to population pressure and therefore increased demand for land for other human needs like food crops, cash crops, settlement etc, the exploitation of this potential is becoming a constraint; also that the distribution of the existing forests in the district cannot allow for accessibility to this resource by a significant proportion of the population - this is compounded by the restriction on the use of the forest (especially Kakamega Forest); and finally that the socio-cultural arrangement of the local community in the study area could be a constraint to adequate provision of woodfuel to the farm household. It is with this in mind that we proceed to the next stage of our discussion, data analysis.

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CHAPTER IV

DATA ANALYSIS.

In the preceding three chapters, a frame of reference has been established against which the current chapter, discusses the study problem. Thus, with due regard to the theoretical framework established in chapter one, the policy context in chapter two and the socio-economic and geographic environment presented in chapter three, discussed here are the field findings.

As indicated in Chapter 1, the theoretical framework, the work under consideration takes an approach which touches on a whole spectrum of rural development issues. The rationale being that energy is not only a factor of production in the development process but that while playing this facilitating role, it is more or less an implicit input in the said process and as such some of the explaining factors of its shortage are hidden in the dynamics of the rural development process at the farm household and community levels.

Thus the chapter or discussion is divided into three main sections (albeit interelated): the first section presents the socio-economic dynamics of the farm household; the second section pays attention to the supply and demand patterns of energy in the study area; and the final section, the issue of the local

communities perception of the energy problem - and here the approach taken in analysing this aspect is the problem definition and plausible solutions as expressed by the local community members.

4.1 THE FARM-HOUSEHOLD SOCIO-ECONOMIC ATTRIBUTES/ CHARACTERISTICS

Under this section, the farm household characteristics discussed include: the household size, age structure, employment patterns, income levels and landuse patterns. Though there are many other household attributes of interest, the author of this work considered the above mentioned to be the most appropriate in attempting to address the energy supply issue in the study area, as it shall become apparent in the disucssion that follows.

TABLE 4.1: HOUSEHOLD SIZE

NUMBER OF PERSONS	PERCENTAGE
2 - 4	10.3
5 - 9	59.8
10 - 14	26.8
15 and above	3.1
TOTAL	100

Most of the households (60%) had 5 to 9 persons and the average household size was 7.3 persons; with the largst farmhousehold having 19 persons and the smallest 2 persons. There are several implications as

regards the importance of the family size with respect to domestic energy supply and consumption. First in terms of fuelwood requirement, the larger the family size the more the amount of fuelwood need to satisfy the domestic energy requirements. At a per capital 1 fuelwood consumption of 941 kg per annum[1], the households with between 2 to 4 persons will require about 1882 to 3764kg per annum, as compared to the households with between 5 to 9 persons (which comprise 60% of the households in the study area) which will require approximately 4705kg to 8469kg per annum. In terms of land requirements, if we are to rely on on-farm fuelwood suply, the households in the catagory 2 to 4 persons will require between 0.47 acres and 0.94 acres committed to fuelwood (tree) production alone, as compared to the households in the category 5 to 9 persons which will require between 1.2 acres and 2.1 acres of land committed to fuelwood production alone.

Secondly, in terms of food requirement, again if we assume all the food requirement is met form the family farm, the households in the category 2 to 4 will require between 240 kg to 480 kg per annum as compared to the category 5 to 9 persons which will require between 600 kg to 1080 kg of maize per annum. In terms

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[1]The figure is an estimate calculated from the High potential ecological zone figure of 5648kg per family average consumption per annum (Hosier, 1981).

of land requirement, at an average of 540kg per acre production levels, the households in the category 2 to 4 persons will require 0.4 to 0.89 acres to meet their annual maize requirements; where as the households in the category 5 to 9 persons will require between 1.1 acres and 2 acres to meet their annual maize requirements. This analysis reveals an apparent competition between these land uses with the households having the most number of perosons experiencing more land pressure. A household of 9 persons requires 2.1 acres for fuelwood and 2 acres for maize production, a total of 4.1 acres, but given an average farm-size of 3.8 acres, this household will experience a deficit of 0.3 acres. Further in terms agricultural land availability per person, this household of 9 people will have only 0.4 acres per person as compared to a family of 4 persons which will have agricultural land availability per person of 0.95 acres (given on average farm size of 3.8 acres).

Thirdly, the household size will determine the level of expenditure, ceteris peribus, and as regards energy this means that there are other competing income consuming items of expenditure which the family may view as priority. Consequently little or not money may be allocated to fuelwood purchasing for example. This in part explains why there is over dependence on fuelwood which for some time has been a free commodity. This arquement should be appreciated

with due regard to the age structure and income levels, Tables 4.2 and 4.3.

In Table 4.2, the number of persons falling within the age brackets 0-9 and 10-19 making up about 51% of the population are in school going age. The implication is that school fees comprises one of the major income consuming items in the household expenditure

TABLE 4.2: AGE STRUCTURE

Age Group	Number	Percentage
0 - 9	141	23.6
10 - 19	163	27.3
20 - 29	134	22.4
30 - 39	73	12.2
40 - 49	42	7.0
50 - 65+	44	7.35
TOTAL	597	100

budget and in competition with other items of expenditure that the household requires including energy. Further, the 51% of the population may not be available for income generating (or productive) activities during most of the year and as such constitute quite a burden to family income. Using the conventional age - groups (after Walji and Mousted, 1978) the dependency ration (the number of dependents, that is the number of persons below and above the working ages per 100 persons in the labour force)[2] came to 68.7%. Further the age structure presented in Table 4.1 reveals that 41.6% of

the population in the study area (those between the age of 20 and 49 years) are in the category of those who are reproductively active and on the absence of population control practices these will bring form more human beings that will bear heavily on the existing household resources. This is true expecially in respect to the land resource bearing in mind that about 65% of the respondents acquired land owner ship rights through inheritance, if this trend continues then land subdivision will also continue consequently even less economic farm sizes will result and the household farm will not be able to accommodate the various land-uses. In terms of future fuelwood requirement planning these naked facts should be taken into consideration. Furthermore the age group 0-9, which constitutes 23.6% comprises a proportion of the population which require a high level of primary health care that involves a lot of water boiling and cooking every now and then to the extent that the amount of energy (or fuelwood) requirement is quite substantial, in the event of this being available the level may be quite high.

Bearing this in mind and considering the income levels employment pattern, Table 4.3 and Table 4.4, it

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[2]Dependency ratio =

$$\frac{\text{population 0 -14 years + 65 years and over}}{\text{Population 15 - 64 years.}} \times 100$$

TABLE 4.3: ESTIMATED HOUSEHOLD MONTHLY INCOME[3]

INCOME BRACKET	NUMBER	PERCENTAGE
<500	38	58.46
501 - 1000	16	24.62
1001 - 1500	5	7.69
1501 - 200	1	1.54
> 2000	5	7.69
TOTAL	65	100

is apparent that the economic base in terms of income generation is very weak pointing to the fact that if the present environment (the interaction between the demographic space and economic space dynamics against limited physical factor endownment, (land) persists the ability of the study area to afford alternative forms of energy will continue to deteriorate. The question of affordebility of alternative forms or sources of domestic energy, like bottled gas, electricity or off-farm energy supply sources (for example purchasing from the local market) should be appreciated from two perspectives (albeit interrelated).

First the low levels of income perse as depicted in Table 4.3 and partly explained by the employment stracture in Tables 4.4(a) and 4.4(b). From this per-

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[3]The question on household income levels had a very high, 38% non-response and for most who responded to was a difficult task to estimate their income so that figures given should be taken with a pinch of salt. Realizing this constraint, the researcher decided to use the employment or occupation sturcture togive an indication of the levels of income in the study area.

Thus the income figures were calculated as a percentage of those who responded to the question, that is 65 insteed of 105.

spective it has been argued that in urban areas for example, the stracture or choice of forms of energy is positively related to the level of income (Beifer institute, 1984). By the 1980 prices, for example, those households falling in the income bracket 0-760 (Kshs) per month could not afford electricity or bottled gas and thus relied on fuel-wood, charcoal and kerosene for their domestic energy needs. In the study area this group of households constituted over 58% of the house holds (that is those who earn Ksh. 500 or less) therefere, in terms of the ability (purchasing power) to afford alternative forms of energy, most of the farm-households in the study area, that is 58%, are constrained by the levels of income which are very low.

In fact, if we consider that on average a household consumes about 2 bags of charcoal per month[4] each costing 55 Kshs, then the household will spend 110/= per month on charcoal only and for a household earning Kshs. 500 per month this will constitute about 22% of the household income, which considering other household requirements is quite high. But for households earning 2,000 Kshs, this will constitute only 5.5% of the monthly income which is relatively low. This implies

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[4]This is an estimate arrived at from Hosier's figure for high potential areas charcoal consuption of about 786 kg per annual per household.

that the question of energy is closely linked to issue of equity or income distribution where by the majority (in this case 58%) of the rural populace are caught up in the poverty trap with limited range of chices. Where the minority (8% who earn over 2,000 Kshs) are able to aford alternatives varied, that is, they have a wide range of choices as provided by incomes under their command.

OCCUPATION STRUCTURE

The occupation structure, Table 4.4(a), gives an indication of the expected level of income, in the category of professionals (indicated in the table as surveyor/teacher constituted only 4.7% of the respodents, whereas the lower cadre (those in the category driver/clerk and casual/subordinate staff constitued 23.8% of the population. Further more 47.6% were dependent basically on the farm of which 43.8% were merely subsitence farmers. This implies that the farm is not only a source of household food requirements but also provides employment for a large number of people in the study area and therefore conpetition for land will aso include income generating farm interprises, aside from food and fuelwood. In terms of the ability to purchase alternative forms of energy, those in the categories subsistence farms, casual/subordinate staff, and others who comprising 72,4% of the population will be disadvantaged given the low levels of

TABLE 4.4(a): OCCUPATION STUCTURE (HEAD OF HOUSEHOLD)

OCCUPATION	NUMBER	PERCENTAGE
Subsistence farmer	46	43.8
Farmer	4	3.8
Surveyor/teacher	5	4.76
Bussinessman	4	3.8
Carpentry/construction	7	6.7
Driver/clerk	6	5.7
Casual/sub. staff	19	18.1
Unemployed	3	2.9
Others	11	10.5
TOTAL	105	100

income expected and are most likely to continue to rely heavily on woodfuel as a form of energy unless more remunerating income genrating opportunities are created for them. The 2-9% who are unemployed will be the worst hit because they will not be able to afford off-farm energy sources but also other household requirements.

The employment structure of the wives, Table 4.4(b) reveals even a more disimal picture with a many 80.25% of the wives being subsistance farmers and only

TABLE 4.4(B): OCCUPATION STRUCTURE OF THE WIVES

OCCUPATION	NUMBER	PERCENTAGE
Subsistence farmer	65	80.25
Farmer	5	6.17
Petty trade/beer brewing	6	7.41
Teacher	1	1.23
Others	1	1.23
Non-response	3	3.70
TOTAL	81	100

1.23% being in the category of professionals (teacher), 6.17% engaged in commercial farming, that is they are able to produce over and above the subsistence level. Again these information reveals the level towhich the household farm is important in the study area. Considering that the task of fuelwood procurement is seen as the responsibility of the wife, the kind of employment structure presented above renders the women more or less helpless in terms of the ability to purchase either fuelwood or charcoal from the market without having to seek the financial assistance of the husband, who may not consider them to be as serious as it ought to be.

4.2 LAND-USE PATTERNS

The question of the strength of the economic base of the farm household should be appreciated with due regard to the land-use patterns or agricultural practices in the study area. The predominant agricultural practice is mixed farming in two respects: one is in terms of livestock raring and crop farming; and two is growing of food crops and cash crops. Considering the latter, we find that the level of cash crop development is very low. The survey revealed that only 16.2% grow coffee, 18.1% tea and 2.9% horticultural crops (which are high value and labour intensive crops) and 10.5% grow sugar cane as cash crops. This is as opposed to the food crops which have a much wider

coverage, with 97.1% growing maize, 90.5% beans and 37.1% bananas. Considering that as many as 69.3% of the women and 47.6% of the men are totally dependent on farming for employment then these figures reveal that there is an acute underemployment on the farms and this implies that the purchasing power is very low.

In the former case, that is livestock husbandry, the situation also is not pleasing, with as many as 52.8% having between 0-3 livestock units of which 16.7% keep no livestock (cattle) at all. This points to the fact that the possibility of using biogas plants is limited and infact absent for the 16.7% who have zero livestock units. The limiting factor seems to be land as reflected in the household farm size distribution (Table 4.5) where 15.24% have 1 or less acreas of land which is quite close to the 16.7% who also do not have any livestock units. At village level some villages like V4 and V7 (Vukhayma and Bwichima) have as many as 27% of their households having farm size of 1 or less acres. The modal class is 1.1 - 3 acres of land where in some villages (like V5) have as many as 86.7% of the households having this farm sizes. Going by the FAO/UNO standards whereby the minimum acceptable farm size for subsistence is 3.5 acres per household, then one can argue that in the study area quite a significant proportion of the households are operating below this desirable minimum.

Table 4.5: SIZE OF FARM HOLDINGS PER VILLAGE.

FARM SIZE	VILLAGE V1 %	NO.	V2 %	NO.	V3 %	NO.	V4 %	NO.	V5 %	NO.	6 %	NO.	V7 %	NO.
< 1	13.3	2	6.7	1	13.7	2	26.7	4	6.7	1	13.3	2	26.7	4
1.1 - 3	26.7	4	53.3	8	20.0	3	53.3	8	86.7	13	40.0	6	46.7	7
3.1 - 5	6.7	1	6.7	1	33.3	5	6.7	1	6.7	1	20.0	3	13.3	2
5.1 - 7	13.3	2	20.0	3	6.7	2	0.0	0	0.0	0	20.0	3	0.0	0
7.1 - 9	0.0	0	6.7	1	6.7	1	0.0	0	0.0	0	0.0	0	0.0	0
9.1 - 11	13.3	2	0.0	0	0.0	0	0.0	0	0.0	0	6.7	1	0.0	0
11.1 - 13	13.3	2	0.0	0	13.3	2	0.0	0	0.0	0	0.0	0	0.0	0
> 13	13.3	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0

This issue of land squeeze is also reflected in the grazing pattern whereby 50% of the households that keep cattle have to supplement the pasture on their own farms with grazing along the roads, in school play fields, neighbours farms or even risk arrest by taking their livestock to Kakamega forest. But this vent for surplus may not be a long term solution since with population increase even those who had some fallow land will put it to cultivation and will not be available for the neighbours for grazing purposes. And for those who depend on their own farms for grazing may be forced to cut down on the number of livestock units. In fact as few as 2.9% of the households practise zero-grazing, while the remaining 97.1% practise either tether or free-grazing. At this point it is important to note that the integration of livestock into the farming system increases not only the land labour absorptive capacity (Livingstone, 1986) in terms of provision of

PLATE I: Agro-forestry - an attempt by farmers to accommodate crop, livestock and woody-biomass production on same piece of land. Note that the land (in background) is more or less saturated and may not be appropriate for crops like maize.

PLATE II: Diminishing land resources force some to resort to supplementing own-farm pastures with grazing in school compounds (conflict in land-use)

fertilizer (manure) and also production of milk which can be a profitable enterprise at the level of employment creation and income creation - but also provides the potential for biogas plant development. Therefore this low level of livestock development has unfavourable implications in regard to feasibility of alternative forms of energy.

4.3 ENERGY SUPPLY AND CONSUMPTION PATTERNS.

In appreciation of the fact that energy is an intricate component of the complex dialectics of the rural farm household production system, the above section (4.2) presented the socio-economic background against which the current section (4.3) is discussed. It has been established for example that the economic base in the study area is rather weak and this has tended to limit the farm households effective command over alternative sources of energy or rather limited the range of choice available to the farm household, this fact is again revealed from a close scrutiny of the supply and demand patterns of farm household, as discussed in this section. It has also been established that the farm household is operating under conditions of diminishing land resource which is already bearing significantly on the farm household to accommodate the various competing land-uses.

These plus the socio-cultural background established in the preceeding chapter, 3, should be borne in mind in the current discussion. Discussed hereat are the energy supply patterns and the discussion goes a little further to the aspects related to tree planting and agroforestry as practiced in the study area. Finally the domestic energy consumption patterns are discussed. At this level a word of caution is but appropriate, that the author will not be a slave to mere statistics but in instances where necessary will venture into qualitative analysis which may not necessarily be revealed in the statistics presented.

4.3.1 ENERGY SUPPLY PATTERNS.

Table 4.3.1(a) reveals that a significant proportion of the farm household, 50% depend on the on-farm fuelwood resources. This has come about mainly as a result of the government restriction on the accessibility of the local community to the forest resources. This restriction has not only affected the local community in the study area in regard to fuelwood procurement but also in terms of agricultural production.

Traditionally, those who had small uneconomical parcels of land found vent for surplus in the fringes of the forest where they could grow mainly food crops. But they can no longer do so especially with the introduction of the Nyayo tea zones, whereby the fringes of

Table 4.2.1(a): SOURCE OF FUELWOOD.

SOURCE	PERCENTAGE
Own Farm	50.00
Buy from market	7.69
Around village	5.76
Neighbours' Farms	4.80
Own farm + a combination of the others	20.20
Kakamega Forest	4.80

Kakamega Forest where these people were growing crops are now earmarked for growing tea and are no longer available to them. In addition this restriction on the accessibility to the Kakamega Forest has affected livestock production in the area since those who did not have sufficient pasture previously owing to the small size of their farm holdings, supplemented this with grazing in the forest and thus could afford to keep more livestock than the carrying capacity of their farms. As mentioned above this reduces the capacity to switch to biogas as a substitute to fuelwood.

Further, apart from the fact that this proportion of the households (50%) which have been forced to depend on on-farm fuelwood sources face the problem of competition for land space from other land-uses (like food production, livestock husbandry, etc.), the social-cultural arrangement (as presented in chapter 3) may not be conducive for accessibility to tree

resources. This is such that this proportion of households (50%) in most cases will be found to be using inferior quality fuelwood in terms of prunnings from trees and dry twigs collected along the hedges. This social-cultural arrangement at the household level was tested by cooking at the decision making structure within the household.

This was addressed at two levels: First, decision making as regards the land-use patterns (or farm enterprises); at this level two questions were posed to the respondents where they were asked who makes decisions on what to plant and 44.8% of the cases the decision was taken by the head of household (husband) against 42.9% of the cases where the wife made the decision, with 11.4% of the cases the decisions being made by both the husband and wife in consultation. The second question was on who makes the decision on where to plant and again the decision making structure was similar to the first aspect of land-use with 47.1% cases of the husband making the decision, the wife 39.4% of the cases and both the husband and wife in consultation 12.5% of the cases.

This is in contrast to the aspect of the woody-tree resources where male dominance in decision making in regard to its use is quite apparent. A question was posed to the respondents as to who makes the decision to cut down trees; and the following was the structure

that emerged. In 60.7% of the cases the decision was made by the husband against 25% of the cases where the wife made the decision and only 8% of the cases where the decision was made by both husband and wife in consultation. This structure of decision making is mainly due to the manner in which a tree is viewed as a source for building materials (and building houses is indeed the work of the man as defined by the socio-cultural arrangement) and income earning item. A look at the tree species grown reveals a significant preference for the exotic species which have certain qualities that fulfil the said requirements.

TABLE 4.3.1(b): MAIN TREE SPECIES.

SPECIES	PERCENTAGE
Cyprus	32.9
Eucalyptus	26.5
Croton	27.8
Others	12.8
TOTAL	100.0

In Table 4.3.1(b) for example Eucalyptus and Cyprus tree species were the most prefered at about 60% of the cases against the 40% cases for the other species. This is mainly explained by the fact that the Eucalyptus and Cyprus tree species provide very good building material in terms of straight poles which are favoured by prospective buyers. Further the persistence

of the cultural aspect in the accessibility to the woody resources at the household level is also revealed by looking at who plants trees on the farm. In 75% of the cases tree planting was done by either the husband alone or husband and the children as opposed to about 1% of the cases where the wife planted the trees.

Participation in tree planting should be appreciated in terms of defining the ownership of this woody resource and therefore accessibility to its use within the household. This is reflected in the proceeding discussion where it was revealed that in 60% of the cases it is the husband who made the decision to cut down trees which compares significantly with the 75% of the cases where the husband alone or with the children participated in the planting of trees.

As it has been demonstrated in sub-section 4.1, this group of household that depend on own-farm fuelwood supply are faced with the issue of competition among the various land-uses. Table 4.3.1(c) reveals the woody biomass configuration (an indication of it) on the households' farms.

It is apparent from this configuration that the farmers have attempted to maximise the use of their pieces of land in appreciation of the competition among the various land-uses for the limited land resource. In

PLATE III: A woodlot - Note the type of trees grown are mostly Cypress and Eucalyptus which are used for building or cash-earning purposes and may not be available for fuelwood.

PLATE IV: The most common woody biomass configuration (trees grown arround the house) - an attempt by farmers to economise on space-use.

TABLE 4.3.1(c): WOODY BIOMASS CONFIGURATION.

Where trees are planted	Percentage*
Round the house	40.0
Hedge	9.5
Cropland	5.3
Woodlot	12.6
Hedge and arround the house	18.0
Hedge and woodlot	4.2
Around house and woodlot	4.2
Other	6.1
TOTAL	100

*as a percentage of those who responded to this question (95)

40% of the cases for example, the farmers grow trees arround the house and in total about 68% of the cases the trees are grown either arround the house or along the hedges or both. On the other hand, those who grew trees in the cropland only were a mere 5.3% of the households and in 12.6% of the cases trees were grown in woodlots (where a piece of land is set aside for growing of trees only - see plate).

Thus the farmers demonstrated an awareness for the need for exercising economy in the use of land and also the fact that the aspect of tree planting has been institutionalized into the community. About 70% of the respondents said that they got information on tree planting from their own experience and a mere 5% from the government officer and 3% from public meetings

(Barazas). Further, on the question of sources of tree seedlings, the survey revealed that about 50% of the farmers had their own tree nurseries, 11.3% got the seedlings from their neighbours, 13.4% collected wildlings and only 16.5% got the seedlings from government nurseries.

For the purpose of government intervention in terms of agro-forestry or rural afforestation programmes, these facts are critical. They reveal the fact that the package of these programmes should take account of what the farmers have been able to do for themselves and how this can be used to stimulate them to do much more. In a community like Shiswa sub-location the message propagated should go further than mere telling farmers to plant trees - it should instead concentrate on how to accommodate tree planting in the land/space budget and appropriate tree species. The statistics on source of seedlings reveal, for example, that as many as 50% of the households get seedlings from their own nurseries indicating that this category of farmers, in the event of agroforestry or afforestation programme, would need that seeds rather than seedlings be made available to them because they are already a step ahead in the said programmes. In fact among the problems identified by the respondents were: the difficulty in obtaining seeds and the fact that the government nurseries were too far.

PLATE V: Some have to "scavenge" for fuelwood on neighbours' farms and make-do with inferior fuelwood, twigs. Little girls participate actively in this one as if to learn the "trade" early enough.

PLATE VI: Kakamega Forest, an alternative source of fuelwood that has become inaccessible to the local community due to Government restrictions. The buffer zone in the foreground has been earmarked for growing tea (Nyayo Tea Zone) and unavailable for agricultural use by local community.

PLATE VII: An alternative source of fuelwood could be this sawmill, but distance is a limiting factor (this sawmill is located about 8 km from the study area)

PLATE VIII: A jaggery - competes for fuelwood with the domestic uses and could aggravate the woodfuel problem - also competes for land with other land-uses like agricultural production in the study area.

Secondly, from Table 4.3.1(a) the inadequacy of the on-farm fuelwood is revealed whereby as many as 20.2% of the households have to supplement the on-farm fuelwood supply from other sources. In total this category of households constitute the remaining 50% of the households in the study area. Again within this category are those who are hit hardest - the 5.76% who have to scavenge arround the village for dry twigs which are by all standards inferior in terms of the flame power that can be generated from them for cooking purposes. The implications are that these categories of households quite often than not consume poorly cooked food and are therefore exposed to the nutrition related diseases. Also in this category of households are the 4.8% of the households who have to scavenge on the neighbours' farms - this group will not enjoy this opportunity for long since as the population grows and land sub-divided those neighbours who formally had large farms will become more economical in the use of whatever resources available on the farm and might find it more profitable to sell fuelwood and thus restrict neighbours from collecting fuelwood from the farm free of charge.

The category of farmers (households) that purchase fuelwood is only 7.69% and this should be looked at in appreciation of the economic base of the households as discussed under section 4.1 of this chapter. It was

shown that as many as 58.5% of the households had KShs.500 or less as their monthly income. Such low levels of income do not allow the household sufficient purchasing power to supplement the insufficient on-farm fuelwood by buying from other sources. Thus, whereas the proportion of households that purchase fuelwood from other sources is low, it should be seen as an indicator of the intricate or complex nature of the rural energy supply issue as explained by low levels of income of the households in the rural areas - whereby poverty is the real issue in the rural areas and energy shortage is just a symptom of this underlying poverty.

Further, the participation of this category of households in the energy market presents an opportunity to break the social-culturally determined division of labour where procurement of fuelwood was a monopoly of the female folk and non of the man's business. Purchasing of woodfuel by all means requires committing a certain proportion of the household income to this course and as indicated under section 4.1, it is the men who earn this income. The men are thus forced to start discussing about woodfuel, which was once taboo, and treating it with more seriousness as an important item of expenditure in the household income budget. Thus woodfuel supply as an aspect of the complex of rural development in this way is contributing to social change where role redefinition within the farm-hold and

hopeful the larger society. It would be more desirable, however, to speed up the process of social change through government propaganda and use all sorts of mass media.

The other category of farm-households was that where they got their fuelwood supplies from Kakamega Forest, about 5% of the households. Again, this figure may seem insignificant but it points to the fact that the local community considers the said forest a God-given resource to which they have the right of access - that it is a kind of resistance to what they see as unnecessary government intervention. This fact should not be ignored but as a matter of policy the local community should be provided for in attempt to conserve such resources. In this case there appeared to be contradiction/divergence between the government officials pronouncements and actual practice, such that an interview with the Deputy Provincial Forest Officer in Kakamega seemed to suggest that the local citizens were allowed to collect fuelwood especially deadwood from the Kakamega Forest; but many of the respondents complained of harassment by the forest guards and in some instances they have to run for their lives. It is thus important for the government to ensure that pronouncements and actual practice agree.

4.3.2 ENERGY CONSUMPTION PATTERNS.

The domestic energy consumption patterns statistics reveal overdependence on limited forms of energy. For cooking purposes fuelwood accounts for well over 85% and in sum (that is including other combinations with it) it accounts for as much as 94.2% of the domestic energy requirements for cooking purposes. This could be attributed to the fact that it (fuelwood) has been to a very large extent a free commodity that could be obtained at very minimal, if any, expense financewise and in terms of man-hours expended in its procurement. Even at present, despite its threatening scarcity, it is relatively cheaper than the other alternatives.

TABLE 4.3.2(a): TYPE OF ENERGY USED IN COOKING.

TYPE	PERCENTAGE
Fuelwood	85.6
Kerosene	2.9
Charcoal	1.9
Charcoal and Fuelwood	7.7
Charcoal, fuelwood and kerosene	0.96

As demonstrated in section 4.1, if on average a family consumes 2 bags of charcoal each costing Kshs.55, in a month the household will spend Kshs.110 which is about 22% of a family earning Kshs.500, and

55% for a household earning Kshs.200 - in the study area the households earning Kshs.500 or less constituted 58% of the households. If we are to take the other alternative, bottled gas, and assume that on average a family will consume one "tank" per month costing Kshs.120, this will be 24% of the household's income (earning Kshs.500) and for the household earning Kshs.200, it will constitute 60% of the income. This kind of expenditure pattern would be suicidal for the households earning Kshs.500 or less and being rational citizens they have resorted to the cheaper option fuelwood - which as revealed in the preceeding sub-section to some extent can be got from own farm or within the neighbourhood, albeit low quality.

This over-dependence on fuelwood has also dictated the technology used in cooking. In Table 4.3.2(b) the households which use the three stone hearth only constitute 78.1% but in sum those who use three stone hearth constitute 99.05% of the households.

The three stone hearth cooking technology is prefered for its appropriateness in terms of being flexible enough as to accommodate all sizes of "sufurias" as need may arise and especially given the large family size, which on average is 7.3 persons. It also has the advantage of serving several purposes at the same time such that cooking can go on at the same time there is space heating and the heat and smoke that

TABLE 4.3.2 (c): DIETARY PATTERNS

TYPE OF FOOD	PERCENTAGE
Breakfast	
Tea/coffee	87.3
Maize and beans	2.73
others	10
Total	100
Lunch	
Ugali	48.5
Maize and beans	29.2
Bananas	10.8
Others	5.4
Total	100
Supper	
Ugali+Mboga/meat	96
Bananas	1.0
Others	3.0
Total	100

In regard to the midday meal, lunch, there is more variety but ugali is most consumed at a fair occurence of 48.5% followed closely by maize and beans at 29.2% occurrence and bananas 10.8%. Again in terms of fuel-wood requirement and time spend of the 3 main food types ugali takes less time at most 1 hour, followed by bananas at most 2 hours and the most demanding being maize and beans at least 3 hours. The last meal of the day, supper, also shows a heavy preference for ugali at 96% level of occurrance as compared to bananas at 1% level of occurance.

Reasons given by respondents as to why they prefered a particular food included: The fact that it was able to sastain one foor a long time before one would need to have another meal, which had about 28% level of

occurence that it was easy to get 22% level of occurrence; that is was just a traditional meal 16%; sweet to children 14%; nutritions 12%; others 2%; and the fact that it was easy to prepare 2% level of occurrence. These results are not statistically significant but one can make certain inferences from them. The first two, that is, one the fact that ugali is prepared because it can sustain one for a long time and that it is easy to get in reflects the general economic status of the farm households tying up the issue ability to afford other more nutritions foodstuffs, there is a tire need to meet the basic food requirement. Furthermore the issue of energy did not come out clearly.

However, an attempt was made to capture this information by posing two questions to the respondents: one was which meal took the longest time to prepare; and the second question was, why they (the respondents) thought it took a long time to prepare. In response to the first question means and beans were identified as taking a long time at 65.5% followed by ugali at 32.2% occurrence. Responses to the latter question included, the fact that the meal was hard to boil, lack of firewood and that it needs a lot of firewood and time.

4.4 THE COMMUNITIES PERCEPTION OF THE WOODFUEL PROBLEM

With reference to the statistical analysis hinging arround the supply and demand patterns of energy as conditioned and influenced by the socio-

cultural, economic and physical environment, in the study area, this section pays attention to the issue of the perception of the local community of the energy supply problem. From the onset, it is worth noting that the issue of perception is by and large an abstract construct and as such not a quantifiable issue, but can be infered by putting bits and pieces of information together. It also tends to be subjective, but if appreciated within the confines of an established framework or in context, it assumes a significant level of objectively.

The approach taken therefore is at two levels; one is the problem definition and suggested solutions bu the local community and second, which is more inferential, draws from the statistical analysis done in the preceeding sections.

In the first instance a question was posed to the respodent as to what problem they encountered in the procurement of fuelwood and the resposed were categorised as follows: what is evident from the statistics in the Table 4.3.2(d) is the fact that 91% of the firm households are experiencing the problem of fuelwood shortage in one way or the other, that is in only 9% of the cases was there no problem encountered. Although it might seem that categorises of problem definition are not significant, the improtant thing is that these

are the views of the local community.

The first category defines the problem in terms of its (firewood) scarcity perse as compared to the second category which defines it in terms of labour and time expended in the procurement of fuelwood. In the former case therefore the problem is defined as in terms of

TABLE 4.3.2(d): COMMUNITY'S DEFINITION OF THE ENERGY PROBLEM.

PROBLEM DIFINITION	PERCENTAGE
Fuelwood in scarce	28.8
Labour and time	27.9
Fuelwood is expensive	11.7
No problem	9.0
Other	8.1
Restriction on use of kakamega forest	19.8

the inadequecy and does not go beyond that, in the latter case, the responses look at the inadequency of fuelwood in terms of the apportunity cost, that is the labour and time, in terms of the level of perception of the fuelwood problem the latter category are more aware of the seriousness of teh problem. The other category, the 11.7%, defines the problem in terms of the market price and represent those who are already participating in the fuelwood market. The final category, the 19.8%, see the problem ad being caused by an external force, that is the governmet.

These responses should, however, be looked at with reference to the plausible solutions as expressed by

the respondents. Here perception is gauged from two levels; one is the demand management, that is the level to which the solutions reflects an appreciation to conserve energy in terms of the technology used in cooking for example, secondly, the supply enhancement, in terms of increasing the amount of energy resorces available to the household. With regard to the former, no response was recorded suggesting the need touse energy conservaion methods, thus on this count, the perception of the community of energy problem is ratner too low. The latter case, supply enhanceemnt had 100% occurence with the need to plant more trees having the highest level of occurence at 55% reflecting the fact that to a large extent the community sees fuelwood to be the most appropriat form of domestic energy supply. This was supplemented by a 4.5% suggestion for the need for more land to plant trees; 4.5% advocacy for the need to be apportioned apart of the Kakamega forest for their fuelwood needs; 3.4% seeing the solution as provision of emeployment; 2.3% suggesting the need for more money to buy fuelwood; 3.4% saw the solution as lying on the government to provide asolution to this problem and another 3.4% could not think of a solution to the problem; and 1.1% suggested the need to be suplied with electricity.

From those suggestions it is apparent that the need for substitutes to fuelwood is very low since most

of the suggested plausible solutions point to mere increasing the supply of fuelwood. It is only a very minimal oproportion 1.1% who suggested the need for energy source substitution. Thus on this account again, though the community is aware of the need to enhance the supply of energy their perceived range of choice is very narrow. This could be a good starting point for purposes of intervention whereby the community's awareness of the alternative energy sources should be aroused.

This issue of perception was again tasted at a second level in terms of what the community sees as the priority problem areas. A question was posed to the respondents as what were the main problems encountered in the area (in order of priority). Woodfuel shortage was ranked fifth after poor roads, dirty water, land shortage and employment. Thus, in order to address the issue woodfuel scarcity these other problems should be considered a long side. Finally, from the analysis of energy consumption patterns, it was revealed that only one person or 0.95% of the households used energy saving jikos and rest used the three stone hearth thus reflect a low level of an awareness of the need for energy conservation.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

In the preceeding four chapters the study problem was defined, the relevant literature reviewed and the methodology employed in the study indicated; the Kenya energy policy framework was evaluated; and a physical and human background of the study area was provided; finally the fourth chapter was dedicated to analysis of the socio-economic and energy indicators. All these chapters have contributed towards an understanding of the rural energy situation in Kenya and specifically in the study area, Shiswa sub-location. The current chapter offers a conclusion to the study by highlighting a number of aspects: presents a synthesis of the main findings eminating from the previous four chapters; from this synthesis it points out general conclusions that can be drawn; makes policy recommendations aimed at addressing the study problem and finally indicates areas for further study.

5.1 SYNTHESIS OF MAJOR FINDINGS.

The study was aimed at assessing the domestic energy situation in Shiswa sub-location, Kakamega District. This was with a view to contributing to the better understanding of the energy supply problem, that is, to supplement the existing knowledge of the said. The specific objectives were:

(a) To examine critically the energy production supply and consumption patterns in Shiswa sub-location.

(b) To investigate the possibility of the study area to accommodate the energy supply programmes formulated at the centre.

(c) To gain an insight into the local community's perception of the energy problem as a basis for planning the said programmes.

(d) Make recommendations for appropriate intervention approaches to alleviate the energy shortage problem.

In an attempt to meet these objectives, the study was guided by the frame of reference that rural energy supply is an intricate component of the process of rural underdevelopment. This is seen as arising from the interaction of the interelated complexity of the various spaces within which the rural households operate, that is, the social-cultural space, economic space and physical resource endowment space against the demographic dynamics of the rural area. It is also in appreciation of the fact that the demand for energy is by and large derived demand, which is in response to other more explicit needs. It is, so to speak, a factor of production that is not consumed as an end in itself but as a means to an end (that is, to facilitate the production of other goods and services for final consumption. Thus the demand for energy for domestic

purposes is a function of the households' production activities including need for space heating, dietary patterns and other social obligations which in turn are determined by the socio-economic dynamics of the household and society at large. Further, the supply of energy will then be in response to this demand but within the budget constraint of time, labor, land and the requisite purchasing power. Finally, the perception of the local community of the energy problem in terms of attempts and expressed desire to alleviate the said problem will by and large be influenced by the foremen-tioned factor interaction which will also determine the ability of the farm household to accommodate the energy supply programmes formulated at the centre.

In chapter II an overview of Kenya's energy policy framework revealed the government's expressed intention to develop the indigenous energy resources and to encourage energy conservation or demand management practices. But within the supply enhencement approach there is a kind of lopsideness whereby electricity is favoured in terms of financial and manpower resource allocations by the government in disregard of the fact that only a very small percentage of the citizenry use electricity. And again within the electricity develop-ment, the proportion of financial resources committed to rural electrification programme is not proportionate to the weight of rhetoric in policy statements. Thus at

the policy level the rural areas are disadvantaged. Further, in regard to demand management approach expressed intent is not backed by the necessary financial resource allocations, neither is there a proper guideline on how the citizenry should implement the intended measures.

In chapter III, it was established that the study area lies in the agro-ecological zone categorised as high potential agricultural land characterized by high and reliable rainfall totals. In terms of woody biomass production this appears to be quite suitable, but this positive aspect is more or less negated by the population pressure on agricultural land such that increasingly less land is available for the production of the said. It was, in fact, established that the proportion of the woody biomass relative to the total cover has been diminishing over the years. Also at the district level the distribution of the gazetted forest is such that a large proportion of the population is not within economical reach of the forest resources, thus limiting this proportion of the population to the on-farm fuelwood supplies. In addition to those communities who are within economically feasible reach to the forest, the restriction by the forest officials has rendered them inaccessible to this resources. To the extend that though the forest is physically close to them, functionally it is inaccessible to them. They

are therefore forced to depend more on the on-farm fuelwood supplies but again there are two main factors militating against the appropriate availability of and accessibility to the fuelwood resources. One is the socio-culturally established household decision making structure in regard to the tree resources. Here the women have limited say in the utilization of the tree/ woody biomass resources, yet they are charged with the duty of preparing meals. The other factor of disadvantage has already been established as that of population pressure which is district wide such that within the immediate environment or neighbourhood of the study area the off-farm fuelwood sources are limited. Further it was established that communal land is a thing of the past and therefore rural afforestation in terms of communal and plantations is not a feasible alternative to the study area farm-households.

It was found out from the survey that the energy production, supply and consumption patterns were characterised by certain salient features (as discussed in chapter IV): First on the side of consumption, there is overdependence on one form of energy source, fuelwood with as many as 94% of the farm households using fuelwood for cooking and for lighting purposes about 99% depend on kerosene. This kind of arrangement was attributed to a number of factors: one the fact that until recently fuelwood has been by and large a free

commodity that could be procured without any commitment of financial outlay. Kakamega Forest in whose periphery the study area lies provided the main source of a wide variety (in terms of quality) of fuelwood and every farm household needed only labour to collect this free good. This was available from the women folk at no cost. Therefore in terms of affordability virtually every family could afford fuelwood. Even now with the trend being towards the commiditization of fuelwood, it is the only form of energy that can be gotten to some extent free although of the lowest quality in terms of scavinging on twigs around the village.

The issue of affordability of alternative energy sources was also reflected in the analysis on the farm-household economic base. It was revealed that as many as 58.5% of the farm households had a total monthly income of Shs.500 or less, these fall within the category of the rural poor. Within this 58.5% of the farm households, 10.9% of them live in abject poverty in the sense that not only was their income low but also the employment pattern revealed that the head of household and wife were both subsistence farmers and to make it worse their farm size was 1 or less acres of land. This proportion of the farm households are caught up in a low level production trap and would need special consideration. On the overall the employment pattern revealed that as many as 64% of the women/wives

and 44% of the heads of households were sibsistence farmers. Only 4.8% of the husbands and 0.99 of the wives were professionals. Again the level of agricultural production was very low with very few growing high value cash crops. Thus fuelwood remains the most appropriate in this respect.

The second aspect is linked to the first one whereby the cooking technology is to a large extend wasteful. As many as 96% of the households use open fire (three stone hearth); this has a conversion efficiency of only 10% with most of the heat lost into the surrounding - albeit open fire is prefered for providing for space heating and cooking at the same time and the fact that it is more apropriate for large families as compared to other alternatives like kerosene stove or energy saving jiko. Finally, the level of fuelwood requirements depends on the family size, with the farm household with more persons requiring proportionately larger amounts of fuelwood.

On the supply side the scarcity of on-farm fuelwood is reflected more explicitly with 50% of the farm households having to supplement their own farm fuel supplies with off-farm sources. Of this 50% of the households 23.0% have to do with inferior fuelwood by scaving on twigs around the village and dead wood on neighbours' farms, about 8% have resorted to buying fuelwood from those who have accessibility to the

forest or buying whole trees from neighbours and chopping it up for fuelwood. This percentage appears small but reflects the transition of fuelwood from a free commodity to a monetized/commercial one. This introduction of another item of expenditure into the farm household income budget implies competition for the families limited resources. But also the issue of affordability, as discussed under the section on energy demand, is apparent with the implication that this commodity may not be available to the 10% who are living at mere subsistence owing to their inability to afford this. The other factor determining the supply level is the decision making structure within the household. It was established that the decision making matrix was dominated by the men and was not appropriate to the accessibility of the women folk to the woody biomass resources. This was reflected in the involvement in tree planting where men by tradition had the upper hand. Further, it was also established that tree planting was a well institutionalized aspect in the land use planning of the farm households in the study area, with farmers already trying to exercise economy in the use of land in an attempt to accommodate the various landuses on gradually diminishing land resource. This was reflected in the woody biomass configuration on the farms, whereby most households grow trees either around the houses or on hedges so as to make the rest of the land available for agricultural

production. The point is that the farmers have gone this far and can be assisted to get much further by introducing them to more disciplined farm management techniques in terms of agro-forestry (modern) and choice of appropriate tree species in order to achieve harmony in the land use pattern and maximise on the returns per unit of space.

It was further established that with increasing population (size of farm households) and the system of acquisition of land ownership rights, through inheritance, the farm size continue to shrink to the level whereby it is becoming increasingly difficult to meet competing farm household needs. Analysis revealed for example that as many as 61% of the farm households had farm sizes below the minimum desirable for subsistence (3.5 acres), of which 15% had 1 or less acres of land. it was thus established that it will be difficult for the said proportion of the households to accommodate fuelwood production alongside agricultural production. Further, it was found out that no more of communal land existed in the study area to accommodate rural afforestation programmes of communal plantations but there was room for agroforestry albeit of varied magnititude from farm household to farm household. Finally, the data analysis revealed that the perception of the local community of the energy shortage was relatively low in terms of problem definition and

suggested solution and the level of adoption of energy conservation measures.

5.2 POLICY INTERVENTIONS/RECOMMENDATIONS.

Against the scenario set in the preceding sections, certain policy intervention suggestions are put forth and to a large extent reflect the guiding frame of reference that the issue of rural energy should be seen within the broad context of the rural development. In attempt to alleviate the problem at issue, therefore, a package of approaches is presented and summarised in Table 5.1 which is to a large extent specific to the study area. These approaches are to a great extend interelated tot he extend that certain levels of intervention are a prerequisite to the realization of the other and others are supplementary to the other as it shall become apparent in the discussion that follows.

The first approach of improving the efficiency of wood use through the adoption of improved stoves addresses the issue of inefficient cooking methods. It was established that a majority of the farm households used open fire (or three stones hearth) which has a very low conversion efficiency of about 10%. Through adoption of improved cook stoves upto 50% efficiency of saving can be achieved (Opole). While advocating for these improved cookstoves certain facts ought to be

borne in mind: first of all, that they (the cookstoves) are to replace an old age technology which has been proven to meet the needs of the farm household in terms of serving the purpose of cooking and space heating simultaneously, being flexible in terms of accommodating various sizes of cooking utensils (sufurias) as need may arise; also accommodating varied sizes of fuelwood pieces and thus requiring relatively less labour for chopping up the fuelwood; the techniques of making the three stone hearth are simple enough to extent that this technology is available to every farm household; and finally that they are made from locally available materials at virtually no cost and the cost of replacement is also not an issue. The implications are that for these innovations to have any meaningful adoption rate the design aspects should as much as possible take into consideration these aspects. It would be futile for example to expect a subsistence farmer who is hardly getting by to commit 65/= to the purchase of a ceramic jiko which may not only be too small for his large family of 8 persons' cooking requirements, but is also fragile and will need to be replaced after a month or two when he can get a three hearth stone at no cost but for the labour involved. So far the Ministry of Energy and related agencies have not come up with a cookstove design that would meet half these needs. It is therefore a challenge to them to research into this further.

TABLE 5.2: PROPOSED TECHNOLOGICAL CHANGES IN ENERGY SYSTEMS[1]

Nature of change	Techniques involved	Effects
1. Improved efficiency of wood-use	Adoption of improved stoves	Reduced demand for wood
2. Interfuel substitution	Switching to parafin, biogas, etc.	Reduced demand for wood
3. Improved wood production systems	Agroforestry, woodlots sustained yield mana-	Increased wood supplies
4. Increased off-farm fuelwood supply	Incorporate domestic fuelwood requirements in the planning for forest resources' production & utilization	Reduced dependence on on-farm fuelwood resources and increase wood supplies
5. Increased per unit land productivity	Adoption of zero-grazing, poultry and small animal production, high valued crops	Increased purchasing power of the farm-households for alternative energy forms; Reduced dependence on fuelwood; Increased capacity for biogas; Released land for production of

[1]Borrowed (but modified) from "Energy use in Rural Kenya Household demand and Rural Transformation", Beifer Institute, 1985.

Dispite these seemingly overwhelming disadvantages of the improved cookstoves, there are ways of arriving at a compromise. One is that the improved cookstoves should not be seen as completely replacing the three-stone hearth but should supplement it instead, so that the improved cookstoves can be used for cooking purposes of quick and light meals whereas the open fire can be used for other more serious cooking needs.

Secondly, the issue of affordability could be solved not only through developing cheap cookstoves but in the medium and long-run through measures aimed at improving the levels of income of the rural households. Furthermore this can confortably be accommodated by relatively ..?.. of rural households especially the 7.7% who earn over Kshs.2000.

The second possibility is that of interfuel substitution to be achieved through switching to other alternatives as paraffin or biogas which is aimed at reducing the overdependence on fuelwood. This is the attempt to diversigy the sources of energy for domestic use (Ibid). This option is closely tied up with the question of the level of household resource endowment in terms of income generation, agricultural production especially animal husbandry and land. This is because it advocates for greater participation in the monetary economy in terms of, for example, purchase of biogas digestor which is estimated to cost over Kshs.6000, on average and requires a certain minimum number of livestock for production of the raw materials for the digestor. This resource demands, in the shortrun excludes the farm households who earn less than Kshs.500 per month and do not keep livestock (especially the cattle, sheep and goats) owing to limited land resoure. In the long-run, however, with the fifth proposal as a prerequisite leading to intensive farming methods in

terms of zero grazing, poultry and small animal production and the growing of high value cash crops, it should be possible for over 50% of the farm households to afford this alternative.

The said fifth approach is to be seen to lead the rural farm to becoming a self sustaining system of production. This is in the sense that the various aspects of the package aimed at raising the farm productivity should not only benefit from the others but also contribute to the sustainance and improvement of the other components, such that while the zero-grazing unit demands cattle-feed from the farm or off-farm it is itself not only generating income in terms of milk production and sale but also producing manure for the crops on the farm and for the biogas digestor. Whereas the biogas not only produces the required energy resource but also helps in the improvement of the quality of fertilizer that will go into crop production. In the final analysis the farm is transformed into a profit making enterprise actively participating in the monetary economy, away from mere subsistence level. This fifth approach is in no way an easy option - it involves substantial commitments in terms of financial outlay and manpower. Givern the low level of incomes in the study area this will involve extension of credit facilities for purchase of the livestock unit and supportive facilities not to mention

the extension services requirements. It therefore calls for a concerted effort on the side of the government and other development agencies to address this issue.

It is indeed the main arguement advanced in this work that the longterm solution to the rural energy problem can be found by solving the issue of poverty - energy supply problem will, one would say with a fair degree of confidence, be automatically solved. It is only when the farm households are able to generate levels of income over and above the subsistence level that they are willing and able to diversify their energy energy resource by purchasing the commercial energy forms. In the short-term the adoption of fuel-wood substitute like biogas by a few well-off farm households will to a certain level contribute to net increase in fuelwood availability by reducing the consumption of fuelwood and whatever is not being used by this category of households can either be sold to those who cannot afford to plant more trees on their farms or become available to the disadvantaged segment of the society to be collected as deadwood.

The other option is also an aspect of supply enhancement approach which is more of a district level - that is to increase the off-farm fuelwood supply through incorporation of domestic fuelwood requirements in the planning for forest resources' production and utilization programmes. This is so that the communities

in the periphery of the gazetted forest reserve can have accessibility to the forest resources without undue harrassment. Investigations revealed that whereas the forest officers at the district headquarters claimed that the local community could collect deadwood from the forest at will, the reality was that those who tried to go to the forest for the said purpose were harassed by forest guards. It is therefore necessary that the local leaders and the relevant officers get together to work out a formula as to how best to effect this. This particular proposal is aimed at assisting that category of the farm households which constituted 10% of the farm households that were greatly disadvantaged in terms of land and financial resource endowment, to the extend that in the foreseable future they can neither afford to plant more trees or purchase from other sources. In other words it is a kind of charitable approach or option that is inevitable given the forementioned facts. It is also aimed at reducing the dependence on on-farm fuelwood resources and generally increase wood supplies available to the farm households.

The final intervention approach is that of increased wood production through agroforestry, woodlots and sustained yeild management (Ibid) which is also an aspect of supply enhancement strategy. As was indicated in the statement of the problem chapter I

section 1.1, this is one of the favoured strategies by the government. It has also been suggested by the Beifer Institute (1985) to be the most appropriate in the rural areas, especially the agroforestry component of the strategy. Agroforestry, which is "a comprehensive term covering many forms of land use in which tree and shrub cultivation is combined with the production of agricultural or horticultural crops on the same piece of land", is considered to be a solution to the inevitable competition between agriculture and forestry (Jackson,1987). It offers, so it is said, quite a wide range of benefits, to quote Jackson at length:

> "The diversity of the components of agroforestry systems not only enhances the stability of the natural resource-base; it leads to a diversity of products, which helps to provide a sound economic resource-base for the rural people. Food production may actually be increased (partly through control of soil degradation, but also through nutrification where leguminous trees are part of the system), but there are other benefits: a supply of fuel is assured; bimber, medicines, dyes, nuts, edible leaves, fibres, tannin, resin, waxes are produced; honey can be produced if beekeeping is incorporated into the system . . ."

In this it is said to be able to meet the needs of the peasant farmers as he perceives them; uses locally available low cost inputs; increases productivity and

to crown it all it stabilises the production unit (Ibid). With all these allegations in favour of agroforestry, to be able to achieve half of these requires a slightly high level of discipline in terms of closely monitored crop and tree husbandry. To be able to grow trees in the same piece of land with food or cash-crops for example and not disadvantage the crops by way of too much shade requires that a farmer takes note of careful tree and crop alignment relative to the sun rays so that both the trees and crops have sufficient sunlight to enable them to grow properly. It also requires constant monitoring of the growth of the trees which will need to be pruned every now and then which implies that there may be more demands on the farm household labour. Further careful selection of tree species which will not only be fast growing but also be multipurpose.

All these various aspects of agro-forestry have certain implications: that extension services related to agroforestry will have to be intensified in order to disseminate the agroforestry practices. Currently, there are hardly sufficient agricultural extension frontline staff in the study area, there will therefore need to train more frontline staff, by both Ministry of Agriculture and Energy and Regional Planning. Use can also be made of the schools for demonstration purposes and supply of seeds and seedlings of the appropriate

tree species. Production of the appropriate seedlings should also be intensified so that they are available to the farmers within the shortest distance possible by establishing tree nurseries at the local schools and the village headmen's homes. And since the local community has already taken up the practice of tree planting or seedling raising, supply of seeds will be an appropriate approach.

However, the unfavourable socio-culturally determined decision making structure within the household where the womenfolk have limited accessibility to the tree resources will have to be tackled alongside the introduction of these other innovations. This will have to be done through educational campaigns in schools and "barazas" to sensitize the malefolk on the need to participate actively in the production and procurement of woodfuel. The trend towards more male involvement in the procurement is in progress but at a painfully slow pace and needs to be facilitated through the said campaigns. In conclusion as it has been indicated before, these approaches should supplement one another so that we could have different groups adopting either or a combination of these approaches depending on particular farm-household resource endowments.

5.3 AREAS FOR FURTHER RESEARCH.

The study has in no way been exhaustive in addressing the issue of Rural Energy. Therefore there is room for further research to contribute to the understanding and solving of the problem investigated. In this regard, the following areas could be explored further:

(a) More detailed land-use studies to explore the possibility of coming up with a variety of model farms to maximise on per unit crop and woody biomass production. These should focus more on the very small-scale farms and take into account other farm household resources.

(b) The possibility of exploiting self help-efforts in provision of energy in the rural areas - both in developing more appropriate technologies in energy end-use and pooling resources for making available alternative energy resources.

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APPENDIX

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

GENERAL INFORMATION

1. Name of village ----------

2. Respondent male and female ----------

3. Respodent head of household, Yes/No ----------

4. Occupation type

   a) Husband ----------

   b) Wife ----------

5. Place of employment

   a) Husband ----------

   b) Wife ----------

6. Estimated total income per month Kshs. ----------

7. Household size ----------

   ages ----------

LAND-USE

8. Is your land

   a) Bought ----------

   b) Rented ----------

   c) Inherited ----------

   d) Squatted ----------

9. Do you have title deed for your land Yes/No ----------

10. Total acreage of farm ----------

11. Acreage under:

   a) Crops ----------

   b) Grazing/pasture ----------

   c) Trees /agro-forestry ----------

   d) Non enable

12. Most important crops on farm:

a) cash crops: ----------, ----------, ----------

b) subsistence crops -------, ----------, ----------

c) What are your yields for the most important cash crops?

crop ----------, yield ----------

crop ----------, yield ----------

d) What are your yields for the 3 most important subsistence crops?

crop ----------, yield ----------

crop ----------, yield ----------

crop ----------, yield ----------

12. Do you intercrop? Yes/No ----------

which crop ----------

and ----------

14. Type of livestock kept on farm:

a) Exotic and cross-breeds ----------

b) Local breeds/Number ----------

c) Goats and Sheep/Number ----------

d) Any other (specify) ----------

15. (i) Do you practise zero grazing Yes/No ----------

(ii) If yes what are the sources of fodder ----------

----

16. Where do you graze your livestock

a) own farm ----------

b) Along the road or around the village ----------

c) Neighbours' farm ----------

d) Kakamega forest ----------

e) Any other (specify) ----------

17. (a) Is this where you have always grazed Yes/No ----------

(b) If No specify where and reason for the change of grazing area

---

---

18. Sources of information on crop planting and livestock keeping

(a) Own experience ----------

(b) Neighbour ----------

(c) Agricultural extension officer ----------

(d) Others (specify) ----------

19. If Agricultural Extension Officer how many times in a year does he visit you

---

20. Marketing of farm produce

(a) Individually ----------

(b) Cooperative ----------

21. Means of transporting farm produce to and from market

---

22. What are the main problems encountered on the farm?

1. ----------

2. ----------

3. ----------

23. Suggest possible solutions to these problems

ENERGY PRODUCTION, SUPPLY AND CONSUMPTION

24. (a) What are the main meals eaten:

for Breakfast ----------

Lunch ----------

Supper ----------

(b) Which of the meals mentioned above (in 'a') takes the longest time to prepare

---

(c) Explain why it takws the longest time ----------

---

25. Which meal (food) is mot prefered ----------

Explain why it is most prefered ----------

---

26. What is the form of energy supply for:

	Cooking	Heating	Lighting
(a) Charcoal			
(b) Fuelwood			
(c) Kerosene			
(d) Others (specify)			

27. of the following which do you use for cooking?

(a) Three stone hearth (open fire) ----------

(b) Ordinary jiko ----------

(c) Energy saving jiko ----------

(d) Kerosene stove ----------

(e) Others (specify) ----------

28. (i) Where do you get your fuelwood? ----------

(a) Own farm ----------

(b) Neighbours' farms ----------

(c) Around the village ----------

(d) Kakamega Forest ----------

(e) Buy from market ----------

(f) Other (specify) ----------

(ii) If (d) how far is it from home ---------- km

How long dows it take to and from the forest?

(iii)if (e) how much do you spend in a day ----------

in a week ----------

(iv) How long does it take in a day to collect firewood?

---

29. (i) What problems are encountered in procurement of fuelwood?

1. ---

2. ---

3. ---

(ii) Suggest possible solutions ----------

1. ---

2. ---

3. ---

30. Where trees are grown

(a) Cropland

(b) Hedge

(c) Woodlot

(d) Round the house

(e) Other (specify)

31. Main trees species on fram and their uses:

Species ---------- uses ----------

Species ---------- uses ----------

Species ---------- Uses ----------

Species ---------- Uses ----------

32. Who plants trees:

(a) Husband

(b) Wife

(c) Children

(d) Other specify.

33. Sources of information on tree planting:

(a) Own experence

(b) Neighbour

(c) Government Officer

(d) Baraza

(e) Other (specify)

34. 1 Sources of seedlings:

(a) Own nursery

(b) Given by neighbour

(c) Collect wildlings

(d) Government nurseries

(e) Others (specify)

35. (a) Do you encounter any problems in getting seedlings?

Yes/No ----------

(b) If yes list the problems

1. ----------

2. ----------

3. ----------

(c) Suggest possible solutions to these problems

1. ----------

2. ----------

3. 3. ----------

36. (a) Did you cut any trees on your farm

(i) In the last 1 week Yes/No ----------

(ii) In the last one month Yes/No ----------

(iii)In the last 3 or so months Yes/No ----------

(b) If yes for what specific prupose did you cut them (or it)? ----------

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(ii) If for firewood, which part of the trees was used for fu fuelwood)

(iii) Who made the decision to cut the tree(s)

(a) Husband

(b) Wife

(c) Other (specify)

37. During the time for planting crops who decides on:

(a) What to plant ----------

(b) Where to plant ----------

(c)

38. (a) Have you sold any item in your household (e.g. cow, hen or sheep) in the last 1 week or month

Yes/No ----------

(b) If yes why did you sell it? ----------

---

39. (a) In your opinion, what are the main problems encountered by the people in this area? (list in order of importance)

1.----------

2. ----------

3. ----------

4. ----------

(b) Suggest possible solutions to these problems

1. ------=----------

2. ----------

3. ----------

40. Other information not covered by the questionnaire

(iii) Who made the decision to cut the tree(s)

(a) Husband

(b) Wife

(c) Other (specify)

37. During the time for planting crops who decides on:

(a) What to plant ----------

(b) Where to plant ----------

(c)

38. (a) Have you sold any item in your household (e.g. cow, hen or sheep) in the last 1 week or month

Yes/No ----------

(b) If yes why did you sell it? ----------

---

39. (a) In your opinion, what are the main problems encountered by the people in this area? (list in order of importance)

1.----------

2. ----------

3. ----------

4. ----------

(b) Suggest possible solutions to these problems

1. ----------

2. ----------

3. ----------

40. Other information not covered by the questionnaire
