FUELWOOD AND TREE PLANTING: A CASE STUDY FROM FUNYULA DIVISION IN WESTERN KENYA

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in

THE FACULTY OF GRADUATE STUDIES
(Department of Forest Resources Management)

We accept this thesis as conforming

to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

February 1993

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Date 29 March 1993

ABSTRACT

This dissertation examines village fuelwood and tree planting in four villages in Funyula Division of Busia District, Western Kenya. It also explores gender issues and the existence of cultural norms and beliefs that might influence tree planting activities.

The actual study involves an environmental and socioeconomic description of the study area and population, through direct observations, and information derived from a questionnaire survey. In addition, there is a comparison of household fuelwood use to determine the villages consuming the most wood.

The questionnaire survey shows that 65.5% of respondents agree that there is a fuelwood shortage while results obtained from the firewood measurements and environmental analysis show that Namasali, a lakeside village, experiences the most acute fuelwood shortages. However, perception about wood scarcities is not matched by the planting of trees for fuelwood provisioning. Only 3% of the sampled households had planted trees for this purpose. Trees are planted, primarily, to provide building poles and fruits to satisfy the need for food and shelter. This is in keeping with what has been found in other parts of Kenya, and in other African countries, that the primary reason for tree planting is rarely fuelwood.

Findings from this study also show that, although there are no gender-based differences in perception of fuelwood scarcity, there are cultural hindrances to the full participation of women in tree planting. Culture, to some extent, also influences choice of tree species, and site of tree planting in the homesteads. For example, the planting of the homestead hedges is confined to men, mainly, while there is a general reluctance to plant indigenous tree species, more specifically the Mvule, a valuable timber tree of the area.

It is concluded that fuelwood scarcity is due to the varying micro environment of the villages studied, changes in land ownership and distances to hill lands. Seven major recommendations and five minor ones are made for specific tree species to include in the Funyula farming system.

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ABBREVIATIONS

AFC	Agriculture Finance Corporation
AFRENA	Agroforestry Research Networks for Africa
ANOVA	Analysis of Variance
ASCII	American Standard Code for Information Exchange
Can	Canadian
cap	capita
COFOPLAN	Proceedings of the Third Regional Workshop of the Training Programme on Planning and Management of Participatory Forestry Projects
Cum/freq	Cumulative frequency
DAO	District Agriculture Officer
DFO	District Forest Officer
EATEC	East African Tanning and Extract Company Limited
EMI	Embu Meru Isiolo Districts
FAO	Food and Agricultural Organization of the United Nations
FESD	Forest Extension Services Division
FMH	Farm Management Handbook of Kenya
GDP	Gross Domestic Product
GK	Government of Kenya
ICRAF	International Center for Research in Agroforestry
IITA	International Institute for Tropical Agriculture
ILO	International Labour Organization
KEFRI	Kenya Forestry Research Institute
KENGO	Kenya Environment and Energy Non-Governmental Organizations
K£	Kenya pound = 20 K Sh
Kg	kilogram
KNA	Kenya National Archives

K Sh	Kenya shilling
KWDP	Kenya Woodfuel Development Project
LMZ	Lower marginal zone
MENR	Ministry of Environment and Natural Resources
MO	Medical Officer
NGO	Non-governmental organization
OPEC	Organization of Petroleum Exporting Countries
RAES	Rural Afforestation Extension Services
RLFS	Rural Labour Force Survey
RRA	Rapid Rural Appraisal
SADCC	Southern African Development Coordination Conference
SAS	Statistical Analysis Systems
SPSS	Statistical Package for Social Sciences
TOE	Tonnes of oil equivalent
UN	United Nations
UNDP	United Nations Development Programme

ACKNOWLEDGEMENTS

I would like to thank all those who extended help to me both in Kenya and Canada over the four years of my graduate work. It is not possible to thank everyone individually. However, my special gratitude goes to the many residents of Funyula who welcomed me into their homes and facilitated the interview and survey process; to Timona, Charles and David for helping in data gathering; and to Peggy Ndeda for housing me and, thus, enabling me to live within one of the study sites. Special thanks go to Mr. Mulindi the DAO, Funyula Division, for helping with transport by including me in his field tours.

I would also like to thank my Canadian friends Karen Golinski, Brigitta and Edward O'Regan for their emotional support and editorial services. Special thanks go to Anoja Wickramsinghe, a visiting professor from Sri-Lanka. Anoja showed me the intellectual aspects of village fuelwood studies and made numerous suggestions. The portrayal of the village landscapes is, largely, due to her.

Members of my supervisory committee deserve special mention. Dr. Ingram took on the difficult task of supervising my work while Dr. Hightower inspired me to think independently. Dr. Guppy helped with statistical analysis and to him I am truly grateful. Last but not least, I am grateful to Dr. J. McLean. He patiently taught me how to use the computer, took a keen interest in my work and gave much needed personal support.

Grateful thanks also go to all my relatives and friends who helped in one way or another. My sisters Eulalia and Julia became "mothers" to my children. My in-laws Anne, Alukano and Oboki provided much needed hospitality and translation services. My children Obura, Lydia and Robert worked hard at their school work and thus lessened my worries. In addition, they encouraged me to persevere and complete my programme. Finally, special thanks go to my husband John for patiently suffering my long absence from Kenya and for being the pillar of strength without which this work would never have materialized.

This study was made possible by funds from CIDA/GTF and the Egerton University that gave me time off to pursue graduate work.

To the memory of my parents, peasant farmers and fuelwood gatherers.

CHAPTER 1

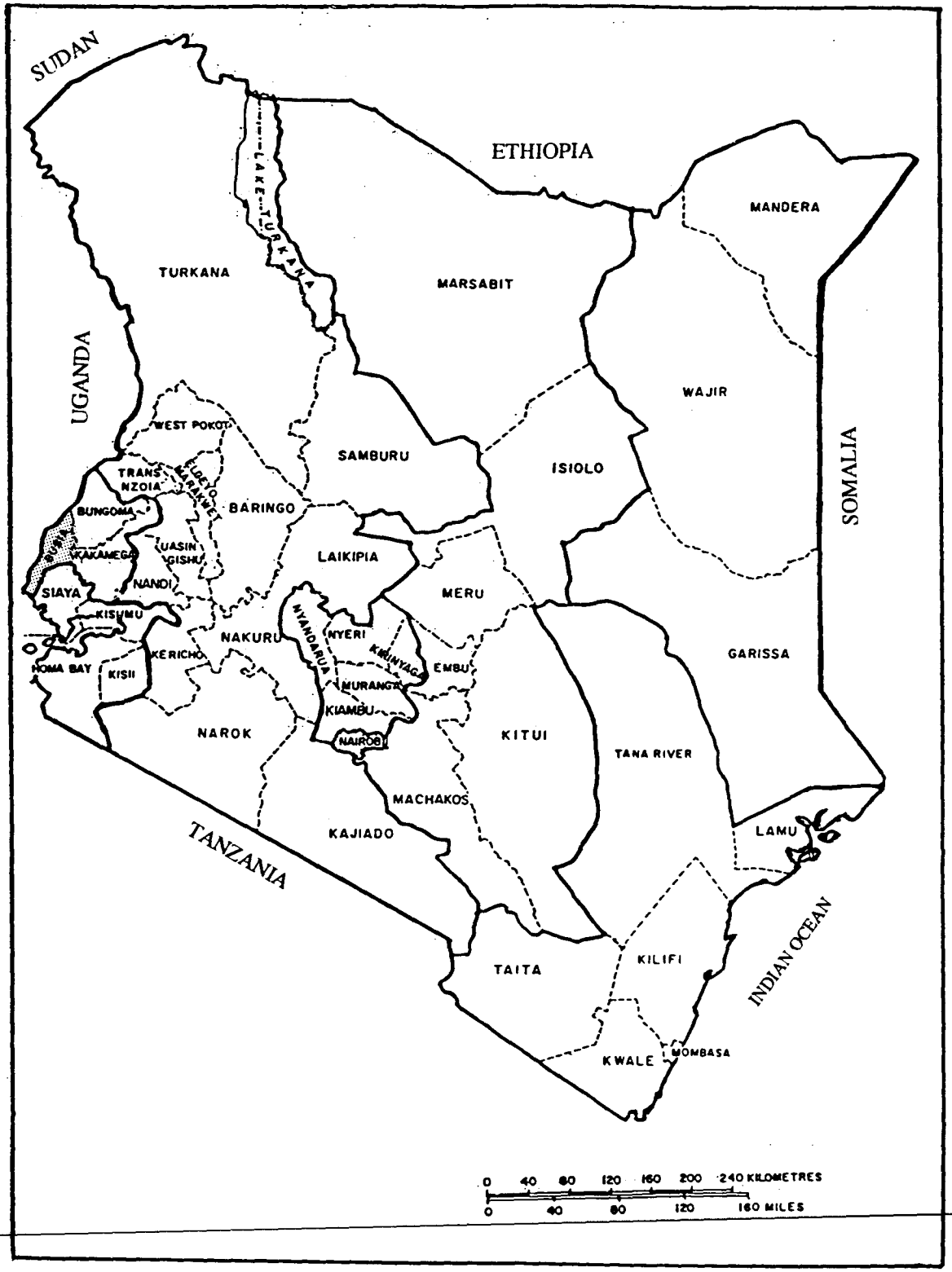
INTRODUCTION

This dissertation is a study of the fuelwood situation and tree planting practices in four villages of Funyula Division, Busia District, Western Province in the Republic of Kenya (Figure 1.1). It is about a rural people who must put more and more of their daily resources into obtaining increasingly scarce fuelwood. Furthermore, it is about poverty, subsistence economies and social development. It therefore aims to find solutions for better land management to alleviate perceived and real problems of fuelwood and tree planting.

In order to carry out such a broad and open ended study, a multi-disciplinary approach has been necessary. Various branches of investigation are incomplete but sufficiently explored to piece together a set of recommendations that should help in solving local problems of fuelwood scarcity and the realities of natural resource management in a developing country. The dissertation describes and analyses the biophysical and sociocultural environment of the study population the Abasamia, a subtribe of the Abaluhya tribe of western Kenya. It includes a description of land use and land use changes, tenure and land ownership patterns that have a bearing on the availability and accessibility of fuelwood.

The dissertation also explores gender issues and the existence of beliefs that might influence tree planting. The study is based on data collected in 1990 and 1991 by means of various methods that include use of government records, direct observations, interviews, firewood measurements and, finally, a structured questionnaire survey. Villages, as opposed to larger areas, were chosen as part of focusing on the grassroots' environment to understand better problems and challenges facing rural farmers.

Fig. 1.1. DISTRICT MAP OF KENYA



This introductory chapter gives a preamble to the problem and states the goals and objectives of the study as well as outlining my arguments and hypotheses and their relevance to the pressing need for better management of tree resources and provisioning of fuelwood.

Since the major increase of oil prices in 1973, development planners in third world countries have recognized fuelwood shortages. In Kenya, fuelwood supplies are critical because more than 90% of the country's population of 21.4 million depend on it for domestic energy. Woodfuel provided 30.3 million tonnes of oil equivalent (TOE) energy in 1990 while petroleum fuels and electricity provided only 1.9 million TOE (Republic of Kenya 1988a). With the current rates of population increase at 3.34% per annum, dependency on fuelwood is unlikely to decrease in the near future. At present, it is not feasible to consider switching to alternate sources of energy because of the expenses involved. Already the country imports 2,178,000 tonnes of crude petroleum spending well over K£ 422 million of scarce foreign currency annually.

Development of hydroelectric power has been increasing at the rate of 5% per annum but is hampered by the fact that Kenya does not have big rivers apart from the Tana, on which much development is already taking place. In addition, it is uneconomical to develop to the maximum hydro potential because such development requires expensive imported technology. Even if electricity became available in the rural areas, it would be out of reach for the majority of the population because of the initial capital requirements of improved housing and cooking stoves. Furthermore, dependency on imported petroleum has severely eroded the country's balance of payments and affects other spheres of national development. Also, the gradual decline of the Kenya shilling has meant rising energy costs and has spelled disaster for development dependent on imported energy.

Kenya is a relatively poor country with a per capita gross national product (GNP) of Kenya pounds (K£) 522 which is equivalent to Can $522[1] (Republic of Kenya 1989). Only 2.9% of Kenya's 582.55 million hectares land mass is managed forest. Of these forest lands, plantations constitute less than one percent, roughly, 169,000 hectares (Republic of Kenya 1991). Fuelwood plantations make up 11,900 hectares. These are useful in supplying institutions such as schools, hospitals and industries. Indigenous forest plantations are located mostly in vital water catchment areas and are not available for fuelwood harvesting. There are geographical imbalances in the distribution of fuelwood. The arid and semi-arid areas of the country which form 80% of the land mass have 70% of the wood resources. There are pockets of wood shortages in the so called agriculturally high potential areas.[2] The country is using very limited wood stocks. It is estimated that by the year 2000 the country will have a shortfall of 30 million tonnes of wood (MENR 1985).

To address the perceived biomass energy supply shortfall and the resultant land and environmental degradation, a special division of Rural Afforestation Extension Scheme was established in 1971 within the Forestry Department of the Ministry of Environment and Natural Resources. In 1979, a Ministry of Energy was formed with a special mandate to develop fuelwood resources among other objectives. The government spends a large sum of money on fuelwood and tree planting. In 1988 money spent by the government of Kenya (GK) ministries on various agroforestry and tree planting programmes was K£ 11.35 million[3] equivalent to Canadian $11.35 million. This does not include money channelled through the churches and other organizations such as the International Center for Research in Agroforestry (ICRAF). By 1990, well over K£

[1]The exchange rate then was 20 K Sh to the dollar. One K£ is 20 K Sh.

[2]On the basis of rainfall and potential main crop productivity, Kenya is divided into high, medium, and low potential areas.

[3]This figure was calculated from project expenditures of the Kenya Forest Department for 1988.

17.67 million (Can. $20.8 million due to the falling Kenya shilling) had been spent on these projects.

In spite of this concerted effort, Kerkhof (1990) is of the opinion that many of the tree planting projects in Africa have failed. He and Hosier (1985), attribute this failure to lack of baseline studies on individual communities to understand their tree needs. Since no such studies have been conducted among the people of Funyula Division in Busia District, the purpose of the present study is to bridge that gap in knowledge, about the fuelwood needs and tree planting practices of the inhabitants of Funyula, the Abasamia, by looking at selected villages in Funyula Division.

Funyula Division is one of the areas of Busia District facing fuelwood shortages. It has no natural forests and yet the rural people continue to depend on wood resources for their cooking, food preservation, building, furniture making and other wood based needs. The present study focus on the Abaluhya of Funyula Division in Busia District. Busia was not covered by the Beijer Institute's studies. This is not to say that Busia District has no fuelwood problems. Indeed, the 1989-1993 *Busia District Development Plan* stresses a lack of fuelwood resources when it notes that:

> "The district does not have sufficient tree cover and therefore fuelwood materials are scarce, particularly in the southern parts of Budalangi Division and some parts of Samia and Amogoro Division" (Republic of Kenya 1988b p. 132).

There are already signs of land degradation in many parts of the district due to increasing destruction of natural vegetation as a result of the growing demand for woodfuel and building materials (sand, bricks, building poles and grass). The areas most exposed to the problem were noted as the hill tops in Amogoro, Funyula and Budalangi Divisions.

In line with the current government policy of planning from the grassroot level[4], the present study is designed to compare wood use in Samia North and South Locations

[4]Current planning is supposed to emanate from the lowest levels of society upwards instead of the trickle down planning used in the past.

of Funyula Division. It also examines tree planting practices, the people's perception of fuelwood scarcity and their response to the perceived deficits. In addition, the study analyses the physical characteristics of the area that would permit tree planting. Moreover, it also examines the sociocultural and socioeconomic environment of the study population.

The reasons for fuelwood scarcities will become clear with the village micro-environment and resource analysis. Tree planting is not a remedy for fuelwood needs because people plant trees mainly for poles and fruit and obtain fuelwood as a by-product. There are some constraints to women's full participation in tree planting especially in the site of the homestead fences. There is also yet an inexplicable objection to planting Mvule,[5] *Chlorophora excelsa*, a valuable timber, fuelwood, and amenity tree. The information gained here should be useful to planners and researchers interested in this particular area and to other fuelwood deficient communities in the country and elsewhere on the African continent.

Study Goals

This study is designed to understand how individuals in Funyula perceive fuelwood problems and the strategies they have adopted to cope with any shortages they may experience. This understanding will assist in defining socially acceptable and economic strategies to encourage tree planting while conserving the local environment.

Tree planting programmes should be integrated with the physical characteristics of the area, so that alterations in the landscape blend in with the existing flora and other landscape features. Background information on the inhabitants of the target area must, therefore, not only be collected but it must be properly evaluated as a prerequisite to fuelwood planning and tree planting. In addition, information on the macro- and micro-environment of the study area must be analyzed.

[5]Mvule is the common and trade name for this East African mahogany *Chlorophora excelsa* (Appendix 7).

The long-term goal of this study is to develop an analytical framework in order to plan the management of fuelwood and tree resources so as to improve living standards of the people of Busia District by tapping the protective, productive and service roles of trees.

In Kenya, rural populations depend on wood for over 95% of their energy requirement (Hosier 1984, MENR 1985). A reduction or absence of wood or trees would severely affect the food preparation capability of the rural dwellers and thus affect their lifestyles and living standards. This dissertation evaluates current opportunities for, and obstacles to, expanded government programmes and increased local involvement in tree planting. It focuses on questions central to policy development for improvement of the fuelwood situation in areas with the greatest shortages and for which there is critical need for new solutions and programmes.

Study Objectives

To achieve the above stated long-term goals the following objectives were set.

1. To collect baseline information on the physical and ecological characteristics of the study area.
2. To evaluate the fuelwood situation, revise and develop tree planting plans to take into account the specific environmental, cultural and socioeconomic setting of the inhabitants.
3. To study local beliefs about trees and tree planting.
4. To determine whether there is a difference in fuelwood consumption between the four villages under study and to explore possible correlations with environmental factors.
5. To determine whether gender influences perception of fuelwood scarcity and tree planting activities.

Scope of Study

The study was carried out in Funyula Division of Busia District. The area was chosen because there have been no previous evaluations of fuelwood needs in this region. In addition, the area does not have gazetted government forests. Procurement of forest resources such as timber is from other parts of the country including neighbouring Uganda. This creates a substantial financial burden on local residents.

The fuelwood issue, as related to shortages and the imperatives for tree planting, is becoming critical. A good plan to ensure the long term provision of fuelwood and other tree resource products is therefore necessary. Another reason for choosing this area is the fact that the author is familiar with the people, their language and culture. Because tree planting involves land, the study is limited to inhabitants who own or have access to land.

Overview of Chapters

Chapter 2 reviews work done on fuelwood and tree planting projects with emphasis on the developing countries, Africa in general, and Kenya specifically. Definitions of fuelwood and the environmental, sociocultural and socioeconomic consequences of its scarcity are discussed. Conceptual aspects of fuelwood scarcity and wood consumption are given prominence in order to help understand the nature of the material and the environmental impacts of its over-harvesting. Since in many societies and cultures fuelwood procurement is a female activity, literature on gender issues and forestry is also addressed.

Chapter 3 outlines the study hypotheses in addition to providing brief statements on how data are to be gathered and hypotheses tested. Chapter 4 sets out the methods used in the course of these studies. Detailed descriptions of observational data gathering methods, informant interviews, and survey questionnaire formation and administration are provided. Use of data from archives as a check on informant interviews is outlined.

In Chapter 5, the biophysical and administrative setting of the study area, with emphasis on climate, topography, soils, vegetation, and village micro-environment are described. A detailed profile of each of the villages studied *vis a vis* availability and accessibility of fuelwood is given. This chapter is followed by a brief discussion of the socioeconomic, and sociocultural environment of the study area in addition to land use changes given in Chapter 6. The effects of fuelwood gathering on habitat and local biodiversity are also considered in this chapter.

Chapter 7 is a presentation of direct observational and informant interview results. Here, the historical perspective of local residents is reviewed in order to understand the cultural and tribal resource management systems that have evolved in the area. Results of the questionnaire survey and discussion are presented in Chapter 8. They are also discussed and compared to results obtained using qualitative methodologies. Data on individual villages are analyzed and compared to findings from other areas of Kenya, Africa and the rest of the developing world. Finally, Chapter 9 gives a summary of the analyses and provides conclusions. Recommendations are made on ways to improve wood and other tree product availability in the area and elsewhere in the country. Areas of future research needs and prospects for possible global linkages are outlined.

CHAPTER 2

LITERATURE REVIEW

The following is a review of literature on the fuelwood crisis and tree planting efforts carried out in the last two decades in response to the energy crisis of the early 1970's. Subsequent years have seen several international organizations begin tree planting and energy conservation projects in many developing countries. Several publications have come out of these experiences, among them are those by Eckholm (1976), Foley and Barnard (1984), Agarwal (1986), Leach and Mearns (1988) and more recently Kerkhof (1990).

This review is divided into five major sections, each of which has a bearing on fuelwood and tree planting efforts of rural village communities in different parts of the developing world and Kenya in particular. The first section is general with an emphasis on Africa; the second section is a definition of fuelwood and a treatise on the consequences of its scarcity in order to help the reader understand the complexity of the topic and its connection to tree planting. This is followed by a section that looks at fuelwood procurement and tree planting problems in Kenya. Since fuelwood availability is a problem that affects women more directly than men, gender issues are discussed under the heading "gender issues and social forestry", a title that encompasses fuelwood and tree planting. Finally, the extent to which culture and beliefs constrain participation in tree planting and their effect on women's access to wood resources is covered. From this review and results of the pilot study, hypotheses are developed.

The last two decades may go down in the history of forestry as the decades of "community forestry," farm forestry, social forestry, and agroforestry. The term community forestry has come to mean different things in different parts of the world. Duiker et al. (1991) have tried to distinguish between the term as applied to North America and the developing countries. The western concept of the term is based on

studies of communities dependent on timber or wood industries (Lee et al. 1990). The approach of the western researchers has therefore centered on the relationship between logging or timber industries and the communities dependent on them and on the various tenure systems as they affect productivity and the livelihood of the communities. In contrast, in the Third World, to which this study refers, community forestry is variously known by such terms as farm forestry, village forestry, rural forestry, social forestry, and agroforestry (Foley and Barnard 1984). The economies of many developing countries are at subsistence level. The communities in such countries are more often engaged in tree planting to satisfy their basic needs of timber, fuelwood and food and not in forest management. The FAO (1978) definition of community forestry as the growing of trees outside government forests, though dated, describes best the tree planting practices discussed in this study.

Agroforestry has been defined as the art and practice of planting trees mixed with crops and or animals on the same land management unit. However, in the final analysis, agroforestry is a form of farm forestry as it is mainly practiced by rural farmers. Agroforestry is based on the ability of specific tree species to address land use problems such as soil fertility, erosion, fodder, food and fuelwood. It is said to be an inexpensive, indigenous technology (Oduol 1986, Engelhard et al. 1986). It therefore, has special appeal to the multi-professional teams working on energy solving initiatives.

All of the above have come about as a result of droughts and famines that swept through Africa in the early 1970's and the global oil price increases by the Organization of Petroleum Exporting Countries (OPEC) in 1973. Some of these changes are a result of the United Nations directed policies on the environment such as the *Tropical Forestry Action Plan* (FAO 1985). This five-point plan includes "Fuelwood and Energy" as one area, among others, that need action. The plan was adopted and implemented, with assistance from the United Nations Development Programme (UNDP) and the World Bank, in more than fifty three tropical countries. Other world research institutes (World

Resources Institute), and action groups have produced reports such as the *Tropical Forests: A Call for Action* (World Watch 1985) and the *Brundtland Report* (Brundtland 1987) that have reinforced the importance of fuelwood and tree planting.

Thus, with direct or indirect external encouragement or help, developing countries started projects on fuelwood and tree planting to stem the tide of environmental degradation and desertification. Foley and Barnard (1984) list seventy-one such projects in Africa, forty three in Asia and seventeen in Latin America and the Caribbean. Many of these projects have failed (Foley and Barnard 1984; Agarwal 1986; Nair 1987, 1989 and Kerkhof 1990). The authors give reasons for failures and suggest remedial actions. Foley and Barnard (1984) deal, mainly, with tree planting outside the forest estates, i.e., farm forestry and community forestry, while Agarwal (1986) reviews the fuelwood situation in developing countries drawing most of her examples from Asia and India in particular. Leach and Mearns (1988) give reasons for the starting of the "mega" woodfuel projects as being the results of the faulty "gap theory" that analyzed fuelwood supply/demands in various countries and predicted massive deficits by the year 2000. According to these authors the theory ignored trees growing on farms and the savanna woodlands. Kerkhof (1990) is concerned with lessons to be learned from successes and failures of these projects in sub-Saharan Africa. It is clear from these and other publications, that the fuelwood supply is a complex, problem of the poor in developing countries and that the mere prescribing of tree planting does not solve it. Each region, country and village has its own peculiar geophysical, social, cultural and economical factors that influence availability, acquisition and consumption of fuelwood and tree planting. While FAO and other international researchers move on to more prestigious subjects, fuelwood remains the "problem that won't go away" (Eckholm et al. 1984).

Nature of the Problem

Fuelwood is an energy problem of the poor in mainly Asia and Africa. It accounts for 54% (1,200 million tonnes) of the wood consumed worldwide (FAO 1985; Goodman 1986). Moreover, 1,500 million people lack adequate supplies while 350 million more face acute shortages (FAO 1985; World Resources Institute 1985; Earth Report 1988). Most of these predictions, however, are based on the faulty "gap theory" that predicts that many African countries will have run out of fuelwood by the year 2000 (Leach and Mearns 1988).

It is no wonder then that when OPEC increased oil prices, in 1973, it spelt the end of an era of cheap energy, oil-based fertilizers, pesticides and rapid mechanization for Africa. This shift was particularly devastating for countries such as Kenya with no commercial oil deposits. The impact of OPEC's action was deeply felt in the Kenyan household and landscape. Until 1973, many African countries had paid little attention to fuelwood problems. The resource was thought to be inexhaustible and mainly collected "free" from one's own land, communal lands, or procured at minimal cost from government forest estates.

Fuelwood shortage is particularly serious because 90% of the inhabitants of Africa depend on woodfuel for their cooking and heating (Timberlake 1985). According to Shea (1988), more than 50 million Africans are facing fuelwood shortages after overcutting the woodlands around them. The deforestation and desertification spreading around major African cities is thought to be a consequence, in large part, of the perennial searching for and gathering of firewood (Timberlake 1985; Eckholm et al 1984).

Deforestation appears to pose the most serious environmental problem world-wide (Eckholm 1976; Moss and Morgan 1981; and Anderson 1986, 1987) and firewood collection in underdeveloped countries is seen as contributing to this process. It is estimated that 87% of the total forest production and 60% of total energy needs of the world comes from the forests. The key to understanding the potential impact of firewood

needs on deforestation is the African continent's rapid population growth rate of 3.0% per annum (United Nations 1990). At this rate of increase, the population, which stands at 642 million people, is likely to double by the year 2005. The impact on forest resources will be quite substantial as people clear land for agriculture to feed the expanding populations. In addition, these people will continue to rely on fuelwood in the foreseeable future as they lack the technology and foreign exchange to switch to alternate energy sources. As a consequence, more than 240 million people may face acute shortages of fuelwood by the year 2000 (de Montalembert and Clement 1983; FAO 1985).

Nonetheless, the population theory ignores one factor which has been known for sometime now. For example, Mortimore and Wilson (1965) and Mortimore (1967) had noted high tree densities in areas with high populations (500 people per km^2). More recently, documentations of agroforestry systems show that tropical areas with high population densities have developed complex agroforestry systems where tree cover predominates (Englhard et al. 1986; Rocheleau and Raintree 1985). It is not demand for fuelwood that creates deforestation but rather land clearance for agriculture (Foley and Banard 1984). Rural people who most depend on fuelwood rarely harvest whole trees. They harvest the products of land clearing exercises, in effect collecting what may be considered waste (Munslow 1989). These realizations have resulted in a shift in focus of the fuelwood production problems from the forests onto the farms. This is, therefore, a review of on-farm tree planting and fuelwood provisioning. But before this review continues any further, definitions of fuelwood and consequences of its scarcity are presented in the following paragraphs.

Fuelwood: A Theoretical Perspective

The US National Academy of Sciences (NAS)(1980 and 1983) defines fuelwood as any wood that is obtained from trees and used to produce energy. This definition includes firewood, charcoal, standing trees and plantations established specifically to provide these products. Firewood is a "bundle of multiple uses" (Williams 1983). It can be burned for heating, lighting , protection from insects, predators, and for the transformation of raw material forms and in symbolic and ritual purposes. Wood is also a "bundle of characteristics." There is wood that gives off toxic fumes and wood that sparks so much that it is dangerous to use. There are woods of high and others of low calorific value. Thus fuelwood exists in many forms e.g., dead wood, rotting logs, charcoal or cultivated trees. The value of any fuelwood will depend very much on the technology and tools used in its procurement and the use to which it is put. It will be more valued if used in either village or agro-industries, for example, tobacco curing, brick, pottery and bread making. Its value also depends to some extent on methods used in its procurement.

Williams (1983) describes four modes of fuelwood procurement. First naturally fallen wood, usually branches and twigs, is gathered and used to meet peoples' household needs. Second, the environment may be manipulated in different ways to obtain wood. This may take the form of cutting whole trees or pollarding branches. The third type of procurement is a variation of the second except the scale is larger and the wood may be converted to charcoal or sold for commercial gains. Finally, trees may be grown specifically for fuel.

Generally, fuelwood is considered to be of low value (NAS 1983). It can easily be substituted for because there are many alternative energy sources such as oil, gas and electricity. But these options are rarely attainable or feasible in many developing countries because their utilization depends on foreign technological and capital inputs few countries possess. Even where these alternate energy sources are available, they may

require a level of infrastructure and an initial investment in cooking stoves that few rural households can afford. As noted by Agarwal (1986 p. 13).

> "other renewable energy alternatives, such as solar and wind technologies or even biogas are not yet at a stage of development where they can be adapted successfully to adequately serve the needs that woodfuels currently serve in Third World countries."

Woodfuel in all its various forms, both as standing trees or firewood, will remain important for the survival of rural populations in the poorer parts of the Third World on an indefinite basis.

Difficulties of Quantifying Fuelwood

Fuelwood scarcity poses problems in its quantification because it is difficult to come up with a direct and precise scale of measuring it. Over the years a number of authors (Openshaw 1971; Earl 1975; Hughes 1984, 1987; Hosier 1984) have tried to document the amounts of fuelwood consumed by various communities as a way of arriving at possible scarcity values. Since fuelwood occurs in so many forms, consumption estimations and measurements still challenge researchers. In view of these difficulties, fuelwood scarcities are estimated from indicator variables such as the mode of procurement and the way it is used, including the effect of scarcity on the environment and human populations. The numerous consequences of a scarcity of trees and fuelwood are presented in the next paragraphs.

Consequences and Social Implications of Fuelwood Scarcity

Various authors (Eckholm 1976; Foley and Barnard 1984; Timberlake 1985) have described the social implications of fuelwood scarcity in different parts of the world. Wood which, hitherto, had been collected free or exchanged among neighbors may begin to appear as a commodity on the market. Time spent in fuelwood gathering or distances to collection points may increase. This time depends on factors such as availability and type of wood, its geographical location and the terrain. It may also depend on the type of

tools used to gather the fuelwood. Agarwal (1986) compiled a table of reported time taken by villagers in fuelwood collection in different parts of the world. These ranged from 0.3 hours per day for data from Java in Indonesia (White 1976) to a high of five hours in villages in Nepal, India, and Ghana (Bajracharya 1983; Swaminathan 1984; Agarwal 1983). The longest recorded distances for people travelling on foot (presumably) were ten kilometers in India and the Sahel (Agarwal 1983). Where trucks and animal drawn carts are involved distances can be very great indeed. As will be seen later in the review of gender issues, the increase in distances, time, and size of firewood bundles represents a social cost in terms of reduced time for other farm and household chores. In addition, fuelwood scarcity has a detrimental effect on the health of family and the wood gatherers.

Scarcity may also force households to institute conservation measures, changes in fuelwood use and in the manner of fuelwood collection. For example, fire may be tended to make wood last longer or it may be put out altogether to save wood. Tree species that are normally not used, (for example, thorny or smoky and irritant species that impart a bad taste to foods) and crop residues may be used. In extreme cases, dung is used to provide energy. This has implications for the families' ability to produce food as organic manure is diverted from the fields to the fireplace.

In the Sahel region of Africa, wood scarcity has forced some families to reduce the number of cooked meals per day (Agarwal 1986 quoting Floor 1977). Hughart (1979) reported the same phenomenon in Bangladesh. According to Hoskins (1979b) and Hosier (1984), in Guatemala and Kenya, respectively, less nutritious foods are replacing beans which require much more fuel energy to prepare. The nutritional and health implications of fuelwood scarcity have been reviewed by Brouwer et al. (1990). Suffice it to say that fuelwood scarcity affects both food preparation and preservation and has a bearing on health on account of the heavy loads and long distances involved in wood procurement under scarcity conditions.

Ecological implications

The ecological implications of fuelwood scarcity are very difficult to quantify, but the consequences are easy to predict. One implication is the use of crop residues for fuel, thereby reducing soil fertility, and accelerating erosion, deforestation and desertification. In areas where crop residues or dung are used as fuel, land is likewise deprived of much needed organic matter. The harvesting of trees for fuelwood removes the mantle needed to protect the land against wind and raindrop erosion. Where land is fragile, such a scenario is only a step away from desertification. Fuelwood removal from forests has been blamed for deforestation (Timberlake 1985, Eckholm et al. 1984). In 1983, it was estimated that world-wide 3.7 million hectares of forest and woodland disappeared every year due to clearing for agriculture and fuelwood provisioning, (de Montalembert and Clement 1983; FAO 1985). Recent estimates now put world-wide deforestation at 17 million hectares annually (Saouma 1991). The increased deforestation is blamed on the increasing populations that necessitate more land clearance for agriculture. It is also blamed on damage of temperate forests from industrial "emissions of sulphur dioxide, ozone and other industrial wastes" (Saouma 1990 p. 4).

Wood harvesting for fuelwood may also cause changes in the habitat resulting in species extirpations, that is, the species may locally disappear from an area. Extended extirpations result in loss of genetic diversity and eventually species extinction. The species most vulnerable to fuelwood gathering are detritus dwellers, and dry wood inhabitants such as wood borers, slugs, tree frogs, and at a higher level woodpeckers. On the other hand, tree planting (especially of exotic species) may alter growing conditions for indigenous species, particularly where specific regeneration conditions are involved. Thus tree planting may create its own environmental problems if not carefully planned. This is because besides providing fuelwood standing trees have many other tangible and intangible benefits.

The Value of Standing Trees

In addition to fuelwood, the other most important products obtained from trees are lumber, paper and pulp, plywoods, veneers, hardboards and particle boards. Indeed, in 1989 trade in wood and wood products alone stood at an annual value of US $91,000 million worldwide (de Montalembert 1991), making the wood processing industry one of the biggest in the world. In many developing countries trees also form the basis of small scale village construction, craft and tool industries on which the very poor depend for their survival. These village industries can add substantially to the national economies of poor countries. For example, in 1988 Kenya exported wood crafts worth K£ 1,939 thousand (Republic of Kenya 1989). Besides wood products, trees provide important food items such as fruits, vegetables, nuts and edible oils. Many trees are also tapped for their sap from which syrups, treacle and wines may be manufactured.

In addition to direct food products, trees provide a habitat for wildlife on which some tribes still depend for their protein needs. Examples of some sources of protein and other foods from the forests and hence trees are given by FAO (1983, 1984, 1986) and Falconer (1990). The very diversity and richness of tropical forest ecosystems is due to the numerous food products that different animal and plant species derive from trees. Moreover, in the rangelands of Africa trees are important and valued as sources of dry season fodder for livestock. The pastoral and nomadic tribes in Asia, Latin America and Africa have developed a knowledge of fodder trees and shrubs and the way these interact with the environment. For example, as early as 1958, Dougal and Bodgan described forty tree and shrub species that were important browse to the nomadic tribes of the Baringo area of Kenya. Most of the trees are native acacias. Chemical analysis of their leaf fraction found them to have very high crude protein and calcium content thus making these fodder trees an important item of diet for the rangeland animals. Besides fodder, trees also provide bee forage, the basis of the bee-industry in the dry lands of Kenya (Jaetzold and Schmidt 1982).

Several other tree products, ranging from coffee, cocoa, rubber, palm oil, coconuts, cashew nuts, kapok, and gum arabic (from which myrrh is produced) have been or still are important crops in the economies of developing countries. Poulsen (1982) gives a comprehensive list of the non-wood products of trees.

In addition, the importance and value of trees in various farming systems of the world has been highlighted by several authors under agroforestry systems descriptions (Fernandes et al. 1984; Nair 1989a; Michon and Bompard 1986; Fernandes and Nair 1986; Oduol 1986; Nair 1989).

Trees affect food production in several other indirect ways. Through litter fall, "nutrient pumps" and the nitrogen fixing capabilities of some species, trees add nutrients to the land. These properties of trees are the basis of fallowing or shifting cultivation (allowing land to rest for a few years before cultivation is resumed). Based on a review of work done at the International Institute for Tropical Agriculture (IITA) in Nigeria and several other tropical countries, Young (1989) gives the amount of nitrogen in litter fall to be between 45 and 600 kg/ha/yr. A system of soil fertility enhancement called "alley cropping" (a descriptive term for hedgerow intercropping) has been developed at IITA. Alley cropping regenerates soil fertility, provides green manure, firewood and stakes. It has a potential to conserve soils from rain and wind erosion and provide tree fodder depending on the tree species used (Kang et al. 1985). The role of trees in water conservation especially in the tropics is covered by Nye and Greenland (1960), Young (1976, 1989), and Nair (1984).

Like all green plants, trees play a big role in the atmosphere through photosynthesis, atmospheric oxygen and carbon dioxide are recycled. At the lithosphere level, roots of trees penetrate the ground, aerating it and thus ensuring survival of ground dwelling animals. Nair (1984) gives a good account of the nutrient recycling mechanism of trees and the degree to which they control water infiltration of soils, in addition to floods.

Other benefits from trees are shade that provides a cool environment to man, animals and plants. In the tropics, tree shade can be very important in crop and animal production systems. On the other hand, too much shade can constrain productivity and can lead to outbreaks of fungal and viral diseases on crops. Trees provide many products of which fuelwood, though important, is just but one. There are also many tree species requiring specific climatic and ecological conditions for best performance. Therefore, before embarking on any tree planting exercise, it is important to understand the biophysical and sociocultural environment of the study area.

What have been discussed so far are environmental and social consequences of fuelwood scarcity. These consequences are mere symptoms of the problem. Furthermore, they are often influenced by many compounding factors so that it is difficult to give a precise picture of what is happening. As a consequence, researchers have been involved in elaborate biomass estimations and fuelwood consumption measurements as a way of providing more reliable figures (Nichol 1983; Munslow 1989). But, as will be shown later, all these approaches have their inherent difficulties.

Biomass: An Indicator of Wood Scarcity

Many countries use remote sensing and satellite imagery to estimate their forest and woodland biomass production. Kenya and the countries of the Southern African Development Co-ordination Conference (SADCC) are among these (Munslow 1989). Remote sensing techniques, in combination with secondary data, are utilized to estimate biomass stocks and potential fuelwood yields of the region. Whereas such information is useful in showing changes in regional biomass resources at fairly close intervals, Munslow (1989) admits to the limitations of this method for it neither pinpoints sites of acute fuelwood deficit nor is it specific as to species involved and the reasons for biomass changes. The nature of the problem can only be ascertained by ground verification and detailed surveys.

Village Fuelwood Surveys

The necessity for basic village surveys can be seen from failures of several tree planting projects which have been undertaken in many parts of Africa, especially in the Sahel region, to specifically address fuelwood problems (Foley and Barnard 1984; Raintree and Lundgren 1985; Kerkhof 1990). Mnzava (1980) notes that failure of tree planting efforts in Tanzania is due to lack of knowledge of the rural people's requirements. He gives the example of the Maasai, a pastoral tribe, subsisting on mainly milk and blood that require no cooking. They take little interest in planting trees since a shortage of fuelwood is not a major concern to them. Tanzania is one of the African countries which started village afforestation projects as early as 1967 in anticipation of a future fuelwood deficit (Skutsch 1983, 1985). But by 1978, it had become obvious that very little was being achieved in terms of community fuelwood planting.

Wisner (1985) laments the common assumption shared by government agencies, donors and other rural development workers, that fuelwood shortages in all regions have similar causes and therefore, require similar solutions. He further feels most of the so called causes of fuelwood scarcity are over-generalized in the literature and are rarely derived from empirical data. He goes on to compare Kenya and Lesotho's acute fuelwood scarcity. Although both countries experience a fuelwood deficit, the causes for the shortages differ. In Lesotho, land is still mainly communal but men have long abandoned any attachment to it and instead work as migrant labourers in the South African mines. Wage remittances have increased the incomes of households in rural Lesotho to such an extent that they undermine agricultural production. As a consequence, many Basotho women can afford to buy fuelwood and dung and therefore have no incentive to plant their own trees. However, the continued employment of the Basotho men is precarious as it is dependent on decisions made in S. Africa.

In contrast, in Kenya "rapid privatization of land resources is the basic cause of both poverty and domestic energy problems" (Wisner 1985 p. 25). Here, land

privatization has created attitudes which form barriers to the commodity even where trees are still plentiful (Brokensha and Njeru 1977, Riley and Brokensha 1988). But there are areas of Kenya where people are using their social network of kinship and reciprocity to minimize fuelwood problems (Bradley et al. 1985). In other words, although fuelwood is scarce in both countries, the cause of the problem differ thus calling for different solutions.

Fuelwood and Tree Planting in Kenya

Kenya has been the focus of fuelwood studies. These were initiated by the Royal Swedish Academy of Sciences (The Beijer Institute) which had chosen this country for its pilot studies on Energy and Development Issues (Goodman 1984). Kenya's peculiar geography and demographical statistics make it very vulnerable to fuelwood changes; the country is 80% arid or semi-arid, the population is predominantly rural and concentrated on 20% of the landmass, and the bulk of cooking is done by fuelwood. Given its present population of 21.4 million and a growth rate of 3.34% per annum[6], will Kenya be able to meet its future energy requirements?

Fuelwood Supply

The Kenya Forest Department, the government agency charged with the responsibility of looking after the country's wood-based resources, tried to plan for the future by creating the Rural Afforestation Extension Scheme (RAES) in 1971. RAES now called Forest Extension Services Division (FEDS) (COFOPLAN 1991) aimed to ensure an adequate supply of fuelwood and poles by taking tree planting to the rural areas. Concern with fuelwood goes back a long time in the history of forestry in Kenya. As early as 1909, Hutchins (1909) could foresee a serious fuelwood problem and recommended the establishment of fuelwood plantations. By the 1930's there were many

[6]The figures are provisional 1989 census results from the Kenya Economic Survey 1991.

introductions of exotic tree species for fuelwood, soil conservation and what was then called hill culture. This has resulted in the establishment of more than 100 exotic tree and shrub species to date (Getahun 1989).

In 1977, the Forest Department recognized the seriousness of fuelwood shortages and carried out the first fuelwood survey (Akinga 1980) in the country. Later, Kenya's Central Bureau of Statistics and, more recently, the Beijer Institute, acting on behalf of the Ministry of Energy and Regional Development, were contracted to undertake the Kenya Fuelwood Development Project (KWDP) (Hosier 1985). The Beijer Institute recognized that fuelwood programmes should fit into the social, cultural, economic, religious, political, and legal framework of the local area. Following the above surveys, it became clear that the Kenyan rural household is dependent almost entirely on wood biomass for its energy requirements (O'Keefe and Raskin 1985; Hosier 1984). The surveys show that fuelwood supplies 74% of the total energy consumption in the country and that 70% of urban and 95-100% of the rural populations rely on wood energy (MENR 1985; Republic of Kenya 1991).

Kahuki (1979) estimates Kenya's fuelwood consumption for the year 1976 to be 15 million cubic meters (raw wood); this figure is expected to rise to 30 million cubic meters by the year 2000. Kahuki's estimates are based on commercial sales of firewood and charcoal by the Forest Department. He ignores the all-important fuelwood used by rural populations. On their part, O'Keefe et al. (1984) put the country's total fuelwood stocks at 935 million tonnes. Seventy percent of this wood stock is found in the sparsely populated arid and semi-arid rangelands. They further reckon production from natural forests to be 10% of the woodstock while cropped lands produce 10%. It is predicted that by the year 2000 there will be a shortfall of 30 million tonnes of wood (MENR 1985). Table 2.1 gives Kenya's fuelwood supply demand projections up to the year 2000. Foley (1985) postulates that 40% of all fuelwood consumed in Kenya comes from the farmlands. When proximity to users is taken into account, on-farm fuelwood production becomes the single most important source.

Table 2.1. Kenya's wood resource supply demand projections in millions of metric tonnes.

	1980	1985	1990	1995	2000
Supply:					
Yields	13.1	12.6	10.7	7.8	5.2
Stocks	5.7	6.6	9.8	18.8	11.3
Total	18.8	19.2	20.5	26.6	16.5
Demand	18.8	24.5	30.3	38.6	47.1
Shortfall	0.0	5.4	9.8	12.0	30.6

Source: MENR 1984

The Beijer Institute's study (Hosier 1985) concentrates in areas of high agricultural potential and heavy populations, namely, Kakamega, Kisii, and Muranga Districts of Kenya. Its surveys show biomass to be more plentiful in these regions (Engelhard et al. 1986; Hosier 1985). The "paradox" is that it is in these areas with much tree cover that fuelwood is most scarce. In fact, Bradley et al. (1985) record an inverse relationship between wood biomass cover and human population in Kakamega District. They also observe a tendency to replace natural vegetation with planted trees as the population increases. In some areas of Kakamega up to 38% of farms have been planted with trees. However, this extensive biomass cover masks a very serious fuelwood deficit because the planted trees are reserved for pole production. Additionally, the Beijer Institute's study shows the futility of using biomass cover as an indicator of fuelwood availability because as it was shown Kakamega with much tree cover nevertheless experiences fuelwood shortages.

Supply in Tribal Communities

Other researchers working on different aspects of rural life in sparsely populated areas of Kenya have also noted the fuelwood problem. For example, Brokensha and Njeru (1977), Brokensha and Riley (1978) and Riley and Brokensha (1988), working in Mbere are initially concerned with the effects of land adjudication[7] on the Mbere community. They discern a relationship between land adjudication and the community's access to firewood resources. There is a reduction in free access to fuelwood as individuals acquire title to their land holdings. Barnes (1984), working in the Kisii highlands of Nyanza Province shows that, although individualization of land has a negative effect on the availability of fuelwood by limiting access to land on which one can collect the commodity, it motivates households to plant trees for hedges and boundary markings. In this way, land adjudication and individualization has produced a positive effect.

[7]Formally communal land was apportioned to individuals and titles issued.

Haugerud (1984) demonstrates the moving of wood across ecological zones, with the agriculturally low potential areas of Meru, in the Mt. Kenya highlands, supplementing the high potential zones. Hosier (1985) attributes the difference in fuelwood use across ecological zones to higher population density in the highlands. Ensminger (1984) compares wood use among the pastoral and sedentary, Galole Orma tribe of northern Kenya and finds that the latter use 70% more wood than the former. The increase in wood use is attributed to a change in diet, cooking needs, and lifestyle as the population becomes more sedentary. Perlov (1984) and Ellis et al. (1984) find a similar trend among the pastoral Samburu and Turkana respectively. However, Ellis et al. (1984) find a positive interaction between the pastoral Turkana and the woody resources of the ecosystem. They also demonstrate a relationship between firewood use and household size. There is an implied relationship between wood availability and consumption. The average Turkana uses 1.14 Kg of fuelwood per day. Generally, the nomadic people's fuelwood consumption depends very much on diet. Jensen (1984) finds this same trend among the Amboseli Maasai. During the wet season when milk is plentiful very little fuelwood is consumed but during the dry season when the diet consists of maize meal which has to be cooked, wood consumption increases.

The foregoing discussion shows that consumption and use of wood greatly differs in various communities thus making it hard to find a general planning formula that would be applicable to the whole country. Each community has to be studied to find out its fuelwood needs. With more than thirty major ethnic groups in Kenya, this is indeed a difficult but necessary undertaking.

To meet the projected fuelwood shortfall, the following policies have been instituted:

Firstly, the Kenya Forest Department has been reorganized administratively to strengthen RAES and reflect the importance attached to community forestry and agroforestry (Appendix 1). Secondly, a Ministry of Energy and Rural Development has

been created and given the mandate to oversee production of fuelwood and other energy products.

Gender Issues in Community Forestry

A discussion of fuelwood is incomplete without discussing gender issues in the management of wood based resources. This part of the review will therefore cover these concerns.

Early writers and researchers of gender issues and forestry in the third world were concerned with documenting the extent to which women were involved in various forestry and forest related activities that impacted on the environment. Women were depicted as repositories of knowledge regarding forest products use and growing pattern, producers of trees, vendors of items manufactured from forest products, and decision makers regarding the management of forest resources (Molnar 1991). Evidence for some of these early discussions on women's environmental protection and nurturing come from case studies or studies of donor funded projects in developing countries. Fortmann and Rocheleau (1985), for example, dispel the myth that women are not significantly involved in tree production and use. They cite examples from Nepal and the Sahel region where women are the main collectors of fuelwood. They elaborate on the "Plan Sierra" in the Dominican Republic where, due to their efficiency and patience, women have increasingly taken over tree nursery management.

Fortmann and Rocheleau (1985) illustrate women's environmental consciousness by using the Chipko movement of India as a case study. The Chipko movement is well known for its militant women who prevented the destruction of forests in the foothills of the Himalayas (Shiva 1989). Fortmann and Rocheleau further cite a workshop organized by the Kenya Environment and Energy Non Governmental Organizations Association (KENGO), in which women participants are said to have had a superior knowledge to that of men regarding woody species on the farms. They particularly stress the differing

needs and rights of women and men over trees. The importance of women's groups in tree planting and the environmental movement is further shown by Kenya's Green Belt Movement which has started over 850 greenbelts and 63 tree nurseries (Maathai 1988).

Hoskins (1988) records that the Sierra Leonian women were able to name up to 31 products they gathered from the bushes while men could only name eight. She suggests use of women's superior knowledge of trees as a basis for programmes on germplasm selection and improvement. Rocheleau (1988) concentrates on elucidating women's participation in agroforestry and farming systems. She is particularly concerned with how agroforestry reflects "the prevailing sexual division of labour, skill, responsibility, and control within the larger society" (Rocheleau p. 149). She emphasizes the gender based differences in legal status, use of and access to space and type of activities, which have a bearing on what type of plant can be raised, managed, harvested and used.

However, culture sometimes has a negative effect on women's decision making, use, and control of resources at their disposal. For example, in Kenya and Sierra Leone women are prevented by men from planting trees because men fear women will lay claim to land (Hoskins 1980; Chavangi 1984). Chavangi (1984) further states that women's engagement in tree planting is viewed as a direct challenge to their husbands' authority. A set of taboos are in place to effectively prevent women from planting trees. For example, it is believed that if a woman plants trees she would become sterile[8]. Preventing women from planting trees means they have no control over trees on their husbands' lands. This has an effect on their ability to provide fuelwood for household energy. Thus, in Kakamega Kenya, the numbers of trees available on any holding has little bearing on firewood availability since cultural constraints and the complicated resource allocation systems prevent women from having access to trees on their

[8]Motherhood is highly valued so that such beliefs are effective in ensuring compliance.

husbands' farms (Chavangi 1984, Engelhard et al. 1986). This example from Kenya is widely quoted but is it typical of all Kenyan women? It should be remembered that Kenya is a country with more than 30 ethnic groups, each with its social and cultural norms.

The problems and challenges of gender issues in fuelwood provisioning and tree planting with their effects on the environment are of interest to several multilateral and bilateral donor agencies. Among the most important supporters of environmental programmes involving women are such bodies as the United Nations Food and Agricultural Organization (FAO), the International Labor Organization (ILO), the United Nations Environmental Secretariat and the International Union for the Conservation of Nature (Molnar 1991). Through Cecelisk (1985, 1987), the ILO has documented the time it takes women to secure firewood. Williams (1983) devoted a whole thesis to the social organization of firewood procurement by both genders as an example of sexual division of labour. In most societies firewood gathering is a female activity. Williams attributes this to the low status of the activity and to the low value of the resource. Fuelwood is not highly valued because it is collected by women on a daily basis. Activities that are performed on a daily, routine basis are less highly regarded than activities that are done on a less frequent and less predictable basis. This is not to say that fuelwood is not important. As we have seen, it is the primary energy source of cooking for many rural societies whose very survival depends on it.

Firewood shortages increase time women spend in wood collection and reduce time available for other household chores. Extreme cases where women spend up to 35 hours per week in collecting firewood are recorded for the Sahel regions (Hoskins 1980). It is now becoming routine for governments to document women's farm labour activities. In Kenya, for example, a recent rural labour force survey (RLFS) carried out during one week in 1988 found that women spent 3.9 hours and men 0.7 hours per week on fuelwood gathering (Republic of Kenya 1991). Not only does fuelwood scarcity affect

time distribution, it also increases the distances travelled to collection points and the loads carried by women. Fuelwood loads carried by women may range from small handfuls of twigs to loads as heavy as 15-45 Kg (Ki-Zerbo 1980; Cecelski 1987).

Williams (1983) discusses the theoretical aspects of fuelwood scarcity and concludes that as fuel becomes scarce men would become involved in its gathering especially if it offered them an opportunity to earn cash. Cecelski (1985) notes that as fuel becomes scarce and more of a commodity, men become more and more involved in its acquisition, often using bicycles and carts. Whereas men's involvement in fuelwood gathering in a society where women are normally the gatherers may imply a recognition of the scarcity and an active participation in providing solutions it could also mean a usurping of the women's responsibilities because of the monetary and status gains involved.

The Kakamega example, already discussed, shows how, where fuelwood gathering is an institutionalized female responsibility, scarcity or none, women have to cope as best they can. In Kakamega, planted trees form 52% of all woody biomass (Engelhard et al. 1986) and yet women face fuelwood shortages. Apparently, Kakamega women have no right to harvest planted trees on their husbands' land holdings without permission from the latter. They can only collect fuelwood from fallow lands and communal lands. Due to the increasing populations, the fallow lands are no longer available whereas after land adjudication, communal lands have disappeared. For the time being, social networks of kinship and reciprocity ensure that families are adequately supplied with wood in times of great need such as funerals. However, purchasing fuelwood is the only solution available to the women at other times.

Beliefs about Trees and Tree Planting Practices

Whether women engage in tree planting for fuelwood provisioning or not will vary from group to group and country to country depending on people's culture and beliefs. Beliefs and feelings will often determine how a person behaves towards an object or towards the natural environment (Fishbein, 1963). Wagner (1949) working among the Bantu of North Kavirondo[9] found a complicated system of beliefs and prohibitions that governed the people's way of life. Failure to observe some of the prohibitions was regarded as offensive to tribal spirits and resulted in one performing cleansing ceremonies to bring about appeasement of the spirits. These rules or prohibitions extended to which animals or plants one was allowed to use, eat or associate with. For example, Wagner (1949 p. 198) notes that "Large fig-trees (*omukuyu*) and other shady trees with a big crown and rich foliage are . . . considered to be the occasional abodes and meeting places for ancestral spirits and therefore must not be cut down". He further notes that "if in a succession one sees two fig-trees, the leaves of which are hanging down, the harvest of one's crops will be plentiful" (Wagner p. 206). Similar beliefs are to be found in different parts of the developing world. Agarwal (1986 p. 53), for example, notes that "in Senegal, cashew trees are believed to be the abodes of ghosts and there are similar associations with the banyan tree in north India". Wagner (1949 p. 206) further observes the belief among the Bantus of North Kavirondo that "if an owl cries near a homestead, one of the persons living there will die soon". According to Skutsch (1985) this belief is also found among some Tanzanian tribes. As a consequence of this belief, the cries of an owl produce fear. These birds may also be chased away or their abodes destroyed. It can thus be seen that taboos and superstitions

[9]Bantu is an ethynonym that classifies under one group tribes whose word for man ends in the suffix "-ndu" "-tu" or "-to" namely, "Mtu" "Muntu" "Omundu" "Omoto" (Makila 1978). Thus the Abaluhya whose word for man is "Omundu" belong to the Bantu group. Kavirondo on the other hand is a name used by the British colonialists to describe the present day Abaluhya.

negative or positive effect on the flora and fauna. These beliefs vary with respect to species and country, region or tribal group involved.

To summarize, the review presented here illustrates the problems of fuelwood procurement for household use by rural people. Literature from various parts of the world that focuses on tribal communities and women's daily burdens and struggle of wood provisioning are highlighted. There is special emphasis on studies conducted by the Beijer Institute in Kakamega District of Kenya because these form a basis for some of the hypotheses presented in the next chapter.

CHAPTER 3

HYPOTHESES

Several questions arise from the literature review and initial reconnaissance of the study area. Are some regions of Funyula actually suffering from wood shortages? If so which communities, landscape units and household groups are most vulnerable? The people of Funyula are related to the Kakamega people and it would be interesting to compare some of the findings from Kakamega with those from Funyula. One of the most important findings from Kakamega concerned women and tree planting (Chavangi 1984; Bradley et al. 1985). Is there a difference between the roles of men and women in the extent to which they contribute to tree planting and regeneration? Is there a gender based difference in perception of fuelwood scarcity? Are there any beliefs or taboos influencing the extent to which tree planting is taking place in Funyula Division?

This study of Samia communities seeks to ascertain relationships between a range of variables. Based on first hand information, the initial reconnaissance to explore the fuelwood shortage, and subsequent data collection and interviews, five sets of hypotheses have emerged. From a Kenyan context, these hypotheses are useful and are largely untested. Moreover, they are more relevant to the local situation in producing more responsive land management policies in the area that can come from research such as this.

Fuelwood Consumption

Hypothesis 1a. Regional Fuelwood Consumption.

There is no difference in fuelwood consumption between households in the two locations of Samia North and South.

Hypothesis 1b. Village Fuelwood Consumption.

There is no difference in fuelwood consumption between the villages studied.

During the pilot study, undertaken between June 11 and August 10, 1990, the impression obtained from informants and direct observations of the landscape and activities of people in Samia North and South[10] was that the south is facing a greater fuelwood shortage than the north. The species used for fuelwood in the south were the thorny *Acacias.* In a few instances whole trees were being harvested for fuelwood. The presence of fuelwood at the most important market in the south tended to confirm this impression. These being some of the indicators of fuelwood scarcity, it was assumed that this area was facing firewood scarcity. On the other hand in the north there was charcoal making activity and wood usage behavior inconsistent with scarcity. Interviews of the government officers working in the area also reinforced this view (Chapter 7).

It is normal for those who have more of a resource consume more than those who have less of it. If, indeed, there is a difference in fuelwood availability between the north and the south, consumption of the resource should differ to reflect this difference. Proof of this hypothesis would lead to the second hypothesis on perception of scarcity. Data for testing hypothesis 1b was gathered by measuring fuelwood used per person per day for each of the 100 households in the four villages studied. The mean weight of fuelwood consumed per person for the four villages is compared using analysis of variance procedure. Data for the two villages in Samia North Location and Samia South are also compared using the student t-test.

[10]The division of the area into north and south was based on the administrative division of Funyula into the two Locations of Samia North and Samia South.

Hypothesis 2. Perception of Firewood Scarcity

There is no difference in perception of fuelwood scarcity between heads of households in Samia North and South.

This hypothesis derives from the first one. If people are using less fuelwood in one region than another, then their perceptions about resource availability should differ. This could be tested by giving a questionnaire that directly asks whether the people concerned perceive a shortage or not. But as we have seen from the literature review and the nature of fuelwood, shortages manifest themselves in the long distances travelled, the longer hours taken to gather the wood, the type of wood used, switching downwards to crop residues and dung or upwards to use of higher fuels such as electricity and gas.

Woodfuel may also become a commodity or it may cause changes in the social relations in fuelwood provisioning. For example, men may take over where previously women were collectors (Argawal 1986; Ceceliski 1987) and in extreme instances changes may include tree planting to provide for fuel (Soussan 1991, Williams 1983). All these factors could be used as measures of perception of fuelwood scarcity. In order to test this hypothesis, a questionnaire survey is used. To compare between households in the two sets of villages in the north and south of the division a chi-square test is used.

Hypothesis 3. Gender and Wood Scarcity

There is no gender difference in perception of fuelwood scarcity.

In most societies it is mainly women who gather and transport fuelwood (Eckholm 1979; Hoskins 1979a; Williams 1983; Ceceliski 1985). It logically expected that women should be the first to notice changes in fuelwood availability as distances to fuelwood collection sources increase.

The increase in scarcity of fuelwood determines which coping mechanisms are instituted. Some of the coping mechanisms are switching to other fuels, cooking fewer meals, purchasing fuelwood or planting more trees. On the other hand, how men view

fuelwood scarcity is very important because they often control decision making on matters pertaining to land and cash resources that would enable some solutions to the fuelwood problem to be realized. On the basis of the foregoing balance between gender roles, it is hypothesized that there is no gender difference in perception of the extent of fuelwood scarcity.

The same section of the questionnaire used in general perception of fuelwood scarcity between the two locations of Samia North and South will be analyzed for gender.

Hypothesis 4. Gender and Tree Planting

There is no gender-based difference in tree planting activities.

Women have variously been depicted as tree planters (Fortmann and Rocheleau 1985; Rocheleau 1988), and environmental protectors as evidenced by the Chipco Movement in India and The Green Belt Movement in Kenya (Molnar 1991). Yet as Fortmann (1985) observes, tree planting boils down to a question of land and tree ownership. Chavangi (1984) and Bradley et al. (1985), for example, reported that women in Kakamega District of Kenya were not planting trees because of the use of cultural taboos devised to make sure women did not lay claim to land through their tree planting activities. Dankelman and Davidson (1988) note that in Gambia and Senegal formal entitlement programmes giving rights over land to male household heads reduced women's interest in tree planting. Would this be true of the women of Funyula? As stated before, the people of Funyula belong to a subtribe of the Abaluhya as do the inhabitants of Kakamega. The question is to find out whether there is a gender difference in tree planting among the people of Funyula Division and, if so, why?

Data for the testing of hypothesis 4 were obtained by comparing the data by gender using the chi-square test (Chapter 8).

Beliefs about Trees

In the study area, cultural beliefs and taboos influence tree planting.

Effects of cultural beliefs are not stated in a statistically testable form because the subject is sensitive and time and financial resources did not allow for enough data for statistical analysis to be gathered. However, this subject is important to an understanding of the tree planting practices. It was therefore felt necessary to investigate some aspects of it.

From the literature review instances of taboos and cultural beliefs influencing people's behaviour towards trees have been cited. Skutsch (1985), for example, documents taboos to do with owls among the villages she studied in the Republic of Tanzania. In one village people feared owls because they represented spirits. She notes that all trees around houses were removed. Noronha (1980) attributes the dislike of trees by Sukuma people of Tanzania to the association between trees and *Quelea quekea* birds; these birds are a big grain pest and have caused famines in the past. Chavangi (1984) and Hoskins (1984, 1988) claim that taboos are used to prevent women from planting trees in order to stop them from laying claim to land. According to Chavangi (1984) the Abaluhya of Kakamega believe that if women plant trees, they would become sterile, or their husbands would die. The inherent fear of death ensures the observance of such prohibitions. In addition, *The Busia District Development Plan 1983-88* (Republic of Kenya 1988b) notes failure of people to plant *Chlorophora excelsa* because of the belief that those who planted this tree would come to some harm.

The degree to which taboos and cultural beliefs influence tree planting could be judged by asking directly about such beliefs. But first it had to be established that the said beliefs existed. For instance, did villagers believe in cutting down trees to chase away owls? Did they fear planting the *Chlorophora excelsa* tree? Were women prevented from planting trees? All these questions have to be formulated in such a manner that they do not threaten the people's sensitivities.

This brief chapter has presented the four hypotheses of the study that will be statistically tested. Rationale for each hypothesis were also given. The question of cultural taboos and their impact on tree planting will be explored. The next chapter gives the methods of gathering data to be used to support or refute the aforementioned hypotheses.

CHAPTER 4

RESEARCH METHODOLOGY

Several data collection techniques were used in this study. Rapid Rural Appraisal (RRA) methodology (Chambers 1985, Conway 1985), was used to conduct the pilot study and generate working hypotheses. RRA is a data gathering method used in development research to acquire information on the type of future research or development to undertake. It consists of use of archival information such as government statistics, annual reports, maps of the study area and historical records, to provide insight into farming practices of an area. RRA saves time and suggests areas of further inquiry. It is more valid when used for physical and environmental factors but less useful for biological and socioeconomic systems. Additional information on the physical and environmental factors may be obtained from secondary data sources e.g., rainfall records, soil types, maps etc., and direct observation.

For the RRA exercise, the author joined the Divisional Agriculture Officer (DAO), the forester and a horticulturist on a two day tour of the division. This tour was followed by a meeting with all the agricultural extension officers (working in the sublocations) at one of their monthly meetings.

Background information was collected using the Forest Department's annual reports, the *National Development Plan 1984-1988* and *1988-1992* (Republic of Kenya 1983b and 1988b), *Busia District Development Plan 1983-1988* and *1988-1992* (Republic of Kenya 1983a and 1988a), the *Kenya Economic Review 1991* (Republic of Kenya 1991) and the *Farm Management Handbook of Kenya* (FMH) by Jaetzold and Schmidt (1982). Kenya topological maps 101/1 (Busia), 101/3 (Samia) and 101/W/4 (Sigulu) at a scale of 1:50,000 were used to prepare a base map from which other maps showing roads, infrastructures, and the villages under study (Figure 4.1), rainfall (Figure 4.2), and agroecological zones (Figure 4.3) were made. Other variables of interest were

Fig. 4.1. FUNYULA DIVISION: ROADS AND INFRASTRUCTURES

Source: Kenya topological maps 101/1 (Busia), 101/3 (Samia), and 101/W/4 (Sigulu). British Directorate of Overseas Surveys, 1970 D.O.S. 423 (Series Y731).

Theresa C. Aloo

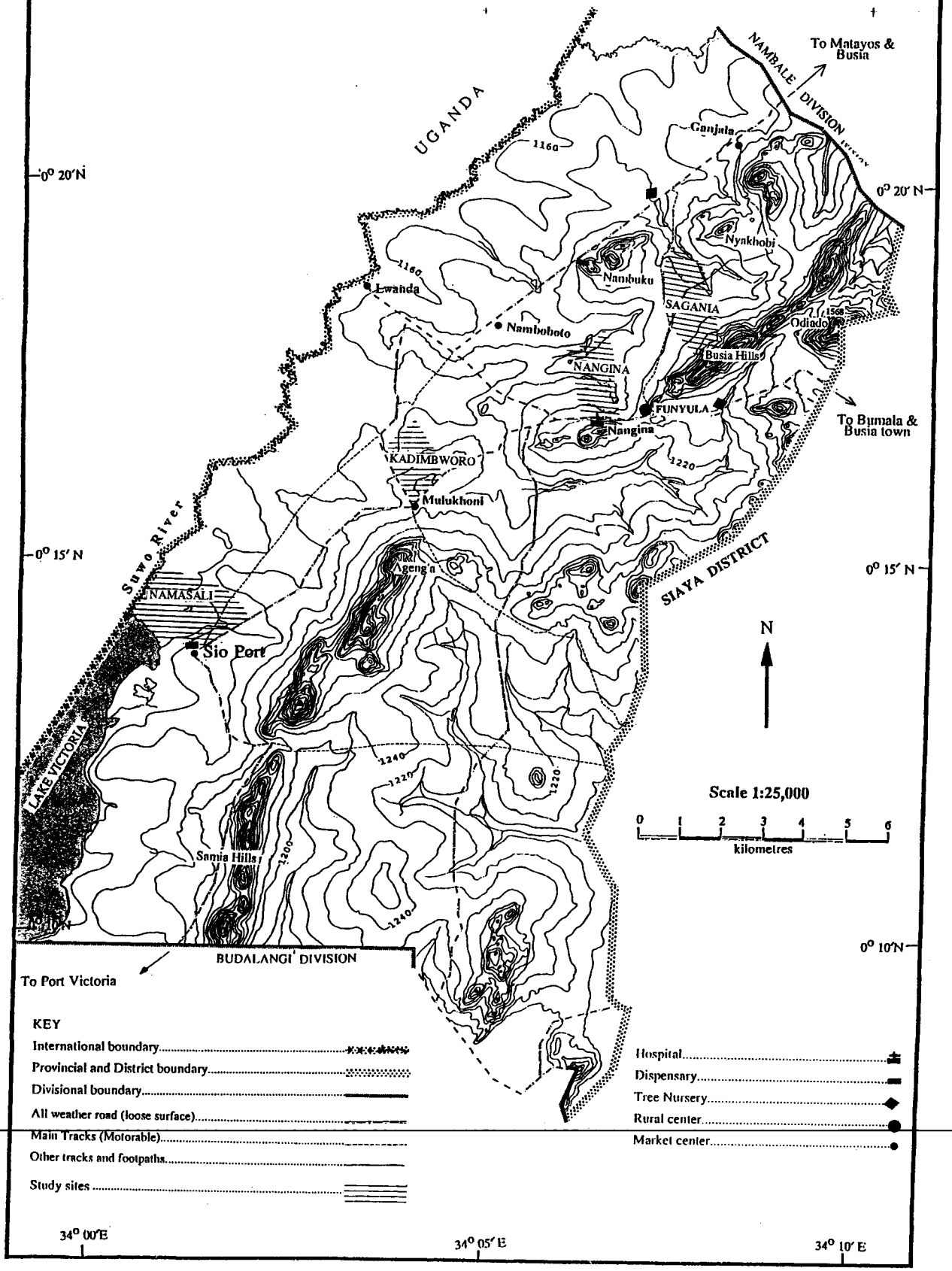
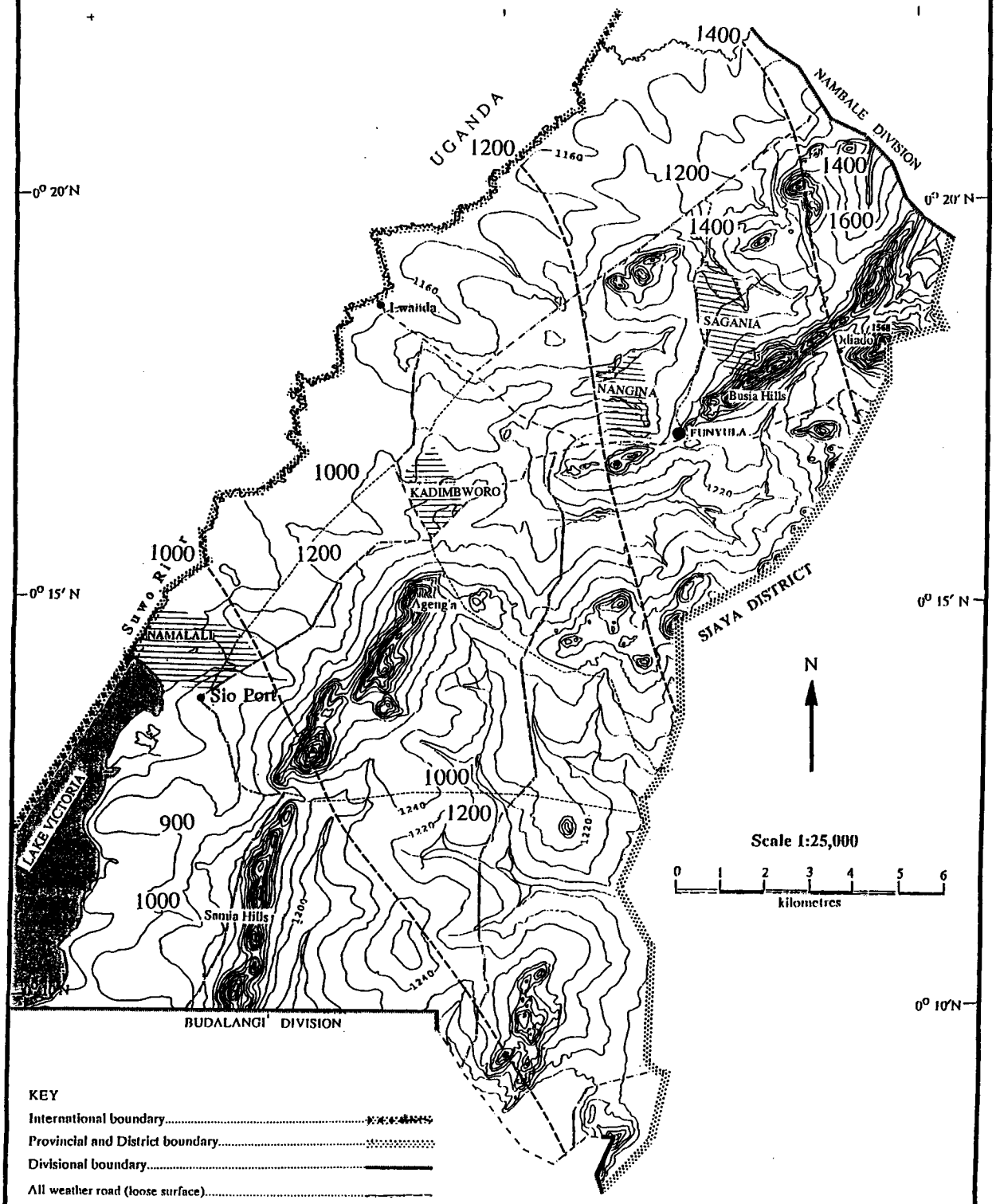


Fig. 4.2. FUNYULA DIVISION: RAINFALL MAP

Source: Kenya topological maps 101/1 (Busia), 101/3 (Samia), and 101/W/4 (Sigulu). British Directorate of Overseas Surveys, 1970 D.O.S. 423 (Series Y731).

Theresa C. Aloo



KEY

International boundary

Provincial and District boundary

Divisional boundary

All weather road (loose surface)

Main Tracks (Motorable)

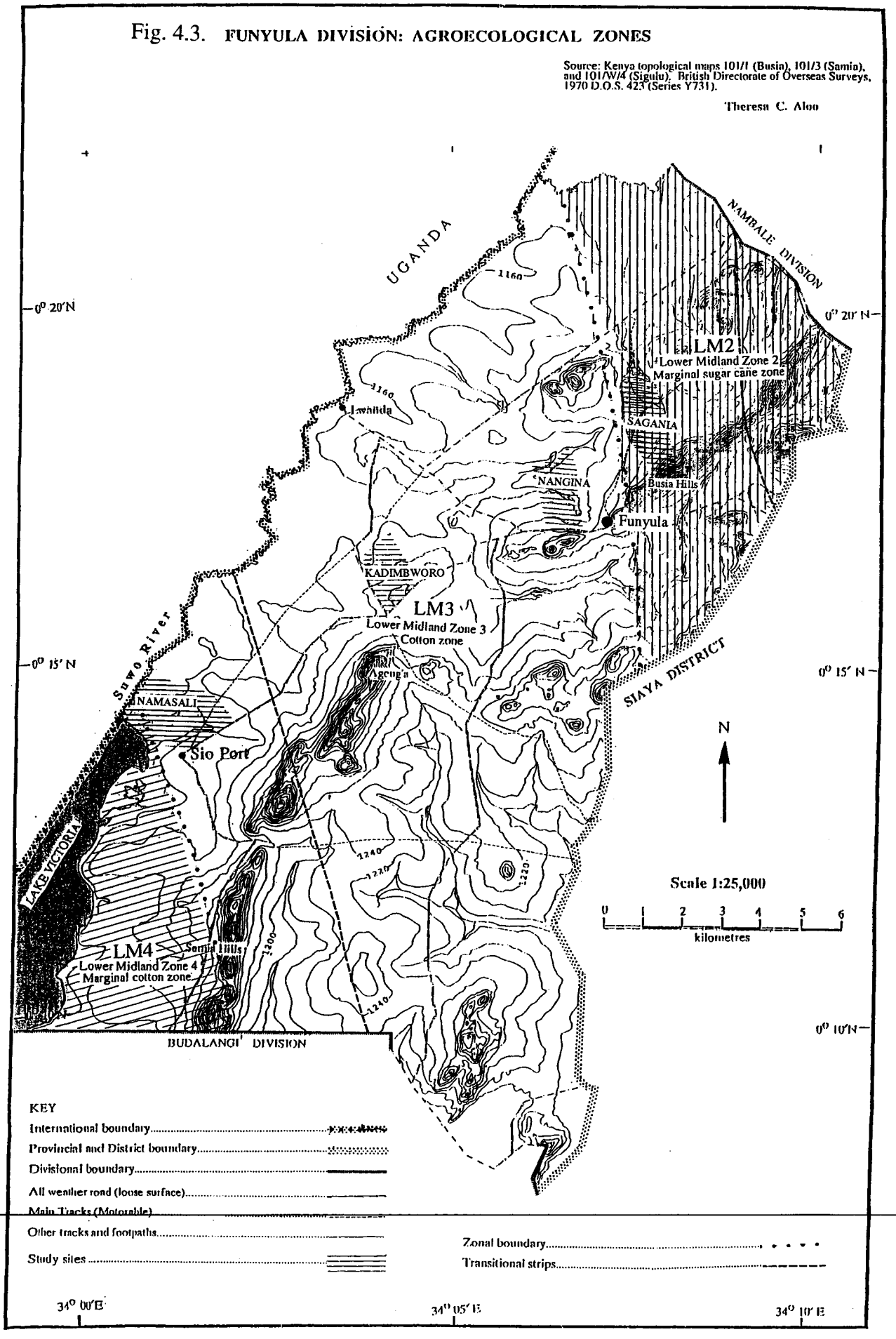
Other tracks and footpaths

Study sites

Rainfall in millimeters 900 1000

(source Jaedzold and Schmidt 1982)

Fig. 4.3. FUNYULA DIVISION: AGROECOLOGICAL ZONES



species composition on fallow and cultivated lands. Attention was paid to crops growing under dominant trees.

Finally, a survey study was conducted using a structured questionnaire to gain quantitative information on the study population and help in testing the hypotheses on regional perception of firewood scarcity, gender and wood scarcity, gender and tree planting and cultural beliefs and tree planting practices. During the administration of the survey questionnaire, fuelwood consumption studies were simultaneously carried out among one hundred households that managed to supply firewood to be weighed.

To summarize, the methodology used consists of RRA, a pilot study, that comprises of gathering background information from maps and published data, in-depth focused and unfocused informant interviews, perusal of archival data, and direct observation of the biophysical and environmental variables. Firewood consumption measurements and a structured questionnaire survey form the major part of the study.

Assessing Fuelwood Consumption

Basic problems such as assessing the amount of fuelwood used by rural farmers is a big challenge. A variety of approaches have been used to assess fuelwood use by rural farmers. Fleuret and Fleuret (1978), working in a Tanzanian peasant village, asked household members to display the quantities of firewood equivalent to what was actually used in any one week. The lengths and circumferences of these pieces were measured and used to calculate the volume of wood consumed. Onyebuchi (1986) carried a pre-weighed bundle of wood (25 Kg) which he showed to respondents who were then able to say how many such bundles they used in a week. Mung'ala and Openshaw (1984), measured bundles made available by respondents and asked how long the wood lasted. They applied a correction factor to the initial weight of the fuelwood by taking a sample, air drying it, and reweighing it to obtain the moisture content of the wood. Skutsch (1983, 1985) used a recall method to estimate consumption. The respondents were asked

to state how many bundles of wood the household used in each main season. A simulated bundle was shown to respondents in some villages while in others, the actual bundles being brought in from the fields were weighed. Skutsch also used a correction factor for moisture content. More recently Maikhuri (1990), working in villages in India, weighed wood which a household head indicated to last one day. After a day's cooking the wood that remained was reweighed. Maikhuri also recorded, as far as practicable, the wood species involved. He saw this as an important step since wood species differ in density, moisture content and thermal capacity.

In this study, to measure firewood used per person per day, Mung'ala and Openshaw's (1984) method was used, in a slightly modified form. A 50 Kg hand spring balance, and a sisal strap were used to weigh one day's supply of fuelwood. The most abundant wood species in the bundle was recorded. The following day the remaining wood was reweighed[11] and the number of people for whom meals had been made recorded. From these weights the amount of firewood used by one person per day was calculated. Where there was no wood in stock, a return visit was scheduled when the household would collect firewood. In all, 100 households had their fuelwood measured.

Informant Interviews

Key informants were chosen on the basis of reputation for being knowledgeable. They also had to have lived in the area most of their adult life. Several other individuals, herein referred to by their official titles or as interviewees, were also interviewed. These consisted of heads of relevant government ministries, traditional tool makers, charcoal makers, and ordinary peasant farmers. The latter consisted of both men and women.

[11]It is possible that the scheduling of wood measurements may have influenced consumption but this was not verified.

Interview Questions

The following questions formed the core of what was asked during the interviews. These were varied to suit the particular individual being interviewed.

Generally, would you say there is fuelwood shortage in this area?

What factors contribute to shortage or availability of fuelwood?

Are farmers in the study area planting any trees?

If yes, for what purpose are they planting these trees?

From where are seedlings obtained?

Which tree species are planted most?

Who is planting trees?

Are women allowed to plant trees?

Are they allowed to cut down trees?

Would you say the number of trees on the farms have increased or decreased?

Are there any trees that people in the study area would not plant at all? If yes, which trees, and why would they not plant them?

List any other reasons that might prevent people from planting trees on their farms.

Have people in this area always planted trees or is tree planting a new introduction?

Would you plant the Mvule tree?

Are owls bad to have around a homestead? If so why?

Would you remove trees frequented by owls?

Design of Questionnaire Survey

Villagers, herein referred to as respondents, were interviewed using a structured questionnaire (Appendix 2). The design of the questionnaire followed closely recommendations of Jackson (1988) and Babbie (1973). The questionnaire was divided

into five sections consisting of questions on the general household, the farming system used, consumption of fuelwood, tree planting practices, and finally, on the background of the respondent.

A household's tree planting practices were measured through the use of questions on actual tree planting, and beliefs about trees. Since most people in the study were illiterate, questions were constructed as simply as possible. Dichotomous responses of yes/no and agree/disagree were preferred over complicated responses because the translation of such concepts as strongly agree, agree, disagree and strongly disagree did not have equivalents in the vernacular language and tended to confuse respondents.

Respondent Selection

Sampling and interviewing were done at four sites: Nangina, Sagania, Namasali and Kadimbworo villages in Funyula Division. Accessibility was a main factor in the choice of these sites because the author depended on public transport to get from one village to another. Public transport is found on only one of the all-weather roads that crosses diagonally through the area from Bumala to Sio Port. Irregular country buses and *matatus*[12] are the main means of transport on this road. Care was taken to select villages that were ecologically, socially and demographically representative of the area. The most remote village is Sagania, located four to five kilometers from the main road.

The respondents were chosen randomly. A list of household heads in each village was drawn up using the services of a resident research assistant and the village headman. From this list, 30 household heads were randomly selected. A further ten households heads were randomly selected and put on a separate list to be used as replacements in case contact with a target respondent failed.

[12]Small trucks or vans used for public transport in many parts of Kenya.

The Sampling Frame

The household was the sample unit and the head of the household the target respondent. It was assumed that the male household head made decision about the farm since men were the registered land holders. On the other hand the female members were assumed to make decisions about the running of the house, food provisioning and the gathering of fuelwood. Therefore, the sample consisted of equal numbers of randomly selected men and women.Where marriage was polygamous, the most senior wife was interviewed.

Direct interviewing and non-participant observations were selected over other methods of data collection because of the poor state of telephone and postal communication services in rural Kenya, and because of the high rate of illiteracy among respondents. Direct interviewing was also preferred due to the amount of information it could yield.

The three research assistants were university undergraduates who resided in these villages and knew many of the residents. They were able to introduce the author to different respondents. They also informed respondents of the intended interview and scheduled a convenient time. Furthermore, they helped in the weighing of fuelwood mentioned earlier. The interview itself was conducted by the author. The survey was administered to 122 household heads. Only two visits were made to any one household after which the case was considered unsuccessful.

Limitations of Methodology

Quantitative survey research methodology in developing countries has been the subject of much criticism. It is therefore important to review some of the problems involved in such research.

Chambers (1983) terms some academic surveys as "long-and-dirty" due to length of time spent in the field and as well as the length of the questionnaires themselves. On

the other hand, Ijomah (1973 p. 98) terms survey research in Africa as "mere academic colonialism". He and O'Barr et al. (1973) contend that in rural African communities division of labour is simple and role differentiation underdeveloped, making the communities more or less homogeneous in social characteristics. It is argued that in such a setting survey research is of little value. The survey population for the present study was homogeneous in terms of ethnicity, language, religion, culture, and to some extent occupation.[13] To overcome some of the difficulties inherent in quantitative survey, a combination of methods was used in these studies i.e., Rapid Rural Appraisal, questionnaire survey, direct observations and measurements. The methods were also used because of their complementarity.

Errors in data collection can arise due to interview errors or sample bias. Interviewees may give a response because they think that is what is expected of them or they may wish to represent their community positively. Such incorrect responses introduce bias in the results. The questions about landed property and livestock holdings may have introduced errors because of a tendency among rural people to hide what they possess.[14] It is analogous to asking someone his/her bank balance. Such questions are threatening. Questions about landed property were particularly difficult for female respondents because these are not land holders.[15] Female interviewees were, therefore, allowed to consult other members of the household about landed property. Land being a very sensitive issue, no effort was made to confirm the area data given by respondents by field surveying.

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[13] Of the respondents, 77% were peasant farmers while the rest were part-time farmers (Table 6.5).

[14]There is a belief that counting animals and children invites "the evil eye" i.e. jealous people who may harm one's children or animals.

[15]Customarily, women do not own land and thus, under cultural norms, they are not supposed to discuss land matters. In one village some men reported to the chief that their wives were being questioned about land matters. They only co-operated after being reassured of the safety of their lands.

Errors may also arise due to poor rapport between interviewer and respondent where the latter may not have understood a particular question. Every effort was made to minimize such interview errors. In addition, respondents were assured of anonymity.

Sample Bias

In using purposeful sampling of villages, great care was taken to include all households in each of the four villages covered in the study. Consequently, under the simple random sampling technique used to draw sample units, all households in the four villages had an equal chance of being selected.

Final Operation Strategies

Before the field research component of the study was undertaken in the summer of 1990, the U.B.C. ethics committee gave its approval. Permission to conduct research in Kenya was obtained from the office of the President of the Republic of Kenya. This is a compulsory requirement for anyone registered in a foreign university or not affiliated with the in-country research institutions. A permit (Appendix 3) was issued and this enabled me to interview government officers and to have access to relevant government documents. Additionally, the district commissioner, Busia District, the district officer, Funyula Division and the chiefs of Samia North and South Locations were notified of the intended study (Appendix 4 and 5).

The questionnaire was translated into the Kiluhya language (Kisamia dialect) by the author, her brother-in-law, and a primary school teacher residing in the study area. The three translations were compared and items that differed were discussed and an agreement reached on the most appropriate translation. Items on which consensus was not reached and which were difficult to translate into the vernacular language were left out. The consensus translation was used in the interview sessions.

Before each interview began, respondents were asked for their verbal approval to participate. Verbal approval was required because of the high illiteracy level among rural

farmers. For example, 47.5% of the respondents had never attended any form of schooling. However, it was made clear to each participant that he or she was free to participate or refuse to do so, that their participation would be confidential, and that any information supplied would not be used in any way that would compromise them.

From July 1 to 14, 1991, a test interview, involving ten household heads, in a non-target village, was conducted. The questionnaire was refined over a four week period. Questionnaire items which were found to be unsuitable were discarded. For example, it was found that repetition tended to annoy respondents. The questions with answer categories "Strongly agree, Agree, Neither agree nor disagree, Disagree and Strongly disagree," were particularly difficult for the respondents to understand what was required of them. These items were changed to simple "Agree or Disagree" answer categories. The actual survey took place between 16 August 1991 and 30 January 1992.

Data Analysis and Interpretation of Results

Data from the RRA technique are analyzed and reported in diagrammatic and descriptive forms. Data gained from government officials are reported verbatim. Direct observational data are recorded in form of figures, diagrams and tables; these are given in Chapters 5 and 8.

The fuelwood measurements were analyzed using the Statistical Analysis Systems (SAS) program and the mean consumption of fuelwood per person per day in the villages compared using analysis of variance. Data from the questionnaire were coded and entered into the computer using dbase IV program and thereafter, transferred to an ASCII file and analyzed with the SPSS/PC program. For each of the close-ended questions, the numerical frequency of each answer and the corresponding percentage are summarized and tabulated whenever possible. Survey responses are cross tabulated for location, gender, and education level of respondents. Where appropriate, conclusions are based on chi-square tests of significance since the questionnaire data are categorical.

Definition of Terms

A *location* is an administrative unit in the Kenya government administrative structure.

Village is an area usually inhabited by people from the same clan or even grandparents. It may be marked by streams, hills and valleys. However, the boundaries are generally fluid and depend on the geographical distribution of the clansmen within limits. It consists of scattered homesteads.

Homestead is a group of dwellings inhabited by between one or several households.

Household is used to denote any unit which comprised of a person or group of persons generally bound by ties of kinship and normally residing together under a single roof or several roofs within a single compound and who share the community life in that they are answerable to the same head and share a common source of food. Polygamous wives living within a single compound were included in the same household regardless of their cooking arrangements.

Household head is usually the male head. For purposes of this study, both male and female drawn in the sample were considered to be household heads.

Fuelwood is any wood obtained from trees and used to produce energy. This definition includes firewood, charcoal, standing trees and plantations established specifically to provide these products (NAS 1980, 1983). Based on the pilot study and results from a nationwide survey by the Beijer institute that found use of charcoal by rural households to be negligible (Hosier 1984), this study only considered standing trees and firewood as contributing to rural fuelwood.

Tree planting was taken to mean any action or behavior that increased or was likely to increase trees on the farms. People's beliefs and knowledge about trees and the actual actions of tree planting were therefore taken to be measures of tree planting.

Beliefs were taken to mean what people thought or were brought up to believe about trees.

Practices meant the people's deliberate or non-deliberate actions that increased trees on the farm. For example, what they planted in their *shambas* gardens and the numbers of trees they planted, whether they raised their own seedlings, bought seedlings from a tree nursery or collected wildings, were deemed to be practices.

Age was recorded as the year of birth. Where respondent did not know the year he/she was born, the year recorded on the Kenya National identity card[16] was taken as the actual year of birth.

Education was measured in terms of schooling in a formal institution of learning.

Religion was the religion the interviewee professed to practice.

In summary, three methods followed in the gathering of data i.e., RRA, used in the pilot study, a fuelwood consumption measurement and a questionnaire survey have been presented. In addition, the statistical tests applied in analysis of the fuelwood consumption and questionnaire data have been given. Finally, various terms are defined and the way they are used in this study clarified. The next chapter presents a geographic and administrative description of the study area.

[16]Each Kenyan, 18 years and older, has to carry an identity card on which his or her actual or estimated date of birth is recorded.

CHAPTER 5

BUSIA DISTRICT: FUNYULA DIVISION: AN ENVIRONMENTAL ANALYSIS

Administrative Setting

The description that follows gives the geography and administrative settings of the study area. The villages of Namasali, Kadimbworo, Nangina and Sagania (Figure 4.1), make up a relatively small part of Funyula Division. Namasali and Kadimbworo are situated in Samia South Location while Nangina and Sagania are in Samia North. Funyula Division itself is located in Busia District (Figure 5.1) of Western Province in the Republic of Kenya. The division consists of eleven sublocations; Butabona, Bujwang'a, Buburi and Budongo in Samia South; Lwanda, Mudoma, Bukangala A, Bukangala B, Wakhungu/Odiado Nambuku/Lugala and Luchululo/Bukhulungu in Samia North location.

Sublocations are the smallest units of administration in the central Government of Kenya (GK) structure. Here, the provincial administration under the Office of the President, is represented by assistant chiefs. The next higher unit is the Location, each with its chief. The chief of Samia North location, for example, is responsible for an area divided into seven sublocations with their respective assistant chiefs. The two locations of Samia North and South make up Funyula Division headed by a district officer (DO). Next comes the district with the district commissioner (DC) and finally, the province administered by the provincial commissioner (PC). Thus, Samia North and South are in Funyula Division of Busia District of Kakamega Province in the Republic of Kenya. Figure 1.1 shows the position of Busia District in relation to other districts in Kenya, while Figure 5.1 shows Funyula Division within Busia District. The land area and population of Samia North and South locations are given in Table 5.1. where they are

Fig. 5.1. Map of Busia District showing Funyula Division

(Republic of Kenya 1988b)

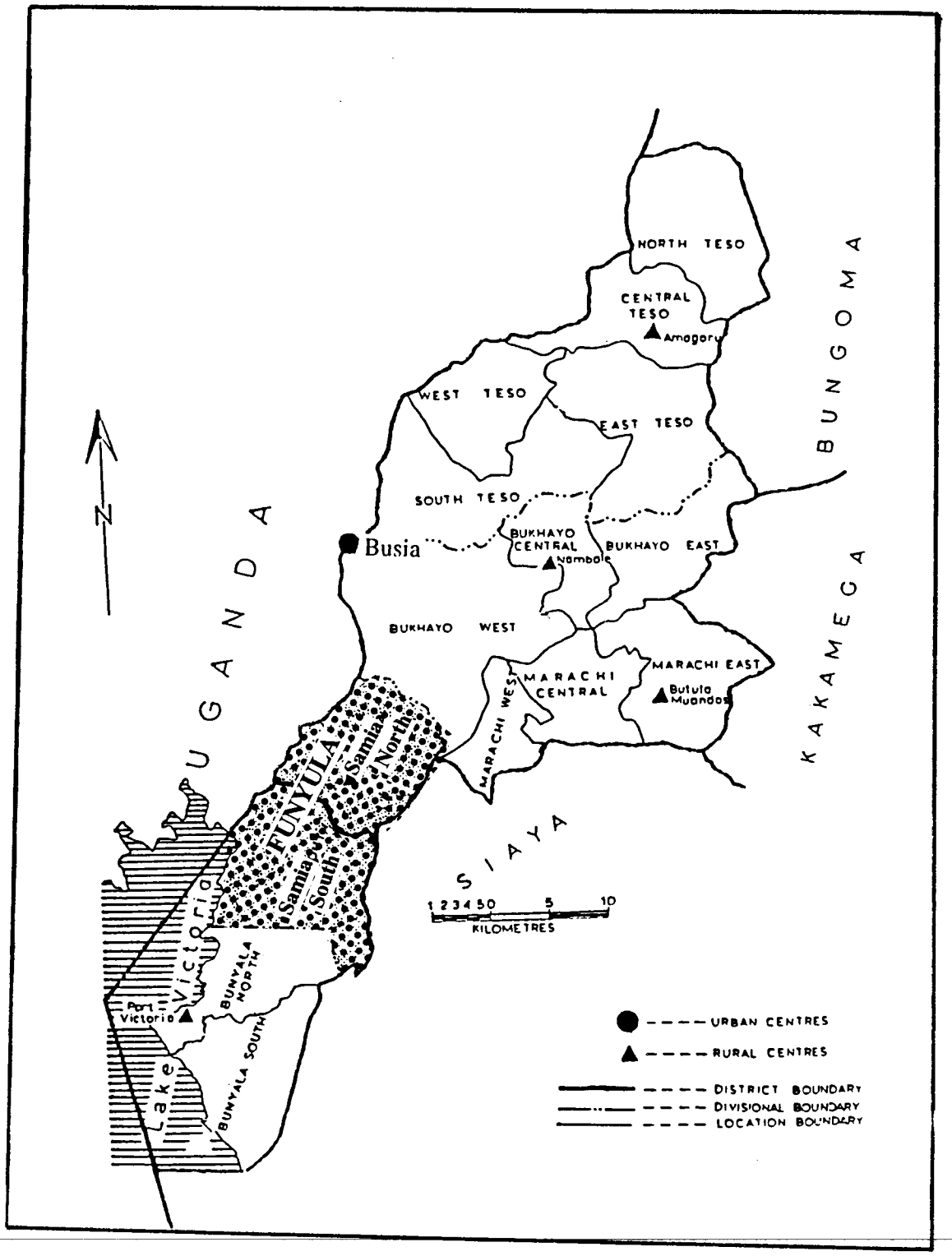


Table 5.1. Area and population of progressively larger administrative units in the Republic of Kenya.

Administrative Unit	Area (sq km)	Population	Density Persons/km^2
Samia North Location	112	34,410*	307
Samia South Location	136	32,613*	240
Funyula Division	248	67,022*	270
Busia District	1,776	423,000	238
Kakamega Province	8,335	2,543,000	305
Kenya (Republic of)	582,546	21,397,000	35

Source: Republic of Kenya (1991).

*Population estimates based on 1979 census data, calculated at the rate of increase of 3.5%/annum.

compared to the area and population of the division, the district, the province and Kenya as a whole.

All other government departments are staffed at each of the administrative levels by officers progressively more senior in rank. For example, agriculture officers are represented by agricultural field assistants at the sub-locational level, a technical officer at the divisional level, several district agricultural officers in charge of major crops at the district and provincial agricultural officers at the provincial level. The Forest Department has no representative at the sub-locational level. Forestry itself is divided into Management and Rural Afforestation Extension Services. Forest Management is found in districts which have gazetted government forests (areas surveyed and declared under the legal status of Kenya to be Government Forest lands). Rural Afforestation Extension Services on the other hand covers the whole country with the lowest officer being a forester at the divisional level, followed by a District Forest Officer, Provincial Forest Officer and finally, the Director of Forestry (Appendix 1).

Biophysical Setting

Geomorphology and Topography

The 248 square kilometers under study extend between 0° 08' to 0° 22' North and 34° 00' and 34° 11' East (Figure 4.1). The highest point at Odiado Hill is 1568 m above sea level while the lowest is 1134m, on the shores of Lake Victoria to the south west of the division. Along the western border flows the river Suwo which also forms the international boundary between Kenya and Uganda. To the north is Nambale, to the south Budalang'i Division, and in the east, the Siaya District in Nyanza Province. The main geographical features of the area are Lake Victoria, the River Suwo, and the Busia and Samia Hills which stretch almost diagonally from east to west across the division. The Suwo rises from the high country in the Mt. Elgon area and flows westwards through

mud and reed-covered banks and flat swampy alluvial plains to reach the lake at Sio Port in Samia South.

Hydrology and Soils

Funyula Division, consists mainly of red thin, shallow clay soils with very little natural fertility (Ottichilo 1985). However, there is significant local variation, a result of the influence of hills and streams. The hills have moderate to steep straight slopes often up to 60 meters high and about 650 meters across (Scott et al. 1971). Most of them are elongated with a narrow ridge crest but a few are oval, for example, Nangosia near Nangina village. These hills are covered by thin freely draining soils of banded quartzite. The low fertility status of the soils is due to their old age. The area between the hills, the interfluve crests, is flat or gently undulating up to 1500 meters. Shallow, gravelly loams over laterite give rise to areas locally known as *etale*, or they may be deep red clays, *olugusi* or sandy clays, more than two meters deep, *olusenye*. The slopes, on the other hand are gentle or straight and up to one kilometer long. Here, moderately acidic, brown, sandy clay loams predominate.

In areas lining stream courses, slightly alkaline, imperfectly drained dark grey clay soils subject to seasonal flooding are to be found. Most of the streams are narrow, up to five meters wide, with very strongly gullied banks. Here, the soils are similar to those on the stream benches except for turning slightly acidic. Riverine vegetation mixed with some large trees such as *Albizia coriaria* is found on these soils.

Climate

Lake Victoria greatly influences the climate and hydrology of the area. The daily westerly winds from the lake converge with the south east trade winds causing air to rise and producing heavy showers, especially in the afternoons. The lake shores are slightly drier than the interior. Due to the influence of the lake, the annual rainfall is between 900-1000 mm per annum at Namasali in the south, 1000-1200 mm at Kadimbworo, and

between 1200 and 1400 mm in the two northern villages (Figure 4.2). Therefore, on the basis of rainfall alone, the villages could be placed into three categories. Sagania is in lower midland ecological zone 2 (LM2) while Nangina and Kadimbworo are in LM3 and Namasali is in LM4 (See Figure 4.3). The amount of rainfall received by each village influences the type of crops and trees growing in the various village landscapes and thus, fuelwood availability. For example, LM2 is thought to be a marginal area for sugar cane production; LM3 is ideal for cotton and LM4 is marginal.

In general, annual rainfall is bimodal with a peak in April and a shorter one in November during the so called short rains. The pattern of rainfall distribution can be seen from rainfall records (Table 5.2) and bar chart (Figure 5.2) for Nangina Catholic Mission during a nine year period 1980-1987, and 1990 (rainfall for 1988 and 1989 was not recorded). In 1990, the long rains peaked in February and the short rains in September while June had no rain. On the other hand, the nine year high peak is in April and a smaller one in November. From this bar-chart, the driest month is January. Rainfall is thus unreliable and during the "short rains", thunder and hailstorms are frequent.

Annual mean maximum temperatures are between 26-30^{o}C while mean minimum temperatures are between 14 and 22^{o}C. Average potential evapotranspiration is between 1800 mm and 2000 mm per annum. This means that despite good rainfall, there exists an acute water scarcity. Crops are, therefore, subjected to periods of drought which often result in food scarcities during the low rainfall season (June-July and December-February). Nonetheless, it is possible to raise two maize or sorghum crops per year, if drought resistant varieties are planted in the short growing season from August to November. (Trees, through their expansive root systems that enables them to tap water from lower soil horizons may be less sensitive to these drought conditions. Food and fodder trees would provide nourishment to humans at this critical period.)

Table 5.2 Funyula Catholic Mission rainfall data in millimeters

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1980	21.5	4.2	82.2	164.5	153.3	23.3	49	243.1	45.4	82.3	171	34.6	1074.4
1981	24.5	22.8	269.8	231.1	170	86.9	97.1	85.3	133	124	55	7.6	1307.1
1982	93.4	24.2	32.7	133.4	330.8	150	68.1	130.4	107.6	231.4	186.8	55.5	1544.3
1983	19.1	115.4	112.5	234.8	162.7	62.4	65.2	177.9	124.6	162.9	92.2	78.4	1408.1
1984	7.9	39.5	40.9	133.7	121.7	93.8	145.5	136.7	101.2	114	196.7	145.5	1277.1
1985	86.7	34.5	181.7	243	161.2	119.1	96.9	84.2	46.6	109.1	138.8	64.7	1366.5
1986	14.5	46.1	264	169.1	101.1	81.2	64.2	79.7	91.2	126.2	101.3	154.1	1292.7
1987	85.6	60.4	133.7	156	225.6	65.2	52.1	135.8	101.2	125.5	217.1	18.2	1376.4
1990	6.6	287.9	239.2	124.8	125.3	0	31.1	107.5	144.9	71.2	72.9	88.1	1299.5
TOTAL	40.0	70.6	150.7	176.7	172.4	75.8	74.4	131.2	99.5	127.4	136.9	71.9	1327.3

Source: unpublished data from Kenya Meteorological Station.
Data for 1988 and 1989 were not recorded.

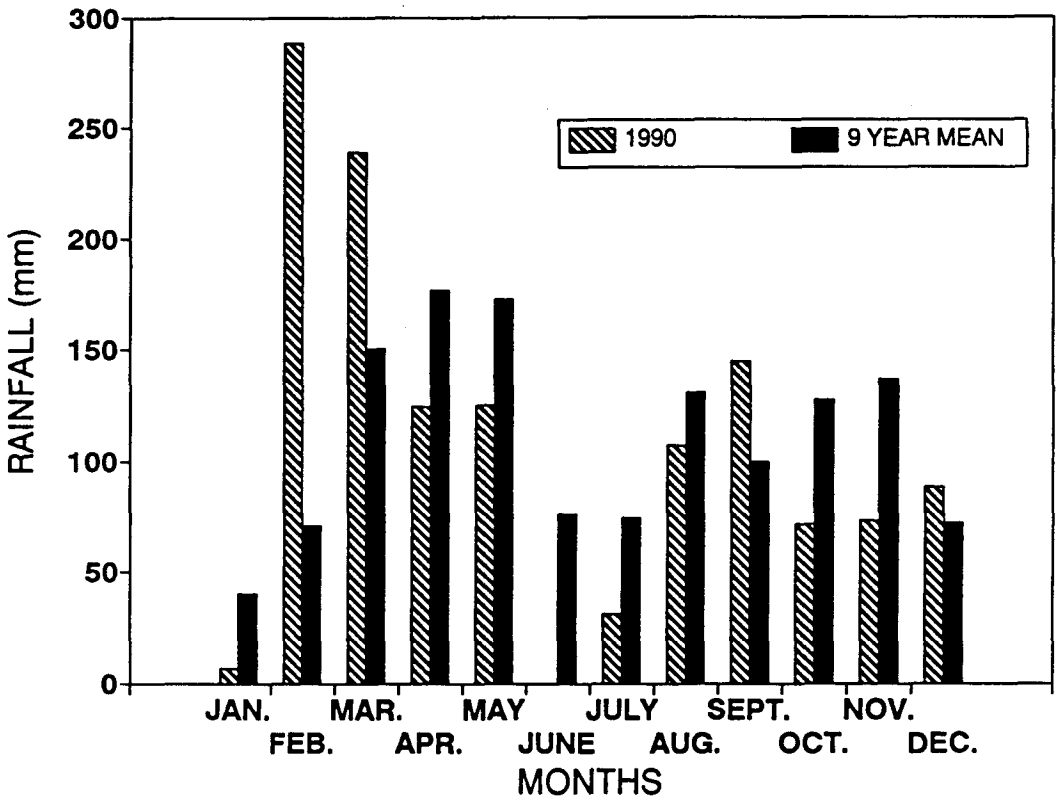


Fig. 5.2 Nangina Catholic Mission Rainfall Bar Chart.
Source: unpublished data from Kenya Meteorological Station.

Vegetation

According to Unesco's vegetation classification scheme (White 1971), Funyula Division falls into what is called the *East African evergreen bushland* and *secondary Acacia wooded grassland*; this is basically savanna woodland. The vegetation classification used in these studies follows the system used by Grunblatt et al. (1989). The hills are generally covered with grasses and thick or sparse scrub dominated by *Acacia seyal*, *Euphorbia candelabrum* and *Combretum* spp. Vegetation burning continues to take place up to the present time.

The area immediately below the hills (interfluve), often comprises open savanna woodlands of *Combretum* spp. while on the interfluve slopes the woodland becomes increasingly sparse until it turns into grasslands and sparse shrubland of *Acacia seyal* on the rocky benches or *amatale*. Termite mounds abound on hills and benches and are closely associated with thicket formation (Scott et al. 1971). Streams are lined by patches of woodland swamps. Scattered homesteads are to be found. The present short time between fallows, as a result of increasing human population, has resulted in the disappearance of much of the thicket and bushland vegetation. There is great variation between individual sites as reflected in the study villages.

Profile of the Four Villages

Namasali

Namasali village, the most southerly of the villages studied (Figures 5.3 and 5.4) is near Sio-Port on the shores of Lake Victoria, the largest fresh water lake in Africa. This low lying village (2.8 km^2) is at an elevation of between 1128 and 1260 meters at the highest point (Figure 4.1). A good part of the village is taken up by papyrus, *Cyperus papyrus* and the lake reed, *Phragmites communis* swamp. About one kilometer from the lake shore the land rises abruptly to 1140 meters. Here on the escarpment there is a clear

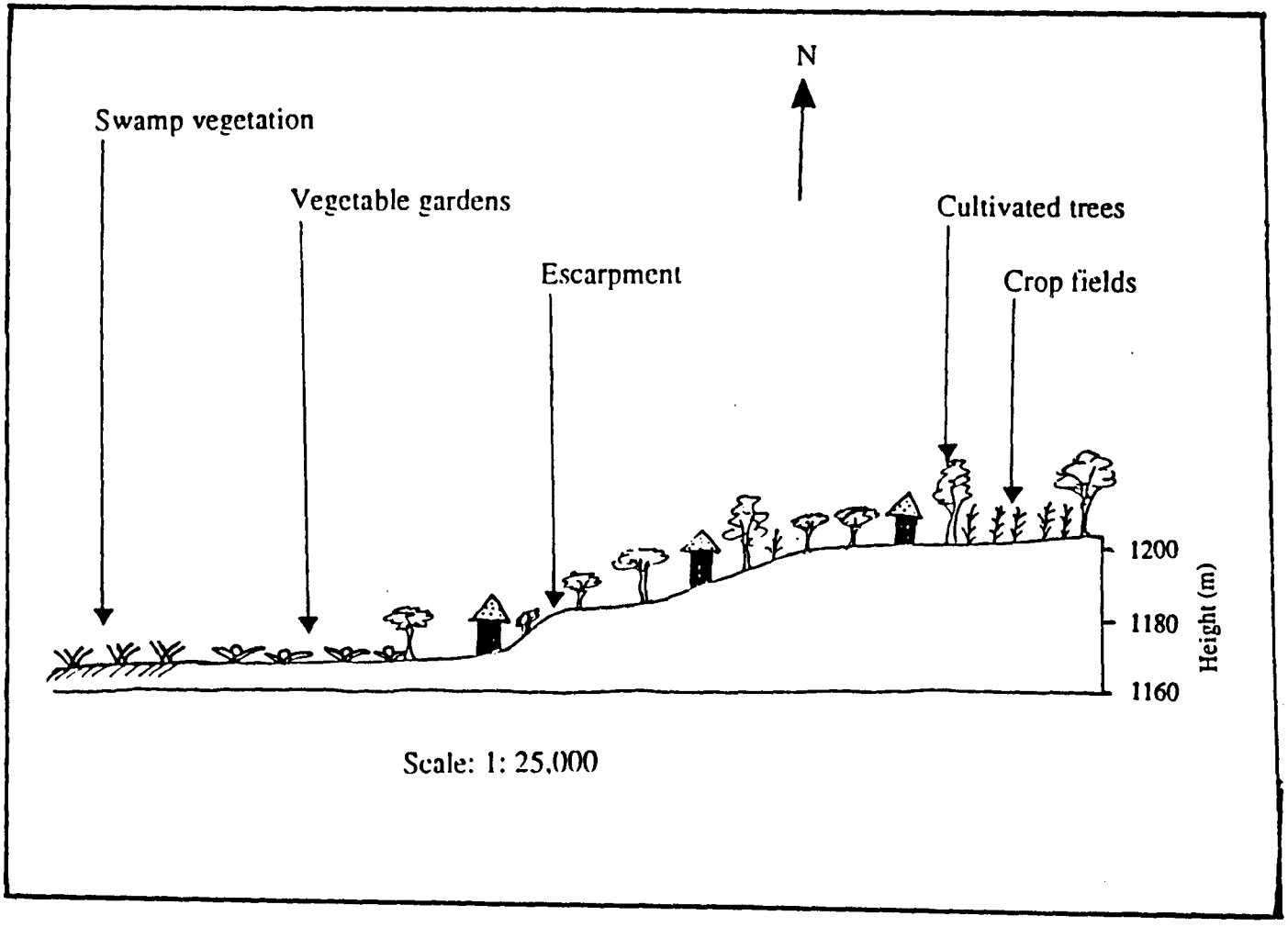
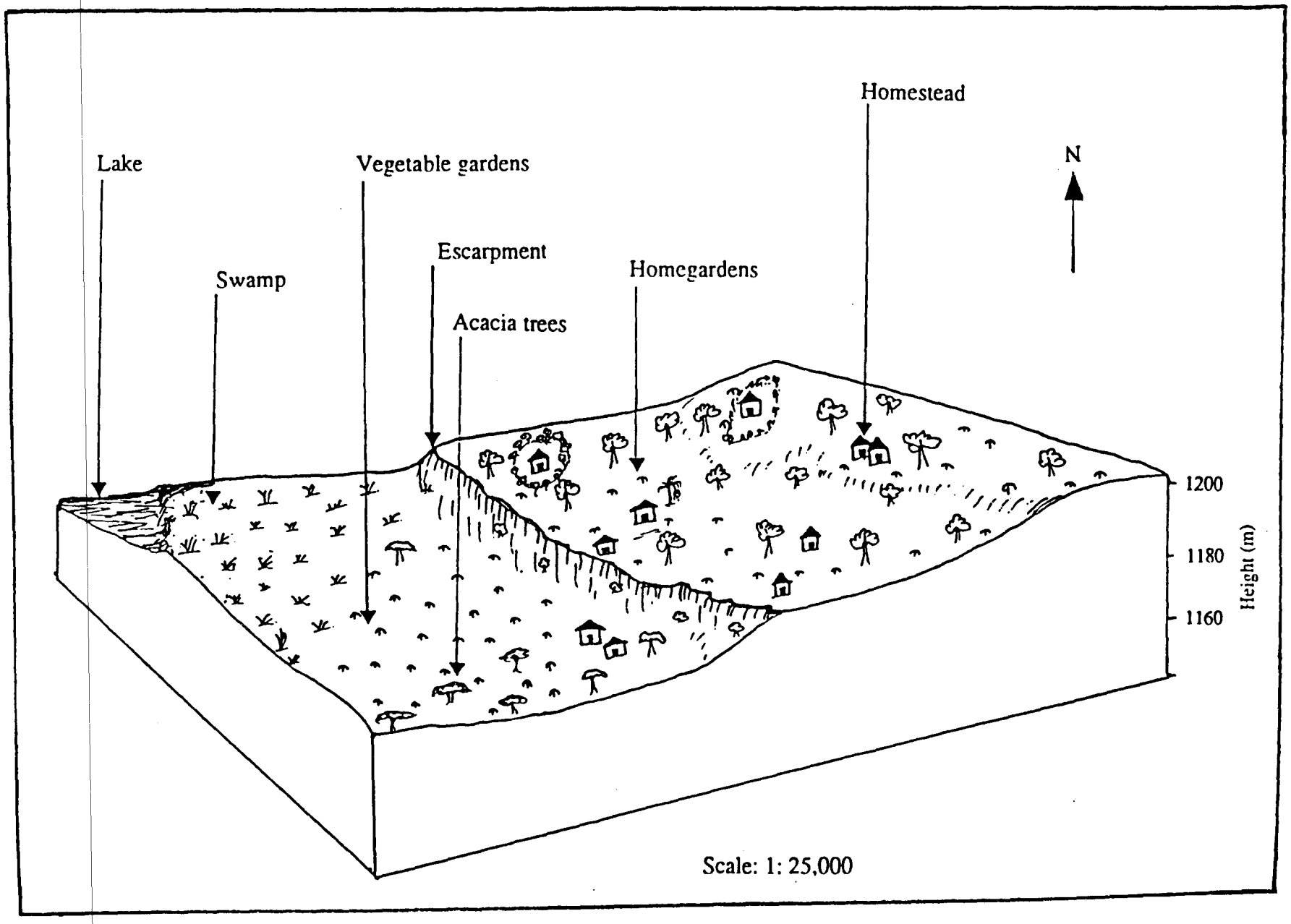


Fig. 5.3. Schematic diagram of Namasali village

Fig. 5.4. Landscape profile of Namasali village



sign of the lake level before the present times. Thereafter the land is gently undulating. The lakeside escarpment consists of rocks mixed with black, clayey, sandy soils (Scott et al. 1971). Cultivation is not possible on the escarpment because of the near perpendicular slopes. *Acacia* trees mixed with *Lantana camara* and *Eurphobia candelabrum*, are found growing in between rocks.

Although the village proper does not start until the top of the ridge, five homesteads are found at the bottom of the escarpment. There are 78 households in this village of about 400 people who belong to different clans and are dominated by the Ababuri. The inhabitants derive their livelihood mainly from farming and fishing. Many households in this village own two pieces of land to take advantage of the varying ecological conditions offered within short distances. The village homesteads are mixed with gardens of mainly cassava and cereals. There are fallow lands interspaced with crop lands. The fallow lands and the grasslands near the Suwo River form grazing lands forthe village's livestock. Farmers make small channels to drain the swamp land on which they grow vegetables, sweet potatoes and cotton on the clay, sandy soils derived from the lake. The dominant tree species in the fallow lands of Namasali is *Acacia seyal.* The side of the village overlooking the Suwo River (Figure 5.4) has extensive black, clay soils that are subject to periodic flooding. Consequently, the area is mainly grassland.

The village proper starts where the ridge flattens out and the land starts to undulate gently. Here soils are thin and rocky but gradually become thicker and more reddish in colour. Fuelwood, as we shall see again later, is obtained most often from the Acacia trees, the fallow lands, and the homestead gardens.

Namasali's proximity to the lake affects the village negatively. The daily northerly winds from the lake disperse moisture further inland leaving Namasali drier than the other four villages under study. The average rainfall is between 1000 and 1200 mm. Since Namasali is in the Lower Midland Agroecological Zone 3 (LM3) or the

cotton zone[17] (Jaedzold and Schimdt 1982), this classification puts it in the same zone with Kadimbworo and Nangina. As can be seen from Figure 4.3, Namasali is in the transitional zone between Lower Midland Agroecological Zone 3 and 4.

Although the village is next to the lake and river, procuring drinking water is a problem as it entails walking the one or one and a half kilometers to the lake or river. There are two boreholes which provide alternate sources of drinking water when they are operational: one is at Namasali school and the other is located in the village. The difficulties of providing water for domestic consumption, especially during the dry season, imply that there is even less water for the establishment of tree nurseries and to water tree transplants.

Kadimbworo

Kadimbworo (1.6 km^2) is the smallest of the four villages studied (Figure 4.1). To the south of this village is the Hakati-Lwanda road and to the north is Munana. The western border of the village is the Sio-Port - Lwanda road while to the east is Lukure village. Like their counterparts elsewhere, the 180 inhabitants of the 38 households in the village practice agriculture. On the basis of geomorphology, Kadimbworo is the least diversified of the four villages under study. It is on moderately gentle slopes (Figures 5.5 and 5.6), and it rises from 1160 to 1200 meters above sea level. The soils on the rolling slopes are deep, red laterites gradually turning into light, sandy clays near the flatland. Although, it occupies the same ecological zone, LM3, as Namasali (Figure 4.3), Kadimbworo has a slightly higher rainfall, 1200 - 1400 mm per annum on the average (Figure 4.2).

Farming activity is similar in the four villages studied. Homesteads are mixed with fallow fields, cassava and cotton crops. The villagers take advantage of the

[17]Jaetzold and Schimdt (1982) classified Kenya into agro-ecological zones established by FAO (1978), but in addition, included a more differentiated system showing yield probabilities of the main crops growing in a particular area.

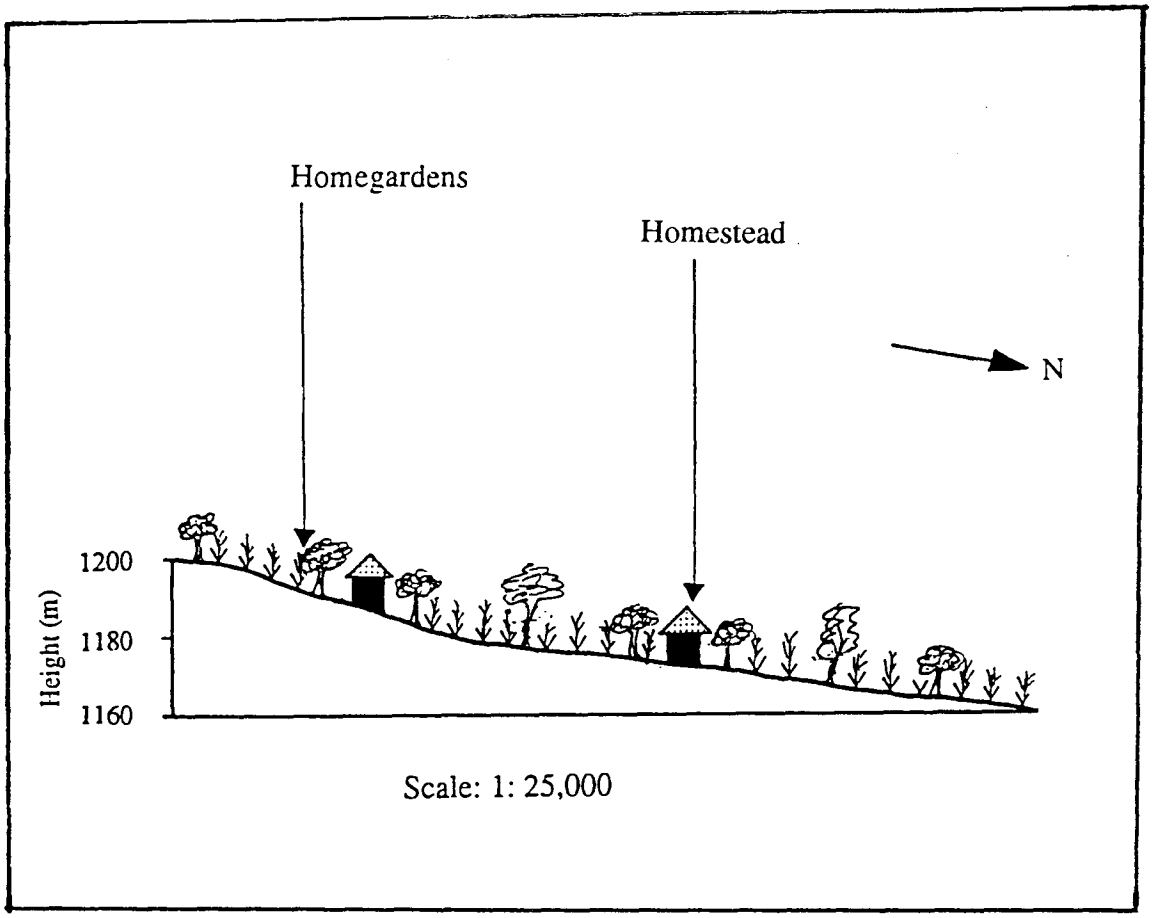


Fig. 5.5. Schematic diagram of Kadimbworo village

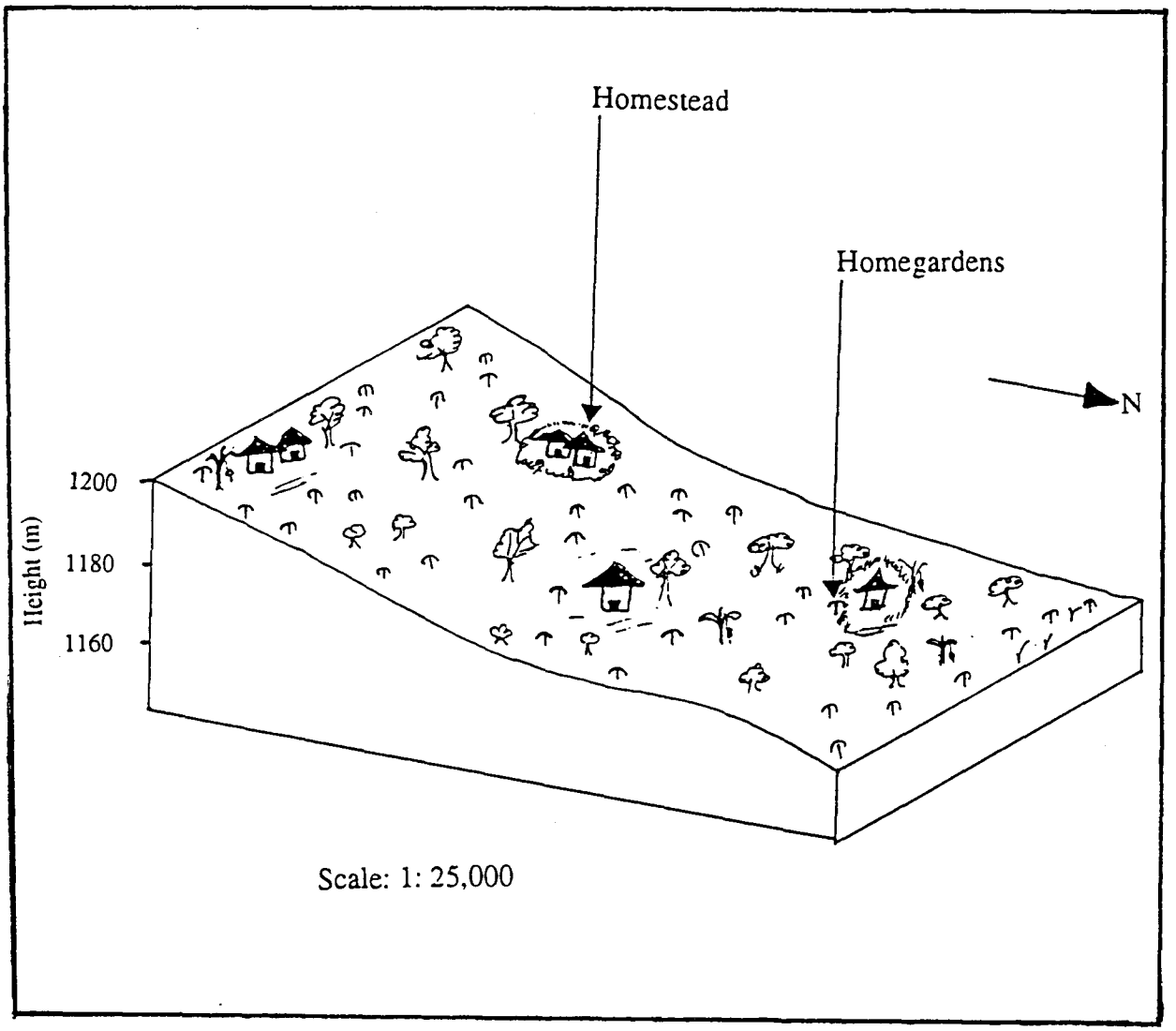


Fig. 5.6. Landscape of Kadimbworo village

microclimate provided by *Ficus capensis (Mukuyu)* trees to cultivate bananas and vegetables under their shade. This practice is not unique to Kadimbworo, but is also found in the other villages wherever *F. capensis* happens to be growing. There is hardly any virgin or near-virgin land remaining in this village. All the land has been cultivated in the last ten years. Therefore, fuelwood is obtained mostly from the homestead gardens, the fallow lands and roadside shrubs.

As in the preceding village, water is a major problem for the inhabitants. There is only one borehole in nearby Lukure village. This is shared by several other neighboring villages and the Ageng'a Family Life Center. Lack of sufficient water thus impacts on the people's ability to raise on-farm tree seedlings and to water any transplants facing drought conditions.

Nangina

Nangina village (1.9 km^2) is to the southwest of Funyula, the Divisional Headquarters (Figure 4.1). It is inhabited by the Abakhulo clan. The inhabitants of this village moved their homestead site from the valley to the vicinity of the main road to take advantage of better communications offered by the Sio-Port to Bumala road which forms the village boundary with Nangina Catholic Mission to the south. The second reason for moving, one old man said, was to release the more fertile lowlands for agriculture purposes. To the north of Nangina is Khapala and the west Sirekeresi village. More than 300 inhabitants in 67 households derive their livelihood principally from farming. There is also a butchery, an eating house, and two grocery shops in the village.

Nangina rises from 1180 meters at the valley bottom to 1340 meters on Nangosia Hill (Figures 5.7 and 5.8). The name Nangina is instructive as it means rock or stone in Kisamia. The area above 1260 meters on Nangosia hill is not inhabited. Native vegetation of *Acacia sp.*, *Albizia grandbractiata*, *A. coriaria*, and *Euphorbia candelabrum* thickets grow here. However, past over harvesting of trees for fuelwood for

Fig. 5.7. Schematic diagram of Nangina village

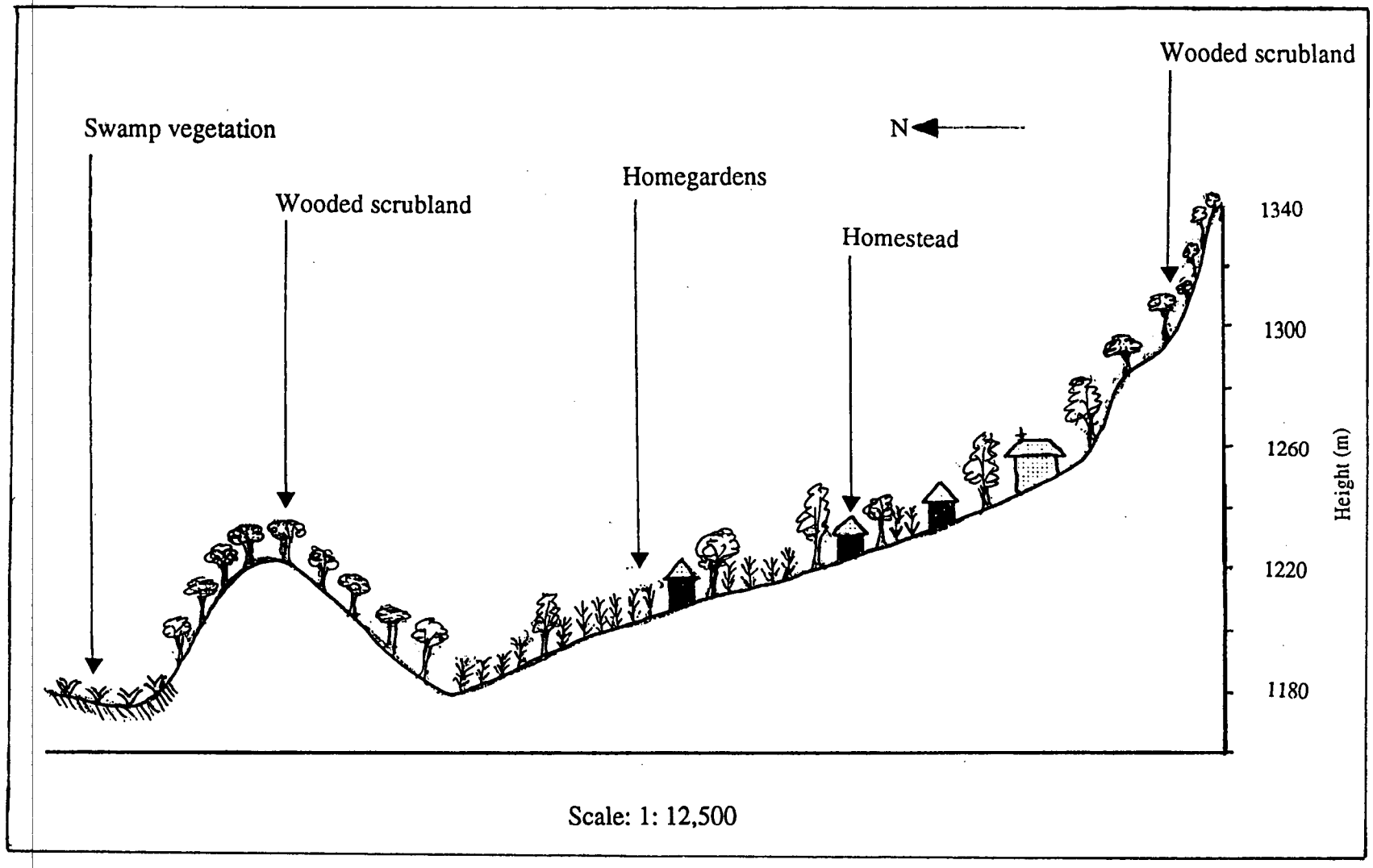
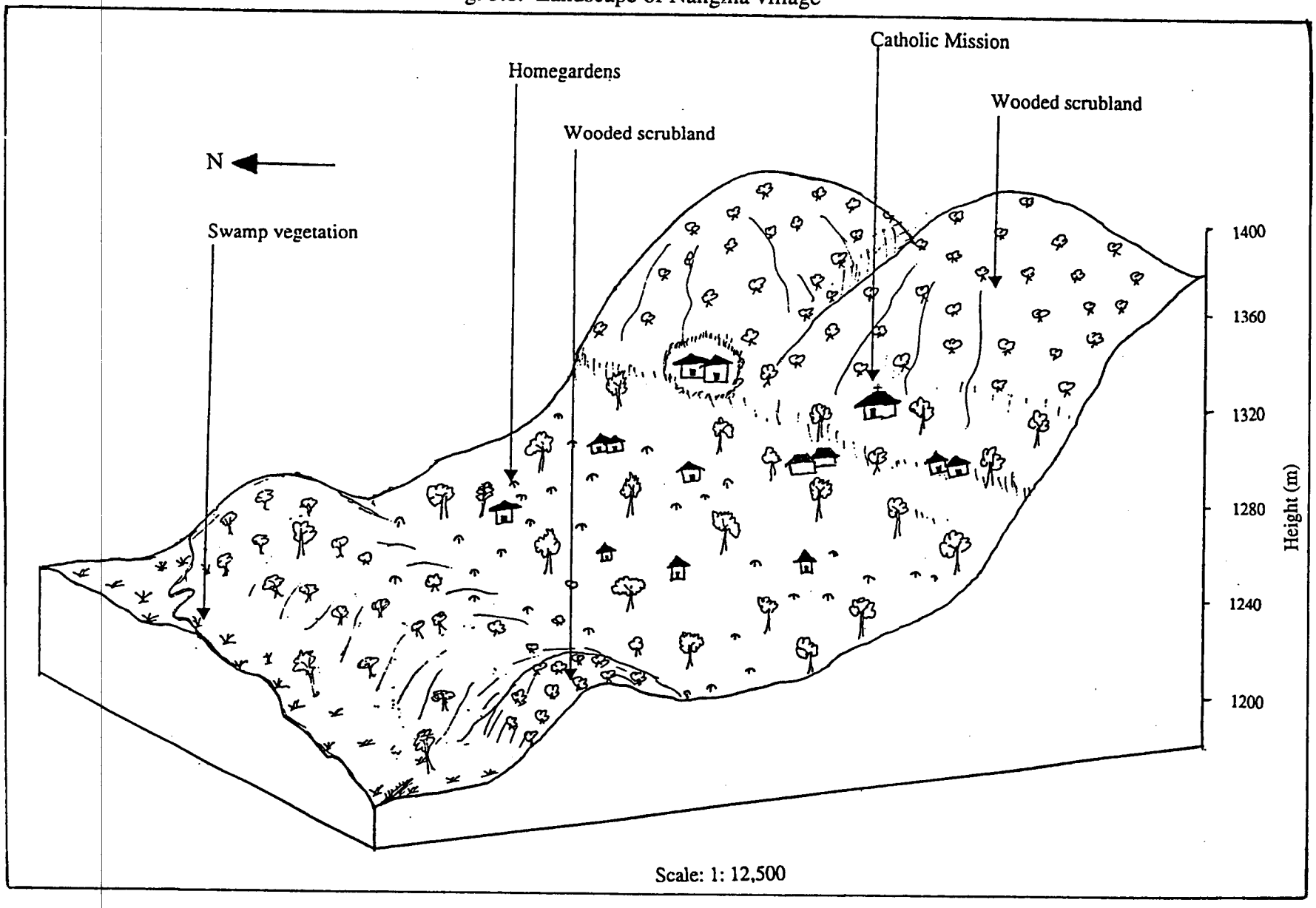


Fig. 5.8. Landscape of Nangina village



the mission station has resulted in a depletion of fuelwood in the hill vegetation. The gaps left from fuelwood harvesting have been invaded by the weedy *Lantana camara.*

The mission itself occupies a rock outcrop *(etale).* Here soils are thin, shallow, sandy clays. Lower down the hill the soils gradually thicken, their texture and colour changing from deep red to light grey in the valley bottom.

The village proper is in the gently rolling land below the mission. Most houses are near the main road. Lower down the valley are crop fields mixed with fallow lands. The lands nearest the valley bottom are not cultivated and the surrounding bush harbours monkeys which are also found on the hill top. Being pests, the presence of monkeys encourages villagers to clear the bush around them, thus having a negative impact on species conservation and fuelwood availability.

Nangina is in the lower marginal cotton zone or Agroecological Zone, LM3 (Figure 4.3). Rainfall is between 1400 and 1600 mm per annum (Figure 4.2). Fuelwood sources for this village are available from the homestead gardens and the abundant fallow lands. Most of the fallow land has *Lantana* spp. growing on it. A few of the village inhabitants own two plots of land, one in the village proper and one on Nangosia hill beyond the Mission. Farming is in scattered gardens around and beyond the homesteads. The hill land is not cultivated because it is too steep for this purpose. Unfortunately, it is also not readily available for firewood collection because the mission land, in between, forms a barrier around which the owners have to detour in order to reach sources of additional fuelwood.

The village obtains its drinking water from a protected well locally known as Pere Kuni's. Three homesteads belonging to fairly well to do residents are fenced with cypress while the rest have *Markhamia lutea* for marking the boundaries or are unfenced. The land nearest the road and the west of the village is rather rocky as is the adjoining mission land which is very shallow with marrum pans sometimes only half a meter below the surface. The fertile and rich land near the valley is overrun by bush in which

monkeys abound. As already stated, the presence of monkeys, creates a desire to keep the land clear of trees and shrubs.

Sagania

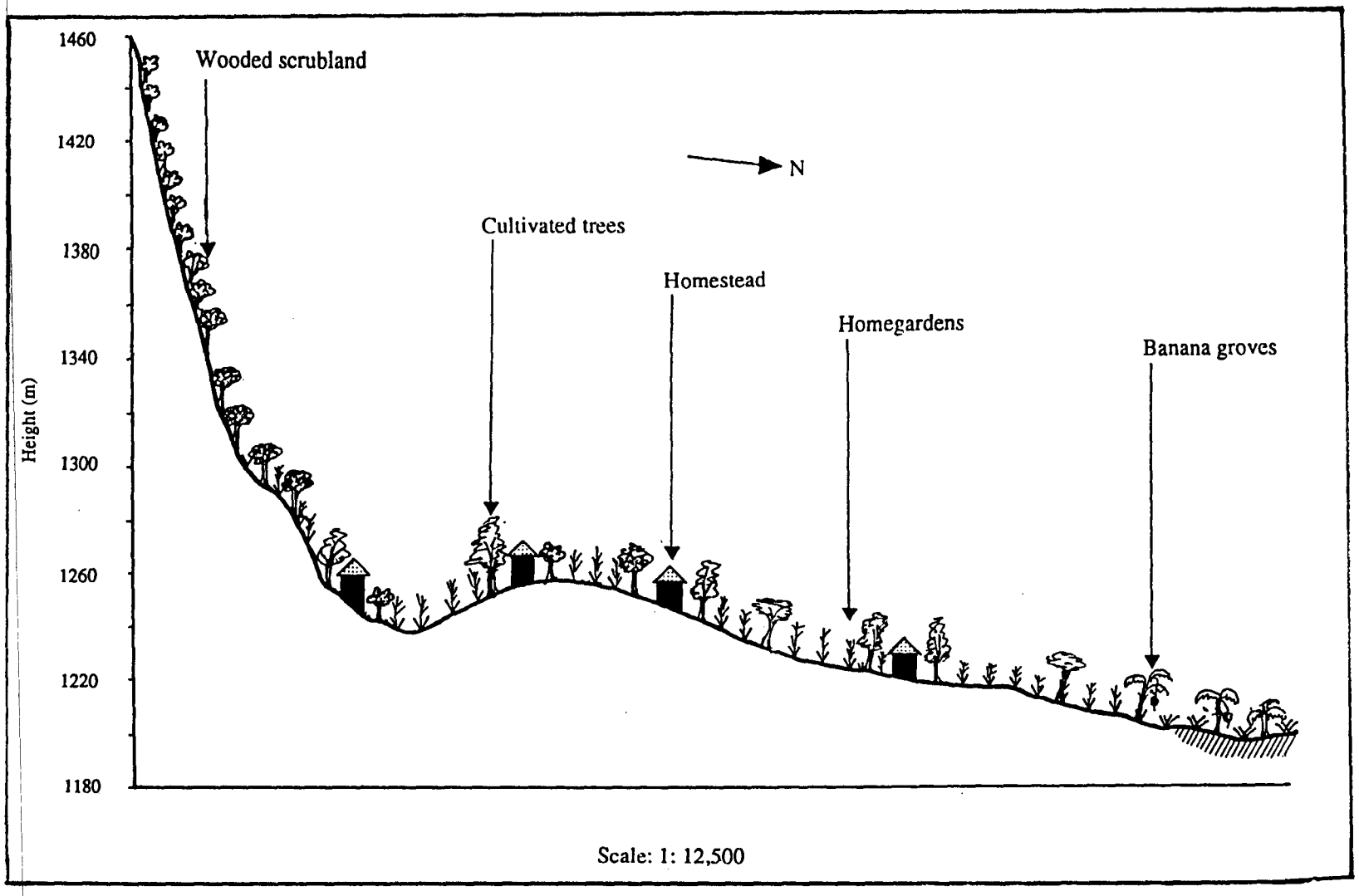
The most northerly and biggest of the study sites, Sagania (2.2 km^2), is located between the Samia hills with Sitango'mbe hill to the east, Nyakhobi to the north, Sibale village to the south and Bukangala to the west (Figure 4.1). Schematic diagrammes of the village are given in Figures 5.9 and 5.10. Sagania consists of 90 households and a population of about 450 inhabitants. Most of the inhabitants belong to the Abamurembo clan. There is one primary school, a *posho*[18] mill and three small shops or *dukas* to serve the inhabitants, most of whom are farmers. Communication to the outside world is via the road from Funyula running westwards to Namboboto and onwards to Matayos and Busia town, and the one through Nyakhobi village to Ganjala and Matayos. The scattered homesteads are connected by village footpaths.

Until recently, the inhabitants lived near Maakalo stream in order to be in close proximity to water. But anticipation of land adjudication forced them to scatter over the area where they still practice subsistence farming. In the richer, grey soils of the valley bottom, near the stream, vegetables, root crops (e.g., arrow roots and sweet potatoes) are planted, often mixed with banana groves. Some farmers have left riverine vegetation to continue growing because they value the grass reeds found in this habitat which are used for house thatching.

As one moves away from the streams, the rather poorly draining soils give way to deep red laterites on which cereal gardens mixed with homesteads are found. The soils near the hill are shallow with murram pans penetrating to the surface. This area is also used for grain crops and cassava. Some hills have deep soils at their bases so that cultivation is slowly encroaching up the hillsides. The top of the hill is banded quartzite

[18]A machine for grinding maize (corn).

Fig. 5.9. Schematic diagram of Sagania village



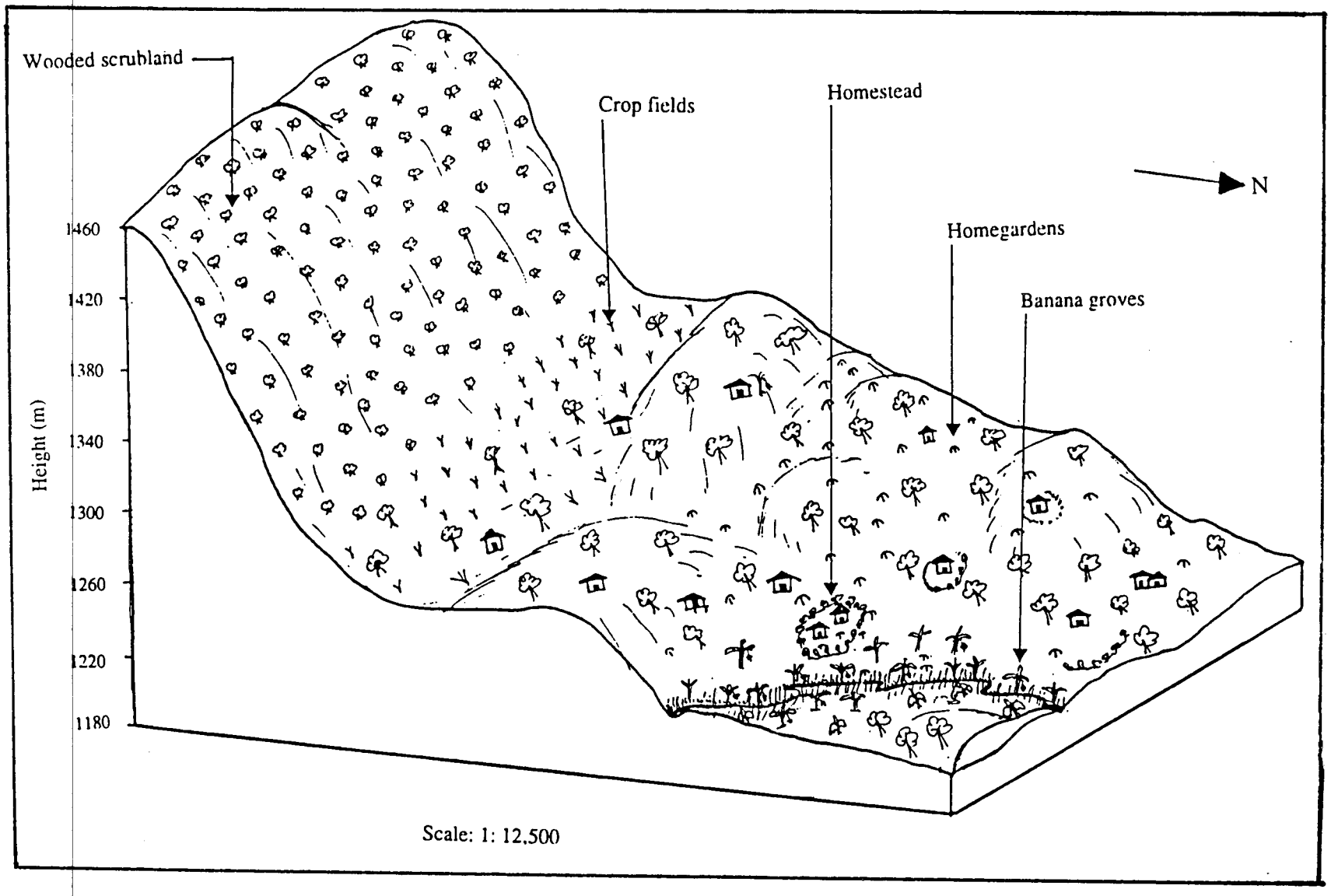


Fig. 5.10. Landscape of Sagania village

covered with scrubland of thick *Acacia* thickets, *Combretum* sp., *Albizia* sp, *Euphorbia candelabrum* and an occasional Mvule tree. The *Acacia* thickets are associated with termite mounds. The inhabitants of Sagania obtain their fuelwood from their homestead gardens, fallow lands and the riverine and roadside vegetation supplemented by acquisitions from the hills. This village has, therefore, more sources of fuelwood than the three discussed so far.

Like Nangina, Sagania receives between 1200 - 1400 mm of rainfall per annum according to FMH and is found in the lower marginal sugar cane zone or Agroecological Zone 2 (LM2). At a density of 205 persons per km^2, the population pressure is beginning to be felt on the land. Cultivation has been continuous so that, now, little of the original vegetation remains.

The four village profiles are summarized in Table 5.3. The main biophysical factor differentiating the villages are the general topography, elevation and to some extent rainfall. These factors also affect vegetation. Soil descriptions were based on direct observations. Nonetheless, observation showed that Namasali differs from the others in the type of soils, vegetation and dominant trees growing in its habitat. These differences have an implication for fuelwood provisioning and tree planting. The villages also differ in their access to water sources, an important factor in tree seedling production.

To summarize, this chapter has covered the geographical and administrative settings including a profile of the individual villages. The detailed soil and vegetation descriptions were discussed to indicate sources of fuelwood for the villages and possible areas for tree planting. Since food is important, and crops compete with trees for the land resource, the farming system was briefly mentioned. A more thorough discussion of the farming system practiced in Funyula Division is given in Chapter 6 where the socioeconomic and sociocultural profile of the study population is also described.

Table 5.3 A comparison of the village biophysical characteristics

Item	Sagania	Nangina	Kadimbworo	Namasali
No. of households	90	67	38	78
*Area (km^2)	2.2	1.9	1.6	2.8
Population	450	300	180	400
*Density	205	158	112	140
Elevation (m)	1180-1460	1180-1340	1160-1200	1128-1160
Rainfall (mm)	1200-1400	1200-1400	1000-1200	900-1000
Vegetation	Hv Albizia mix	Hv Albizia mix	Mixed Fallow	Acacia/Papyrus
Natural water bodies	stream	stream	none	lake/river
Ecological zone	LM2	LM3	LM3	LM3/LM4

Hv = Hill vegetation.

*Estimated from maps.

CHAPTER 6

SOCIOECONOMIC AND SOCIOCULTURAL ENVIRONMENT OF THE STUDY POPULATION

Appreciating a people's way of life and aspirations, including educational attainment, population and demographical distribution is useful in comprehending a community's fuelwood and land use problems. These factors influence a farmer's decision making, and hence, what happens on his land. Knowledge of a given culture is basic in understanding how a farmer utilizes the natural environment. In some communities, cultural norms and taboos have been instituted to prevent women from planting trees (Hoskins 1980; Chavangi 1984). Others such as the Maasai of Kenya and Tanzania may not bother with tree planting since they are pastoralists.

In this chapter, a population profile of the respondents, their age structure, educational attainment, occupation and marital status will be discussed. In addition, the general household structure and family organization in Funyula Division is also covered. Furthermore, traditional land use changes including tree planting practices are described. Finally, a short description of tenure and land ownership patterns in Funyula is provided. The information presented here was obtained through direct observations during the pilot study, supplemented by data obtained from the respondents during the questionnaire survey, data from *Busia District Development Plan 1989-1993* (Republic of Kenya 1988b) and informal knowledge of the inhabitants by the author acquired during upbringing as a (Mu)Luhya of the (Aba)Samia subtribe who themselves belong to the linguistically similar tribes called the Bantus found in many parts of east, central and southern Africa.

Population Profile

Demography and Age Structure

The population of Funyula given in Table 5.1, is an extrapolation of the 1979 Kenya census figures and the figures given in the *Busia District Development Plan 1989-1993* (Republic of Kenya 1988b). The Kenya government carried out a national population census in 1989. However, results have yet to be published. From the provisional report of the 1989 census, the rate of population increase is 3.5% for the whole of Busia District. This is used to calculate the population of Funyula Division given in Table 5.1. This table also shows the area's population, as compared with that of Busia District, Kakamega Province and Kenya.

Samia South has 240 people per square kilometer while the north is more densely settled at 344 persons/km.^{2} In contrast the individual village populations are estimated to be 400 in Namasali, 180, in Kadimbworo, 300 in Nangina and 450 in Sagania.

Of the respondents, there were 63 males and 59 females, a ratio of one female to 1.07 males. The general population ratio is one male to 1.08 females. Age ranges between 22 and 83 years. The sample is categorized into people aged 22-40 years, 41-60, and those above 60. Choice of age groups is arbitrary but coincides with young, middle aged and old adults. Table 6.1 gives the frequencies and percentages of the various age categories in the interview sample.

The rate of population increase in the study area is 3.5%, putting it among the fastest growing areas in the country. Like the rest of country, the area has an age distribution skewed to the very young age distribution. Table 6.2 gives this distribution for Busia District and Funyula Division. The proportions of different age groups in the district were used to derive proportions for Funyula because Funyula population data as given in the Busia District Development Plan 1989-93, are not broken down into age classes. The districts' young people (1-14 years old), and by inference those of Funyula

Division, make up 47.7% of the population. According to the to the Busia District Development Plan (Republic of Kenya 1988b), when the young are added to the old, that is those sixty years old and over, it means 55% of the population is non-productive This generalization ignores the work carried out by children and the aged in helping to fetch firewood and water, besides looking after livestock. Nevertheless, most of the work is done by the most productive labour force (those between age 15-59) of whom women form the majority (56.6%). Of the women in the labour force, 88%, are at their child bearing age (15-49 years); they also have additional duties of household chores and looking after small children.

There is heavy outmigration of young, and generally better educated men, to other parts of the country in search of paid employment. Although there is a fair amount of wage remittance from employed relatives in urban areas, it is difficult to quantify.

Education

Education is the key to knowledge and communication. Formal education is widely accepted in Kenya; there is a policy of free primary education. However, there is still a high rate of illiteracy among the rural population, in spite of intensified efforts in adult education. As can be seen from Table 6.3, a high proportion of respondents (47.5%) have no formal education.

Out of a population of 11,513 school age children in Funyula Division, 11, 236 are estimated to be in attendance at the 59 primary schools in the area. Fewer children go on to high school because of a limited number of secondary schools and the necessity to pay for higher education.[19] The nine secondary schools in the division have an enrollment of 1,580 pupils out of 4,717 secondary school age group that is found in Funyula Division. The sex ratio in primary school is 1:1, becoming 1:1.77 female to male at the secondary level. This state of affairs is rooted in the people's culture that

[19]At between K Sh. 7,000-10,000 (Can. $ 280-400) per annum, the secondary school fee is high for most peasant families. Per capita national income is only K Sh 6000.

Table 6.3. Educational level of respondents.

Education Level	Sagania	Nangina	Kadimbworo	Namasali	Total Frequency	Percent of Total
Never went to school	17	13	16	12	58	47.5
Primary level	9	15	10	11	45	36.9
Post primary	6	2	4	7	19	15.6
Total	32	30	30	30	122	100.0

Source: Field Data

Table 6.4. Frequency of various marriage categories in study sample.

Marital status	Frequency	Percentages
Single	4	3.3
Married	105	86.1
Polygamous	24	22.9
Monogamous	81	77.1
Widowed	11	9.0
Divorced	2	1.6

Source: Field Data

favours boys over girls.[20] Many girls also leave school either to get married or as a result of early pregnancies.

The sample consists of predominantly married people. There is a high rate of polygamous marriages (Table 6.4). For example, 23% of the respondents were in polygamous unions while 77% were in monogamous marriages in contradiction of the teachings of Christianity to which 121 respondents said they belonged. One respondent said he was a Moslem.

Livelihood

There are few employment opportunities in the study area. Until recently there were no manufacturing industries but now a sweet-making factory has been constructed, although at the time of the study it was not operational. A majority of the respondents are peasant farmers. The occupational distribution of the respondents is given in Table 6.5. The RRA exercise and the interview results showed that fishermen were to be found only in Namasali while charcoal and brick makers were restricted to Sagania. During the survey, none of the respondents said they were fishermen. Nonetheless, it can be seen that charcoal makers are located in villages with hill areas and therefore sources of firewood. To some extent the villager's off-farm occupations are determined by the type of natural resources available to them, that is water or natural vegetation on the hills. Observations revealed that tool and craft making were part time jobs and were not yet well developed in this area. Charcoal, brick, and craft making are to a large degree dependent on wood resources, and therefore, of consequence to the stability of the environment.

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[20]When resources are limited, parents invest more in boys than girls. School fee is seen as a form of investment to be recovered when a son gets a job and starts remitting part of his earnings to his parents.

Table 6.5. Frequency of occupational distribution among respondents.

Occupation	Sagania	Nangina	Kadimbworo	Namasali	Total Frequency	Percent of Total
Farmers	24	22	28	20	94	78.7
Teachers	3	0	0	3	6	4.9
Craftsmen	2	1	1	2	6	4.9
Shopkeepers	0	1	0	4	5	4.1
Fishmongers	2	3	0	0	5	4.1
Brick makers	0	2	0	0	2	1.6
Charcoal makers	1	1	0	0	2	1.6
Others/Not specified	0	1	0	1	2	1.6
Total	32	30	30	30	122	99.8*

Source: Field Data.

*Error due to rounding off.

Household Structure and Family Organization

The Social Structure

Social groups are aggregates of people who develop feelings of belonging together. They associate more closely with each other than with outsiders and influence the thinking, feelings, and actions of members. The farm household in Funyula has developed a system of norms that prescribe appropriate behaviour patterns for each member of the family. These norms have emerged through socialization and social interaction processes including values and beliefs that people hold. There are norms concerning husband and wife and relationships between senior wife and co-wives in a polygamous home. There are also norms about role definitions within the household.

From personal knowledge gained by virtue of belonging to the tribe, the author knows that the Samias are patriarchal. Women are supposed to obey their husbands and in-laws. The man is the head of the homestead while the woman only heads her house. She has no decision-making authority over land and homestead matters. However, the community is characterized by strong ethnic loyalties, interpersonal interactions, and relationships. These relationships consist of reciprocal rights and obligations that extend to women helping each other in providing fuelwood during times of need such as festivals and funeral ceremonies. It is also a tribal duty for men to help provide logs used to burn at funerals of diseased kinsmen.[21] No funeral ceremony was directly observed during the course of this study.

Family Organization

Although the surveyed areas are generally called villages they are not villages in the strict sense, but rather a collection of homesteads scattered over a large area. Basic data by which to adequately describe the social stratification within and between villages

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[21]The fire is lit outside the hut of the diseased and burns day and night for a specified number of days.

are lacking. The following information on family organization of the Abasamia is based on the author's own knowledge as one of the tribespeople. In Funyula Division the family is the basic unit of production and consumption. The homestead or household is organized around the male head, his wife (wives) and children. Depending on when the homestead was established, it can be a very complex entity. It will vary in number of residents, amount of land held, and wealth. It may consist of one, two or more households. For instance, a man may live in a homestead with his married sons and their families. The sons will generally establish separate households with separate cooking arrangements, although it is not unusual for the youngest son and his family to continue using his mother's cooking unit. For purposes of this study, where married sons were still residing in their father's homestead, each household was treated as a separate cooking unit.

The average household size is seven persons. A majority of the respondents interviewed were married (86%) while 9% were widowed, 3.3% single and 1.6% divorced (Table 6.4). Twenty-three percent of the married respondents were in polygamous marriages. The extended family is a very important feature of the people of Funyula. It forms the basis of work groups and gives support during funerals and other social functions. A large family is an ideal to which every woman aspires. Boys are valued because they form continuity for the clan. Girls are valued for the wealth they may bring in the form of a dowry at the time of marriage. Children are also viewed as an economic asset and insurance against old age. In addition, a large family provides labor for the farm.

Infrastructure

This section describes the road network, market centers, health centers, and other institutions important in any rural development programme such as tree planting and fuelwood planning. This information was partially derived from the Busia District Development Plan and the survey data, including direct observations.

A majority of the respondents (81%), occupy grass thatched huts. The rest are in improved houses with iron (*mabati*) roofs and occasionally cemented floors. These dwellings require poles and timber for construction. Since house type is one indicator of wealth in rural Africa (with those in houses with iron roofs being considered better off than those in grass thatched houses) (Prewitt 1975), the above result suggests that a majority of the respondents are not well to do.

It is difficult to categorize the villages into socioeconomic classes. The variables used to distinguish between socioeconomic class in rural Africa are often house type, bicycle ownership, livestock ownership, and cash cropping (Prewitt 1975). Using these variables (Table 6.6), there were no discernible socioeconomic classes among the study villages. Social stratification within villages and within and between households was found to be beyond the scope of this study.

In general, the area itself is also not prosperous when you compare with the rest of the country. But it is well served with a good network of dirt roads (Figure 4.1). Certain sections of these roads are impassable during the rainy season, making communication difficult. Moreover, the only road served by public transport is the Bumala-Sio Port road that connects the two major market centres,[22] Funyula in the north and Sio Port in the south of the division. In all, the north has five market centers while the south has four. Funyula, the biggest of these centers, is the Divisional Headquarters

[22]Market centers are supposed to serve 2,000 and 10,000 rural people. They have a number of primary schools, a secondary school, and a health center.

Table 6.6. Frequency of items indicating socioeconomic status of respondents by village.

Item	Sagania n = 32	Nangina n = 30	Kadimbworo n = 30	Namasali n = 30	Total Frequency	Percent of Total
Iron roofed	4	7	9	3	23	19
Bicycle ownership	10	11	12	11	44	36
Cattle ownership	10	6	9	12	37	47

and is thus classified as a rural center.[23] This is an important centre in the commercial and business transactions of the division. However, there are no banking facilities except for a mobile bank. Farmers are therefore limited as to sources of credit for farm improvements. The only other financial institutions to which farmers can apply for credit is *The Agriculture Finance Cooperation*[24] (AFC) with a branch at Busia, the District Headquarters. The available infrastructures are not yet developed sufficiently to support a viable wood or timber based industry. The village wood-based industries such as charcoal making are geared towards meeting family basic needs.

Health

Community health is very important if the strenuous job of looking for firewood and tree planting has to be accomplished. It appears that the people of the study area are well served by the health department. There is one mission hospital, one health center and four dispensaries in the division. Nevertheless, infant mortality is high (117 per 1,000) and cases of malnutrition rampant (Republic of Kenya 1988b). The latter problem is exacerbated by beliefs.

According to *Busia District Development Plan 1989-93*,

> "traditional beliefs and practices are still very important. The Samia hold that malnutrition, . . . infertility, and madness are best dealt with by using traditional medicine. . . . [They] still withhold fruits and vegetables from children who are malnourished because of the belief that such fruits may weaken the children more."

The most important cause of illness is malaria, followed by respiratory infections e.g., bronchial-pneumonia, tuberculosis and upper respiratory tract infections (Republic of Kenya 1988b).

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[23]A rural center should serve approximately 15,000 people. In addition to what a market center has, a rural center should have piped water, electricity, sewage disposal system, banking facilities, telephone and postal services.

[24]This is a government financial institution started in order to advance money, for agricultural development, to farmers in Kenya.

Woodfuel and trees in general have an important part to play in the health of a nation. Their use enables food to be cooked, thereby killing germs and making the food safe for consumption. Trees also directly provide fruits which have essential vitamins for health. To what extent the Samias withhold fruit from children is not known. All the same, the nutritional status of the population could be improved through provision of more tree food products.

The incidence of diarrheal diseases is a direct reflection of the level of hygiene and availability of safe drinking water in the community. None of the villages in the study has safe water supplies. Fuelwood could again play a big role in rendering the water safe. People will only boil water if they know about the connection between disease and contaminated water, and if they have plenty of wood with which to boil it.

Traditional Land Use and Land Use Changes.

Changes are taking place in the traditional land use patterns in Funyula Division and Busia District. These changes are not immediately apparent except when individual landscapes and communities are carefully examined and analyzed. The present description of land use in Funyula Division is based on *The Farm Management Handbook of Kenya* (FMH) (Jaedzold and Schmidt 1982), Ottichilo's (1985) study and the author's own observations.

Funyula Division is classified agriculturally as lying in the high potential area. It is capable of producing a variety of crops. The list of crops growing in the farmers' fields (Appendix 6), attests to this classification. About 1,290 hectares of the division are taken up by infrastructures (road networks and buildings), steep hills and water. The hills are still used in the traditional fashion, for livestock grazing during the dry season and as a source of fuelwood, building materials and herbal medicines. A few people use the trees on the hills to produce charcoal for sale to government workers or to towns such as Busia. Stones have also been removed for use as building material. Quarries are also

found scattered in people's plots where there are lateritic ferasol outcrops. However, this is not a major land use as it depends on the availability of quarry quality stone, labour and demand. Most land is still devoted to subsistence farming with livestock and crop husbandry dominating.

Livestock Husbandry

Livestock consists mainly of Zebu cattle as well as local breeds of goats and sheep. Cattle are kept as wealth to be disposed of when the family needs school fees or some other emergency cash. Goats also are a source of cash. They are kept mainly for use in ritual ceremonies, such as, funeral rites or as gifts for in-laws. Over 63% of respondents owned some type of livestock (Table 6.7).

Observation and RRA revealed that extensive grazing is the preferred form of livestock management although tethering does take place where animals are few and there is not enough labour. Direct observations and the opinion of the informants showed that animals are generally in poor condition because of poor management, high incidence of tick borne diseases and tsetse flies. During the informal surveys in the RRA, complained of increased incidence of tsetse flies which they blamed on the *L. camara* bush. The author failed to observe any wire fences in the homesteads surveyed. This seems to be a problem as animals graze other people's crops and may also affect tree regeneration[25]. The only source of water for the animals are streams, River Suwo or Lake Victoria. Seasonal ponds nearer grazing areas are favoured during the rainy season.

[25]The interview session with the agriculture officer (Chapter 7), was interrupted three times by farmers coming to complain of stray animals. Indeed, the DAO said one of his pre-occupations was settling disputes among farmers complaining of stray animals.

Table 6.7. Livestock ownership and type.

Answer category	Frequency	Percent of Total
None	45	36.9
Cattle	20	16
Cattle and goats	8	6.6
Cattle and sheep and goats	9	7.4
Goats	16	13.1
Sheep and goats	14	11.5
Pigs and others	10	8.2
Total	122	99.7*

Source: Field Data

*Error is due to rounding off.

Farm Labour

Human labour supplemented by draught is used on the farms (Table 6.8). Use of animals is restricted to breaking up the land and is practiced among only a few of the livestock owners. The Ministry of Agriculture runs a Farm Machinery Division which is intended to hire out tractor services to farmers. At the peak plowing season these machines may not be readily available due to demand from multiple users or to mechanical failures. None of the farmers interviewed has been able to use this service. Farmers believe that the tractors mix up the farm boundaries. Boundary marking is still done in the traditional way by digging small furrows to separate the gardens. A tractor would obscure these type of boundaries. In spite of the foregoing statements, 10% of the respondents in the questionnaire survey said they planted trees for boundary marking. Thus, as a form of boundary marking, tree planting is not yet widespread. This contrasts with findings in Mbere District (Brokensha and Riley 1978 and Riley and Brokensha 1988) and Kisii districts of Kenya (Barnes 1984) where increased tree planting for boundary marking was observed.

Fisheries

In the past, fishing was an important industry that must have had an impact on the woodfuel resources of the fishing villages. Surplus fish used to be preserved by a combination of methods that included smoking and sun drying. Today no such activity takes place as there is no surplus fish to preserve. Most of the small fish species which the inhabitants depended on have been eliminated by the bigger carnivorous, Nile perch introduced into Lake Victoria by "British colonial sports anglers 30 years ago" (Calgary Herald Friday, April 7 1989).

Fishing is still important in the southern location among inhabitants of the lakeshores but the fish is marketed fresh to owners of refrigerated trucks who export it to larger consumers in Nairobi where there is a "strong demand for perch in American and

Table 6.8. Source of farm labour.

Category	Number	Percent of Total
Family	69	56.6
Family/Hired	30	24.6
Family/work groups	18	14.7
Hired	5	4.1
Total	122	100.0

Source: Field Data.

European restaurants" (Time, September 14, 1992). Perhaps, afraid to show that they had money, the fishermen interviewed, said that they only fished for subsistence. On a small scale women continue to smoke surplus meat or fish for home consumption since refrigeration technology is not yet accessible to the rural farmer.

Crop Husbandry

The author relied on her own familiarity and ability to compile and identify the crops that were found growing in the farmer's fields in Funyula Division (See Appendix 6; the list is not exhaustive). Cotton, the only major cash crop of the area, grows in most soils, although the best sites are on the grey sandy loam soils on benches (*amatale*). Cotton hectarage has declined in the last few years. For example, in 1984 the district recorded 3,600 ha of cotton, down from 24,000 ha in 1982 (Republic of Kenya 1988b). The decline is due to delays in paying farmers. During the course of this study, 50.8% of the respondents were growing cotton. But they complained of poor germination due to poor rains in 1991.

Coffee is a recent introduction into the district and only two farmers in the sample raised the crop. The variety of coffee raised is Robusta. Sunflowers are also grown but only on an experimental basis. The study area has no reliable cash crop.

Food Crops

The major food crops are cassava, maize and sorghum. Cassava, introduced to the area as a famine crop during the 1930's (KNA 1940), is now a major staple food. Towards the end of the rainy season, cassava cuttings are interplanted with cotton or maize. It is then weeded along with other crops until the latter are harvested. Large sized cassava roots can be harvested from six months after planting. However, the roots are usually left to continue growing for two or more years and are harvested according to family food needs. Cassava fields may extend to the foothills. Cassava and cotton sticks, and sorghum and maize stocks may be used for fuel especially where there are shortages.

More often, however, they are used for kindling the fire. Sorghum is usually sown together with maize or millet in the more fertile areas. Sweet potatoes are grown near streams or in what is judged to be rich soil e.g., red loams or black clays; bananas may be found near streams, under a *Ficus capense* tree, or near homesteads; vegetables e.g., kale, cow peas, and tomatoes, grow near streams. Those far from streams rarely raise tomatoes and kale because watering during the dry season would be a problem. Peanuts, bambara groundnuts, and sesame seeds are occasionally raised, usually, during the short rains. Sesame seeds and bambara nuts were not observed in the farmers' fields; the crops are seasonal and rare. Their existence in the farming system was revealed during a visit to the local markets as part of the RRA exercise. When vendors (resident women) were asked about the source of these crops, they had said they raised them themselves.

Land Borrowing

From personal experience the author knows that those whose lands are not near streams or are unsuitable for special seasonal crops may "borrow land" from neighbours to raise a particular crop. To "borrow land", means land is loaned to a relative for one or two seasons. No money transaction is usually involved. The owner of the land expects to be given some of the harvest from the plot. However, information gathered during RRA, revealed that borrowing of land is slowly being replaced by plot renting, where a user pays a fee to cultivate the land for a specified period.

The only form of soil improvement noticed is fallowing, which in reality, is a form of shifting cultivation. Direct observations showed that farmers tended to dig up and down the slope, seemingly oblivious of the consequences of this practice on soil erosion. It could be said that trash lines are the only form of erosion control and soil improvement. However, some farmers in Namasali village were observed to dig channels to drain their swampy soils of excessive water. During the informal interviews it became apparent that use of agro-chemicals was rare except on livestock.

Tree Husbandry

From prehistoric times, trees have played an important part in the lives and culture of the Samia people although the area is not forested but rather consists of open savanna woodlands. As already mentioned, trees provide wood energy with which foodstuffs are cooked. In the past, they also formed shelter for the homestead against animals and maurading tribes. For instance, Wagner (1949 p 40) observes that:

> "In those parts of Kavirondo where leopards or where the owner of the homestead wishes to protect himself against theft or sorcery, the homestead is surrounded by a hedge of thorn-bushes or Euphorbia interplanted with various protective plants".[26]

Trees were also used in religious ceremonies. According to Osogo (1966), whenever a clan moved to a new place it planted a *Mukuyu, Ficus capensis* that became a shrine at which the clan would worship.

There are no established government or private forests in the area. Most tree needs are, therefore, met from the on-farm trees or from other districts within Kenya but mainly from a neighbouring country. After twenty years of Rural Afforestation Extension, Ottichilo (1985) was able to record only 300 ha of woodlots for the whole of Busia District. The author's own appraisal showed none in the four villages surveyed.

Nevertheless, the number of respondents who said households they represented had planted trees is high (95.5%). The survey and direct observations showed that the most commonly planted tree is the indigenous *Markhamia lutea* which is used for homestead boundaries. A large variety of exotic tree species were also recorded in the homesteads (see Appendix 7 for a list of indigenous and exotic trees recorded in the Funyula village landscapes).[27] No herbarium specimens were collected. The most

[26]The fence, not only formed a barrier against real dangers to the homestead, but also contained "magical" plants that protected the homestead and the inhabitants against sorcery and other supernatural powers.

[27]This list is not exhaustive. It was compiled by recording the tree species directly as they were encountered, using the Kenya Trees and Shrubs by Dale and Greenway (1961) for field identification.

common of the exotics in the southern villages were *Cassia siamea* and *Melea azadirachta* while the northern villages recorded *C. siamea*, *M. azadirachta* and *Cupressus* spp. Two people claimed to have planted *Chlorophora excelsa*. Only one person admitted to planting trees for medicinal purposes. But when asked which tree they most wanted to plant, 24% of the respondents mentioned the neem tree, *Azadirachta indica*. Further probing established that they had heard that the neem could cure several diseases,[28] and they wanted it for that purpose.

Besides the neem tree, people also want to plant *Terminalia* sp. and *Grevillea* sp. as ornamentals. Those who asked for these species had come in contact with Kenya Energy and Environment Non-governmental Organization (KENGO) workers who were promoting some tree species in the area. Respondents who had not planted any trees were young and had recently established their homesteads. It is assumed that in due course these individuals will plant some trees.

Fruit Trees

A tour of the division with the DAO showed that some farmers in the study area grow oranges extensively. However, none of those interviewed fall in this category. Observations made of the trees growing in the homesteads during RRA and the survey showed most homesteads to have a fruit tree or two of one kind or another, the most common being mangoes and pawpaws of the unimproved variety. Other fruit trees found in the division are guava, lemons, the jumbolan, *Syzygium cuminii*, and the durian, *Durio zibethinus* (Appendix 8). The latter has large fruits, the size of watermelon, with a strong pineapple-like smell.

Many interviewees showed interest in planting more citrus although there are problems facing the existing crop. Trees were seen to be infested with aphids and a hard scale that resulted in a sooty mould covering the leaves. However, the survey showed

[28]This Indian tree is called *Arubaine* (forty) in Swahili, meaning the one that cures forty diseases.

46% of the interviewees rating termites as the biggest problem preventing good tree growth in the area; 23% said it was a combination of termites and inadequate rainfall, while 10% thought it was inadequate rainfall and poor soils. The author was often asked to provide suitable pesticides to protect planted trees against termites and what respondents referred to as *enyende*, probably nematodes. The respondents complained of lack of funds with which to purchase pesticides and distance to pesticide distribution points. To some extent the lack of adequate infrastructure discussed in Chapter 5 limits the farmers ability to plant and successfully manage their food and tree crops.

Seedling Source

Forty percent of household heads say they obtained their seedlings from government tree nurseries, 17% propagated their own seedlings, while 6% obtained them from nearby primary schools with tree nurseries. Other seedling sources include buying or bringing them in from outside the division. Government nurseries therefore form the largest source of seedlings in the area. This is not surprising as water is a problem in this area, preventing farmers from establishing on-farm nurseries. The only on-farm nursery seen by the author during the course of the study belonged to a young boy who was receiving aid from the Nangina Family Helper Project. In addition, to its charitable work, the project also promoted tree planting among its aid recipients.

From direct observations of the homestead gardens and the farming practices in Funyula Division in general, the author saw no evidence of organized agroforestry although 23% of respondents said they had planted their trees among crops. Numerous *Markhamia* sp. which marked old homesteads are found growing with crops. The *Markhamia* sp. continue to coppice once they are cut. The stems are thinned and a few left to continue growing to provide poles. It is this thinned out *Markhamia* sp. and prunings that provided some of the fuelwood.

What has been discussed so far is the planting of trees in the homestead compound and lands. The discussion also included a brief overview of the farming system which was also discussed in Chapter 5. The study population owns land on which crops and trees are raised. Nonetheless, the following part of the discussion will endeavor to show the type of land tenure system prevailing in the study area in relation to the rest of the country.

Tenure and Land Ownership Patterns

According to Fortmann (1984), the success of any tree planting effort depends on how secure land owners are with regard to their ownership category. In Kenya where land sizes are often small, on farm tree planting competes with agriculture, the mainstay of the economy. Agricultural production in Kenya is predominantly based on smallholder private farms. There are a few large scale private, cooperative and public enterprises, all under different land tenure conditions.

Land tenure is the right to hold and use the natural resources found in the land profile. There are basically three types of land tenure in Kenya.

1. **Customary land tenure** is an indigenous land holding system practiced by various ethnic groups prior to colonialism. Under this system land was held, owned or controlled by a family group, a clan, a chief or a group of elders. Ownership was communal, guaranteeing a secure source of fuelwood and other wood products to all inhabitants. There are a few communally owned pieces of lands which are now classified as Trust land and are administered by local authorities or the Commissioner of Lands on their behalf. Most such lands are in pastoral areas where nomadic tribes live.

2. Freehold land is rent free land held by individuals with minimum restrictions on use. Free hold titles are granted to household heads. Most of the land in the study area falls in

this category, communal land having been consolidated,[29] registered and title given to a male household head. Such land is supposed to be inherited by one son. In practice, however, this does not happen as it would be at variance with tribal inheritance laws that dictate that, upon the death of a father, each son gets his share of the family land. Consequently, there is a lot of land fragmentation with serious erosion of households' ability to supply fuelwood and other basic needs. The relationship between land fragmentation, fuelwood supply, and tree planting requires further study.

3. **Leasehold land** is land subject to terms and conditions of a lease. Rent is paid by the lessee, usually to government. Once land is leased or adjudicated to freehold, it becomes private property subject to commercial transactions and speculation.

To summarize, this chapter has examined the socioeconomic and sociocultural characteristics of the study population. A description of the demography, education level, health and occupation of the respondents was also included. In addition, the type of infrastructure and institutions found in the area are covered. Stress was laid on those aspects that influence tree planting and fuelwood provisioning. In addition, the various crops and trees planted in the farming system, and the homestead gardens, including sources of tree seedlings, were discussed. Finally, because land tenure is important to tree planting it was also described. In the forthcoming chapter, more results from the pilot study and a historical perspective of the study population is presented. A summary of interviews with key informants, and various government officers involved in the conservation of natural resources, and environmental management, is also presented.

[29]An individual's scattered plots of land were surveyed and he or she given one continuous block from communal lands or neighbouring pieces in exchange.

CHAPTER 7

INTERVIEWS AND OBSERVATIONAL RESULTS

This chapter presents a history of the tribal group under study, highlighting themes relevant to resource use and management. Traditional land and tree tenure are discussed. Various beliefs about trees are discussed. The chapter also presents results from the Rapid Rural Appraisal (RRA) that was carried out using a modified combinations of Chambers', (1985) and Conway's (1985) methods. The author talked to and interviewed several farmers, eleven knowledgeable informants, tool makers and such government officials as the agricultural officer, the forester and the chiefs. Only summaries of what they said are presented. However, interviews with government officials and one representative from each of the population categories are edited or translated into English and presented in their original form, as far as possible.

Historical Perspective

Historical information is of relevance to the present studies only in so far as it will throw light on land and natural resource use by the inhabitants of the area. It should also establish a basis for the comparison with the Abaluhya of Kakamega on whom there is some literature pertaining to fuelwood deficits and tree planting.

The Study Group: The Abasamia

The Abasamia belong to the Abaluhya tribe who themselves belong to the Interlacustrine cluster of the East African Bantu, occupants of Kenya's Western Province. Fire or wood burning is very important to the Abaluhya tribe and it features in many of their ceremonies. The tribal name is derived from the word *ohkuyia* which means to burn (Osogo 1966). Fire was the focal point of the Abaluhya, "people of the same hearth," around which they sat to exchange news and pass on the tribal history. It was not only

used for cooking, food preservation and for protection from cold and wild animals but it was also used in industry and for ceremonial purposes. Up to now, whenever a Muluhya dies a fire is immediately lit outside the deceased's hut and continues to burn until the mandatory mourning days are over.

The Abaluhya tribe consists of eighteen sub-tribes (Table 7.1) of which the Abasamia are one. Very little is known about the history and culture of the Abasamia of Funyula Division. Their sketchy history gives a conflicting picture as far as wood resources are concerned. Apparently, from the time the Abasamia settled in the area between 1490-1733, they became "the most skilful and famous blacksmiths in western Kenya and parts of eastern Uganda" (Were 1967, p. 33). Were further contents that the inhabitants could practice smithing because "in this place they now had iron-ore, wood for charcoal, plenty of fish, good grazing land and abundant food". The Abasamia lived in walled villages and only spread out when intertribal raids stopped, sometime at the turn of the century. According to eight of my eleven informants, there was very little history of tree planting. The only trees planted were *Euphorbia tirrucalli* for fencing homesteads. The trees provided poles for roofs of huts and wall posts. *Grewia trichocarpa* (*Ekhoma*) provided wood for tool handles while *Albizia grandibracteata* (*Omulongo*), was used for firewood. To prevent gaps from developing in the overgrown fences of *E. tirrucalli*, a herb, *Afronantum montana* was planted along side the *Euphorbia* fences. Two of the respondents in this study said the widely planted *Markhamia lutea* was introduced into the area from neighbouring Nyanza Province; five did not know its origin while the rest of the informants thought the tree was indigenous to the area.

It is not clear whether the Abasamia depleted their wood stocks or not, for in the 1930's efforts were being made to increase tree cover in the area. In the words of one medical officer working in the area at the time:

Table 7.1. Western Province's Abaluhya subtribes.

District		
Busia	Bungoma	Kakamega
Samia	Bukusu	Wanga
Nyala	Tachoni	Logoli
Hkayo		Tiriki
Marachi		Tsotso
		Nyore
		Nyala
		Nyangori
		Kabras
		Idakho
		Isukha
		Kisa
		Marama

> "the Deputy Director of Sanitary Services issued a directive that all MO's should encourage cultivation of fruit trees and that they should also plant trees around all dispensaries. . . . orange, lemon and gum trees were beginning to flourish at all the dispensaries with one exception. In Samia, up near the Uganda border, I had been quite unable to get any trees to grow."(Carman 1976 p 39)

Carman goes on to explain that his efforts were doomed to fail as "the surrounding country was almost innocent of indigenous trees" (Carman p 39). At the time Carman made these observations near Nangina, the place was used for herding animals and must have appeared bare. Today, with a much denser population than in 1930, the Samia landscape has several tree species, both self-regenerating and planted. By 1969 the government was not just encouraging officers working in the area to plant trees but rather "the forest department was busy during the year with negotiations for the afforestation of Samia Hills in Busia District" (MENR 1970). At the time the department wanted to replace the indigenous vegetation on the hills with eucalyptus, cypress, and pines. However the people of the area effectively prevented the government from acquiring their hill lands. They set alight the areas, thereby, burning trees that the government had planted. Eventually, the government was forced to give up its move to acquire the land. Following this confrontation with the government, the inhabitants tend to be suspicious of official representatives. For example, on one occasion I was asked by a concerned old man whether I worked for the government, and whether it was about to take away their hill land again. This suspicion is not surprising given their previous experience. An interview with one of the chiefs is typical of the experiences with such counterproductive government directives.

One of the Chiefs

> "People are really planting many trees. They are responding to government efforts. I have ordered each homestead to plant at least 50 trees each year."
>
> (Interview with one of the chiefs 14 June 1990). In order to respect the anonymity of the interviewees. No names will be used for interviewees.)

This particular chief seemed to be echoing the words of the North Kavirondo native Council 1941 Afforestation resolution that states:

> "that the head of every village in any location within the District of North Kavirondo shall before the 30th June in any year plant 50 trees of such kind or kinds in such places and such a manner as the official headman under the instructions of the District Commissioner North Kavirondo District shall direct and shall keep such trees in a proper state of cultivation" (KNA 1941).

A chief is a very powerful person in the rural areas. He represents government and his word is often law. He can invoke the chief's act to enforce whatever he has decreed. It would not be unusual for a chief to order people to plant a certain number of trees. The chief in turn is under pressure to show his commitment to tree planting. He is supposed to have a tree nursery in his location. There were none in the two locations of Samia North and South.

Powerful though a chief appears to be, he is generally harassed by the many people who compete for his time. He is a litigant in petty squabbles, organizes meetings and receives visitors on official tours. He is also responsible for many government activities and projects started at the locational level. It is thus difficult but not impossible, for such a busy person to manage a tree nursery.[30] Moreover, chief's nurseries are supposed to be run on *Harambee*[31] or voluntary, basis.

The hills were utilized as communal lands where people grazed their stock, collected building materials, firewood, medicinal herbs and fruit. At the time of this exchange with the forest department, land adjudication was taking place in Funyula Division. The hill areas were parcelled out to individuals, and hitherto communal land

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[30]While serving in government, a now retired assistant chief had run a thriving nursery, in Samia South, from which many residents obtained their seedlings. Since his retirement, however, the nursery is non-functional

[31]Harambee means lets pull together. It is a rallying call for people to work together on or contribute money for community based projects. Communities have their priorities for the type of project they want to support, usually one they have started themselves. Chiefs' nurseries are not one of them as chiefs represent the state.

passed into private hands. As in other parts of Kenya, only male household heads were allocated land. In keeping with tradition, women used to be allocated fields to cultivate in order to raise crops to feed their families. This continues to be the practice although both men and women are supposed to be equal under the Kenyan Constitution.

In the past, huge trees, with a commercial value such as the Mvule, were owned by whole clans. The cutting of the Mvule was integrated with canoe making for which this species was almost exclusively used. Even then, the price of a Mvule was high because it entailed the payment of a cow or two, the brewing of beer, and sharing of meat on the day the canoe was launched. Many of the customs and taboos observed among the Abaluhya of Kakamega also apply, with minor differences, to the people of Funyula. Individual ownership of trees is a new development which seems to have been reinforced by the issuing of land titles.

Female Interviewee

It seems women viewed fuelwood procurement as a big problem as typified by the following remarks by a young female interviewee:

> "The work I hate most is gathering firewood. My father thinks there is still firewood left in the hills behind our house. I tell you there is nothing. The only thing we find are those *L. camara* bushes. I hate gathering *Lantana* sp. It is prickly, does not dry easily even if you leave it in the sun for a long time. When it comes to using it for cooking its smoke will sting your eyes until you shed tears."
>
> personal interview with young girl, 3 July 1990.

The above comment is not surprising as women are traditionally the main wood gatherers for the family cooking which they carry out. They are in a better position to distinguish between different wood qualities that are important in cooking. They may select species on the basis of their density, moisture content, non-sparking ability, type of smoke

produced and type of flavor imparted to different foods. This is something only those who use the wood most are likely to know.

An interview with a lady from Namasali on July 25 1990 gives the problems in this village faces.

> "For us fuelwood is a chronic problem. I use acacia trees. I strip the bark to remove thorns. I then leave the wood to dry for a few days. Once that is done the wood burns quite well. Trouble comes during the wet season then I am sometimes forced to buy wood from the market."
>
> Interview with Namasali woman, 25 July 1990.

A lady teacher from Sagania village did not think there was much fuelwood problem. She even wondered why I was asking her about such a minor issue when the issues facing them were to do with the changed education system.

> "Frankly I don't think we have much fuelwood problems. Not now and not in the next few years. If you had asked me about what government is doing to mess up our education system I would have been very pleased."
>
> Interview with a lady teacher 19 June 1990.

What the women said depended on their village situation and to a certain degree the work they did. This teacher was preoccupied with problems of her trade and although enlightened did not see fuelwood procurement as a problem. Being a full time teacher she had someone helping with the actual acquisition of fuelwood. She may have failed to appreciate the existing problems. However, Sagania is one of those villages which appeared to have more wood sources than the rest. The lady teacher may have reflected the situation as it is in that village.

A woman from Nangina village showed a different view. She expressed difficulties in acquiring firewood. When asked why when her household owned part of the land on the hills her answer was

> There is no fuelwood in those hills. It is finished from over harvesting by the school and the Catholic Mission[32] over the years. In addition we have no direct access to our own lands. We are not allow us to pass through the school grounds. We have to take a detour.
>
> Female interviewee from Nangina village 21 June 1990

The problems of Nangina are therefore a combination of factors. The inhabitants are unable to go to their own lands on the hill because of the existence of the Mission lands in between the village and the hill area.

Men, on the other hand, were more concerned with building poles and lamented their scarcity. A typical answer from one of the men asked whether firewood was scarce was as follows:

> "Firewood is not a problem; so long as we have all this bush around we shall continue having firewood. We do lack building poles though."
>
> Interview with a man from Sagania village, 25 June 1990.

In one homestead at Sagania, husband and wife argued over the question of wood scarcity. The man insisted there was no scarcity, pointing at a pile of wood in the eaves of their hut. The woman scorned at what the man said and declared that the wood was useless as it was *Lantana* sp. It would take another two weeks to dry and be utilizable. Here the two parties are considering different aspects of the wood. The man only saw the quantity, while the woman was concerned with quality of the wood. From these varying responses and impressions, it was concluded that there was a gender difference in perception of the wood scarcity. It also seemed that there was a regional scarcity.

It has been argued that where men own the land, women tree planters have very little say in the choice of species to be planted (Fortmann 1985). Men land owners would make decisions on matters pertaining to land would favour the planting of trees that serve their needs. The prevalence of *Markhamia* species on the homestead gardens seemed to confirm this view. *Markhamia* sp. was mainly used for pole provisioning.

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[32]Wood is used to cook school and hospital meals.

The view of the government officers, obtained from interviews with the forester and the agriculture officer is that there is no fuelwood scarcity in this area.

Agriculture Officer

> "I don't see any problem with firewood. However, fencing posts and poles are a problem. For example, none of the farmers practices tomato staking because it requires a lot of sticks. I suppose they could get sticks from the hills but these would be of poor form. Labour would also limit them. Anyway people prefer to use the hills to produce charcoal. The hills are a big resource but they are not managed properly. They are periodically burnt to control ticks and tsetse flies and also to stimulate new grass growth which ends up killing young tree seedlings. I am afraid the hills will soon be bare. The hills should be re-afforested with indigenous species. Owners of hills resist afforestation because they fear that government may take them over. They also have no capital or labour for that type of work.
>
> Free range animals are another menace. They trample any seedlings that are planted. If the hills are afforested, owners fear that grazing for their animals will be reduced."

Interview with DAO, 23 June 1990, Funyula Divisional Agriculture Office.

The agriculture officer is obviously well informed about the problems facing the area in terms of tree products and land use planning that had an impact on agricultural productivity.

In contrast, the forest officer's work is hampered by less direct access to farmers. The following is a reproduction of the interview with him.

The Forester's Remarks

> "This area is generally very harsh. I can understand why little is accomplished. You cannot blame the people. There is definitely no fuelwood problem. People are planting trees. I think they are responding to our efforts. We have not visited many farmers because of lack of transport. We normally plant for the community. We planted for Mr. A and Mr O [these happened to be very influential people in the community]. Other people will not let us plant for them. They are very suspicious. We have made it known that we are available to help. People don't like planting indigenous species. They say they already have them

> in their plots. We exported a lot of seedlings to Bungoma District because they had overstayed in our nurseries."
>
> The Divisional Forester, personal interview 22 June 1990. DAO's office, Funyula. (The forester does not have an office).

The forester has no assistants at the sublocational level and no office at which farmers could reach him. His activities centered around the two government nurseries on occasions when he was able to visit them. The nurseries also lack basic equipment and tools essential for good nursery management. For example, they have no tool stores, watering cans or root pruning equipment.

It is thus not surprising that the questionnaire survey results (Chapter 8) show that whereas, all farmers interviewed had never been visited by a forest official, 30% said they had seen an agriculture officer. It may be concluded that, in spite of on going rural and engaging in extension activities over the past two decades, the Forest Department has yet to reach farmers of this area. In addition, the fact that trees stay in the nursery for a long time indicates that farmers are either not visiting the nursery to take seedlings or the seedlings are not what the farmers want. Indeed, as the forester said the people are less interested in indigenous trees especially *Markhamia* sp. which they have in their homestead gardens. As will be seen later, other trees such as the Mvule are also not taken by farmers but for different reasons.

Beliefs about Trees and Tree Planting

There is a belief that if you plant the Mvule you would die. Nine of my respondents shared this belief. Only one informant dismissed it as rubbish. Moreover, he stated that, as a young man, he had planted Mvule in 1947. He had recently, been able to sell it for 5,000 Kenya shillings (Can $250). The second informant who did not believe in Mvule causing harm was a retired religious instructor. Probably, Christianity influenced and changed this man's beliefs about Mvule.

On the question of cutting the sausage tree, *Kigelia aethiopicum*, there is disagreement. Seven informants declared it was against the norm to cut this tree, without explaining why. Two said they had once cut it, while the rest could not remember whether there were any norms or taboos governing the cutting of the species. The sausage tree is one peculiar African tree with a lot of legend surrounding it. Its wood is of limited use. The Abaluhya and Luo of Kenya use the fruits of the *Kigelia* tree in funeral ceremonies. The Luos bury the foot and half long fruit if they fail to recover the dead body of a relative. The Abasamia are said to use the tree in burial ceremonies of a woman who dies childless. The Kikuyu and other tribes use *Kigelia* fruits to make an intoxicating brew called *muratina* (Leakey 1977). Because of the association of the sausage tree with funeral rites the Abasamia consider it unclean and not to be touched or used unnecessarily.

Eight of the informants thought a woman should never plant the homestead fence as that is a man's job. They explained that in a homestead it is the man who has authority, while the woman takes care of her household. Three respondents, among them the religious man, do not subscribe to this belief. Asked whether only men should plant trees, three informants categorized the type of trees to be planted as fruit trees, and fences. They thought the rest of the trees, especially the indigenous species, were not anyone's business to interfere with, whether the person was man or woman, except a medicine man. Five informants did not see anything wrong with women planting trees if these do not include the homestead fence. The remaining six informants found nothing wrong with women planting trees. The question whether women could cut down trees was met with surprise. The interviewer was expected to know the cutting down of trees was a male task. However, this task allocation does not apply to small shrubs.

Most of my informants think there has been a reduction in vegetation cover due to increased population which had made people move over larger areas. No one was more

aware of the disappearing vegetation and trees than one of the tool makers who had this to say:

> "I am worried about my trade. I used to use Mvule and *Albizia* sp. to make the traditional three legged stool. Now I have to use other species. Mvule is no longer available while *Albizia* costs much money. The cost may range from 800 - 1,000 Kenya shillings (Can $40 - 50). I use the *Ficus natalensis* to make mortars (*ebinu*). That tree is cheaper. It costs about 300 shillings (Can $15). I am able to make twenty mortars from one tree. I don't make much money from this work. You see I have to pay someone to cut down the trees. There is very little for free nowadays, so I sell the unsuitable branches to charcoal makers."

Interview with a traditional craftsman. 28 June 1990.

In an interview with a charcoal maker given below, it became apparent that people of the study area are aware of the complex interactions of their resources and the other spheres of life.

> "I normally buy trees to make charcoal. I pay in kind. The land owner takes one third of the charcoal I make. He then sells it. Business is not bad. You know, petroleum prices keep going up. That is good for me. People who used to use paraffin can no longer afford it. Anyway, it is not available right now.[33] Business would be better if more charcoal did not come in from Uganda."
>
> Interview with a charcoal maker 20 July 1990.

The charcoal maker demonstrated an awareness and understanding of the opportunities available to him due to the changing prices of petroleum products. What is played out on the international scene will thus have an impact on this man's life and eventually that of others dependent on the environment he manipulates to harvest trees for charcoal.

It is clear that the Abasamia did not have a culture of planting trees except for the homestead fence which served a specific purpose. However, they utilized the natural tree resources in their environment and had developed beliefs and prohibitions which ensured that certain trees were used or avoided according to tradition. Historical data and interviews with informants also suggested a gender difference in perception of fuelwood

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[33]There are occasional periods of paraffin shortages. Consequently, some areas of the country do not get their regular supplies.

scarcity. Furthermore, while government officers are aware of the macro-problems facing the inhabitants, their perception of the fuelwood situation is at variance with that of the inhabitants. Government officers do not engage in fuelwood collection as they purchased energy sources to cook their food. They all used charcoal. Data gathered by these interviews and direct observations were not conclusive. The questionnaire survey was designed to address these issues in greater detail.

CHAPTER 8

RESULTS AND ANALYSIS OF FIELD DATA

Results of the fuelwood consumption and questionnaire survey presented here are linked to the major question on whether the people of the study area perceive fuelwood as a problem and what strategies they are using to address the perceived problem. They also address the five hypotheses.

Fuelwood Consumption

The fuelwood consumption study was based on a data base of 100 records, 25 records from each of the four villages under study. The raw data in respect of initial weights and weight recorded after one day's cooking were used to calculate fuelwood consumed per cooking unit per day, as well as per capita fuelwood consumption. The data were categorized into the two locations of Samia North and South and a t-test was calculated to test the significance of the mean differences between the two locations. The statistical analysis was carried out using Statistical Analysis Systems (SAS Institute, 1985). Table 8.1 gives results of the t-test analysis. Mean firewood consumed in Samia North and Samia South was not significantly different ($t = 1.98$; $p = 0.06$). Hypothesis 1a is therefore accepted.

Differences in Village Consumption

Analysis of variance (ANOVA) was carried out on mean consumption of fuelwood (kg/capita/day) for the four villages (Table 8.2). This procedure showed that there was a difference in the mean fuelwood consumption per person per day among the four villages.

Hypothesis 1b (that there is no difference in fuelwood consumption between the households in the four villages under study) is therefore rejected. Results indicate that there is a basis for believing that fuelwood consumption in the four villages differs.

Table 8.1. Comparison of Fuelwood Consumption in kg/capita/day in households in Samia North and South Locations (t test (LSD) for variable consumption).

Location	N	Mean	SD
Samia North	50	2.29	0.68
Samia South	50	2.03	0.50

Critical Value of t = 1.98
P = 0.06

Table 8.2. Comparison of Fuelwood Consumption (kg/capita/day) in four villages ANOVA.

Source	DF	SS	MS	F Value	Pr > F
Model	3	6.57	2.19	5.47	0.002
Error	96	0.40			
Total	99	45			

Tukey's Studentized Range (HSD) Test For Variable: Consumption

Village	Mean	N	SD
Nangina	2.35[a]	25	0.00
Kadimbworo	2.34[a]	25	
Sagania	2.22[a]	25	
Namasali	1.73[b]	25	

Means not followed by the same letter are significantly different $P \leq 0.05$.

Effect of Cooking Unit Size on Wood Consumption

Data was also categorized into household size or size of cooking units i.e., the number of persons for whom meals were prepared on the day of the survey. These ranged between two and twelve people. Two to four persons were put in the category "small," five to seven in "medium" and more than eight people were deemed to belong to large households. This categorization was arbitrary but reflected acceptable norms for small, medium and large households in Kenya. The average fuelwood used in kg/person/day from these categories was calculated and the mean fuelwood consumed compared using Tukey's Studentized range test. The three means of fuelwood consumed per person per day for small, medium and large households differed (Table 8.3).

National and Global Data Comparison

The present study shows fuelwood consumption in Funyula Division to be 1.5-2.9 kg/cap/day. This figure is higher than the one reported by Ellis et al. (1984) for the Turkana of Kenya (0.6-1.8 kg/person/day). But the Turkana are a pastoral tribe whose diet consists mainly of blood and milk that need little cooking. The highland Samburu, another pastoral tribe, used 3.7 kg/person/day. These figures were based on a study of only three households (Perlov 1984). It is hard to imagine how three households could be representative of the Samburu. Nevertheless, the high fuelwood use, in this highland pastoral tribe, is explained by the fact that the Samburu need to warm their houses at night. Hosier (1984) gives a national average household consumption rate of 4354.7 kg/annum. The size of the household on which these figures are based is, however, not given. If the national average of 5 persons per household is used, Hosier's figure works out to 2.4 kg/person/day. This is slightly higher than the average for the four villages (2.2 kg/cap/day).

The extent of fuelwood consumption can not be precisely measured as the values depend on many variables such as household size, type of food, amount cooked, species

Table 8.3. ANOVA of fuelwood consumption (kg/capita/day) in three different sized households.

Source	DF	SS	MS	F Value	Pr > F
Model	2	14.72	7.36	22.51	0.0001
Error	97	31.71	0.33		
Total	99	46.42			

Tukey's Studentized Range (HSD) Test for variable Consumption

Household size	Mean	N
Small (2 - 4)	2.73[a]	26
Medium (5 - 8)	2.11[b]	52
Large (9 - 12)	1.64[c]	22

Means followed by different letters are significantly different at $P \leq 0.05$.
Critical Value of t = 3.37

of tree used, and condition of the wood. On the whole, the values reported here compare favorably with those from studies in other parts of the world. For example, rural tribal communities in the Himalayas use 1.5 kg/person/day (Pandey and Singh 1984), while villages in South-east Asia use 1.7-2.5 kg/cap/day (Wijesinghe 1984). More recently, Maikhuri (1990) has reported consumption rates of between 4.9 to 10.4 kg/cap/day for the tribal communities of North East India. Maikhuri (1990) explains the high rates recorded in his study as being caused by the readily available forests and the extra uses to which firewood is put. These uses include all-night fires to warm the huts and to chase away elephants and other wildlife.

A regression analysis of the data (Fig. 8.1) shows that the lowest amount of wood needed by two people is 5 kilograms. Thereafter there is an increase of 1.2 kilograms of wood per cooking unit for every additional person. The larger the household the more wood is used per cooking unit. On a per capita basis, less wood is used in such households. Maikhuri's study (1990) shows that wood consumption varies with season and festivals. In the present study seasonality or effect of ceremonial consumptions were not investigated. Since air temperatures in the study area remain relatively high (21°C) throughout the year, it was not envisaged that fuelwood consumption would vary greatly from season to season. Fuelwood needs during marriage or funeral ceremonies are bound to be high. In Chapter 6 and 7 reference was made to funeral fires whose wood procurement involved men. Indeed, a few respondents remarked on the extra fuelwood required during funerals. Wood was required to cook for mourners and it was also required for the ceremonial funeral fire made outside the hut of the deceased and kept burning for several days until another ceremony is performed. Wood for village industries can also be considerable, but industrial use of fuelwood was not investigated in these studies. Local beer brewing was a sensitive issue since it is illegal. Brewing is widespread and must have contributed to household wood consumption.

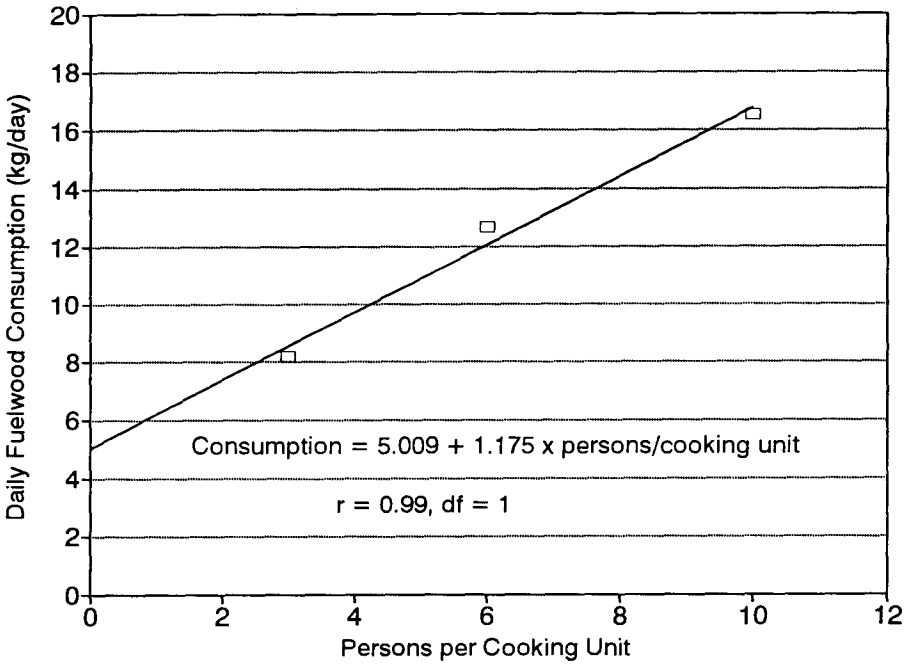

Fig. 8.1 Regression graph showing fuelwood consumption in different sized households in Funyula Division

The present study shows similar trends to those of Cline-Cole et al. (1990) and Maikhuri (1990) in that smaller households use larger quantities of firewood per person than bigger households (Table 8.3). The bigger households are therefore more efficient in their use of the resource than smaller ones. Fuelwood consumption depends on several other factors besides household size. It will depend on amount and type of food cooked, frequency of cooking and fuel-saving strategies employed during cooking. In Kenya, Hosier (1984 p 54) recorded that "households consuming a maize and beans diet use, on average 1400 kilograms more wood per annum than households consuming *ugali*[34] based meals". In the present study area, most of the people rely on a diet of *ugali*. This fact, coupled by warm weather, may account for the lower than the national average fuelwood consumption estimated by Hosier (1984).

Fuelwood consumption figures may also form a basis for comparison with what is removed for pulping and other industrial uses. In addition, they are useful in helping to determine to what extent a community is depleting its wood resources. Fuelwood consumption studies are also contributing to the provision of more accurate country statistics on total wood consumptions. In the past, these figures depended on commercial wood sales by Forest Departments or industries. In this respect, the present study is a further contribution to the growing body of knowledge on village fuelwood consumption. The study has also achieved one of its stated aims i.e., to show areas of fuelwood scarcity in Funyula Division.

[34]Kenya's staple dish consisting of a stiff porridge made out of corn meal and eaten with meat, fish or a vegetable relish. In the study area, *ugali* is made out of sorghum mixed with cassava flour.

Species Consumption

The wood species recorded in the bundles were ranked as to frequency of occurrence, (Table 8.4). The values of the frequency of occurrence of a particular wood species in each village were added up to give a cumulative frequency which indicated the most frequently harvested species for fuelwood use. A better measure should have involved separating of different species in the bundle and having them weighed, a procedure which the time constraints of the study did not allow.

Lantana camara headed the list of most frequently collected species, followed closely by *Markhamia* sp. The most disliked species on the list of those being utilized by the four villages was *L. camara.* The general complaint was that it is rough to the hands, does not dry quickly and produces unpleasant smoke (See female interviewee, Chapter 7 p. 107). Nonetheless, this species appears to be the most abundant in the fuelwood bundles (Table 8.4). This use of a non favoured species may indicate a form of scarcity. Those using *Acacia* spp. complained of their long spines which made it difficult to handle. Green branches or whole trees had to be felled and then stripped of the bark and spines before they could be dried and used. But acacia was alleged to take a short time to dry and burned with intense heat. From the intensity with which it burnt, acacia is far superior to other species, according to Namasali users. The indigenous tree species that forms the village's main wood sources is *Acacia seyal*, which is thorny and generally disliked by wood collectors. The overall frequency of occurrence of planted species (47%) in fuelwood bundles gathered by women (Table 8.4) is an indication of the importance of cultivated trees as a source of fuelwood.

The next most commonly used species is *Markhamia lutea. M. lutea* is planted for homestead demarcation and in the home gardens where it is an important source of fuelwood. However, the fact that fuelwood is occasionally obtained from places as far away as four kilometers, and even purchased, indicates the existence of a deficit in the home gardens.

Table 8.4. Frequency of occurrence of different wood species in the four villages.

Village	Frequency of species in bundles				
	Namasali	Kadimbworo	Nangina	Sagania	Cum/freq.
Acacia sp.	14	0	0	0	14
Markhamia	12	3	10	4	29
Cassava stalks	5	1	2	3	11
Lantana	2	9	11	14	36
Melia sp.	0	5	0	0	5
Cassia siamea	2	3	1	2	8
Cassia spectabilis	0	0	0	3	3
Albizia sp.	1	2	3	5	11
Mixed Indigenous spp.	3	7	5	6	21

Source: Field Data.

Although the study did not cover the wettest season (March to May), it is thought that the purchasing of firewood from the market is as a result of the difficulties of drying *Acacia* spp. at this time of the year (interview with Namasali woman Chapter 7). This research did not extend to finding out household incomes, a difficult enough undertaking in rural Africa. However, it is thought that the people of Namasali find it attractive to purchase firewood because of having more money from fishing.

Cassava sticks were used to kindle fire and also as a stop gap fuel before other wood was gathered. Cassava was less favoured because it is very light and burns very quickly. Using this species means tending the fire continuously, a most inconvenient process. Cooking was the most common activity consuming fuelwood in each cooking unit. Most respondents indicated that food cooked on the day of the survey was porridge for breakfast which was eaten at about 11 or 12 o'clock, after the day's garden work had been done. This was followed by a late lunch of *ugali* and either fish, meat or vegetable source at 2 or 3 o'clock in the afternoon. Others indicated that the porridge or tea had been eaten with a dish of maize and beans, boiled sweet potatoes or cassava which sufficed as a lunch. Dinner was a repeat of the lunch menu. Boiling water for bathing also accounted for some wood use. However, this was confined to units with very young children who needed to be bathed at home. Most adults and children went to streams or the lake to bathe. None of the survey units or interviewee households were observed to boil drinking water. It was not ascertained whether this was due to ignorance of the consequences of drinking untreated water or whether it was due to fuelwood scarcity. Several factors may be at play in this matter including difficulties of acquiring additional wood resources for this task.

To recap, the hypotheses tested were that there is no inter-locational and inter-village wood consumption differences. The present study shows a difference in inter-village consumption but fails to show one between the locations.

Survey Data

From the four villages surveyed, a data base of 122 records was obtained. Each of the three villages, Namasali, Kadimbworo and Nangina supplied thirty while Sagania supplied thirty-two records. The analysis in the following discussion is based on these 122 records using Statistical Packages for Social Science (SPSS/PC).

General Perception of Fuelwood Scarcity

Nine items were used to measure perception of fuelwood scarcity (Table 8.5). These centered on whether the respondents perceived present or future fuelwood shortages; whether they used dung or crop residues and whether they required permission in order to collect firewood from neighbors plots (Appendix 6). Other questions queried the distance covered to gather fuelwood; whether firewood was sold or if respondents were willing to purchase it; whether households produced any charcoal, planted any trees for firewood or were willing to plant for it.

To the question "Would you say there was a present fuelwood shortage?" a majority of the respondents (65.6%) thought it was already there. A great majority of the respondents (89.3%) could foresee a shortage in the next five years. The questionnaire results contrasted with the interview results with government officers who did not perceive the existence of a fuelwood problem in the area. Apart from the chiefs, other government officers were from elsewhere in the country. They did not own land in this area from which to gather fuelwood; they used charcoal or paraffin for cooking. In addition, being full time employees, they did not have the time to go gathering fuelwood. This may be the reason for their lark of perception of the problem. Results from RRA also show that informants were also not agreed on the question of fuelwood scarcity. But the survey results shows that 65% of the respondents thought that there was a present fuelwood scarcity - one not yet recognized by officials working in the area.

Table 8.5. Frequency of responses to items testing perception of fuelwood scarcity in the four villages.

Item	Sagania n = 32	Nangina n = 30	Kadibworo n = 30	Namasali n = 30	Total n = 122	Percent of Total
Those who perceived present wood shortage	18	13	21	28	80	65.6
Those who perceived future firewood shortage	26	25	29	28	109	89.3
Those using dung	16	26	20	14	4	3.3
Those using crop residues	14	10	18	24	66	54.1
Those who sold firewood	5	8	3	2	18	14.8
Those willing to buy firewood	9	2	12	23	46	37.0
Those who made charcoal	12	13	5	2	32	26.2
Those requiring permission to collect wood	21	24	29	14	88	72.1
Those willing to plant for firewood	18	15	25	22	80	65.6

Logically, it might be expected that trees would be planted to lessen this perceived shortage, but this was not the case. Only 3.3% of the surveyed households planted for fuelwood provisioning. This paradox is what has caused many rural tree planting projects to fail because they were based on the logic that once people have fuelwood shortages they will respond by planting trees to alleviate the problem.

Willingness to Plant for Fuelwood

Although there was a high rate of positive responses on willingness to plant for fuelwood (65.6%), few household planted for this purpose. This showed a contradiction of some sorts in view of the fact that 65.6% of respondents thought there was already a fuelwood shortage. However, it was consistent with what rural development workers had found, that rural people's tree planting priorities are not for fuelwood. Trees are planted for a multitude of products and fuelwood is usually a byproduct of this activity (Munslow 1989; Kerkhof 1990; Foley and Barnard 1984). Therefore, the people of Funyula are typical of rural folk who plant trees for many different purposes but not primarily for fuelwood.

The other indicator of fuelwood scarcity was the degree to which people needed permission in order to gather the resource from neighbours' lands. The proportion of respondents that said they needed permission from neighbours before collecting any firewood was 72.1%. When probed further it transpired that they actually needed permission to collect large sized pieces of wood. Twigs and small branches could still be collected freely from most people's fallow lands. It was clear that most people objected to the gathering of firewood that involved the felling of trees using tools such as *pangas*[35] and axes. Collection of twigs and branches in near virgin land was tolerated. However, fuelwood collection from newly abandoned fields was not condoned. Brokensha and Riley (1978), Barnes (1984), and Riley and Brokensha (1988) had noted this trend of

[35]Long, flat, sharp knife used for digging and cutting large things such as wood, bones etc.

denying neighbours access to one's lands for fuelwood collection to be a result of land adjudication. This seemed to be the case in Funyula too where free access to fuelwood on other people's lands was becoming difficult. The interview with the agriculture officer described in Chapter 7 reinforces this view.

Dung Use

Only (3.3%) of the households interviewed used dung for fuel. Respondents saying their households used dung included three old men and a young lady. The old men explained that they burnt dung in their *kraals* (cattle enclosures) because that was what their forefathers before them had done. The young lady had seen dung being used in a documentary (where the dung was mixed with charcoal). Not understanding the language of the documentary she had copied what she had seen thinking it was a good thing to do. In this community dung use was not a good measure of fuelwood scarcity in this community.

Distances to Collection Points

The distance recorded in the questionnaire ranged from zero for those collecting on their own homesteads and one to seven kilometers for those collecting away from the homesteads. In the analysis, zero and one kilometer distances were pooled and recorded as "Near," while distances greater than one kilometer were deemed to be "Far". The greatest distance that fuelwood collectors could actually have covered, (as estimated from maps) is four kilometers. Respondents gave a maximum distance of seven kilometers. Those who perceived their fuelwood problems as great gave a higher figure for the distances travelled than those who did not have much difficulty in gathering fuelwood. This particular result shows the importance of actually measuring the distances travelled to collection points. Distances recorded from the surveys alone may have been psychological distances that reflect the degree of difficulties the respondents experienced in getting fuelwood. It could also reflect incorrect distance judgment. Literature on

fuelwood is replete with anecdotal distances travelled and time taken by women in fuelwood gathering (Agarwal 1986). It is necessary to authenticate such distances by actual measuring of distances covered either from maps or from other means.

Charcoal Making

The making of charcoal and selling of wood were used to indicate a degree of abundance of the resource. The assumption was that only those with surplus tree resources above their own subsistence requirements would manufacture charcoal or sell firewood. Of all the respondents, 26.2% had engaged in charcoal making. It is suspected that respondents did not answer truthfully to this item because charcoal making is discouraged by the authorities.

Only 14.8% of the households had ever sold firewood. When the question was on whether the respondents had ever seen a friend or neighbour sell firewood, the percentage positive responses went up to 60.7. The same firewood vendor may have been known to several respondents as rural folks in small communities tend to know what their neighbours are doing. To some extent, charcoal making and firewood selling are not yet widespread practices and may only be important in specific villages such as Sagania.

Tree Planting Activities

The study population has its own tree planting priorities which do not include fuelwood. The primary reason for planting trees was to provide building poles and homestead demarcation. This is also true in the Embu, Meru and Isiolo (EMI) (Shepherd 1989) and Kakamega Districts of Kenya (van Gelder and Kerkhof 1984; Bradley 1988). In Kakamega, trees are treated as a cash crop, thereby, creating a fuelwood scarcity in the midst of relatively sufficient wood stocks (Bradley et al. 1984). In Kisii Barnes had observed that trees were planted for boundary marking. She attributed the increased tree planting in this area to be due to land privatization. This phenomenon was not observed in this study. Most tree planting is still confined to the homestead.

The second important reason for planting trees was to provide fruit for consumption and also for sale. The number of exotic fruit trees (Appendix 8) adopted and grown by the villagers without any technological inputs from the agriculture or forest department attests to rural peoples' adaptability and insights into resource usefulness. For example, the durian was planted and marketed by a few people, bringing them some money to supplement their income.[36] The species in this genus are suitable for dry areas and could provide additional food to the inhabitants if more information on them is provided by government workers and other extension agents. The conclusion drawn from the above results is that the people of Funyula plant trees to satisfy two basic needs, the need for shelter and food. In addition they also plant trees for cash, since they sell some of the fruit. They also recognize the need for fuelwood although it is not their priority for planting trees.

Agroforestry Practices

Results of tree planting practices are interesting in clarifying the extent of agroforestry practices in the area. It has been stated that there is widespread agroforestry practice in Western Kenya (Getahun and Reshid 1988). In this study, no hedge row or fodder planting was observed. The intensive homegardens found in Kakamega are also missing. There is a need for more purposeful and organized agroforestry in Funyula Division.

Fuelwood Scarcity: Zonal Differences

The survey results confirmed information gathered from the environmental analysis. More respondents in the two southern villages than in the north view fuelwood as a problem. As illustrated in Figure 4.1, the two villages in the north are near fuelwood sources, that is, the hills and streamsides. However, these sources are in privately held

[36]One farmer said he sold each durian fruit for K Sh 15; the tree could bear up to 50 fruits in a good year, although 15-20 was the usual.

lands and thus, depend on the willingness of neighbors to share them. But as the survey showed, more than 80% of respondents required permission to collect firewood from neighbours' lands. Therefore, in order to be self-sufficient in fuelwood needs, a family should either have or produce enough wood on its own lands.

Namasali is the village that differs in fuelwood consumption from the other three (Table 8.2). From the sociocultural analysis in Chapter 6, the population of the study villages is relatively homogeneous in terms of lifestyles, staple foods, and demography. The observed differences in village fuelwood consumption could be explained as arising from the different micro-environment of the study villages as seen in the biophysical analysis of the villages (Chapter 5). Namasali village has limited wood resources as a big part of it is taken up by non-woody, swamp vegetation (Figures 4.5 and 4.6). There is also the problem of policy induced scarcity which has resulted in permission to collect wood from neighbour's lands being denied. The distances to former communal hill sites is also bigger.

Kadimbworo, an intermediate village, depends on homestead gardens, fallow, and roadside lands for its fuelwood supplies. In conformity with the rest of the villages, Kadimbworo also suffers from a policy-induced scarcity. This village recorded the highest frequency of planted species in its firewood bundles and the lowest use of indigenous species (Table 8.4). The village has insufficient near-at-hand sources of water, making on-farm seedling production, from which trees could be established, an unlikely proposition.

In addition to other scarcity related problems, the inhabitants of Nangina have the Catholic Mission between their village and their hill lands. This forms a barrier which villagers have to detour in order to reach the hill areas, thus putting them under a scarcity situation.

Sagania is the most interesting of the four villages in that it has a variety of lands ranging from stream level to the hill tops and still relies on indigenous vegetation for its

fuelwood requirements. Sources of fuelwood are homestead gardens, fallow lands, riparian, road and hillside vegetation. But it is here and in Nangina that resident charcoal makers were found (Table 6.5). They cut whole tree to make charcoal. This activity is detrimental to the environment and increases the normal erosion process from the hills creating a problem downslope among other residents. Land privatization which has given ownership of hill lands to individuals is therefor not helping to preserve the hill vegetation. It could be argued that the same fate would face the land under the old communal land ownership system if the tribal leader was not strong enough to enforce tribal rules governing use of communal resources.

It is difficult for individual land owners of hill properties to plant trees or rehabilitate denuded hill areas. This difficulty is a result of lack of the financial, labour and other resources necessary for hill conservation. In addition, because many farmers live at subsistence level, they may fail to see the value or importance of hill conservation. From the interview with the forest officer, Chapter 7, it was learned that the Forest Department was willing to help farmers plant trees for hill conservation. However, few of the farmers knew of the existence of this opportunity, nor did they like it as they were still suspicious of the forest officials' intentions. These suspicions arose from confrontations with the government officers at the time of land adjudication. These fears may partially explain failure of government efforts in matters pertaining to land which is regarded by many rural communities as very sensitive.

An alternative to privatization, for example, community management, should have been considered by policy makers, before the hill lands were allocated to individuals. The author believes that an opportunity to bring about maximum good in the community has been lost by the privatization policy. This community lost its traditional dry season grazing lands, fuelwood sources and sources of medicinal and other minor bush products. Farmers downhill now face runoff and soil erosion from sources over which they have no control. This Kenyan example should make other communities who

still have communal lands consider more carefully the environmental implications of any land policies.

As was observed by the agricultural officer (Chapter 7), the hills are valued as sources of wood for making charcoal, building materials in the form of grass, poles, and stone. In addition, they are valued for the dry season fodder they provide to free range livestock. Recognizing these intrinsic values, the owners of hill lands are reluctant to share their resources with the rest of the community. But they are also not in a position to reclaim the land after denuding it through, quarrying, livestock herding and tree harvesting for charcoal. Charcoal making has adverse environmental consequences because whole trees are harvested and converted to charcoal in inefficient open kilns. Similar environmental problems posed by charcoal making are observed by Riley and Brokensha (1988) in Mbere area of Kenya. These authors predict an increase in charcoal making in marginal lands in order to satisfy fuelwood needs of urban centers. In the present study area, the poor public communication and the low esteem with which charcoal making is regarded, have prevented an accelerated onslaught of the hills. This may soon change since petroleum prices keep going up causing many urban dwellers to increase their use of fuelwood energy and thus transforming charcoal making into a lucrative business. Changes in the global fuel oil prices that may affect local fuelwood consumption are not lost on the rural entrepreneurs as evidenced from the interview with the charcoal maker Chapter 7. These commercial interests may spoil local landscapes and contribute to the degradation of the national environment.

Locational Differences

Results from respondents in the north and southern villages were also compared in order to prove or disprove hypothesis 2 (Chapter 3) that there was no difference in perception of fuelwood scarcity between households in Samia North and South. The respondents were categorized into locations; that is answers from respondents in Sagania

and Nangina in Samia North were compared to those of respondents from Namasali and Kadimbworo in the South (Table 8.6). More respondents from the south than north indicated that there was a present fuelwood shortage. This difference was significant at the 5% level ($X^2 = 12.5$; $p = 0.0005$). Based on this item there is a difference in perception of fuelwood scarcity between households in the two villages from north and the ones from the south. When the question was about future firewood scarcity, again more respondents from the south than the north responded positively (Table 8.6). Again the difference between the north and south was significant at the 5% level using the chi-square test ($X^2 = 5.2$; $p = 0.0223$).

When distance to fuelwood collection was used as an indicator of scarcity, a majority of the respondents from the south (23.9% more than those from the north) indicated that the households they represented collected firewood from distant places.

It should be noted that dung use was insignificant in both regions. However, crop residue use in the north and south differed by 31.3% points. More respondents in the south than north used crop residues for cooking. This difference is statistically significant ($X^2 = 10.8$; $p = 0.001$). In addition to other items used as measures of fuelwood scarcity, the differential use of crop residues strengthens the argument that there could be a difference in perception of fuelwood scarcity between the northern and southern villagers.

More respondents in the north than south were from households which had sold firewood (Table 8.6). Although the difference was not significant it tended to reinforce the foregoing result that fuelwood was more scarce in the south than north. More respondents in the south (58%) than north (18%) were willing to buy firewood. The difference was significant ($X^2 = 19.7$; $p = 0.0001$). In retrospect, there should have been a question on whether firewood was purchased. Most of the respondents in Namasali village who said they were willing to buy firewood, qualified their answers by stating

Table 8.6. Response differences between Samia North and South on items testing perception of fuelwood scarcity (n = 122).

Item	North	South	% Diff. (N-S)	X^2	P-value
Perceived present wood shortage	50.0	81.7	-31.6	12.5	.00048*
Perceived future firewood shortage	82.3	96.7	-14.4	5.2	.02230*
Distance to fuelwood	19.4	43.3	-23.9	7.09	.00003*
Those using dung	3.2	3.2	0	0.00	1.0000
Those using crop residues	38.7	70.0	-31.3	10.8	.00102*
Those who sold firewood	21.0	8.3	12.3	2.9	.08691
Those willing to buy firewood	17.7	58.3	-30.6	19.7	.00001*
Those who made charcoal	40.3	11.7	28.6	11.5	.00070*
Require permission to collect wood	72.6	71.7	0.9	0.00	1.0000
Those willing to plant for firewood	53.2	78.3	25.1	7.4	.00638*
Those planting for firewood	3.3	3.5	-0.2	0.00	.21550

*Indicates statistical significance at the 5% level, Chi-square test.

that they actually bought it during the rainy season. None of the respondents in the north bought any wood. The buying of wood indicates a wood scarcity situation.

Village Differences

Results presented in Table 8.5 tend to show that there is a difference in perceived fuelwood scarcity between the northern villages and the southern villages thus confirming Hypothesis 2. But it should be remembered that the fuelwood consumption studies failed to show any difference in resource use in the two locations of Samia North and Samia South. There was also disagreement on this matter during the pilot study.

Differential Activities About Tree Planting

Three items were used to show the extent to which tree planting activities differed between the four villages and the two regions of Samia North and South (Table 8.7 and 8.8). The villages show a difference on two items, the raising of seedlings and the visiting of tree nurseries. When the villages are grouped into regions, there is still a difference on these two items. For example, a majority of the household respondents in both the northern villages (53.2%) and the southern villages (51.7%) had planted some trees. However, more respondents in the north (48%) than in the south (19%) had raised their own tree seedlings. In addition, more respondents in the north (48%) than south (20%) had visited a forest tree nursery. When responses from individual villages are compared (Table 8.8), these differences (i.e., the number of respondents visiting tree nurseries and those who had raised tree seedlings), is still apparent. This is not surprising as the two government nurseries in Funyula Division are both located in the north. The raising of their own tree seedlings in the north may be due to greater water availability. The two northern villages have streams running through them, while only one of the villages in the south is near a significant water resource which nonetheless is far from habitation points.

Table 8.7. Response differences between Samia North and South on items testing degree of tree planting activities (n = 122).

Item	North	South	% Diff. (N - S)	X^2	P-value
Planted any trees	53.2	51.7	1.5	0.00	1.00000
Raised any seedlings	48.4	18.7	29.7	11.03	.00090*
Visited forest nursery	48.4	20.0	28.4	9.66	.00188*

*Indicates statistical significance at the 5% level, Chi-square test.

Table 8.8. Frequency of responses to items testing degree of tree planting activities in the four villages.

Item	Sagania	Nangina	Kadimbworo	Namasali	Total Frequency	Percent of Total
Planted any trees	16	17	13	18	64	.58
Raised any seedlings	13	17	7	4	41	.0016*
Visited forest nursery	16	14	10	2	42	.00037*

Locational Differences in Tree Planting

There is a marked difference between the south and north in number of visits to tree nurseries; this is attributable to the absence of government tree nurseries in the south. KENGO-supported groups had the only organized tree nurseries in Samia South. Thus, the NGOs have managed to penetrate areas where government services are lacking. At the time of this study, however, there were no active KENGO or any other NGO nurseries in or near the villages surveyed.

Gender Perception of Fuelwood Scarcities

To test Hypothesis 3, that there is a gender difference in tree planting and resource use, data from the questionnaire was categorized by gender and response differences compared (Table 8.9).

Slightly more women (68%) than men (64%) thought there is a current fuelwood shortage. However, more men (91%) than women (88%) could foresee a future shortage. Slightly more men (68%), than women (63%) expressed willingness to plant for fuelwood, whereas more women (42%) than men (33%) were willing to purchase it. Nonetheless, the results are not statistically significant. In other words, there is no difference in perception of fuelwood scarcity between men and women (Hypothesis 3). Indeed, as already elucidated, in general, a high percentage of respondents agreed that there was a present and future fuelwood scarcity. This contrasts with the results obtained from the pilot survey where the impression created from the men and women interviewed was that there was a gender difference in perception of fuelwood scarcity. However, the picture changes when it comes to tree planting (Table 8.10).

In these studies women made up 97.5% of the firewood gatherers. Ki-Zerbo (1980), Williams (1983), Ceceliski (1987) and Sousan (1991) note that as the fuelwood

Table 8.9. Response differences between genders on items testing perception of fuelwood scarcity (percent agreeing) (n = 122).

Item	Male 63	Female 59	% Diff. (M-N)	X^2	P-Value
Perceived present wood shortage	63.5	67.8	-4.3	.10	.75700
Perceived future wood shortage	90.5	88.1	2.4	.02	.90042
Those willing to plant for fuelwood	68.2	62.7	5.5	.21	.65041
Those willing to buy wood	33.3	42.4	9.1	.71	.39944

*Indicates statistical significance at the 5% level; Chi-square test.

becomes scarce, especially where distances to source necessitate use of animals or carts to carry the wood or where wood is an item of commerce, men may engage in its acquisition. This phenomenon was not observed in the present studies. In Namasali, the only village in the study in which firewood is on sale, both vendors and buyers are women. This does not mean that there is no fuelwood problem in this village. As the sociocultural analysis shows, in Funyula Division, neither beasts of burden nor carts are used to transport goods. Therefore, the question of using them does not arise. Travel within the division, to take produce to market, is still on foot or by bicycle. The women firewood vendors and buyers balanced firewood bundles on their heads to and from the markets.

The questionnaire survey also shows that both men and women view fuelwood as scarce. This contradicts results from the Rapid Rural Appraisal techniques which showed that more women than men perceive fuelwood as scarce. The survey questionnaire, with its answer options of "Yes" or "No" may have been restrictive and did not elicit as much information from respondents as was desirable. For example, men resented being questioned on fuelwood which they felt was not their domain. Since this was a comparative study, both genders had to be asked the same questions. It is not clear to what extent this resentment by men may have influenced the answers given. Tree planting for fuelwood provisioning has been encouraged by the forest department. Perhaps men agreed that there was a present fuelwood scarcity because they did not want to appear to be ignorant of national concerns.

Gender and Tree Planting

It should be recalled that the basis of the gender hypothesis is the observation that women of Western Kenya are prevented from planting trees in order not to lay claim to land holdings (Chavangi 1984). During the course of this study a question was asked on whether women should plant trees. Over 80% of the respondents answered positively.

This means that there is no basis for thinking women are prevented from planting trees. In general, they could plant trees, but in practice, they are not planting to the same extent as do men. For example, Table 8.10 shows that more men (93%) than women (62%) household heads of the study population had planted some trees. More men (69%) than women (41%) had planted trees in the past two years. Again more men (48%) than women (19%) had raised tree seedlings, and more men (51%) than women (17%) had visited a tree nursery. These results are statistically significant indicating that there is a gender difference in tree planting activities (Hypothesis 4).

The importance of this result does not lie in the fact that more men than women are planting trees, but rather that women are involved in any tree planting at all. It would seem that whatever prohibitions that prevented women from planting trees in the past are slowly breaking down. Some of the factors contributing to this breakdown in the social fabric of the tribe may be religion, education and general modernizing influences. The religion of the respondents is mainly Christian, making the sample population homogeneous for this variable.

The fewer women visiting tree nurseries is to be expected because it is men who own bicycles, the major means of transport in the area. Men also have more time to engage in such visits than women. Respondents who did not approve of women planting trees had no good reasons for this disapproval. They merely said that from time immemorial women did not plant trees.

In conformity with studies from Kakamega District (Chavangi 1988), the present study shows women planting trees to a far less degree than do men. The reasons for the lesser participation in tree planting by women, differed from those given in the above quoted studies.

The Kakamega study identifies five reasons that inhibit women from fully participating in planting trees, namely: culturally devised myths and taboos; restricted access to land, trees and household resources; traditional land tenure systems; and sexual

Table 8.10. Response differences between genders on items to test activities on tree planting (percent agreeing) (n = 122).

Item	Male 63	Female 59	% Diff. (M - F)	X^2	P-Value
Those who planted trees	93.1	62.3	30.8	22.11	.00006*
Planted trees in last 2 years	63.5	40.7	22.8	5.47	.01927*
Raised any seedlings	47.6	18.6	29.0	10.20	.00140*
Had visited forest nursery	50.8	16.9	33.9	14.00	.00018*

*Indicates statistical significance at the 5% level, Chi-square test.

division of labour and responsibilities (Chavangi 1984). In the present study, 80% of the sample population approved of women planting trees. Those who disapproved gave the excuse that from time immemorial women did not plant trees. This excuse is understandable when seen from the historical data which show that trees were planted, specifically for homestead demarcation in which women did not participate.

This study also found that the women of Funyula Division are less restricted from planting trees than those of Kakamega. Kakamega has a history of tree planting to produce poles for cash. Trees are therefore important in the Kakamega cash economy and, thus, they are directly under men's domain. In contrast, trees do not play such a dominant role in Funyula Division. In Funyula, it may not have been necessary to devise as many restrictions to women's participating in tree planting as in Kakamega District.

Beliefs about Trees and Tree Planting

Homestead Fence

The historical information and informant interviews (Chapter 7) show that beliefs about trees influence tree planting among the Abasamia, but to an unknown extent. In the questionnaire survey presented in the present chapter, five items are used to investigate influence of traditional beliefs on the inhabitants' tree planting practices. In this respect, the proportion of the general sample that shares these beliefs is what is important.

Wagner 1949 shows that the Abaluhyia used *Euphorbia tirucalli* or other fences interplanted with plants thought to confer some protective powers to the home. This was done by the head of the homestead. On the other hand (Chavangi 1984) shows women of Kakamega district are prevented from planting the homestead fence[37]. To do so, women are seen as directly challenging their husbands' authority. Respondents were asked to

[37]Traditionally the homestead was the domain of the male household head while the woman or women were responsible for their households (*enyumba*).

state whether they agreed or disagreed with the statement that women should not plant the homestead fence. There was probing of those who agreed. The latter had no logical explanation except to say it was against society's norms and it should not be done. Three of the informant interviewees tended to echo Chavangi's (1984) study i.e., any woman planting trees around the homestead is trying to assert herself over her husband. In a society where polygamy was widespread, a woman who infringed on the husband's domain, was not only a threat to him but to the co-wives too. In this study 23% of respondents were in polygamous unions. It is expected that as the practice of polygamy disappears so will the threat of rivalry between co-wives on who does what in the home. But as noted in Chapter 6, the population is patriarchal with power vested in the male household head. In order not to upset the status quo, most women are happy to comply with restrictions on planting the homestead fence. The women already carry out a major proportion of the farm labour. Equity in planting the homestead fence would make them worse off. This discrimination in the site at which women plant trees supports Rocheleau's (1984) observations that one needs to pay attention to details such duty and resource allocations at the household level an area that was not addressed in this study.

Presentation of the socio-cultural setting showed the most common planting site to be the homestead fence. This near source of fuelwood is under male ownership. It is assumed that men would decide which species to grow in the fences and when and what to harvest. In the study area, the predominant hedge species are finger euphorbia and *M. lutea*, both of which are generally managed by men. *Markhamia lutea* provides building poles and as seen from Table 8.4 it is also a predominant species in the wood bundles collected by women. Its use and management by men does not seem to preclude its being utilized by women. But perhaps if women managed the fences they would use the *M. lutea* more. On the basis of these results it is hard to determine to what extent the tree

practices of respondents are influenced by beliefs about trees and tree planting practices. This remains a fertile ground for further investigations.

Table 8.11 shows that a majority of the respondents (55.7%), disagree with the statement that the cutting of a sausage tree brings bad luck. A majority of the respondents (58.2%) also think that one should not plant the Mvule tree. Almost half of the respondents (46.6%) think women should not plant the homestead fence. The only item with few adherents, is the statement that only men should plant trees to which 19.7% of the respondents agreed. It can thus be seen that a majority of the respondents favour the planting of trees by women. In general it could therefore be concluded that, unlike the Kakamega Abaluhya, among the Abasamia, women are not prevented from planting trees, so long as the site of planting is not the homestead fence. There is a basis for supposing to some extent what beliefs about trees do influence choice of tree species to plant.

Results from RRA and the survey indicate that the inhabitants of Funyula Division are reluctant to plant the Mvule tree. in spite of its known environmental, social and economic qualities and the extent to which it is utilized within the community. There is an implicit fear or reverence for this species which prevents it from being planted. Although it would be ridiculous to suppose that if one planted the Mvule tree one would invite death, the prohibition might be based on long time experience and observance of the trees. Beliefs and prohibitions sometimes exist through past experience with a particular event or phenomenon. For many years, East African foresters tried to establish Mvule in plantations without much success. The cause of the failure was found to be an attack by a gall insect, *Phytolyma lata* Scott (Homoptera, Pysillidae). In addition, the trees were heavily browsed by game animals (Dale and Greenway 1961). Perhaps in the distant past, experience had taught the Abasamia that it was useless to try and plant the Mvule as the chances of success were slim and a conclusion that it regenerates better naturally. Mvule grows well in cultivated fields where individual trees are nurtured and

Table 8.11. Frequency of household heads agreeing to items testing beliefs about tree planting (n = 122).

Item	Male	Female	Total Frequency	Percent of Total
Cutting sausage tree brings bad luck	38.0	50	53	43.4
Women should not plant the homestead fence	49	44	57	46.6
Should never plant Mvule	38	50	71	58.2
Only men should plant trees	25	14	24	19.7
Owl hooting is a bad omen	36.5	41	47	38.5

protected by farmers. Nevertheless, the harvesting of Mvule, without an attempt at replacing it has made it rare in the Samia landscape and may contribute to its local extirpation and consequent loss of genes.

Some beliefs do help in the survival of some trees. *Kigelia aethiopica*, the sausage tree, *Erythrina abysinica* and *Albizia coriaria* are such trees often left standing in cultivated fields. The ceremonial uses of *Kigelia aethiopica* were discussed in Chapter 7. *E. abysinica* is used as a cure for mumps. From literature on agroforestry and nitrogen fixing trees (Huxley and Westley 1989) it is thought that this leguminous tree may be nitrogen fixing. Therefore, although the reason for leaving the tree in the farmlands by farmers might not always seem logical and derived from scientific reasoning, there may be as yet undiscovered benefits on soil fertility. With regard to *Albizia coriara*, in addition to being leguminous and therefore, a potential nitrogen fixer, it has social functions as a meeting place tree.

The inconsistency of conservation based on beliefs strengthens the argument for collecting and analyzing available data in a scientific manner. The belief that, the hooting of owls signifies death, causes fears which make people act irrationally. They may cut down trees to prevent owls from using them as perches or they may chase away owls.

Many Africans seem to have assimilated Christianity or Islam but to a large extent retain some of their traditional beliefs and culture that dictate their relationship with the environment. Thus, it is seen from this study that, although all respondents, except one, professed to be Christians, 23% were in polygamous marriages which in itself goes against Christian teachings. It would seem traditional religious ideas have not been extinguished through the encounter with imported or other indigenous beliefs (Lawson 1984). Development efforts in rural Kenya must therefore take these factors into account.

The conservation of the sausage tree, *Kigelia aethiopica,* is based on an association of the tree with funeral ceremonies. How many other little known species are being destroyed or preserved because of beliefs is not known. Mordi (1987) believes that conservation based on beliefs in spirits is anti-conservation in practice. Since people believe they can cut down the Mvule tree and it will grow by itself, then they will cut down other vegetation believing it will regenerate by itself. This belief may explain the common reluctance of people to plant indigenous trees. Recently, the Forest Department's focus has been to encourage the planting of more indigenous trees. In order for this exercise to succeed, the tree species offered to villagers for planting, must not only meet the people's needs, but extension agents working in this area, must also take into account the people's beliefs.

Notwithstanding the foregoing, the extent to which beliefs about trees have influenced tree planting in general, and the gender differences in particular, remain important issues worthy of future research.

Educational Influence

When respondents' educational attainment is considered, it is interesting to note that more of the educated respondents than the uneducated perceive fuelwood shortages (Table 8.12). For example, 68.4% of respondents with secondary school level of education and 40% of those with primary level are willing to plant for fuelwood while among the uneducated the percentage is 25.9%. There are more respondents with no schooling (n = 58), than in the other two categories making comparison of answers by educational categories rather difficult.

The survey shows that there is no difference in items testing perception of fuelwood scarcity among the educational levels. However, when willingness to purchase firewood is considered then there is a statistically significant difference (Table 8.12). A higher proportion of respondents with secondary school education are willing to purchase

Table 8.12. Response differences to various items by educational level (n = 122).

	No schooling (n = 58) Frequency	Primary (n = 45) Frequency	Secondary (n = 19) Frequency	X^2	P-Value
Perceive present wood shortage	38	29	13	0.09	0.95
Preceive future wood shortage	55	37	17	4.25	0.12
Sold firewood	7	5	6	4.3	0.11
Willing to buy firewood	15	18	13	11.1	0.004
Cutting sausage tree brings bad luck	31	18	4	7.2	0.03
Only men should plant trees	15	9	0	9.6	0.008
Women should not plant homestead fence	30	22	5	4.0	0.13
Should never plant *Mvule*	38	27	6	6.8	0.03
Hooting of owl is bad omen	26	16	5	2.4	0.3
Planted trees in last 2 years	23	26	15	10.1	0.006

firewood than others. The difference is understandable; education gives those who possess it more power over monetary resources. Among the educated were teachers, government workers and petty traders. Such people may be willing to purchase firewood, even where there is not much scarcity, because they are engaged in full time jobs. Fuelwood collection interferes with their official duties, hence, their willingness to purchase. In addition, employed people have the regular monetary resources with which to purchase fuelwood.

There are also differences among the three categories of educational level with regard to beliefs about trees and tree planting practices. The survey shows a significant difference on the questions about the sausage tree, the planting of Mvule and about only men being allowed to plant trees. Surprisingly, there is no significant difference on the question of the homestead fence which, as discussed earlier, is still strongly observed in this culture. As expected, a smaller proportion of the educated than the uneducated (Table 8.12) share beliefs about trees and tree planting practices. None of the respondents with secondary level education agrees with the statement that only men should plant trees. In contrast, 15 (25.9%) and 9 (20.0%) of the respondents with no schooling and primary level education, respectively agree with this statement. But, even some of the respondents with secondary level education 4 (26.3%) agree that women should not plant the homestead fence, while the other proportions are 22 (35.5%) for primary level and 30 (45%) for non-schooled. This shows the importance of the homestead fence in this male dominated society.

Answers about other beliefs also mirror the respondents' educational level. In Table 8.12, it is shown that 31 (57%) of the non-educated, 18 (40%) with primary education and 4 (21%) with secondary education agree that cutting the sausage tree brings bad luck. Almost similar proportions [26 (48%) non-educated, 16 (35.5%) primary and 5 (26%), secondary level] of the respondents agree with the statement "if an owl frequently hoots in a tree the tree should be cut down". The answer categories to

these items did not leave respondents much choice. Some of them said they would chase away owls instead of cutting down trees. Nevertheless, there was an implicit fear or dislike of owls in the study community.

Land Tenure and Gender Issues

In other parts of the country, land adjudication has produced policy-induced fuelwood scarcity (Brokensha and Riley 1978). This is also the case in the present study. A large percentage of villagers required permission to collect wood from their neighbours' lands. Theoretically, land adjudication should have brought security of tenure and, therefore, more tree planting as has happened in Kisii (Barnes 1984). This does not seem to have taken place in the study area. Tree planting is still confined mainly to the perimeters of the homestead. Homestead lands continue to be administered like communal lands. Each member of the household has use rights over land allocated to him/her by the household head. As Mbithi (1974) observes,

> "the household head usually thought of as owner of a holding may in fact have effective control over the use of only a small part of the land he owns. His rights are limited by the rights of use held by other members of his household."

It is believed that this allocation of household lands creates intersibling conflict which has prevented tree planting from spreading widely beyond the homestead compounds. Adult male members of the household who may be interested in planting trees are regarded as staking out a claim in the family land. So long as land continues to be divided equally between a man's surviving sons this conflict might continue.

The traditional system of land inheritance favours sons. Women depend on their marital status to gain access to land on which to collect fuelwood and on which eventually to plant trees. When communal lands existed, it did not matter whether a woman was single, married or divorced, she still had a fuelwood source on the common lands. But now that land is privately owned by men, unmarried women are at a disadvantage. The women in this study happened to be married or widowed and

therefore, had a stake in their husbands' lands or estates. It is worth recording here that among the divorcees there was one lady, 57 years of age, who had been given some land by her father contrary to the cultural norms.

This research shows women to be engaged in tree planting although to a far lesser degree than men. It also confirms the existence of cultural beliefs that hinder the Abasamia's tree planting efforts. The stated aim of the research, to show the existence of beliefs that may influence tree planting has therefore been achieved. Nevertheless, the topic needs to be explored further.

Constraints to Tree Planting Efforts

From the observations made in this study, the degree to which respondents said they planted trees is not matched by the presence of trees in the homestead gardens. Termites and what inhabitants called *enyende* (probably nematodes) were responsible for transplant deaths. In addition, drought is cited as a factor in the non-establishment of trees. The people in the south do not have a locational tree nursery from which to obtain seedling for planting. The envisaged solution is a subsidized government or non-governmental nursery. Private tree nursery enterprises are not viable at present because of the subsistence level of the economy of the area.

The gender problems associated with tree planting are rapidly disappearing. However, there was still reluctance to plant certain species. This reluctance translates itself into a general reluctance to plant most indigenous trees. The long term solution to the culturally based tree planting and fuelwood problems facing the inhabitants should be increased education. As their education increases the inhabitants of Funyula may see the need to conserve the soil and use trees for their multiple products and services to improve their standards of living.

Possibilities for improving fuelwood and tree planting in Funyula Division have been discussed. Most of the recommendations made are within reach of the

inhabitants. They do not require new knowledge or new technologies to implement as they are building on what the inhabitants already know and practice.

In some ways, results presented here confirm those given in Chapter 7 regarding the historical data and that from informants but in other respects there are contradictions. For example, the historical data show limited planting of trees by the Abasamia while the questionnaire survey shows widespread planting. As in the past, the planting of the homestead fence, remains the responsibility and domain of the male household head. Whereas there is no reference to the planting or aversion to planting of Mvule in the historical data, the interviewees, and informants, government officers, including the District Plan, show that there is a strong resistance to the planting of this tree, a fact confirmed by the questionnaire survey.

Synopsis of Findings

The comparison of village fuelwood consumption, succeeds in showing that the lakeside village of Namasali is facing a fuelwood problem hitherto unrecognized by government planners. The reasons for the deficit became apparent with detailed village micro-environmental analysis. Fuelwood consumption in the study villages is less than the national average, but due to the many factors that govern wood consumption, not much importance could be attached to this finding. The study however, is a further contribution to the growing body of knowledge on village fuelwood consumption.

Behavioral indicators of fuelwood scarcity differ between the villages in Samia North and those in the south, indicating differential availability of the resource. The difference is further confirmed by the survey questionnaire that showed respondents from the South expressing more fuelwood problems than those from the North. However, the problem is not matched by tree planting for fuelwood which is undertaken by only 3% of the households interviewed

The inhabitants' primary tree needs were for poles and fruit indicating a need for shelter, food and cash. The high percentage of planted species in the fuelwood bundles showed that there was a certain level of dependency on cultivated trees for fuelwood provisioning. Gender differences in tree planting as a result of cultural norms were recognized. Constraints to the planting of some indigenous trees was also identified. Recommendations on how to address some of these constraints to tree planting and fuelwood provisioning are addressed in the next chapter.

CHAPTER 9

RECOMMENDATIONS FOR PROGRAMME DEVELOPMENT

The last fifteen years have seen multi-million dollar projects on fuelwood and tree planting in many developing countries. Although a majority of the projects were concerned with tree planting, some were designed to look at the efficiency of energy conversion and conservation during use.

This concern resulted in projects that looked at the cooking stove and the charcoal kilns. In many rural Kenyan homes, as well as in the study area, cooking is done on traditional stoves made out of three stones. Such stoves are inefficient in energy use and conservation. Improved stoves have therefore been recommended and tried in many parts of the world, Kenya included. In Kenya, the improved stove is said to be successful in the cities where charcoal is mostly used (Joseph 1987). In such a setting, energy conservation and efficiency is important. Indeed, KENGO tested its stoves in only major cities because few people in the rural areas use them.

On the other hand, in the countryside, the traditional stove serves several functions; it is a meeting place where evening stories and news are exchanged and it provides warmth and additional room lighting (rooms are normally lit by small tin lamps that provide less light than a candle). The traditional cooking stones can also be adapted and modified to suit various pot sizes and quantity of food required by the many visitors and relatives. In contrast, most of the so called improved stoves do not fulfill these social functions. Furthermore, improved stoves are costly when compared with those made out of three stones.

There have been other projects concerned with the efficiency of converting wood to charcoal. Again, improved kilns have been tried. The building of improved kilns represents substantial costs to rural folks who as has been seen in the case of Funyula,

engage in charcoal making as a means of subsistence. Moreover, improved kilns are often immobile, necessitating wood transportation to the kiln site. Whereas large scale commercial charcoal producers such as the East African Tanning and Extract Company (Kenya) use improved kilns, small scale charcoal makers are likely to continue using the inefficient earth kilns because the only cost required is the labour involved in their construction.

Finally, Kenya has been in the forefront of environmental conservation. There is a nationwide campaign to increase tree planting. These educational campaigns and mass awareness programmes are encouraged by the highest office in the land. Free seedlings are issued, once a year, during the tree planting week. In addition, there are educational programmes and other mass media channels to sensitize people on the need to plant trees.

From this study the following needs were identified: the need to provide building poles for better quality housing; a need for soil conservation through control of water runoff from the hills, a need to improve soil fertility and a need to control livestock grazing. There is also a need to provide more nutritious foods for family consumption. To meet all these needs on the prevailing dwindling land resources, it is recommended that a few, select, multi-purpose trees be improved (silviculturally if already present in the system) or introduced in the homestead gardens. Some of the trees worth considering are discussed in the following paragraphs.

Suitable Trees

Drawing from my experience as a long time resident of the study area, and results of this study, I identified the following four trees and a nitrogen fixing perennial as likely to serve the social, cultural, and economic needs of this community. These trees are:

1. Mango (*Mangifera indica*): This fruit tree serves three main functions: first as a source of nourishment; the mango fruit is rich in vitamin C and carotene. Second it is culturally suitable as a homestead tree where its large crown provides a site for social

gatherings and information exchange. Third, because it branches profusely, it provides a continuous source of fuelwood. This tree already grows in the area though from unimproved seedlings. In many Asian countries old mango trees also provide much needed timber, a possibility that has not been exploited in Kenya.

2. The orange, *Citrus sinensis*: This tree serves the economic and nutritional needs of families. The orange fruit, rich in vitamin C, is sold for cash and the surplus consumed in the home. However, orange trees do not handle well for fuelwood. Furthermore, results from this study show that orange trees in Funyula Division are heavily infested by pests. This problem needs to be addressed if farmers are to derive maximum benefit from their trees.

3. *Markhamia lutea*: This indigenous tree is widely used to provide poles for house construction. A *M. lutea* tree is found in most Samia homesteads. It is therefore recommended that silviculture and management research be focused on this species to increase its yield. Farmers need to know when and how to prune and thin for maximum pole production.

4. Neem, *Azadrachta indica*: Although new in the area, the neem tree is also likely to serve the social, cultural and economic needs of the Abasamia. The neem tree produces several straight stems suitable for house construction and energy production. It is drought resistant, is reputed to have medicinal properties and contains azadiractin, an insect repellant (NAS 1980 and 1983; Teel 1985). Moreover, results of this study show that 55% of the respondents expressed a desire to have this species. In addition, from my own personal experience,[38] I am convinced that the neem's growth performance in Funyula makes it ideal for the area.

Results further show that the greatest hindrance to tree growth as identified in this community is termites. Termites have prevented widespread establishment of eucalyptus trees in the area. This problem could possibly be solved by use of pesticides. However,

[38]From seeing the growth performance of some neem trees planted in 1979 at Nyakhobi school.

use of agrochemicals has its own associated problems. In Funyula Division, these are the subsistence level of the economy, lack of infrastructures to support the distribution of the chemicals, environmental effects and the low literacy levels of the population. The latter reason makes it difficult for rural farmers to understand the complicated instructions on pesticide packages, thus, making chemical use more hazardous. Because of its potential medicinal and insecticidal properties, I strongly recommend that neem tree seeds or seedlings be provided to the community to meet their expressed needs. The tree would provide families with building poles and fuelwood.

5. Pigeon pea, *Cajanus cajan:* The pigeon pea is a nitrogen fixing plant, hence it enhances soil fertility. This plant also provides a protein-rich food that is lacking in this area. In Chapter 6, the sociocultural analysis revealed a high incidence of malnutrition among infants that results in Kwashiorkor, a protein deficiency disease. The malnutrition is partially blamed on the introduction of the Nile perch into Lake Victoria. This carnivorous perch has destroyed native fish stocks on which the inhabitants depended for their protein sources. *C. cajan* would therefore fill this nutritional gap and at the same time it could serve a soil fertility enhancer. In addition, the pigeon pea's woody stalks could be harvested for fuel. The plant's agronomy is already known in Kenya as it grows in Machakos District. I therefore recommend its introduction.

Priority Sites

The discussion carried out in Chapter 8 recognized the importance of hill areas as sources of fuelwood and other resources. It also showed them to be potential areas of land degradation. Runoff from the hills will become serious as they increasingly become denuded due to charcoal making and quarrying for building stones.

There is a need to educate owners of hill lands on the desirability and value of preserving the vegetation on their properties or replanting in instances where vegetation has been destroyed. Few of the farmers in the area are able to rehabilitate denuded hill

lands using their own resources. In addition, most farmers live at a subsistence level; thus, the immediate value and importance of hill conservation may not be apparent to them. Furthermore, they may not have the time, labour, and financial resources that this exercise entails. Recognizing the fact that the final, long term, environmental benefits accruing from hill conservation will benefit the local, national, and global community, the cost of rehabilitation and conservation should concern us all. In addition to the present mass campaigns by the government, I recommend that funds be provided to aid those farmers willing to reforest hill areas.

Outlook on the Charcoal Industry

As a result of the recent price increase in commercial fuels due to the Gulf Crisis, it is anticipated that more urban dwellers will turn to charcoal for cooking as an alternative to electricity, gas, or paraffin. The anticipated increase in demand should result in higher prices for charcoal, making it more lucrative to engage in its production. There is need to regulate charcoal production and quarrying activities to prevent any further denuding of the hills. However, most people would not like regulations that interfere with their freedom to do what they please with their lands, especially to harvest what is on them. The Kenya Development Plan 1988-1993 proposes "to provide a Woodfuel Conservation Subsidy Scheme based on reducing the effective price of paraffin to encourage it [paraffin] as an alternative to charcoal and wood" (Republic of Kenya 1988b, p. 179). As I see it, the scheme will subsidize paraffin users at the expense of fuelwood users, with the remote hope that the latter will make the switch from wood use to paraffin use. In view of the uncertainty of the outcome of such a scheme, I strongly recommend that the *Woodfuel Subsidy Scheme* be expanded to include a provision to assist farmers willing to rehabilitate denuded hill areas. This recommendation should be applicable to other areas of Kenya with similar problems.

Policy Issues

In this study, policy induced fuelwood scarcity, resulting from land adjudication, has been discussed. This type of scarcity is not confined to the study area but is to be found in other parts of the Republic as reported by Barnes (1984) and Riley and Brokensha (1988). In Funyula Division, fragile hill areas, previously used as communal lands, were privatized between 1967 and 1974. As a result, an opportunity to serve the whole community was lost. The difficulties of conserving privately held lands has already been mentioned. I believe that the Abasamia should have been left to administer and manage the hills as community property. Between 1967 and 1974, the time of land adjudication, attempts by the Forest Department to alienate hill lands for afforestation met with much resistance from the population of the area. Moreover, this attempt has resulted in distrust of forest officers. This should serve as an example to other countries with fragile ecosystems that still belong to tribal communities not to rush into privatizing such areas. Community (as opposed to private or state) management alternatives should be considered.

Government Nurseries

The Kenya Forest Department's Rural Afforestation Extension Scheme (RAES), has been operating in Busia District for the last 21 years with the aim of taking trees to people. Nevertheless, the study shows that inhabitants continue to bring tree seedlings from outside the district, indicating the inadequacy of the present forest nursery services. Water problems in two villages in Samia South, where there is more need for tree planting, preclude intensive on-farm seedling production. Moreover, there is no government tree nursery in Samia South. The KENGO-initiated nurseries were also non-operational at the time of the study. I recommend that the Forest Department open up a tree nursery in Samia South in order to truly "take the seedlings nearer to the rural people". Additionally, there should be more co-operation between the Department of

Agriculture and the Forest Department in areas of tree planting promotion and seedling production. Both forest and horticultural tree seedlings should be produced in the same nursery to save on operating costs and materials and to also save farmers the time of having to go to two different tree nurseries for their seedling needs. This recommendation should be applicable in the whole country.

Gender Aspects

This study failed to show a gender difference in perception of fuelwood scarcity. However, tree planting activities are gender influenced. In addition, tree planting activities are complicated by the emotive and complicated nature of property rights, the cultural norms and beliefs about trees and the traditional division of labour at the household level. In view of the foregoing, it is recommended that both genders be encouraged to plant trees in the traditionally sanctioned sites so as not to antagonize any section of the community.

Cultural Constraints to Tree Planting

Unlike other problems, it is difficult to recommend and effect changes to a people's beliefs. One possible way is through education. Education takes many forms. Environmental teaching is incorporated into the various levels of the school curriculum and is matched by widespread public campaigns about tree planting. However, demonstration plots as an educational tool have yet to be explored in the study area. There is a lack of scaled down demonstration plots, either public or private, with which farmers can identify. I suggest that these be established to further contribute to the farmers' knowledge of trees and their performance. As a further educational tool, ordinary farmers who contribute most to tree planting should be rewarded by organized visits to other areas of the country and even outside so as to witness successful tree planting efforts elsewhere. Nonetheless, education alone will not solve fuelwood problems if the population continues to increase beyond the carrying capacity of the land.

Although the growing human population is at the core of fuelwood problems, this variable is beyond the scope of this study.

Summary

The following are the main recommendations.

1. Site and species-specific research on a select number of multi-purpose trees be initiated.
2. Some funds from the proposed "Woodfuel Subsidy Scheme" be set aside to assist farmers willing to rehabilitate denuded hill areas.
3. Part of the same funds be used to reward farmers contributing most towards environmental conservation in general and tree planting in particular.
4. The Forest Department open up a tree nursery in Samia South.
5. There be more co-operation between the Ministry of Agriculture and the Forest Department in the running of tree nurseries.
6. Both men and women be encouraged to plant trees in the traditionally sanctioned sites.
7. A curriculum to specifically address environmental issues be developed at all educational levels.

In addition, there are five supplementary recommendations on specific trees and perennial crops i.e., the mango, orange, neem, *Markhamia lutea*, and pigeon pea, which I find suitable for inclusion in the Samia farming system. If implemented, these recommendations should contribute to the social, economic, nutritional, and fuelwood needs of families, thereby improving their standards of living.

Programmes for Future Research

Several areas that may need further research came out of this work. There is the important and interesting problem of property rights and their effect on wood availability. In addition, the policies of land privatization have been shown to have an impact on

fuelwood availability. These issues provide possible areas of future research as a follow up to the present effort.

The recommendations made here on trees to include in the farming system of the area were based on general observations of the biophysical environment and the growth performance of trees that were found growing in the area. They were not based on specific silvicutural growth and yield data, another area that may need addressing. In this regard, a start has been made in neighboring Siaya District by the International Center for Research in Agroforestry (ICRAF) and Kenya Forestry Research Institute (KARI) through their African Forestry and Environment Network Association (AFRENA) collaborative programme (Odera, director KARI 1990 personal communication). Results from the AFRENA experience will hopefully, be available for application and testing in Funyula Division.

The issue of wood use at the household level was never properly addressed during the RRA exercise of this discussion. It would be useful to know the combustion qualities of each wood species and their effect on health and family welfare. There is also a need to detailed social benefits of trees to the community. For example, to what extent do tree products positively or negatively affect family finances?

The soil descriptions given in this dissertation were mainly from general observations. For a more effective management of trees, it will be necessary to map the detailed soils of the area, as well as vegetation composition and successional mosaics. These knowledge gaps are some of the more urgent of the problems because of the changing land use in the villages studied.

The survey listed termites as one area limiting tree establishment and growth. Other pests were also identified on the citrus crop. There is therefore a need to concentrate on trying to solve the termite problem. As the sociocultural analysis of the Division showed, the lack of agrochemical outlets and the subsistence level of the inhabitants precludes recommending use of pesticides. A need thus arises to look at pest

resistant trees in addition to identifying individual sites where pest prone species can survive.

The discussion of beliefs showed the extent to which the Abasamia's beliefs still influence decisions about land management practices. This area needs attention, if results of any other research started in the area are to ever be implemented in a manner useful to the community. Extension workers need to recognize these constraints to tree planting.

Finally, while recognizing the importance of fuelwood, the author believes future research should concentrate on food problems first, followed by satisfying the area's building pole needs and lastly fuelwood. The drought conditions that have affected Africa did not spare the villages studied in this research. At the time of this study, there was widespread food scarcity which tended to make questions on fuelwood appear unimportant. Tropical food trees from the Asian Continent, and the Pacific islands have not been adequately exploited on the African continent. The genus Artocarpus should be investigated with a view to introducing some of its species to some countries in Africa.

This study was able to identify areas of future research needed to improve the Samia landscape. These are diverse topics that need many disciplines to converge on the areas to effectively come out with a programme of research that will be beneficial to the villages around the area, the larger areas of Busia District and finally Kenya, the country.

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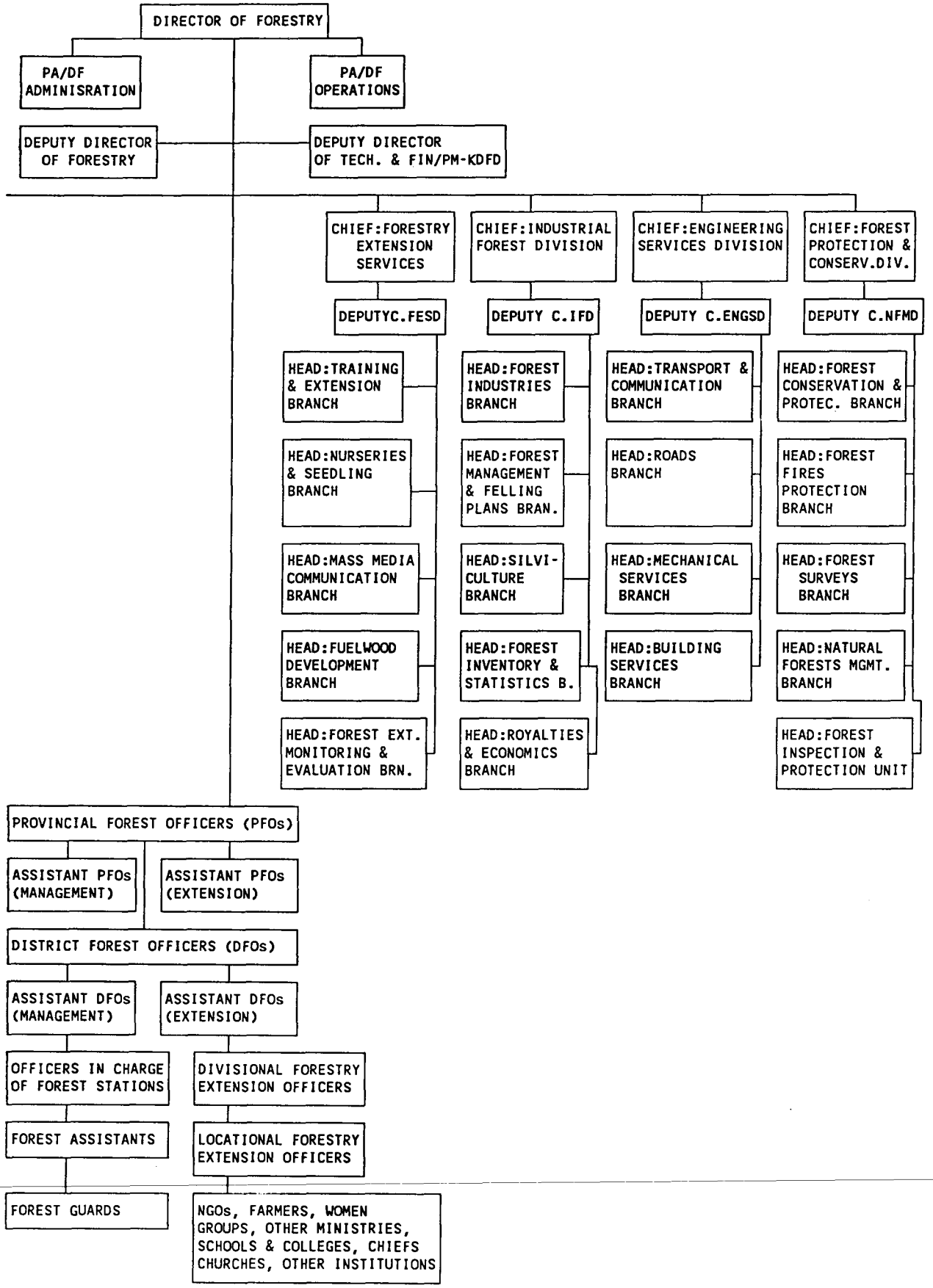
APPENDIX 1
PARTIAL ORGANIZATIONAL STRUCTURE OF THE KENYA FOREST DEPARTMENT



APPENDIX 2

FUELWOOD AND TREE PLANTING: A CASE STUDY FROM FUNYULA DIVISION IN WESTERN KENYA

QUESTIONNAIRE

General Location _____ Date _____
Village _____
Interviewee No. _____
Sex: male ... 1( ) female ...2( )

Please note the following before or during the interview. Type of house and state in which it is.

House type: Grass thatched .... 1( ) Iron roofed .... 2( )

---

1. Do you or the household you represent own any land?

   Yes ... 1( ). No ... 2( )

2. If yes how much land do you own? Hectares _____

3. How long have you lived on this land? Years _____

4. Is all the land under cultivation?

   Yes ... 1( ) No ... 2( )

5. If no please tell us what proportion is used for crop production and for fallow?

   Crops ..... ( ) Fallow ..... ( )

6. Do you raise any cash crops? Yes ... 1( ) No ... 2( )

7. If yes which one did you raise? Crop _____

8. How about food crops could you tell us which of the following you raised and how much you obtained last year

A. Crop

cassava . . . . . 01( )
maize . . . . . 02( )
millet . . . . . 03( )
Soghum . . . . . 04( )
beans . . . . . 05( )
sweet potatoes . . . . . 06( )
groundnuts . . . . . 07( )
bananas . . . . . 08( )
oranges . . . . . 09( )
mangoes . . . . . 10( )
others specify . . . . . 11( )

9. Are you a full time farmer? Yes ... 1( ) No ... 2( )

10. If not what are your other sources of income?

Farmer . . . . . 1( )
Professional (teacher) . . . . . 2( )
Craftsman (carpenter) . . . . . 3( )
Beer Brewing . . . . . 4( )
Brick making . . . . . 5( )
tailoring . . . . . 6( )
shopkeeping . . . . . 7( )
fishing . . . . . 8( )
Others specify . . . . . 9( )

11. What is your household's source of farm labour?

Own family . . . . . 1( )
Hired labour . . . . . 2( )
Farm animals . . . . . 3( )
1+2 . . . . . 7( )
Hired machines . . . 4( )
Own machines . . . . 5( )
work groups . . . . . 6( )
1+6 . . . . . 8( )

12. Do you own any bicycle? Yes ... 1( ) No ... 2( )

13. How about livestock? Yes ... 1( ) No ... 2( )

14. If yes could you indicate which type and how many of each you own:

Type
Cattle . . . . . 1( )
Goats . . . . . 2( )
Sheep . . . . . 3( )
Pigs . . . . . 4( )
Others specify . . . . . 6( )
1+2 . . . . . 7( )
1+2+3 . . . . . 8( )

15. Did you sell any of the animals in the last one year?

Yes ... 1( ) No ... 2( )

16. If yes please tell us how much you obtained from the sale

Amount Ksh _____

17. Would you consider planting trees for fuelwood provision or not?

YES ... 1( ) NO ... 2( )

18. Are there any planted trees on your land?
YES ... 1( ) NO ... 2( )

19. If yes which species?

_____

20. Is there any particular species you would like plant?

_____

21. From where were the seedlings obtained?

Gorv. nursery . . . . . 1( )
Friends . . . . . 2( )
School nursery . . . . . 3( )
Others specify . . . . . 4( )

22. Who planted those trees?

self	1( )	spouse	2( )
children	3( )	1+2	4( )
1+3	5( )	2+3	6( )

23. Where are they planted?

round the homestead . . . . . 1( )
in the homestead compound . . . . . 2( )
farm boundary . . . . . 3( )
mixed with crops . . . . . 4( )
others specify . . . . . 5( )

24. For what purpose are they planted?

fuelwood	1( )	poles	2( )
ornamentals	3( )	timber	4( )
fruit	5( )	medicines	6( )
2+4	7( )	2+3+4	8( )

25. If you had trouble with your trees whom should you consult

the agricultural officer . . . . . 1( )
friends . . . . . 2( )
the forest officer . . . . . 3( )

26. What are the major problems for tree growth?
poor soils . . . . . 1( )
inadequate rainfall . . . . . 2( )
termites . . . . . 3( )
rocky soils . . . . . 4( )

And now let us find out about fuelwood.

27. Who is responsible for firewood collection in your household?

_____

28. How much firewood is collected in one week? _____ (bundles)

29. How far do you go to collect the wood? distance km _____

30. Do you use crop residues? YES ... 1( ) NO ... 1( )

31. How about dung? Yes ... 1( ) No ... 2( )

32. Have you ever sold firewood? YES ... 1( ) NO ... 2( )

33. Would you be willing to buy firewood? YES ... 1( ) NO ... 2( )

34. Would you say at present there is a firewood shortage or there is not?

YES ... 1( ) NO ... 2( )

35. How about in the next five years do you foresee any firewood shortage or not?

YES ... 1( ) NO ... 2( )

36. Do you require permission to collect firewood from a neighbors land?
YES ... 1( ) NO ... 2( )

37. Have you ever burnt any wood for charcoal in the past five years?

YES ... 1( ) NO ... 2( )

38. If yes was it for own use or sell?

own use ... 1( ) for sell ... 2( )

39. Where did you get the wood for the charcoal?

from own land ... 1( ) from neighbors' land ... 2( )

40. Would you say there were enough of the following products:

building poles _____

41. How about timber _____

Please indicate whether you agree or disagree with the following statements by answering agree or disagree.

42. I do not really need advice on tree planting.

Agree ... 1( ) disagree ... 2( )

43. I admire the flowers of the markhamia tree.

Agree ... 1( ) disagree ... 2( )

44. It is bad luck to cut a sausage tree.

Agree ... 1( ) disagree ... 2( )

45. No woman should be allowed to plant trees for the homestead fence.

Agree ... 1( ) disagree ... 2( )

46. I would never plant a "Mvule" tree.

Agree ... 1( ) disagree ... 2( )

47. Only men should plant trees.

Agree ... 1( ) disagree ... 2( )

48. If an owl frequently hoots in a tree near a home, the tree should be cut down.

Agree ... 1( ) disagree ... 2( )

And now I shall ask you some more general questions about trees.

Practice

49. In the last two years have you planted any trees?

Yes ... 1( ) No ... 2( )

50. Would you prefer to raise your own seedlings or to buy them?.

raise ... 1( ) buy ... 2( )

51. Have you ever raised any tree seedlings?

Yes ... 1( ) No ... 2( )

52. Have you ever visited the forest nursery?

Yes ... 1( ) Never ... 2( )

53. Have the Ministry of Agriculture officers ever visited your farm?

Yes ... 1( ) NO ... 2( )

54. How about forest officers?

Yes ... 1( ) NO ... 2( )

55. The forest department tried to afforest the Samia hills in 1970s, please tell us whether you think this action should have been continued or not?

1. Continued. 2. Not Continued.

56. Do you own any hill land?

Yes ... 1( ) No ... 2( )

57. In retrospect do you think it was a good move for the forest department to give up the hill areas or not a good move?

1. Good move 2. Not a good move.

In order to help us interpret these results could you please tell us a little about yourself.

58. Please tell us whether you are single, married, widowed or divorced.

single . . . . . 1( ) Married . . . . . 2( )
Divorced . . . . . 3( ) Widowed . . . . . 4( )

59. If married is it a polygamous or monogamous marriage?

Polygamous . . . . . 1( ) Monogamous . . . . . 2( )

60. What year were you born?

Year of birth 19_____

61. What is your educational level?

Never went to school . . . 1( )
Primary level . . . . . 2( )
Secondary school . . . . . 3( )

62. Do you have any children?
Yes ... 1( ) No ... 2( )

63. If yes how many? No of children _____

64. What religion do you practice?

Traditional religion . . . . . 1( )
Christian . . . . . 2( )
Moslem . . . . . 3( )
others specify . . . . . 4( )

Finally are there any comments you would like to make about this questionnaire?

Thank you very much for participating in this survey.

CONDITIONS

1. You must report to the District Commissioner of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least four bound copies of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice.

GPK 6585—3m—11/88

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS—*see* back page)

Extended to August, 1992
from June, 1990.

PAGE 2

THIS IS TO CERTIFY THAT: C. A. MWANGO (MRS.)

~~Prof./Dr./Mr./Mrs./Miss~~ ALOO
THERESA CONSTANCE
of (Address) EGERTON UNVERISTY
P.O. BOX 536, NJORO,
has been permitted to conduct research in
Samia North and South Location,
Busia District,
NAIROBI & WESTERN Province,
on the topic COMMUNITY FORESTRY/
AGROFORESTRY IN KENYA: THE
FORESTER'S PERCEPTIONS.

for a period ending AUGUST, 1989.

PAGE 3

Research permit No. OP.13/001/19C 119/
Date of issue 15th June, 1989
Fee received Kshs.25/=

Applicant's Signature

for: *Permanent Secretary, Office of the President*

APPENDIX 4

Egerton University
P.O. Box 536
NJORO

May 14th, 1990

The District Commissioner
Busia District
P.O. Busia.

Dear Sir,

This is to inform you that I will shortly call on you in connection with a research I would like to carry out in Samia North and South Locations of Funyula Division. I am a lecturer at Egerton University and currently I am on study leave at the University of British Columbia, Canada. I am sponsored by the government of Kenya and have been cleared by the Office of the President to do this research as part of Egerton University's manpower development programme.

I am interested in interviewing farmers and knowledgeable people on fuelwood and tree planting in general. Because the chiefs hold an important position and no doubt are very knowledgeable, it would be nice to interview them first. In addition I would like to interview the forest officers and agricultural officers stationed in Funyula Division.

Results from this research will be available to relevant government agencies to help them in future environmental planning for the district and hopefully other parts of the country. Since the people I intend to interview are very busy, I shall try and make the interview short and hope that it will be interesting and stimulating. I look forward to meeting you and the people under your jurisdiction.

Yours sincerely.

Theresa C. Aloo
Lecturer/Egerton University.

APPENDIX 5

Egerton University
P.O. Box 536
NJORO

June 1st, 1990

The Chief of Samia North Location
Funyula Chief's Camp
P.O. Funyula

Dear Sir,

This is to inform you that I shall shortly call on you in connection with a research I would like to carry out in Samia North and South Locations of Funyula Division. I am a lecturer at Egerton University and currently I am on study leave at the University of British Columbia, Canada. I am sponsored by the government of Kenya and have been cleared by the Office of the President to do this research as part of Egerton University's manpower development programme.

I am interested in interviewing farmers and knowledgeable people on fuelwood and tree planting in general. Because you hold an important position and no doubt are very knowledgeable, it would be nice to interview you first. In addition I would like to interview the forest officers and agricultural officers stationed in Funyula Division.

Results from this research will be available to relevant government agencies to help them in future environmental planning for your area and hopefully other parts of the country. Since you are a very busy person, I shall try and make the interview short and hope that it will be interesting and stimulating. I look forward to meeting you and your people.

Yours sincerely.

Theresa C. Aloo
Lecturer/Egerton University.

APPENDIX 6

CROP SPECIES RECORDED IN FUNYULA DIVISION

Genus	Family	Common name	Samia name
Ananas comosus	Bromeliaceae	Pineapple	*Enanasi*
Arachis hypogea L.	Leguminoceae	Ground nuts	*Enjugu*
Colocasia antiquorum	Areceae	Taro	*Enduma*
Cajanus cajan (L.) Millsp.	Leguminoceae	Pigeonpea	*(Embaazi)*
Coffea arabica L.	Rubiaceae	Coffee	*Ekakhawa*
Eleusine coracana	Gramineae	Millet	*Obule*
Gossypium hirsutum	Malvaceae	Cotton	*Epamba*
Helianthus annus L.	Heliantheae	Sunflower	*Amawuwa*
Ipomea batatas	Convovulaceae	Sweet potatoes	*Amabwoni*
Brassica spp.	Crucifereae	Kale	*Sukuma*
Manihot esculenta Cranz	Euphorbiaceae	Cassava	*Emiogo*
Musa spp.	Musaceae	Bananas	*Amatemwa*
Phaseolus vulgaris	Leguminoceae	Beans	*Amaragwe*
Saccharum spp.	Gramineae	Sugarcane	*Emikachi*
Sesamum indicum L.	Pedaliaceae	Sesamum	*Enuni*
Sorguhum spp.	Gramineae	Sorghum	*Amabere*
Lycospersicon esculentum	Solanaceae	Tomatoes	*Enyanya*
Vigna aureus	Leguminoceae	Green grams	*Engoli*
Vigna unguiculata (sinensis)	Leguminoceae	Cow peas	*Ekhubi*
Voandzeia subterranea (L.)	Leguminoceae	Bambarra nuts	*Embande*
Zea mays L.	Gramineae	Maize	*Amadimwa*

* = Newly introduced crop.

Plants identified from general field recognition.

APPENDIX 7

INDIGENOUS TREE AND CROP SPECIES RECORDED IN FUNYULA DIVISION

Genus	Family	Samia Name	Uses
Acacia albida Del.	Mimosaceae	*Omugogongo*	Sh Fw
Acacia eggelingii Bak. f	Mimosaceae	*Omuwa*	Fw
Acacia macrothyrsa Harms	Mimosaceae	*Omuyengayenga*	W
Acacia spp	Mimosaceae	*Omugasiri*	W
Albizia coriaria Welw. ex Oliv	Mimosaceae	*Omusengese*	T
Albizia grandibracteata Taub	Mimosaceae	*Omulongo*	M Sh Fw
Annona chrysophylla Boj.	Annonaceae	*Esilongalonga*	M
Antiaris toxicaria (Rumph. ex Pers.) Les ch	Moraceae	*Omulundulundu*	T Sh Fw
Balanites aegyptiaca (L.) Del	Simaroubaceae		F M
Bridelia micrantha (Hochst) Baill.	Euphorbiaceae	*Olulonda ng'ombe*	M Fw
Calodendrum anisata (Willd) Oliv.	Rutaceae	*Olusita simba*	H
Carissa eduli (Forsk) Vanl	Apocynaceae	*Ochoga*	F Tb
Chlorophora excelsa (Welw.) Benth. & Hook. f.	Moraceae	*Omutumba*	T S C M Fw Sh
Combretum ghasalense Engl. Diels	Combretaceae	*Omulanga*	
Combretum gueinzii Sond	Euphorbiaceae	*Omuchuta*	
Commiphora spp.	Burseraceae		
Dracaena afromontana Mildbr	Agavaceae	*Embano*	R M H
Erythrina abyssinica Lam ex DC	Papilionaceae	*Omutembe*	R M
Euphorbia candlabrum Trem. & Kotschy	Euphorbiaceae	*Edwa*	R
Euphorbia tirucalli Linn.	Euphorbiaceae	*Ekhoni*	H P Fw
Ficus capensis Thumb	Moraceae	*Omukhuyu*	Re Sh T
Ficus glumosa Del	Moraceae	*Omudodo*	
Ficus natalensis Hochst	Moraceae	*Omutuba*	Sh
Grewia trichocarpa Horchst. ex A. Rich	Tiliaceae	*Omukhoma*	T Fw
Kigelia aethiopica Deane synonym *K. aethiopum* (Fenzl) Dandy	Bignoniaceae	*Omutabi*	R
Makhamia platycalyx Sprague	Bignoniaceae	*Omusiola*	P T Sh Fw O
Rhus natalensis Bernh ex Krauss	Anacardiaceace	*Olusangula lukhasi*	F
Rhus vulgaris Meikle	Anacardiaceace	*Olusangula lusacha*	F

Appendix 7 (cont'd)

Genus	Family	Samia Name	Uses
Sesbania sesban (L.) Merrill	Papilionoideae	*Omuyekiyeki*	Fw
Spathodea nilotica Seem	Bignoniaceae	*Omudungudungu*	Sh O
Strychnos innocua Del	Loganiaceae		M
Syzygium guineense (Willd)	Myrtaceae	*Omutuli*	F
Syzygium owariense Benth	Myrtaceae	*Omuwayo*	F
Tamarindus indica L.	Tamaricaceae	*Omukhuwa*	F Fw T M
Teclea nobilis Del	Rutacea	*Omudati*	P
Terminalia brownii Fresen.	Combretaceae		
Terminalia mollis Laws	Combretaceae		
Vernonia amygdalina Del	Compositeae	*Omululusa*	M
Vitex doniana Sweet	Verbenaceae	*Omufudu*	F T Fw

Key F = Food; Fw = Fuelwood; T = Timber; Sh = Shade; S = Soil conservation; M = Medicinal; Re = Religious rituals; P = Poles; O = Ornamental.

Dale I. R. and P. J. Greenway. 1961. Kenya Trees and Shrubs. Buchanan's Kenya Estates Ltm & Hatchards, Piccadily, London, W1.

APPENDIX 8

EXOTIC TREES RECORDED IN FUNYULA DIVISION

Genus	Family	Samia name	Uses
Forest Trees			
Agave sisalama Perrine	Agavaceae	*Ekonge*	Fi
Callitris spp.	Cupressaceae		
Cassia siamea Lam.	Caesalpiniaceae	*Omugasia*	P BFw
Cassia spectabilis DC.	Caesalpiniaceae		
Casuarina spp.	Casuarinaceae		O
Cupressus lusitanica Mill.	Cupressaceae		O H
Delenox regia (Boj. ex Hook.) Raf.	Caesalpiniaceae		O Sh
Dovyalis caffra (Hook. f. & Harv.)	Flucourtiaceae		H
Eucalyptus spp.	Myrtaceae	*Omubao*	P Fw
Grevillea robusta A. Cunn	Proteaceae	*Omubodiabodia*	T O Sh
Hibiscus spp.	Malvaceae		H O
Jacaranda mimosaefolia D. Don	Bignoniaceae		O
Lantana camara L.	Verbenaceae	*Obengele*	To Fw
Leucaena leucocephala	Mimosaceae		
Melia azadirach L.	Meliaceae	*Omudwele*	P Fw
Pinus patula Schlecht. and Cham.	Pinaceae	*Omukaratasi*	O In
Terminalia catappa L.	Combretaceae	*Omugorofa*	Sh O
Thunbergia peruviana	Acanthaceae	*Amafulukutu*	H
Tithonia diversifolia (Hemsl) Gray	Compositae		W Fw

Appendix 8 (Cont'd)

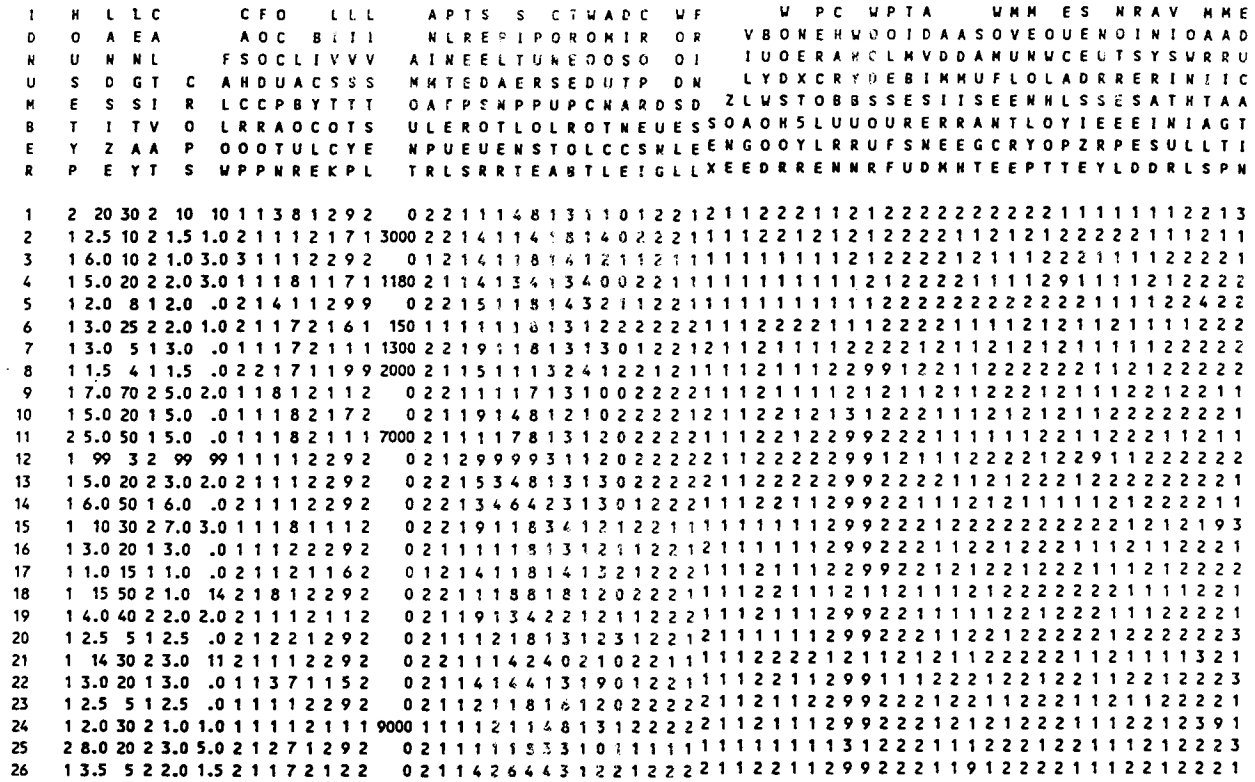
Genus	Familiy	Common name	Samia name	Uses
Exotic Fruit Trees				
Anacardium occidentalis	Anacadiaceae	Cashewnut	*Omukorosi**	
Durio zibethinus Murr.	Bombacaceae	Durian	*Omufenesi*	F Sh
Carica papaya L.	Caricaceae	Pawpaw	*Omupapali*	F
Citrus lemonia Osbeck	Rutaceae	Lemons	*Omulimawo*	F
Citrus reticulata Blano	Rutaceae	Tangerines	*Mangada*	F
Citrus sinensis L.	Rutaceae	Oranges	*Omuchungwa*	F Ca
Mangifera indica L.	Anacadiaceae	Mango	*Omuyembe*	F Fw Sh
Persea americana Mill.	Lauraceae	Avocado		F Ca
Psidium guajava L.	Myrtaceae	Guava	*Omupera*	F
Syzygium cumini (L.) Skeels	Myrtaceae	Jambolan	*Omujambola*	F Sh

Key F = Food; Fi = fibres; Fw = Fuelwood; H = hedge; T = Timber; Sh = Shade;
S = Soil conservation; M = Medicinal; Re = Religious rituals; P = Poles; O = Ornamental.

Dale I. J. 1953. The Introduced trees of the Uganda Protectorate. Uganda Government Printer, Entebbe

APPENDIX 9

COMPUTER PRINTOUT OF QUESTIONNAIRE DATA RECORDS



Appendix 9 (cont'd)

IDNUMBER	HOUSETYP	LANDSIZE	LENGSTAY	CALTIVAT	CROPS	FALLOW	CASHCROP	FOODCROP	OCCUPATN	LABOUR	BICYCLE	LIVSTOCK	LIVSTTYP	LIVSTSEL	AMOUNT	ANIMALPR	PLNTFEUL	TREEPRES	SEEDSOUR	PLANTER	SITEPLNT	PURPOSE	CONSULTA	TREEPROB	WOODCOLT	AMOUNTCL	DISTANCE	CROPRESI	DUNG	WOODSELL	FRINDSEL	SEX	ZONE	VILLAGE	BUYWOOD	WOODSHOR	NEXT5YR	PERCOLLE	CHARBURN	WHYBURN	WOODSOUR	POLESUFF	TIMBERSU	ADVISEND	ADMIREM	ADMIREH	SAUSAGT	WOMFENCE	MVULETRE	MENONLYP	OWLHOOT	EUCALYPT	SEEDSIZE	NURSERY	NOTREEPL	RISESEED	ANYRAISD	VISITNUR	OWINHILL	MARITALS	MARIAGTP	EDUCATIN
56	1	4.0	17	1	4.0	.0	2	1	1	1	1	1	5	1	8760	1	1	1	1	1	1	4	2	3	4	0	0	1	2	2	1	1	1	2	2	2	1	1	2	9	9	2	2	2	1	1	1	1	2	1	1	1	1	1	1	2	1	1	2	2	2	2
57	1	8.0	28	2	6.0	2.0	3	1	7	6	2	2	9	2	0	2	1	1	1	1	1	5	3	3	1	0	0	2	2	1	1	1	1	2	2	2	2	1	1	1	1	2	2	1	1	1	2	2	2	2	2	2	1	1	2	2	1	2	2	2	2	2
58	1	5.0	10	1	5.0	.0	2	1	1	1	1	1	6	2	0	2	2	1	4	9	1	8	1	3	1	2	0	1	2	2	1	1	1	2	2	1	1	1	1	2	1	2	2	1	1	1	2	2	2	2	2	2	1	2	2	1	1	1	2	2	2	2
59	1	1.0	6	1	1.0	.0	2	1	1	1	2	1	7	2	0	2	1	1	1	1	4	4	1	3	1	2	2	1	2	2	1	1	1	2	2	1	1	1	2	9	9	2	2	2	1	1	1	1	1	1	2	2	1	1	2	2	2	2	2	2	2	2
60	2	8.0	29	2	3.0	5.0	1	1	9	6	1	2	9	2	0	2	1	1	1	1	1	4	2	5	4	3	0	1	2	1	1	1	1	2	2	1	1	1	1	2	1	2	2	2	1	1	1	2	2	2	2	2	1	1	1	2	1	1	2	2	2	2
61	2	6.0	30	2	2.0	4.0	2	1	1	1	2	1	8	2	0	2	1	1	2	9	4	8	2	5	4	3	0	1	2	1	1	1	1	2	2	2	1	1	1	2	1	2	2	2	1	1	1	1	1	2	1	2	2	1	1	1	2	1	2	2	2	2
62	1	18	40	2	8.0	10	3	1	1	1	2	2	9	2	0	2	2	1	4	9	3	4	1	7	4	3	0	2	2	2	1	2	1	2	2	2	1	1	2	9	9	2	1	1	1	1	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2
63	2	4.0	36	2	2.0	2.0	2	1	1	7	2	2	2	2	0	2	1	1	4	1	8	8	2	5	1	2	0	1	2	2	1	2	2	3	2	1	1	1	2	9	9	2	2	1	1	2	1	1	1	2	2	2	1	2	2	1	2	2	1	2	2	1
64	2	4.0	64	2	2.0	2.0	1	1	1	1	2	2	2	2	0	2	1	2	9	9	9	9	9	5	1	9	2	1	2	2	2	1	2	3	2	1	1	1	2	9	2	2	1	1	1	2	1	1	1	1	2	2	1	2	2	2	2	2	1	1	2	1
65	1	8.0	27	2	6.0	2.0	1	1	1	1	1	1	2	1	800	1	1	1	2	4	8	8	3	3	1	1	0	2	2	2	1	1	2	3	2	2	1	1	1	1	1	2	2	2	1	1	1	1	1	2	1	2	2	2	1	1	1	1	1	2	2	3
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69	1	20	15	2	10	10	1	1	1	1	1	1	8	2	0	2	2	1	9	1	1	8	3	3	4	4	2	1	2	1	1	2	2	3	1	1	1	1	2	9	9	2	2	1	1	1	2	1	1	2	2	1	2	2	2	1	2	2	2	2	2	3
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99	1	1.5	2	1	1.0	.5	2	1	7	1	2	2	9	2	0	2	1	1	2	1	4	4	2	2	1	2	7	1	2	2	2	1	2	4	1	1	2	2	2	9	9	2	2	2	1	1	2	2	1	2	2	2	2	1	1	1	2	2	2	2	2	2
100	1	4.0	21	2	3.0	1.0	2	1	7	7	1	1	2	2	0	2	1	1	1	1	4	2	1	5	1	2	0	1	2	2	2	1	2	4	1	1	1	2	2	9	9	2	2	2	1	1	2	2	2	2	2	1	2	2	1	1	2	2	2	2	2	3
101	1	2.0	5	1	2.0	.0	1	1	1	1	1	1	1	1	1440	1	1	1	3	1	1	4	1	0	1	2	7	2	2	2	1	2	2	4	1	1	1	1	2	9	9	2	2	2	1	1	2	1	1	2	2	1	2	1	1	1	2	2	2	2	2	2
102	1	14	20	2	7.0	7.0	1	1	1	1	2	2	9	2	0	2	2	1	1	2	2	5	1	1	4	2	3	1	2	2	2	2	2	4	1	1	1	1	1	3	1	2	2	2	1	1	1	2	2	2	2	2	2	2	1	1	1	2	2	1	1	2
103	2	10	11	2	5.0	5.0	1	1	1	1	1	2	9	2	0	2	2	1	1	1	4	2	1	3	1	2	0	1	2	2	2	1	2	4	1	1	1	1	1	1	1	2	2	1	2	1	1	2	2	2	1	2	1	1	1	2	2	2	2	2	1	2
104	2	20	39	2	15	5.0	1	1	2	8	1	1	1	1	4000	2	1	1	2	1	6	6	1	7	1	3	0	1	2	2	1	1	2	4	1	1	1	2	2	9	9	2	2	2	2	1	2	2	2	2	1	2	1	1	1	2	1	2	2	2	2	3
105	1	10	10	2	2.0	8.0	1	1	1	1	1	1	1	2	2880	1	1	1	1	1	4	2	9	1	1	0	7	1	2	2	2	2	2	4	1	1	1	2	2	9	9	1	2	2	2	1	2	2	1	2	2	2	2	1	1	1	2	2	2	2	2	2
106	1	5.5	15	2	3.0	2.5	1	1	1	1	2	1	1	2	0	2	1	1	2	1	8	4	2	5	1	0	0	2	2	2	1	2	2	4	2	1	1	2	2	9	9	2	2	2	1	1	1	2	1	2	2	1	2	2	1	1	2	2	2	2	2	1
107	1	2.0	50	1	2.0	.0	2	1	1	7	1	1	5	2	0	2	1	1	5	1	1	8	9	5	1	2	0	1	2	2	2	2	2	4	1	1	1	2	2	9	9	1	2	2	2	1	1	1	1	2	2	2	2	2	1	2	2	2	2	3	1	1
108	1	3.0	20	2	2.0	1.0	2	1	3	1	1	2	9	2	0	2	1	2	9	9	9	9	1	2	1	2	4	1	2	2	1	2	2	4	1	1	1	1	2	9	9	2	2	2	2	1	2	1	1	2	2	2	1	1	1	1	2	2	2	2	1	1
109	1	2.0	21	1	2.0	11	2	1	1	7	1	1	1	2	0	2	1	1	2	1	1	4	9	5	1	3	6	1	2	2	2	1	2	4	1	1	1	1	2	9	9	1	2	2	1	1	2	2	1	2	2	2	2	1	1	1	2	2	2	2	2	3
110	1	1.0	30	1	1.0	.0	2	1	7	1	2	1	1	2	0	2	1	1	4	1	4	4	9	2	1	3	6	1	2	2	2	1	2	4	1	1	1	2	2	9	9	2	2	2	1	1	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2	2
111	1	2.0	20	2	2.0	.0	2	1	1	1	2	2	9	2	0	2	2	1	4	1	4	4	9	3	1	2	0	1	2	2	1	1	2	4	1	1	1	2	2	9	9	1	2	2	1	1	1	1	1	2	1	2	2	2	2	1	2	2	2	2	1	1
112	1	4.5	20	1	4.0	.5	1	1	1	1	2	1	1	2	1800	1	1	1	3	1	1	4	1	5	2	3	0	1	2	2	2	1	2	4	2	1	1	1	2	9	9	2	2	2	1	1	2	1	2	2	2	2	1	2	2	1	2	2	2	2	2	1
113	1	4.0	33	1	4.0	.0	1	1	7	1	2	1	2	2	0	2	1	1	4	1	3	4	2	2	1	2	7	1	2	1	2	1	2	4	1	1	1	2	2	9	9	1	2	2	2	1	1	1	1	2	2	2	2	2	2	1	2	2	2	2	2	1
114	1	3.0	20	1	3.0	.0	1	1	1	7	2	1	8	1	240	2	2	1	4	1	1	4	1	0	1	3	4	1	1	2	2	2	2	4	1	1	1	1	2	9	9	1	2	2	1	1	1	2	1	2	1	2	1	1	2	2	2	2	2	2	2	1
115	1	2.5	1	2	1.0	1.5	1	1	1	1	2	1	1	2	1440	1	1	1	9	1	4	2	1	9	2	2	0	1	2	2	1	2	2	4	1	1	1	2	2	9	9	2	2	2	1	1	1	1	1	1	2	1	2	1	2	1	2	2	2	2	2	2
116	1	2.0	40	1	2.0	.0	1	1	1	1	2	2	9	2	0	2	1	1	3	1	1	4	2	5	3	3	0	1	2	2	2	2	2	4	1	1	1	1	2	9	9	2	2	2	1	1	1	1	1	2	2	2	2	2	2	1	2	2	2	3	1	1
117	1	7.0	2	2	5.0	2.0	2	1	2	1	2	2	9	2	0	2	1	1	4	2	3	3	1	3	1	3	5	1	2	2	2	2	2	4	1	1	1	1	2	9	9	2	2	2	1	1	2	2	2	2	1	1	2	1	2	2	2	2	2	3	2	2
118	1	4.0	20	1	4.0	.0	1	1	1	1	2	1	5	2	0	2	2	1	1	4	2	2	1	3	4	0	0	2	2	2	1	2	2	4	1	1	1	2	2	9	9	1	2	2	1	1	2	1	1	2	1	2	2	1	2	1	2	2	2	4	2	1
119	1	2.0	15	1	2.0	.0	1	1	1	8	2	1	2	2	0	2	1	1	2	1	4	2	3	3	3	2	5	2	2	2	2	1	2	4	1	1	1	1	2	9	9	1	2	2	1	1	2	1	1	2	2	2	2	2	1	1	2	1	2	2	2	2
120	1	3.5	1	2	2.0	1.5	2	1	1	1	2	1	4	1	3300	1	1	1	2	1	4	4	1	3	1	3	5	1	2	2	2	1	2	4	1	1	1	2	2	9	9	2	2	2	1	1	2	1	2	2	2	2	1	2	1	1	2	1	2	2	2	2
121	1	4.0	13	2	2.0	2.0	3	1	1	1	1	1	1	1	2000	2	2	2	1	4	1	4	4	3	1	1	6	2	2	2	2	2	2	4	2	2	1	1	2	9	9	2	2	2	2	1	1	2	1	2	2	2	2	1	2	1	2	2	2	2	1	1
122	1	5.0	4	2	4.0	1.0	2	1	1	7	2	1	5	2	0	2	1	1	1	1	2	5	4	3	1	3	0	1	2	2	1	2	2	4	2	1	1	2	2	9	9	2	2	2	1	1	1	1	2	1	1	1	1	1	2	1	2	2	2	2	2	1

SPSS:PC DICTIONARY DISPLAY: CODEBOOK

Appendix 9 (cont'd)

Variable: IDNUMBER Label: ID NUMBER
No value labels Type: Number Width: 3 Dec: 0 Missing: * None *

Variable: HOUSETYP Label: TYPE OF HOUSE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 GRASS 2.00 MABATI

Variable: LANDSIZE Label: SIZE OF LAND
No value labels Type: Number Width: 3 Dec: 1 Missing: 99.00

Variable: LENGSTAY Label: HOW LONG LIVED ON PRESENT LAND
No value labels Type: Number Width: 2 Dec: 0 Missing: * None *

Variable: CALTIVAT Label: IS ALL LAND CULTIVATED
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: CROPS Label: SIZE OF LAND UNDER CROPS
Value labels follow Type: Number Width: 3 Dec: 1 Missing: 99.00
.00 no land used

Variable: FALLOW Label: SIZE OF FALLOW LAND
No value labels Type: Number Width: 3 Dec: 1 Missing: 99.00

Variable: CASHCROP Label: WHICH CASH CROPS DO YOU RAISE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 COTTON 2.00 NONE
3.00 COFFEE

Variable: FOODCROP Label: DO YOU RAISE ANY FOOD CROPS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: OCCUPATN Label: WHAT IS YOUR SOURCE OF INCOME
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 FARMER 2.00 PROFESTIONAL (TEACHER)
3.00 CRAFTSMAN (CARPENTER) 4.00 BEER BREWING
5.00 BRICK MAKING 6.00 TAILORING
7.00 SHOPKEEING 8.00 FISHING
9.00 OTHERS

Appendix 9 (cont'd)

Variable: LABOUR Label: SOURCE OF FARM LABOUR
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 OWN FAMILY 2.00 HIRED LABOUR
3.00 ANIMALS 4.00 HIRED MACHINES
5.00 OWN MACHINES 6.00 WORK GROUPS
7.00 FAMILY AND HIRED LABOUR 8.00 FAMILY AND WORK GROUPS

Variable: BICYCLE Label: DO YOU OWN A BICYCLE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: LIVSTOCK Label: DO YOU OWN LIVESTOCK
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: LIVSTTYP Label: LIVESTOCK TYPE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 CATTLE 2.00 GOATS
3.00 SHEEP 4.00 PIGS
5.00 GOATS AND SHEEP 6.00 OTHERS
7.00 CATTLE AND GAOTS 8.00 CATTLE, GOATS AND SHEEP
9.00 NOT APPLICABLE

Variable: LIVSTSEL Label: DID YOU SELL ANY LIVESTOCK
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 YES 2.00 NO

Variable: AMOUNT Label: MONEY FROM STOCK SELL
No value labels Type: Number Width: 4 Dec: 0 Missing: * None *

Variable: ANIMALPR Label: SELL ANY ANIMAL PRODUCT
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: PLNTFEUL Label: WOULD YOU PLANT TREES FOR FIREWOOD
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: TREEPRES Label: ARE THERE PLANTED TREES ON YOUR LAND
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: SEEDSOUR Label: SOURCE OF SEEDLINGS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 GOVERNMENT NURSERY 2.00 SELF PROPAGATED
3.00 SCHOOL NURSERY 4.00 OTHERS
5.00 BOUGHT OUTSIDE LOCATION 9.00 NOT ANSWERED OR NOT APP

Appendix 9 (cont'd)

Variable: PLANTER Label: PERSON WHO PLANTED TREES
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 SELF 2.00 SPOUSE
3.00 CHILDREN 4.00 SELF AND CHILDREN
9.00 NOT ANSWERED

Variable: SITEPLNT Label: SITE WHERE TREES PLANTED
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 ROUND THE HOMESTEAD 2.00 IN THE COMPOUND
3.00 FARM BOUNDARY 4.00 MIXED WITH CROPS
5.00 ROUND HOMESTEAD AND IN C 6.00 ROUND HOMESTEAD & MIXE
7.00 COMPOUND AND MIXED WITH 8.00 SEVERAL COMBINATIONS
9.00 NOT APPLICABLE OR NOT AN

Variable: PURPOSE Label: PURPOSE OF PLANTING TREES
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 FUELWOOD 2.00 POLES
3.00 ORNAMENTALS 4.00 TIMBER
5.00 FRUIT 6.00 MEDICINES
7.00 POLES AND TIMBER 8.00 POLES ORNAMENTALS AND TI
9.00 NOT ANSWERED

Variable: CONSULTA Label: PERSON CONSULTED ON TREE MATTERS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 AGRIC OFFICER 2.00 FRIENDS
3.00 FOREST OFFICER 4.00 DEAL WITH BY SELF
9.00 NOT ANSWERED

Variable: TREEPROB Label: MAJOR PROBLEMS FOR TREE GROWTH
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 POOR SOILS 2.00 INADEQUATE RAINFALL
3.00 TERMITES 4.00 ROCKY SOILS
5.00 TERMITES AND INADEQUATE 6.00 ENYENDE
7.00 POOR SOILS AND INADEQUAT 8.00 ROCKY SOIS AND ENYENDE
9.00 NOT ANSWERED

Variable: WOODCOLT Label: PERSON COLLECTING FIREWOOD
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 WIFE 2.00 HUSBAND
3.00 CHILDREN 4.00 WIFE AND CHILDREN
5.00 HUSBAND AND WIFE

Variable: AMOUNTCL Label: BUNDLES COLLECTED PER WEEK
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
.00 SMALL QUANTITIES AS NEED 1.00 ONE BUNDLE
2.00 TWO BUNDLES 3.00 THREE BUNDLES
4.00 FOUR BUNDLES

ppendix 9 (cont'd)

Variable: DISTANCE Label: DISTANCE TO COLLECTION POINT
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

.00	NEAR HOMESTEAD	1.00	1 KILOMETRE
2.00	2 KILOMETRE	3.00	3 KILOMETRE
4.00	4 KILOMETRE	5.00	5 KILOMETRES
6.00	6 KILOMETRES	7.00	7 KILOMETRES
9.00	NOT GIVEN		

Variable: CROPRESI Label: DO YOU USE CROP RESIDUE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: DUNG Label: DO YOU USE DUNG
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: WOODSELL Label: HAVE YOU EVER SOLD FIREWOOD
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: FRINDSEL Label: SEEN NEIGHBOR/FRIEND SELL FIREWOOD
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: BUYWOOD Label: WOULD YOU BE WILLING TO BUY FIREWOOD
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: WOODSHOR Label: IS THERE WOOD SHORTAGE AT PRESENT
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: NEXT5YR Label: HOW ABOUT IN THE NEST 5 YEARS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: PERCOLLE Label: PERMISSION TO COLLECT
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Variable: CHARBURN Label: EVER BURNT CHARCAOL
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *

1.00	YES	2.00	NO

Appendix 9 (cont'd)

Variable: WHYBURN Label: REASON FOR BURNING
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 OWN USE 2.00 SELL
3.00 BOTH OWN USE & SELL

Variable: WOODSOUR Label: SOURCE OF TREES FOR CHARCAOL
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 OWN LAND 2.00 NEIGHBORS LAND
3.00 BOUGHT

Variable: POLESUFF Label: ARE THERE ENOUGH POLES
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 YES 2.00 NO

Variable: TIMBERSU Label: IS THERE ENOUGH TIMBER
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: ADVISEND Label: NEED ADVISE ON TREE PLANTING
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: ADMIREM Label: ADMIRE MARKHAMIA TREE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: ADMIREH Label: ADMIRE HILL WITH TREES
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: SAUSAGT Label: BAD LUCK TO CUT SAUSAGE TREE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 AGREE 2.00 DISAGREE

Variable: WOMFENCE Label: WOMEN PLANT HOMESTEAD FENCE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: MVULETRE Label: PLANT MVULE TREE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: MENONLYP Label: ONLY MEN SHOULD PLANT TREES
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Appendix 9 (cont'd)

Variable: OWLHOOT Label: IF AN OWL HOOTS IN A TREE CUT IT
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: EUCALYPT Label: EUCALYPT ARE INDIGENOUS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 AGREE 2.00 DISAGREE

Variable: SEEDSIZE Label: TREES HAVE SMALL SEEDS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 AGREE 2.00 DISAGREE

Variable: NURSERY Label: ALWAYS NEED A NURSERY FOR TREES
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 AGREE 2.00 DISAGREE

Variable: NOTREEPL Label: PLANTED ANY TREES IN LAST TWO YRS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: RISESEED Label: * No label *
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: ANYRAISD Label: RAISED ANY SEEDLINGS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: VISITNUR Label: EVER VISITED FOREST NURSERY
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: AGRICOFF Label: HAD A VISIT FROM AGRIC OFFICER
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: FORESOFF Label: HAS A VISIT FROM FOREST OFFICER
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: BURNRUBS Label: BURN RUBBISH AFTER LAND PREPARATION
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 BURN THEM 2.00 MAKE TRASH LINES
3.00 LEAVE THEM TO ROT

Appendix 9 (cont'd)

Variable: OWNHILL Label: OWN ANY HILL LAND
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 YES 2.00 NO

Variable: SAMIAHL Label: WAS IT GOOD TO AFFOREST SAMIA HILLS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 CONTINUED 2.00 NOT CONTINUED
3.00 OTHERS

Variable: MARITALS Label: MARRITAL STATUS
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 SINGLE 2.00 MARRIED
3.00 WIDOWED 4.00 DIVORCED

Variable: MARIAGTP Label: MARRIAGE TYPE
Value labels follow Type: Number Width: 1 Dec: 0 Missing: 9.00
1.00 POLYGAMOUS 2.00 MONOGAMOUS

Variable: YEARBIRT Label: YEAR OF BIRTH
No value labels Type: Number Width: 2 Dec: 0 Missing: * None *

Variable: EDUCATIN Label: EDUCATION LEVEL
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
1.00 NEVER WENT TO SCHOOL 2.00 PRIMARY LEVEL
3.00 SECONDARY AND ABOVE

Variable: NOCHILDR Label: NO OF CHILDREN
No value labels Type: Number Width: 2 Dec: 0 Missing: * None *

Variable: RELIGION Label: RELIGION OF RESPONDENT
Value labels follow Type: Number Width: 1 Dec: 0 Missing: * None *
2.00 CHRISTIAN 3.00 MOSLEM

Variable: SEX Label: SEX OF RESPONDENT
No value labels Type: String Width: 1 Missing: * None *

Variable: ZONE Label: * No label *
Value labels follow Type: Number Width: 8 Dec: 2 Missing: * None *
1.00 SAMIA NORTH 2.00 SAMIA SOUTH

Variable: AGE Label: * No label *
No value labels Type: Number Width: 8 Dec: 2 Missing: * None *

Variable: VILLAGE Label: * No label *
Value labels follow Type: Number Width: 8 Dec: 2 Missing: * None *
1.00 SAGANIA 2.00 NANGINA
3.00 LUKURE 4.00 NAMASALI