Knowledges, fuelwood and environmental management in Kisumu district, Kenya

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Ph.D. Thesis

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Declaration

This thesis has been composed by myself and it has not been submitted in any previous application for a degree. The work reported within was executed by myself, and all information cited are acknowledged at the appropriate point in the text.

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Statement of Copyright

Dedication

To my dear wife Carren and our beloved children

Abstract

Fundamental issues of natural resource management revolve around diverse worldviews, knowledges and practices, which cannot all be captured within the policy framework. The Western worldview, which reflects mainly the utilitarian, economistic view of resources, has influenced and shaped the trend management of natural resources has taken world-wide. The Western worldview contrasts with local knowledges, which are uniquely innovative, highly dynamic, tacit, contextual and/or locality-specific. This thesis explores the fuelwood problem in Nyando Division of Kisumu District in Kenya, seeking both a holistic understanding and an emphasis on the interface between official policy and local rural practice, including the varying knowledges. The study focused on two case study clans, Muga and Kadhier in Awasi and Kochogo Locations, respectively.

Most fuelwood in the study areas is from on-farm and multiple accessible sources. This contradicts the 'fuelwood orthodoxy' school which associates fuelwood consumption with deforestation and 'woodfuel crisis'. Aerospace imageries clearly illustrated a change and decline in stand density of the woody vegetation cover in Nyando Division over time. Differences in fuelwood availability and inequalities in endowment of wood/tree resources in and between the study localities exemplify critical questions of entitlement in the face of 'abundance'. Tree planting was not seen to be synonymous with fuelwood availability. This scenario promotes the fuelwood trade, high dependence on fuelwood purchase and supplements of crop residues by local households. Land privatisation has exacerbated the situation. Distances travelled to collect fuelwood have *decreased* as people turn to alternative and purchased fuels.

Opportunities in the study area for the resolution of the fuelwood problem include promotion of less culturally restricted and less economically valuable trees, and a more farmer-sensitive approach from government and NGOs which recognises farmers as active partners in the interface between policy and rural practice.

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Acronyms

ACTS	African Centre for Technology Studies
C-MAD	Community Mobilisation Against Desertification
CARE	Co-operative for American Relief Everywhere
CMS	Church Missionary Society
DAEO	Divisional Agricultural Extension Officer
DC	District Commissioner
DFEO	Divisional Forest Extension Officer
DFO	District Forest Officer
DLAO	Divisional Land Adjudication Officer
DPT	Divisional Planning Team
DRSRS	Department of Resource Surveys and Remote Sensing
DTO	Divisional Tree Overseer
ELCI	Environment Liaison Centre International
EMC	Environmental Management Committee
EPZs	Economic Processing Zones
FCC	False Colour Composite
FD	Forest Department
GOK	Government of Kenya
GTZ	German Development Agency
GWH	Gigawatt Hours
HRV	High Resolution Vidicon
IBEAC	Imperial British East Africa Company
IMF	International Monetary Fund
ITDG	Intermediate Technology Development Group
IUCN	The World Conservation Union
KARI	Kenya Agricultural Research Institute
KDDP	Kisumu District Development Plan
KFMP	Kenya Forestry Master Plan
KNA	Kenya National Archives
KPLC	Kenya Power and Lighting Company
KWDP	Kenya Woodfuel Development Programme

LAS	Local Afforestation Scheme
LCCs	Local County Councils
LDCs	Least Developed Countries
LEAP	LDCs Energy Alternative Planning
MoA	Ministry of Agriculture
MoE	Ministry of Energy
MoE&NR	Ministry of Environment and Natural Resources
MoE&RD	Ministry of Energy and Regional Development
MSS	Multi-spectral Scanner
MW	Megawatts
NEAP	National Environmental Action Plan
NES	National Environment Secretariat
NGO	Non-governmental Organisation
OTA	Office of Technology Assessment
PC	Provincial Commissioner
PPCSCA	Permanent Presidential Commission for Soil Conservation and Afforestation
PRA	Participatory Rural Appraisal
PSCO	Provincial Soil Conservation Officer
RAES	Rural Afforestation Extension Scheme
SoK	Survey of Kenya
SPOT	Systeme Probatoire d'Observation de la Terre
toe	Tons of Oil Equivalent
UNCED	United Nations Conference on Environment and Development
UNEP	United Nation Environmental Program
WCED	World Commission on Environment and Development
WWF	World Wide Fund for Nature
YOUNDE	Youth Union Development Club

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CHAPTER 1: INTRODUCTION AND CONCEPTUAL ISSUES

1.1 Introduction:

In early Biblical times, the Lord told Prophet Elijah, the Tishbite, during the time of a great famine throughout the land of Israel, to go to Zarephath in the region of Sidon, to a woman who was a widow:

> "So he arose and went to Zarephath. And when he came to the gate of the city, indeed a widow was there *gathering sticks*. And he called to her and said, 'Please bring me a little water in a cup, that I may drink'. And as she was going to get it, he called to her and said, 'Please bring me a morsel of bread in your hand'. So she said, 'As the Lord your God lives, I do not have bread, only a handful of flour in a bin, and a little oil in a jar; and see, I am *gathering a couple of sticks* that I may go in and prepare it for myself and my son, that we may eat it, and die'"
> (1 Kings 17: 10-12, New King James Version - my italics).

The above episode presents a grim picture of poverty and privation, which persist in the world today, still pushing poor people to use poor quality fuels. Many households, particularly in rural areas of low-income countries, continue to depend on fuelwood as their only source of energy for cooking and heating. Popular academic opinion also seems to peg an increased use of woodfuel (charcoal and fuelwood) to the rise in oil prices in the early 1970s. Since that time, a plethora of research and interventions in search of a solution to the looming fuelwood 'crisis' and associated environmental degradation have been initiated albeit to little apparent effect. They are associated with extensive literature, which largely represents the neo-Malthusian view of the people-environment interface as conflicting rather than complementary, and therefore tending to natural resource depletion and degradation.

In Africa, such Western images have, by and large, influenced the trend and development of policies and interventions, as the latter are based on their notional background (Leach and Mearns, 1996; Mearns, 1995). Governments of low-income countries have continued to write and rewrite policies and laws, with the aim of achieving better development, management, and sustainability of valuable land resources, such as fuelwood. Active participants in this endeavour have been mainly from academe, government and non-governmental bodies.

Environmental degradation in this neo-Malthusian discourse has often been seen to be closely linked to poverty, the latter believed to result in growing demand on scarce resources. The cumulative environmental effects of poverty are seen as a "major global scourge" (WCED, 1987: 28). For example, Mellor (1988) terms the relationship an "intertwining of environmental problems and poverty"; Leonard (1989: 19) refers to the: "poverty and environment connection...inseparable twins"; the United Nations Development Program (1990: 7) concluded, "poverty is one of the greatest threats to the environment"; and an IMF Survey (1993: 187) stressed: "poverty and the environment are linked in that the poor are more likely to resort to activities that can degrade the environment".

There is, however, an alternative perspective which is gaining ground. Even leaving aside the role of prosperity in environmental degradation (Redclift, 1996), mainstream perceptions of the people-environment degradation nexus, and the subsequent 'woodfuel crisis' are, according to a growing number of commentators, "an incomplete characterisation" (Lele, 1991: 613). They miss the social dimensions of resource development issues and the institutional arrangements that underpin people's natural resource management practices (e.g., Mearns, 1995: 105; Thrupp, 1990: 248). Mearns argues that by focusing narrowly on deforestation as an energy-related issue, the analysis projects on to people an 'environmental problem' which they may themselves perceive very differently or not at all. "The crisis has been more in professional perceptions than in local lacks;... and those who projected the woodfuel crisis are unlikely to have lived in a village and cooked with biomass" (Chambers, 1997: 181, 182). Thus the 'crisis' is portrayed in this alternative literature as a misnomer and a politico-academic invention (e.g., Chambers, 1997: 181, 182; Dewees, 1989; Leach and Mearns, 1988; Mearns, 1995: 105).

Some basic practical questions that have been left largely unanswered by both sets of literature, and which this thesis seeks to address are: why do local people say that the problem of fuelwood scarcity[1] has continued to worsen, even in the face of an abundance of 'relevant' research, intervention and government policies? Are the policies

[1] For the purposes of discussions presented in this thesis, "woodfuel is assumed to be scarce when households are unable to obtain the minimum amount of fuel that would be needed to meet some level of basic demand" (Dewees, 1991: 147).

being implemented helpful in practice? What is the role and contribution of local populations in addressing fuelwood issues and environmental/land management? In theory, policies should benefit the physical as well as the local human environment. The views and perspectives of the rural poor people in informing policies need particular consideration. Local populations should act as catalysts in the policy formulation process, because of their specific local knowledges and skills regarding their environment.

This is the body of knowledge that has periodically undergone vigorous tests under varying real crises and has adapted through innovative and imaginative mechanisms. Soussan *et al.* (1992: 100) conclude: "Local people's understanding of their environment is typically profound, and capturing this local knowledge is essential if effective change is to be created". But as government operations continue to be mostly 'top-down' and technocratic, local people's perspectives and indigenous knowledge often become a 'backstage' residual variable. Escobar (1995: 45) states that this "politics of expert knowledge...has removed all problems from the political and cultural realms and recast them in terms of the apparently more neutral realm of science". Thus, instead of acting as catalysts in formulating relevant policies, the 'locals' have usually been detached from the 'top-down' process of intervention by the 'experts', "whose specialised knowledge allegedly qualified them for the task" (ibid.: 52). Environmental knowledge is increasingly 'scientized', especially for policy purposes (see Eden, 1998: 425).

The complexity and varying dimensions of the fuelwood issue demand a holistic and multidisciplinary approach. With the great diversity of ecosystems characteristic of the African environment, each rural landscape has its own unique and peculiar features. Fuelwood studies must, therefore, be disaggregated and ecologically, socially, culturally and spatially located, in order to capture pertinent issues within the micro-level diversities and inequalities of the use of fuelwood (cf. Cline-Cole, 1997, 1998; Munslow *et al.*, 1988; Soussan, 1991; Soussan *et al.,* 1992). There are inherently complex, diverse, extremely dynamic, multi-sectoral issues underlying the broader changes in population, food, poverty, land and natural resource management (Leach and Mearns, 1988). There appears to be no single, simple solution, only the need for a better understanding through a broader but grounded perspective, because the fuelwood problem is not everywhere manifest in the same forms or amenable to the same solutions (Soussan and O'Keefe, 1985). It is a reality that most local people in countries of sub-Saharan Africa rely on their environmental resource base for their fundamental economic and social goals. This underscores the great importance local people attach to their environment. Understanding local management practices of fuelwood use and the environment in the rural sector, provides the theoretical and empirical underpinnings of this thesis. To gain a clear understanding of local management practices needs a critical evaluation of the conceptual issues.

1.2 Thesis Background: The Study Area

The thesis explores fuelwood issues in Kisumu District, western Kenya, seeking both a holistic understanding and an emphasis on the interface between official policy and local rural practice, including 'expert' and local knowledges. Studies which focus on the operation of policies on the ground have been few, and the concept of interface as considered by this thesis aims at breaking new ground, especially in the context of fuelwood studies.

The area selected was Nyando Division[1], where I had excellent access to this interface. I was born there, and was returning home to a place where I was still well known and accepted. But now I was seen as an academic from Nairobi (and the United Kingdom); and, due to my training background in forestry, I also had another persona - as forestry 'expert'. In light of the above, I obtained unrivalled access to the lived experience of fuelwood situation as well as to the local knowledge, skills and insights of resource management. At the same time, I had access to the local experts and implementers of policy, in my academic and indeed, foreign-sponsored role. It was this unique opportunity which drove the investigation.

In hindsight, I realised that collecting information from my home area proved not as easy as earlier expected. My dual role as 'insider' and 'outsider' was both useful in certain cases but almost detrimental in others. One of my main problems was

[1] The Division has since been upgraded to a district status effective July 1998.

overconfidence, when I thought I knew so much about certain respondents and locales that it was sometimes tempting to ignore things seen or said. In the first clan, where I knew many respondents personally, this seemed to work both ways, as respondents assumed I would understand , or would already know most things. Secondly, I was tempted to choose respondents based on familiarity and previous family networks. I overcame this temptation by basing my choice of respondents strictly on the outcome of wealth ranking (see Section 3.5.4 and Section 4.2.3). In addition, I often used my key informants to fix interview dates after choosing respondents.

Thirdly, my 'insider' status inhibited 'self-disclosure' in terms of sensitive questions such as income. I found such questions rather disconcerting to some respondents, especially those who were known to me. Most often, they did not answer these questions forthrightly, but hesitantly fiddled with the answers. People were often reluctant to disclose their incomes to an 'insider', perhaps due to the perceived fear that such information might become public knowledge within the clan. Whenever I sensed a reluctance in answering these types of questions, I quickly retreated by changing the style and line of questioning. In other cases, I resorted to direct observation. This underlines the fact that the idea of research is not simply a matter of recording information, but an arena of social interaction where knowledge creation occurs (cf. Arce and Long, 1992).

'Being at home' also had positive effects. Being a member of the community, I was able to detect conflicts and contradictions in information. My dual position of an 'outsider' with 'insider' knowledge made me more informed, as well as being problematic in some ways. In general, the duality of roles made me not take anything for granted, but to problematise almost everything. I often did what Strauss and Corbin (1990) call '*waving the red flag*'. I had to pause and ask myself questions such as, *wait a minute, what is happening here? Why do they say or do it that way?* Such questions constantly helped me to have a critical mind so that I often played ignorant to obvious assumptions and explored implied meanings by further probing.

The thesis takes a case study of two village areas in Nyando Division in Kisumu District, Kenya for in-depth study (see Section 3.5). The two village areas selected were judged to reflect characteristics relevant for the research questions. Contrasts in agroecology and in woody vegetation resource endowment were prime considerations in this selection. In that respect, one village area is more endowed with woody vegetation/biomass than the other (cf. Kearl, 1976: 44; Ward, 1983). This condition has led the village area with less woody vegetation to 'import' (or buy) fuelwood from the other village area with more. This state of affairs portrayed dissimilarities relevant to the investigation and provided a good ground for comparison of the two village areas, regarding the environmental/land management implications of fuelwood demand and extraction. The contrasts also helped to 'control' the investigations as well as to provide a strong basis for logical inferences.

It should also be noted that most previous studies of fuelwood in Kenya have concentrated either on the high potential areas which are densely populated, or the low potential areas (semi-arid regions) with low population densities and adverse climates. Medium potential areas (savannah regions), in which the study area falls, have received little attention, but demand special consideration because they combine high population density with highly variable climatic conditions.

1.3 <u>Aims and Objectives of the Thesis</u>:

The investigation in this thesis rested on the understanding that the fuelwood issue has multiple causes and effects. This thesis, therefore, seeks to explore the nature of the observed fuelwood availability in Nyando Division, based on the initial assumption that the fuelwood issue is not exclusively a question of energy, but rather one that raises a host of other related issues such as poverty, land-use and land-tenure, farming systems and practices, forestry, climatic regimes, etc. The inherent complexity of the local fuelwood issue hinges on wider environmental, socio-economic, politico-cultural and institutional issues which are locality-specific.

The aims and significance of the thesis are twofold:

1. to examine the local (indigenous) knowledges vis-à-vis the Western scientific knowledge relating to aspects of the development and management of wood resources in particular, and environmental/land management in general.

This work was undertaken with a view to identifying gaps in existing knowledges, and aimed to uncover the diverse knowledge bases of the Western science and the locals indigenous knowledge on these issues. The role of the rural people in the task of developing and managing wood resources and the environment in general was also documented. Their information was considered relevant to finding a workable method of conservation and management, to resolving some of the management issues, and to informing policy formulation.

2. to evaluate the role and impact of policy and land tenure legislation (including customary tenure) on questions of wood energy (fuelwood) demand and environmental/land management.

The essence here was to assess the effectiveness of prevailing policies, and aspects of tenure, based on the knowledges, experiences and perspectives of the local people.

To address comprehensively the issues raised above, the thesis had the following supporting objectives:

1. to determine the rural household demand for, and access to, fuelwood in the study area and to establish how these relate to the wider questions of environmental/land management and sustainability;
2. to examine the energy consumption characteristics and patterns of rural households, and to evaluate the factors which are responsible for creating these patterns;
3. to carry out a basic general assessment of the existing woody vegetation cover and biomass resources, in order to provide a qualitative (and a rough quantitative) record of the resource base and the physical environment;
4. to interrogate the knowledges, skills and strategies used by the local people and response mechanisms with regard to environmental and wood energy issues in order to uncover the diverse knowledges and skills involved; and
5. to study the dynamics of environmental change within a longer historic and

politico-cultural time frame.

1.3.1 Research Questions:

The thesis addresses the following specific research questions:

1. What practical link exists between policy statements on wood resources and environment/land management, and the local rural practices and values?
2. How has land registration influenced the availability and use of fuelwood resources?
3. Which management strategies, response mechanisms, knowledges and skills are employed by the local rural communities to address questions of fuelwood 'scarcity' and environmental/land management?
4. What are the environmental implications of fuelwood resource demand and extraction?
5. What are the possible solutions to the questions of the observed fuelwood scarcity in the study area and in rural Kenya in general?

1.3.2 Assumptions:

The above objectives were pursued from a broad base of assumptions which were carefully interrogated. Flexibility was necessary in order to allow the emergence of new issues. This stance assumed the characteristic of qualitative research which "explores the realities....as they are experienced and explained by the people who live them" (Burgess *et al.,* 1988: 310). It further justified and fitted the statement of the problem that fuelwood is a multi-dimensional issue which requires a flexible, holistic and multi-perspective approach. Below are the assumptions that grounded the investigations:

1. That the demand for, and consequent use of, fuelwood resources constitutes a genuine threat to the viability of land use management and production capability.
2. That the dynamics of environmental change and/or degradation produce a cumulative process that becomes clearly evident only within a fairly long time

frame.

3. That the impact of policies, land tenures, and their implementation can be gauged by interrogating the logic behind them, their practical effects, and any other accrued benefits on the basis of existing local knowledges and experiences.
4. That the rural communities' response to an emergent fuelwood scarcity is by way of switching, substitution, or complete transition to more readily available (accessible) and reasonably affordable fuel options.

1.4 Thesis Structure:

In chapter one, the context of the research problem and the conceptual issues that lead to its understanding is provided. This requires a general review of literature pertaining to environmental knowledge, its construction, and the influence of colonial heritage on resource management. The chapter also includes an introduction to the thesis, aims and objectives of the thesis, research questions, basic assumptions, and, briefly, my positionality as an 'insider' conducting research 'back home'.

Chapter two presents a critical literature review which specifically concentrates on locating the study of the fuelwood issue in its scholarly context. The review evaluates existing relevant literature, while considering their characteristic foci, as well as summarising work on Kenya. The review also covers issues of tenure and the management of environmental resources.

In chapter three, the background of the study area is provided. The chapter gives an overall description of Kisumu District and Nyando Division, plus a description of the study clans of Kadhier in Kochogo North sub-Location and Muga in Border I sub-Location. The chapter also illustrates how issues of land tenure influence resource use, by exploring the historical background, with specific reference to the Luo community which inhabits Kisumu District.

Chapter four outlines and discusses the methodology for investigating the fuelwood problem. Here, the importance of using a multiple method approach is stressed and explained.

Chapter five provides a review and analysis of colonial forest policy and the historical evolution of the fuel(wood) use and forestry in western Kenya and focuses on Nyando Division, the study area. This includes the role of the colonial government and the local people on tree growing activities.

In chapter six, post-Independence forest and energy policies and related laws on the environment are examined. The chapter also provides the discussion and visions of a new policy direction, in the context of local and national development.

In chapter seven, detailed exploration of the people-land interaction is provided, giving a focused discussion on the realities, conflicts and contradictions. The chapter also explores local fuel(wood) issues and environment/land management practices, and examines contemporary fuelwood trade and tree growing activities in the study area in general, and in the two study clans, in particular.

Chapter eight provides spatio-temporal mapping of the woody vegetation cover and the relative fuelwood abundance in Nyando Division, using aerospace remote sensing techniques. It analyses and documents the dynamics of the woody vegetation cover over time.

Chapter nine presents perspectives from the field regarding knowledge interfaces and the management of environmental resources. The chapter utilises the concept of interface to analyse the different hierarchical levels of power and interaction right from the village level to the national level.

Finally, chapter ten concludes the study by pulling together the different strands relating to the overall investigation. It charts the way forward in addressing the local fuelwood issue and the interface between policy and rural practices, and suggests implications of the findings for Kenya's overall development, and for development studies in general.

1.5 Conceptual Issues:

At both the national and local level, sustainability is a major theoretical objective behind the management of environmental resources. Simply defined, sustainability conveys the notion that present use patterns do not undermine future levels of production (Simmons, 1997: 105). The state, in theory, tries to achieve sustainability of natural resources through the formulation of relevant policies, which reflect the nation-wide extent of its formal responsibilities, socially and environmentally (Wilson and Bryant, 1997: 125). The potential role of state policies is to structure the interactions between people and their environment (Mitchell, 1997: 15). However, the implementation of policy has unintended as well as intended impacts, particularly at the local level, depending on circumstances at each particular locality. Policy considerations at the national level are more diffuse or differentiated at the local level (Dahlberg and Blaikie, 1997: 3). State policies do not necessarily provide a realistic representation of the nature and diversity of rural resource problems. The state may not be "well informed about the nature of a given problem or about the complex consequences of its own policy actions, which may produce perverse or unwanted effects" (Killick, 1989: 12).

The concept of environmental management is therefore a multi-layered process of interaction of stakeholders (state and non-state environmental managers and users) with the environment in a struggle to contain competing interests and priorities. This is the more inclusive understanding of the environment being pioneered by a growing group of scholars (e.g., Bryant and Wilson, 1998; Khasiani, 1992; Wapner, 1995; Welford, 1996; Wilson, 1996;). It takes a political ecology approach, characterised by recognition of a multiplicity of interest groups and power differentials (see Bryant, 1992, 1997).

This chapter continues by focusing on the diverse worldviews which inform the management of environmental resources in general and shape both policy trends and local practices. These different perceptions and worldviews influence the way environmental knowledge has been constructed. Secondly, the chapter examines the role British colonial heritage has played in the construction of this knowledge and the overall management of environmental resources. Thirdly, the chapter looks into the conceptual issues regarding the use and management of 'common' resources. It outlines the various theories and paradigms often used to analyse resource use and management. The chapter ends with a conclusion, which summarises the different shades of the debate advanced in the entire chapter.

1.5.1 Diverse Worldviews and the Management of Environmental Resources:

According to Omara-Ojungu (1992: 129), studies of resource management generally take three basic departure points, namely, the physical environment, the human attributes and the controls over the interaction between the physical and human attributes. While ecological, economic and technological considerations have been given the greatest importance, the social importance of resource allocation and management in low-income countries has been undervalued (ibid.: 130).

Fundamental issues of resource management relate to the allocation of resources, the setting of priorities, and the making of choices. The ethnological approach sets out to study such issues by stipulating that cultural differences influence the way people perceive and use the resources of their environment (Lund, 1996). Such use and management are connected to specific cultural themes and perceptions of resources (ibid.: 130). Another significant perspective of the ethnological approach is the role of institutional arrangements such as new and old administrative structures, laws and practices, customary rights and privileges. It is generally argued that the success or failure of resource management is tied up with such institutional structures, which shape the nature of resource management practices.

With regard to gender disparities, men and women may also perceive and use resources differently; according to Giddens (1991), women were seen as 'closer to nature' than were men in classical social science. Men and women also have different 'activity-spaces'[1], which differ according to the socio-economic structure and the resource management system of the locality (Lund, 1996: 135). Hence, changing activity-space refers to changes in access to resources, changes in resource management practices, as

[1] Activity-space is defined as the physical sphere of action in which a person carries out her/his productive and reproductive activities, in a specific society at a specific time (Lund, 1996: 135).

well as changes in opportunities. For further conceptual issues regarding gender see, for example, Andrew and Milroy, 1988; Meena, 1992.

The definition of what constitutes a resource depends on perceptions and values which are based on different social constructions in different cultures and lifeworlds. For Simmons (1997: 102), "resources are the materials which human societies perceive as being necessary to their welfare and which they draw from their surroundings"; for Lund (1996: 134), "what constitutes a resource as well as the local conceptualisation of the resource is connected to aspects of both production and reproduction with its value varying accordingly". However, the common view which has shaped development trends in most countries today reflects the utilitarian, economistic Western worldview propelled by the global capitalist economy (*The Ecologist*, 1993). Simmons (1993: 183) states,

> "The Western worldview is the dominant macrocosmic view today and includes such elements as belief in progress, the inevitability of material growth, and fundamentally, the assumption of human dominance wherever possible over a separate cosmos".

More than being elements of Western culture, the Western worldview has been extended in time and space to other distant cultures, for example to Africa, in the form of 'development' (ibid.), and/or 'modernisation'. This brought with it Western technology, that has proved to be more of a "neutral tool to be used for culturally determined human ends" (Simmons, 1997: 190). The gains of Western science and technology in the African economic progress cannot be gainsaid.

Proponents of this worldview subscribe to the intensification and extensification of resource exploitation based on a *laissez-faire* principle, with all its inherent power differentials. The Western worldview has often led to disproportionate pressure being exerted on environmental resources as humans endeavour to progress. This worldview functions on the binary conceptualisation of resource use, e.g., 'economic' versus 'uneconomic' or 'legal' versus 'illegal' (Simmons, 1997: 28). It upholds the idea that "the earth is a set of materials for human use, that material conditions are expected to get ever better for people and that technology is the key to providing that affluence" (ibid.: 239).

Other writers (e.g., Naess, 1989; Sessions, 1994) criticise contemporary environmental management practices based on economic pursuits and global capitalism, and instead emphasise the need to manage the environment so that resources are not depleted. The divergent epistemological bases of environmental management can vary considerably between environmental managers. Nevertheless, the globalisation of the Western capitalist approach has greatly influenced the trend environmental management practices have taken world-wide (Bryant, 1997; Guha, 1989; Miller and Yeager, 1994).

Several scholars have attempted to explain the complexities of different environmental worldviews (e.g., Eckersley, 1992; O'Riordan, 1995; van Dusseldorp and Box, 1993). For example, O'Riordan distinguishes between 'ecocentric' and 'technocentric' worldviews where the former gives priority to environmental conservation over exploitation, while the latter emphasises technological innovation and intense use of the environment. Van Dusseldorp and Box (1993) propose the dichotomy of 'voluntaristic' versus 'adaptive'. Their 'voluntaristic' view has its action mainly embedded in a scientific knowledge system which assumes that people have the potential to understand the processes of nature, to express underlying causalities in theory, and to harness theory to manipulate the environment. Their 'adaptive' view, shared by local knowledge networks, is that a large part of the environment is controlled by powers beyond their reach. They try to accommodate changes in their environment and, therefore, have an adaptive worldview.

Sandell (1996) draws on the dichotomy by van Dusseldorp and Box (1993) to come up with 'domination' versus 'adaptation', where the former tries to adapt nature to human needs, as far as possible, and the latter to adapt it to the local physical and cultural context. Sandell argues that the tension between domination and adaptation mirrors the choice between being dependent upon larger socio-political systems (in coping with local natural fluctuations) or on a multipurpose use of the local territory (ibid.: 167), in order to avoid problems associated with such local natural fluctuations. Morgan and Murdoch (1998: 4, 5) identify 'standardised' versus 'tacit' knowledges. The former refers to explicit, codified knowledge, which is easily transferable; while the latter refers to local knowledge which emerges in a rather unplanned and unforseeable fashion when actors evolve ways of doing things in local situations which are context dependent.

Titi and Singh (1994: 14) define an *adaptive* strategy as "a strategy socially acquired and used to transform nature to meet biological, social and other culturally defined needs". They emphasise that adaptive strategies generally evolve from livelihood patterns and practices over time and have therefore strong links with local knowledges and sustainable livelihoods. For Davies (1993a, 1993b), adaptive strategies are characteristic of vulnerable socio-ecological systems and modes of production, where modification of community rules and institutions are necessary to meet livelihood needs. Davies, however, draws a clear distinction between *adaptive* strategies and *coping* strategies. The latter are characteristic of secure livelihood systems and are used by households and communities only during periods of food stress. They constitute a fall-back mechanism during periods of decline in access to food. "Individuals, families or communities have to confront the situations in which they find themselves at a given time, with the resources of which they are aware under given constraints of land, labour, capital and mobility" (Mortimore, 1989: 3). Adaptation in contrast is generally understood as a sequential process in which solutions to problems become, in turn, a part of the next problem.

1.5.2 The Construction of Environmental Knowledge:

Local people in their diverse localities respond differently to environmental issues. These responses are an endeavour to adjust to, and accommodate impacts of, unfavourable environmental conditions (including the impacts of policy), characteristic of each disaggregated setting or lifeworld[1]. The adjustments result in the (re)construction and production of knowledges; as Arce and Long (1992: 214) argue, "the production and transformation of knowledge resides...in the process by which social actors interact, negotiate and accommodate to each other's lifeworlds, leading to the reinforcement or transformation of existing types of knowledge or to the emergence of new forms". This also forms the overall body of local (indigenous) knowledge lived by a majority of local people. Such knowledge has often been finely tuned to permit damage limitation and to minimise both environmental and social risks (Utting, 1993).

[1] A lifeworld is a lived-in and largely taken-for-granted world (Schutz and Luckmann, 1973).

Local knowledge is uniquely innovative and dynamic, exhibiting differences which are locality-specific and interpersonal, depending on ecological variabilities and existing local circumstances. Many authors have explored local knowledge and the ingenious and sophisticated production systems which Africans employ in often harsh environments (e.g., Amanor, 1994; Ghai, 1992; Mitchell, 1997; Richards, 1985; Thrupp, 1989). These not only derive from centuries of experience but also co-evolve with the local environment (Thrupp, 1989).

The concept of local knowledge systems has its roots in the idea of indigenous or traditional knowledge and management systems, which are based on experiential knowledge, cultural traditions, customary practices and self-regulation (Mitchell, 1997: 189). Much of local people's understanding of the environment is based on tacit knowledge (Morgan and Murdoch, 1998). Tacit knowledge is highly contextual and difficult to communicate, as against codified or standardised knowledge such as Western science. This is cited as one of the challenges of indigenous knowledge, since it suffers from a serious 'scientizational' constraint (Ahmed, 1994: 25). Indigenous knowledges have no formal written channels through which they are transmitted and applied in specific projects, unlike modern scientific knowledge. Local knowledges, whose praxis are through community rules and institutions, form part of the building blocks for coping and adaptive strategies, which include knowledge, technology, practices, beliefs and value systems of communities (Darkoh, 1996). It is defined by the economic, social, cultural, ideological and belief systems in which it is found and articulates continuities that are inherent in diverse settings (Ahmed, 1994). Such continuities are used in formulating intervention strategies in harmony with social organisations, institutions, beliefs and values of concerned communities (Salih and Ahmed, 1994; Blaikie *et al*, 1996).

'Scientific' knowledge is also constructed (Knorr Cetina, 1981; Collins, 1985, 1992). "What is scientific depends on agreement between a group of people who have been given the power, or have taken it, to determine what is scientific" (Röling, 1994: 126). It is represented as consensual knowledge which differs from the local non-written knowledge which is dispersed and non-consensual. 'Science' generally refers to a systematic set of practices used to investigate, or applied to particular phenomena. Such application can either be on a 'reductionist' or 'holistic' form (Simmons, 1997: 23). The reductionist approach breaks the phenomena into constituent parts for detailed analysis. Historically, this approach is the domain of natural science. Natural scientists normally use technology as instruments in their empirical studies. One major thing natural science does is to try to understand the behaviour of phenomena through the application of technology, and hence to advise humans how to live.

Unlike reductionism, holism looks at the subject of investigation in its totality. The behaviour of the whole is an emergent quality not predictable from the simple sum of its parts. Bohm (1993) argues that the scientists' contribution is to create fresh perspectives which re-enter society and are used in the construction of reality by social actors. Modern scientific, codified knowledge has a worldview of humans as apart from and above the natural world. For Gadgil *et al.* (1993: 151), this knowledge has not been particularly successful when confronted with complex ecological systems, because 'science-based' societies have tended to overuse and simplify these systems, resulting in a whole series of problems of resource exhaustion and environmental degradation; therefore, the knowledge of indigenous societies deserves attention. Richards (1985: 159) suggests that "there are good ecological arguments for shifting the emphasis towards greater mobilisation of indigenous skills and initiatives", and also points to potential advantages from combining Western and local knowledges. Although Western resource management has provided many benefits and has enhanced productivity, its sustainability has often been questioned, because scientists lack awareness of the long-term changes within specific ecosystems, with which local knowledge has co-evolved (Leach and Mearns, 1996; Mitchell, 1997).

On many occasions, 'experts' play an advisory role in resource management, often putting standardised policy into practice despite a dearth of applied local knowledge. In contrast, rural people have developed a broad-based, often tacit knowledge of the environment and its management which is an accumulation of practical experience and experimentation (Richards, 1987; Rhoades, 1987; Millar, 1994; Rhoades and Bebbington, 1995). While 'experts' are generally engaged in prototype monocultural and specialised experimental projects, or 'science', local villagers are more concerned with what can satisfy their daily needs. Villagers, therefore, involve themselves in wide-ranging purposive trials or what may be referred to as 'random test design' (cf. Richards, 1985) and are not obsessed with the systematic record-keeping of 'scientists'. Claude Lévi-Strauss (1966, cited in Rhoades and Bebbington, 1995: 298) in his earlier writings referred to peasants' *science of the concrete* as opposed to scientists' *science of the abstract.*

Several authors argue that policy is largely formulated on the basis of the principles of positivist/reductionist Western scientific knowledge (e.g., Gumbricht, 1996; Pretty, 1995; Röling, 1994), and the positivist approach seems only to require aggregate data rather than insights from local practitioners, i.e., the local people themselves. This makes the knowledge basis of policy largely segmented rather than holistic, and it is this kind of knowledge that has often shaped the policy direction (cf. Eden, 1998). Leach and Mearns (1996) ably challenge the views of environmental change often popular within professional circles in Africa and among Western 'scientists'. Using historically informed research on African environments drawn from a cross-section of disciplines, they question the orthodoxies or meta-narratives popular with 'experts'. The pursuance of such "received wisdom about environmental change obscures a plurality of other possible views, and often leads to misguided or even fundamentally flawed development policy in Africa" (ibid.:3). In Kenya, Tiffen *et al.* (1994) also undertook historically informed research in Machakos District, to explore aspects of environmental change. They concluded that "the best policies are likely to derive from institutions which permit communication on policy needs between the experts who know and are in the district (i.e., the farmers), and those who derive expertise from their professional studies and knowledge of the national and international situation" (ibid.: 285).

1.5.3 <u>The Colonial Heritage and Resource Management</u>:

The colonial heritage and pre-colonial European influences have played an important part in the historical development of resource use and management in Africa. The trend intensified with the European penetration of Africa in the early and mid-nineteenth century. In East Africa, this followed the 'discovery' of the region by Christian missionaries and missionary-explorers who carried the related messages of Western religion, orderly progress and commercial profit (Miller and Yeager, 1994; Wolf, 1974). There was also some Arabic influence, especially along the coastal region. Cheap resources, the hallmark of capitalist development at the time, were central to Europe's expansionary activities overseas (Wolf, 1982) in the context of increasingly stiff competition for markets and resources (Wilson and Bryant, 1997). In contrast to previous forms of economic activity based on reciprocity and redistribution, capitalism had developed as a dynamic process in which the quest for profit was a paramount concern (Peet, 1991; Polanyi, 1957, 1944; Sender and Smith, 1986).

For Kenya as for the rest of its African territories, Britain's initial colonial strategy was to permit commercial interests to take the lead (Miller and Yeager, 1994: 11). Thus, in 1888 a privately financed trading company, the Imperial British East Africa Company (IBEAC), was awarded a royal charter to develop commerce in the region. The British government later assumed direct control over Kenya in 1895. This territorial take-over, resulting in the British Protectorate, was a way of forestalling competition and controlling areas of strategic economic value. Land alienation and expropriation followed, whereby all the best agricultural and forest land fell into the hands of the white settlers while Africans were put in restricted Reserves (Kitching, 1980). Policies and laws were subsequently enacted to manage the natural resources of the colony such as forests (Okoth-Ogendo, 1991). The thrust of colonial policy in Kenya was for European settlers to see development as synonymous with state-assisted land colonisation (Cowen and Shenton, 1996: 296).

Colonial policies and laws generally led to non-sustainable and inequitable use of environmental resources, thereby causing severe damage to the resource base, especially forests. This resulted in non-sustainable timber extraction, which was also experienced in other colonial territories (cf. Bryant, 1994; Guha, 1989; Tucker and Richards, 1983). The extraction led to widespread deforestation. Although forest policy and laws were used to promote the 'new' European forestry doctrine of scientific forestry, this was mainly consisting of monocultural plantations[1], which functioned on the principle of a

[1] Scientific forestry, a technique first developed in Germany at the end of the eighteenth century, is a system designed to ensure commercial timber extraction, purportedly according to the principles of sustained yield (Heske, 1938; Wiersum, 1995). However, the technique seems to lay more emphasis on

technocratic and economic approach to resource management. The approach upheld a utilitarian view of resources, and a philosophical system, the scientific method, for converting the mysterious into the utilitarian (Burnett, 1985).

In agriculture, the market-led global capitalist production of a *laissez-faire* economy was often used by the colonialists to encourage peasants to produce cash crops for the export market (see *The Ecologist*, 1993; Wilson and Bryant, 1997). For example, in West Africa during the colonial era, the spread of cash crop cultivation took land away from food production and pushed the latter to marginal areas (Darkoh, 1980). The imposition of taxes further ensured the entrenchment of cash crop production. The pressure of taxes forced peasants to abandon age-old land conservation techniques, and as Darkoh (1996: 77) puts it, "to sell the future to pay for the present". Where local people were prevented from producing for the export market, as in Eastern and Southern Africa, companies and settlers, with all the best agricultural lands, took over the production of export crops, while Africans were forced to provide the labour.

The interaction between humans and forest was built around the Western binary conceptualisation (see Section 1.5.1), largely for optimised utility by the colonialists. The impact of colonialism was therefore associated with radically altered environmental management practices around the world (Bryant, 1997). Colonialism and 'modernisation' not only resulted in massive environmental change, but also disrupted existing practices by local people, by alienating them from the natural resources upon which they had previously based their livelihood under a regulated system of usufructary rights (Bryant, 1997: 55; Darkoh, 1996: 76).

In most African pre-colonial societies, resource management practices were predominantly (but not exclusively) geared towards subsistence needs, based on customary practices and self-regulation. Regulation was generally flexible, locally based and socially sensitive (Cline-Cole, 1996: 125). Use and management of natural resources were, significantly, holistic activities which did not separate household from group livelihood strategies, nor the management of production from the management of the environment. Overall, pre-colonial natural resource decision-making rested firmly

yields than on other functions of forests such as conservation, climate regulation, and their socio-cultural role.

with local communities. Decision-making was knowledge-intensive in that decisions were made based on knowledge accumulated over time, in addition to the immediate experiences of the resource users (Field-Juma, 1996). In Kenya, evidence abounds that customary, pre-colonial land-tenure and land-use practices included mechanisms for both food security and resource conservation through controlled exploitation of the land and common sharing and constant renewal of its physical assets (Barrow, 1996, 1992; Mackenzie, 1998, 1995; Scherr, 1990; Wamalwa, 1991).

With the epoch of Independence in Kenya in 1963, there was optimism for change in the pattern of natural resource management. Nevertheless, the post-colonial period in Kenya offered very little alteration in resource management practices. The previous colonial agrarian laws largely provided the background for policy formulation. For example, the first post-Independence Forest Policy of 1968 was almost a replica of the colonial policy. The only notable difference was that it was Africans rather than the British making the decisions, with technocratic knowledge stereotypes still being the basis of such decisions. It was only in Kenya's new Forest Policy of 1994 that substantial changes responsive to the changing circumstances were made, and due to bureaucracy, the new policy is yet to be operationalised (see Chapter six).

1.6 <u>Conclusion</u>:

Western images and the neo-Malthusian view of the people-environment degradation nexus have played significant roles in informing and shaping the trends of policy development and implementation in low-income countries. Resource management in the neo-Malthusian discourse has largely ignored the contribution of the institutional arrangements and practices of local social actors'. Although the Western worldview links rural poverty to resource degradation and the subsequent 'woodfuel crisis' at the local level, this view is contestable. The complexity and varying dimensions of the fuelwood problem demand a holistic and multidisciplinary approach.

Population growth, poverty and resource degradation are issues which cannot be resolved within the prevailing 'top-down', technocratic development model. The integration of local people's ingenuity, knowledges, skills and practices is imperative to addressing questions of environmental resource degradation and sustainability. Intrinsic inequalities and socially differentiated access to resources are key fundamental considerations in land and natural resource management. The exploration of these and other conceptual issues will lead to a better understanding over competing struggles for environmental resources at the local level. Mainstream Western dominant narratives or orthodoxies can not resolve these conflicts. Those orthodoxies seem only to provide a legitimating vocabulary and further perpetuation of the Western worldview and neo-liberal agenda of *laissez-faire* capitalist economies (cf. Li, 1996), with all the inherent power differentials. This was the same trend pursued by the colonial administration in the development of Kenya's policy framework, which marked the birth of the Western binary conceptualisation of resources, driven by a desire for optimised utility for economic gain. That Western ambition severely affected local resource management practices which were more holistic.

Sustainable natural resource management practice requires a broader, inclusive participation in the policy formulation process in order to integrate socially and environmentally diverse local contexts. Since the potential role of the state is to structure the interactions between people and their environment, broad popular participation is crucial. This becomes even more necessary as policy considerations at the national level are more diffuse or differentiated at the local level, and are often based on the principles of Western science. Implementation of such policy often creates unintended, adverse impacts on the local social actors. Such policy misses a true representation of the local reality regarding problems of rural resources.

Local people in their diverse localities respond differently to environmental constraints, some of which result from the impacts of policy. These responses contributed to the overall body of local (indigenous) knowledge, which co-evolves with the local environment, though such knowledges are often transmitted orally and are not as systematised as 'science'. Compelling ecological evidence from the local level warrants a greater complementarity between Western and indigenous knowledges, i.e., integration of knowledge (Mahiri, 1998b). This is a positive route to addressing questions of resource management and its sustainability. The lack of awareness by 'scientists' of the long-term changes within specific ecosystems makes this approach to integration of knowledge more urgent.

CHAPTER 2 : THE MANY FACES OF THE FUELWOOD DEBATE AND THE MANAGEMENT OF ENVIRONMENTAL RESOURCES: THEORIES, MODELS AND PERCEPTIONS

2.1 Introduction

The widespread dependence of the rural population on woodfuel resources in low-income countries has created a major concern about environmental land management, production and sustainability. Fuelwood remains one of the most important sources of energy in those countries, and plays a critical role in the energy economy. It has continued to meet the domestic energy requirements for cooking and heating, especially for the rural population. For example, the household sector accounts for 50-95 percent of total energy consumption in sub-Saharan African countries (Mearns, 1995).

A large body of literature documents and analyses fuelwood, its consumption, demand and supply, and relevant aspects of environmental/land management and biomass fuel use in general. Fuelwood demand and scarcity have taken different trends in various locales and contexts. Several theories and models have been advanced to explain such trends. Some models centre on specific problems in the use of fuelwood, for instance the rural-urban dichotomy, while others consider the environmental impact. The variety of findings produced is further based first, on the scale of investigation, such as village, national or regional levels; and second, on the substantive frameworks of the investigation such as supply and demand, consumption (including fuel-saving technologies), and the production ecosystem. Consumption trends are further influenced by urban-rural and by commercial-subsistence contrasts.

In order to locate this study in its scholarly context, a critical form of evaluation was adopted in the literature review. The review seeks both to build on the strengths of relevant studies, and to evaluate weaknesses against my research questions. I shall therefore consider the characteristic foci of previous studies, as well as tackle pertinent issues on Kenya. The review also covers issues of tenure and the management of environmental resources.

The literature review considers the wider literature (and that related to Kenya) on fuelwood, which includes wood supply and demand, wood-saving technologies, and fuelwood consumption. It ends with issues of tenure in environmental management and woodfuel resources, with particular reference to Kenya.

Although some of the 'fuelwood orthodoxy' school associate fuelwood consumption with deforestation (see Anderson, 1986; Anderson and Fishwick, 1984; Timberlake, 1985), it is arguable that much of the fuelwood is extracted from the forests. Agriculture has been identified as a principal means of forest depletion (ETC, 1987a, 1987b; Leach and Mearns, 1988). The study which, arguably, did most to legitimise gap theory in Africa, *Fuelwood Consumption and Deforestation in African Countries* (1984), was co-authored by Anderson and Fishwick. The 'orthodoxy' school of thought assumed woodfuel demand to be the prime cause of deforestation, which in turn contributes to accelerated soil erosion and 'downward spirals' of environmental degradation (Durning, 1989).

The 'revisionist' school of thought, mainly pioneered by Leach and Mearns (1988) and Dewees (1989), believe that the nature of the woodfuel problem is widely misunderstood and its extent overgeneralized, largely as a result of the type of analysis conventionally used in its identification (see also Section 2.2).

In Kenya, it is estimated that about 71 percent of the energy consumed annually comes from wood, mainly as fuelwood for cooking and heating in rural areas, and as charcoal in urban areas (Bess, 1989; KFMP, 1994). These fuels are drawn from a variety of sources and not necessarily from forests (see Table 2.1). Agricultural expansion has contributed much to forest area decline. It is estimated that Kenya's total forest area declined by 1 percent from 167.4 thousand hectares in 1988 to 165.7 thousand hectares in 1989, largely due to reduction in the area planted under indigenous species and the progressive conversion of forest land to agriculture (Republic of Kenya, 1990: 6). Total fuelwood consumption in the whole country over this period was 7.98 million tonnes annually (ibid.).

Table 2.1: Accessible sustainable fuelwood supply: national projection, 1995-2020. Numbers in parentheses are percentages.

'000 m^3

Source	***1995***	*2000*	*2005*	*2010*	*2015*	***2020***
Indigenous Forests	1166 ***(6.4)***	1143 *(5.8)*	1120 *(5.3)*	1098 *(4.8)*	1076 *(4.4)*	1053 ***(4)***
Woodlands and Bushlands	10585 ***(58)***	10508 *(53)*	10430 *(49)*	10352 *(45.2)*	10274 *(42)*	10196 ***(39)***
Farmlands and Settlements	6146 *(33.7)*	7746 *(39.1)*	9418 *(44.2)*	11079 *(48.4)*	12947 *(52.5)*	14731 **(56)**
Forest Plantations (Forest Department)	354 ***(2)***	416 *(2.1)*	352 *(1.7)*	361 *(1.6)*	380 *(1.5)*	443 ***(1.7)***
Total	18251	19813	21320	22890	24677	26423

Source: KFMP, 1994

2.2 Wood Supply and Demand

In the absence of accurate information regarding wood sources, demand and consumption, most assessments are dominated by assumptions and generalisations which have probably given rise to the existing perceived gaps and disparities.

The supply and demand approach is exemplified by the 'woodfuel gap' theory which became prominent after the oil crisis in the early 1970s. This theory is simply based on the projection of woodfuel consumption, usually in direct proportion to population growth, and calculations made of the resulting tree stock consumed each year. Such analysis created enormous pressure on the affected countries and led to expensive initiatives for the enhancement of wood supply in order to mitigate the apparently looming fuelwood 'crisis'. For several years, energy planning in many developing countries was a matter of balancing projected wood supply and demand. In several countries in Africa, estimates were made of wood demands that would soon outstrip existing supplies: for instance, Zimbabwe (Hosier, 1986a), Malawi (French, 1986), Tanzania (Nkonoki and Sorensen, 1984), and Kenya (O'Keefe *et al.*, 1984). In Tanzania, for example, the fuelwood scarcity in many regions of the country encouraged intensive afforestation efforts for fuelwood production. From 1975 to 1981, planting increased from 3280 hectares to 12050 hectares (IBRD, 1984; Simoes, 1984). In Mozambique, a plantation programme targeted in 1977 to cover 24000 hectares with *Eucalyptus* spp. to service Maputo's wood requirement had managed to plant only 3200 hectares by 1988, at a cost of US $2.5 million (O'Keefe and Munslow, 1989). In several countries in Africa the 'woodfuel gap' between supply and demand provided the rationale for many woodfuel projects.

Wood supply and demand analyses largely rely on the general assumption that fuelwood used in the rural economy is derived mainly from forests or plantations. The reality is often that much of the wood resources, including fuelwood and poles for rural construction purposes, comes from outside forests. In essence, rural communities meet most of their fuelwood demands from multiple and more accessible sources, such as twigs gathered from hedges and fallen from trees (see Plate 2.1a, b - see Appendix A. 1), or residues from other uses of wood in the rural economy, as well as using crop residues and animal dung (Agarwal, 1995: 213 and 1986; Barnard and Kristoferson, 1985; Hill *et al.*, 1995a; Millington *et al.*, 1994; Wisner, 1987: 25). This underscores the necessity of incorporating socio-economic parameters in energy analyses in general, and studies of rural energy in particular (cf. Bhagavan and Grippa, 1987), instead of depending on a generalised, extrapolated linear pattern (Cline-Cole *et al*, 1990). There is an urgent need to develop a co-ordinated initiative to enhance supply that lays emphasis on the on-farm production systems of individual small-holders.

In Kenya, during the petroleum price increases, a 'woodfuel gap' theory emerged based on the country's rapidly growing population (Banwell and Harriss, 1992: 299; Jones *et al.*, 1988; Leach and Mearns, 1988). Centralised large-scale forestry projects were seen as the answer. But, the regional nature of shortages usually meant transporting wood from the plantations over long distances, thus increasing the price of wood well above local market levels (Kerkhof, 1990). During the late 1970s the 'woodfuel gap' statistics were used as the basis for the LEAP model - LDCs Energy Alternatives Planning system (Raskin, 1986). This was developed to evaluate the impact of different energy policy and planning initiatives. It is generally believed, however, that analyses of the 'woodfuel gap' tend greatly to exaggerate and to obscure the scope of the problem.

According to Dewees (1989: 1160), "the LEAP analysis leaves more questions than it answered".

> "Anyone who tries to understand the nature of woodfuel scarcities by playing the numbers game comes very quickly up against the inevitable: the population-driven demand for woodfuel cannot possibly be met from the sustainable management of existing tree resources" (ibid.: 1159).

Among the energy studies conducted in Kenya in the early 1980s (see O'Keefe *et al.*, 1984; Openshaw, 1982), a major fuelwood deficit was identified by O'Keefe *et al.* (1984) with demand figures increasingly exceeding yields of woody biomass. Subsequent studies undertaken in different parts of the country suggested rather that demand and supply balances for fuelwood are vastly more complex and do not follow population growth alone (Bradley, 1991; Bradley *et al.*, 1985; Holmgren *et al.*, 1994; Leach and Mearns, 1988; Mortimore, 1992; Tiffen *et al.*, 1994). A number of factors were found to be involved, such as socio-economic and cultural issues (Bradley *et al.*, 1985; Chavangi, 1984; Chavangi *et al.*, 1985; Ngugi, 1988). It was on this understanding that the Kenya Woodfuel Development Programme (KWDP) was grounded (Bradley *et al.*, 1985: 229), to study the woodfuel trends in high potential areas such as Kakamega, Kisii and Murang'a districts.

The design of the original KWDP led the way in local level planning with an emphasis on gender (Banks, 1982), a level of analysis that was dynamically captured by Chavangi (1984). Bradley (1991) details these linkages in his discussion of the emergence of the KWDP, noting that the analysis of the Beijer Institute led to a concentration on agroforestry in high potential areas. The Programme represented an effort to counteract the general opinion that woodfuel scarcity and acute shortages mostly occur in dry areas of the country. Contrary to intuition, most of the studies cited in this paragraph showed that the greater the population density, the higher the tree volume discovered, because more land is devoted to woody biomass and the shift away from natural toward planted on-farm vegetation is greater. This unexpected trend therefore tends to negate the prediction of the 'woodfuel gap' theory even in places of rising population.

The often inaccurate information regarding the wood/energy balance apparently results from non-comprehensive or inadequate consideration of the patterns of biomass production and use. Data on the supply and use of biomass should ideally include all forms of biomass, monitored over the seasons on an annual basis (Hall, 1994). This demands the need to know the nature, size, and quality of biomass energy flows (cf. Hall *et al.*, 1993; Pasztor and Kristoferson, 1990; Senelwa and Hall, 1993). Senelwa and Hall (1993) developed a biomass energy flow chart for Kenya which gave an assessment of the total biomass energy potential (Figure 2.1). It incorporated agriculture, forestry and grasslands in an effort to promote efficient use of the biomass resource in meeting the country's requirements sustainably, particularly for the energy sector.

Remote sensing has also been employed in the assessment of conditions of woody biomass (Millington *et al.*, 1994). Kenya was covered in this study within the East Africa region. However, the overall project, instituted by the World Bank, was for the whole of sub-Saharan Africa. The use of satellite imagery for estimating woody biomass, and particularly for mapping forest in Kenya under that project, met with some difficulties. These were mainly the low resolution of the imagery and the drastic changes of forest type caused by rapid altitudinal changes. Satellite remote sensing for woody biomass is not feasible unless backed up by extensive ground surveys (Kgathi *et al.*, 1994).

2.3 Fuelwood Consumption

In fuelwood studies that focus on the consumption characteristics and trends within households and communities, various factors other than distances to the resource location have featured. When analysing consumption, differentiation is usually made between domestic (household consumption) and commercial (non-household consumption). However, within the households category, we have both urban and rural. Commercial sector consumption includes fuelwood traders, hotels, rural industries, etc. For the purposes of this study, the focus will primarily be on rural subsistence consumers.

The characteristics and trends of fuelwood consumption have normally been analysed by invoking prevailing theories and/or models, such as von Thünen-like concentric zones or 'ripples' of fuelwood exploitation (Moss and Morgan, 1981; Nichol, 1990), or a Malthusian correlation with population dynamics. The latter relates resource

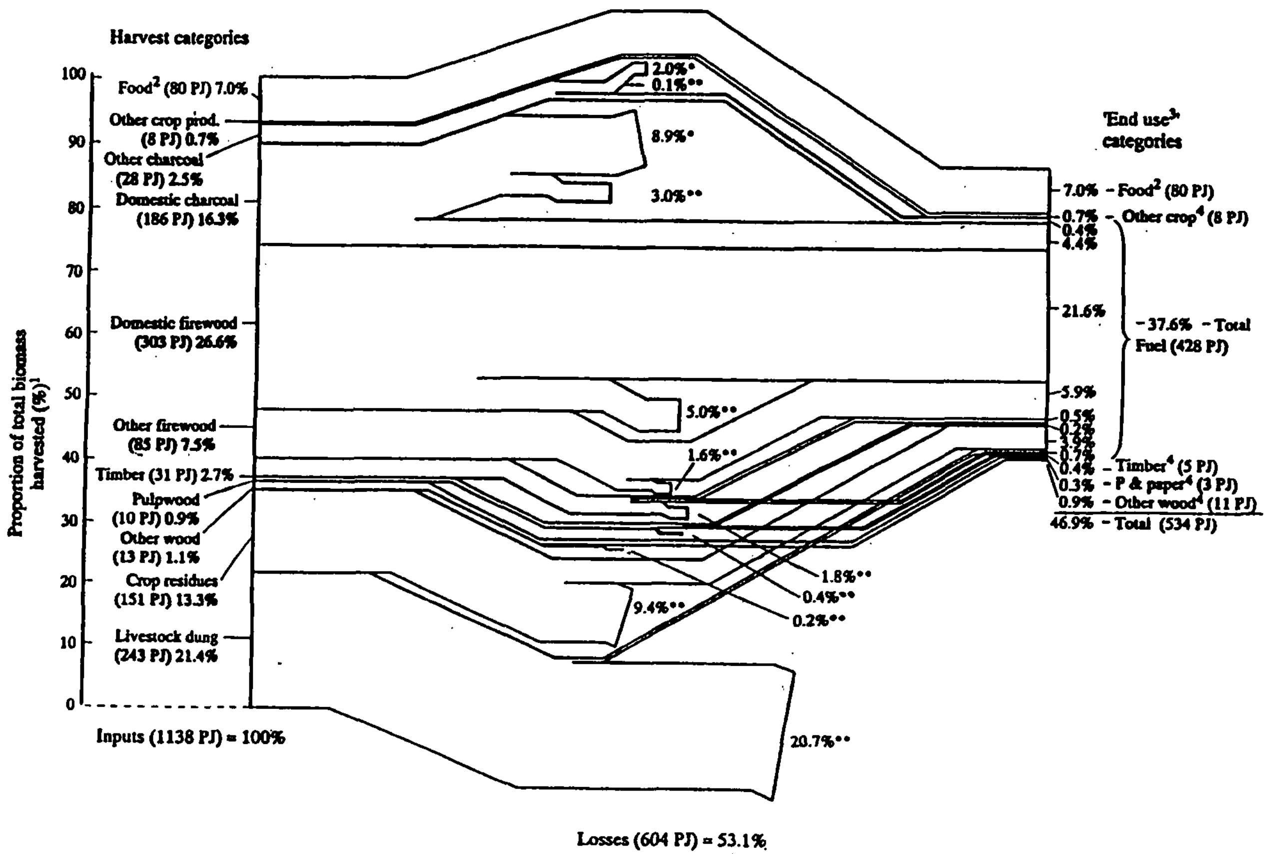

Fig. 2.1 A biomass energy flow chart for Kenya (1980s).
*Energy lost in charcoal production (kilns) at 16% (w/w) efficiency. **Residues and wastes. ¹The scale is based on the total biomass harvested in agriculture and forestry. ²Residues from foods and other crops are assumed to have been accounted for in the crop residues category. ³"End use" shows the final form of the material and not necessarily the effective energy derived. ⁴All other products other than food and fuel from biomass. PJ = 10^{15} J = 10^{6} GJ.

Source: After Senelwa and Hall (1993).

exploitation to environmental degradation as a function of demographics. However, fuelwood consumption is not a linear function of demographics (see Cline-Cole *et al.*, 1990). Moreover, "attempts to blame environmental degradation on overpopulation grossly oversimplify a much more complex problem" (Olembo, 1994: 375). The Malthusian equation rather omits some cross-cutting issues, for example, politics and power relations (Fernie and Pitkethly, 1985: vii; Hetch, 1995). Hetch argues that "as a theory, Malthusian perspectives merely seek out generalised relations among various empirical objects and events themselves, and not abstractions about what produced them" (ibid.:.403). Ellen (1982) suggests that crucial correlations are rarely those gross observable relationships between totalities, but the subtle, hidden connections between peculiarities. Questions of *who* exploits the forest resources *where,* and for *what* purpose, are more relevant in this context than putting wholesale blame on population pressure, as advocated by the Malthusian view which underlines the 'fuelwood orthodoxy' approach.

Although there exist massive inequalities in land ownership patterns in general, which also lead to high inequalities in fuel availability between households, inequalities in the exploitation of 'common forest resources' are also often evident. Commercial over-exploitation of the national forest by a few influential, powerful people has led to rapid degradation of the resource, and thus of the environment (Hetch, 1995; Mortimore, 1989). It is therefore simplistic and inappropriate to explain forest resource depletion with blanket phrases like 'slash-and-burn', 'massive clear-cutting' or forest 'mining', simply due to population pressure. Disaggregated data on local-level 'ground truth' are necessary. Recent studies undertaken in Kenya have yielded results which have overturned the Malthusian school of thinking (e.g., Bradley, 1991; Holmgren *et al.*, 1994; Mortimore, 1992; Tiffen and Mortimore, 1994; Tiffen *et al.*, 1994). The generalisation inherent in the 'Malthusian theory' obscures underlying, specific, localised causal processes. It is necessary to move beyond such generalisations in order to understand the problem; hence the need for specific, local-level research. It is work in such specific local contexts that can illuminate the underlying issues, and that is what this study seeks to achieve.

In the broadest sense, fuelwood consumption is often dynamically linked to aspects of cost and availability, among other factors. Rural people may respond to these aspects in diverse and unique ways. Therefore, capturing the trends of use becomes difficult and fuelwood consumption data tend to be inaccurate as they miss these dynamics. Ideally, long-term monitoring can capture the dynamics of use and seasonal variations, but this is expensive in time and resources. The data provided in Agarwal (1986, cited in Dewees 1989: 161) for woodfuel surveys in some low-income countries in the early 1970s illustrate this point. Woodfuel consumption per capita for Papua New Guinea was reported to be about 1.8 m^3; Nepal 0.9 m^3; and Afghanistan 0.3 m^3. The likely conclusion is that woodfuel consumption in all the three countries reflects availability and cost in the different settings.

In considering the fuelwood consumption and the von Thünen pattern of fuelwood exploitation, there are several underlying factors to examine that determine the nature of distribution and differentials in the consumption characteristics within and between varying household groups and communities, as in cities and urban centres. There are normally significant overlaps and competition for wood resources between uses and users. Several studies in Nigeria established that factors other than distance are responsible for determining the woodfuel hinterland (Adegbehin and Omijeh, 1994; Cline-Cole *et al.*, 1990; Nichol, 1990). For example, Nichol (1990: 47) established that the change in the source of Kano's wood fuel from local to distant hinterlands is not due to, and has not been accompanied by, deforestation of the local hinterland, where tree stocks remain healthy[1] This puts into question von Thünen's theory as the sole explanation for the declining woody biomass around towns and cities.

The main contrast in fuelwood consumption patterns between urban and rural sector corresponds more or less to commercial and subsistence, respectively. However, data on consumption demand careful scrutiny. There is a general paucity and inadequacy of reliable information (cf. Foley, 1988; Moss and Morgan 1981: 21). Foley (1988) cautions against the tendency of arriving at consumption estimates simply by averaging the results of previous surveys which may not have been statistically compatible.

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[1] It is generally believed that, as local wood fuel sources decrease due to deforestation of local hinterlands, the distance travelled to collect wood fuel increases.

In Kenya, the early studies of domestic energy consumption included works by Western and Ssemakula (1979); Hosier (1986b; 1984); and O'Keefe *et al.* (1984). The general finding from these national-scale surveys was that rural population, which comprises 80 per cent of the national population, is nearly 100 per cent dependent on biomass energy. As Hosier (1984) showed, however, the consumption of fuelwood tends to vary significantly across ecological zones (see Table 2.2 a, b and c).

Table 2.2

***(a): Domestic fuel consumption in rural Kenya by ecological zones:* nationwide survey, 1984. Numbers in parentheses are percentages.**

Fuel	*High Potential Zone (kg/annum) n = 380*	*Savannah Zone (kg/annum) n = 160*	*Arid Zone (kg/annum) n = 32*	*Total (%) n = 572*
Fuelwood	4099.5 *(24.8)*	4189.9 *(25.4)*	8209.0 *(49.8)*	16498.4 *(100)*
Charcoal	128.2 *(56.9)*	61.7 *(27.4)*	35.6 *(15.8)*	225.5 *(100.1)*
Kerosene	54.7 *(45.8)*	43.1 *(36.1)*	21.7 *(18.2)*	119.5 *(100.1)*

Source: Adapted from Hosier (1984: 31).

(b): Percentage of households using fuel in rural Kenya by ecological zones: nationwide survey, 1984.

Fuel	*High Potential Zone (n = 380)*	*Savannah Zone (n = 160)*	*Arid Zone (n = 32)*	*Total Households (n= 572)*
Fuelwood	88% (336)	98% (157)	97% (31)	524 (91%)
Charcoal	16% (62)	16% (26)	6% (2)	90 (17%)
Kerosene	97% (370)	98% (156)	63% (20)	546 (95%)

Source: Adapted from Hosier (1984: 33).

(c): Measures of fuelwood scarcity by distance and time: rural Kenya, 1984.

Measure	*High Potential Zone*	*Savannah Zone*	*Arid Zone*
Distance (km)	0.4	1.1	0.5
Time (1 day's supply)	50 minutes	92 minutes	84 minutes
Time/kg	3.9 minutes	7.8 minutes	3.6 minutes

Sources: Adapted from Hosier (1984: 38).

Due to such variations, which are mostly based on substantial changes in climate, one area may have fuelwood in abundance, whilst neighbouring areas are in dire scarcity (Soussan *et al.*, 1992). The variations may also be attributed to local socio-economics and seasonality (Brokensha *et al.*, 1990). Local diversity is an element that deserves attention in national fuelwood surveys, for example the socio-economics of households (see Table 2.3).

Table 2.3: Residential energy use by household income: urban Kenya, 1980.

Income group (thousands K sh)	*% of total for each income group*				
	Firewood	*Charcoal*	*Kerosene*	*LPG*	*Electricity*
0 - 3.1	63.3	28.2	8.5	-	-
3.1 - 9.1	25.5	57.4	17.1	-	-
9.1 - 18.2	16.4	64.2	16.5	1.6	1.3
18.2 - 54.6	6.4	61.3	14.4	9.4	8.5
above 54.6	1.7	32.0	4.1	14.6	47.6
Total (%)	*22.66*	*48.62*	*12.12*	*5.12*	*11.48*

Source: Adapted from Leach and Mearns (1988: 241).

Rural household energy consumption in Kenya can be linked in part to socio-cultural complexity, which renders overarching generalisations of consumption, based on national level-survey data, inappropriate and futile (cf. Hill *et al.*, 1995b). Local and regional specificity needs to be taken into account in such surveys. Several small-scale studies have, however, been undertaken in different locations, normally ranging from district down to village level (Aloo, 1994; Brokensha *et al.*, 1990; Mwangi, 1992; Ngugi, 1992). Despite their limited coverage and limited usefulness in terms of extrapolation and generalisation (see Sayer, 1992), the trade-off is their deep qualitative insight which can help to evaluate and inform relevant policies. This is viewed in this thesis as a valuable compromise with generalizability.

2.4 <u>Wood-Saving Technologies</u>

Fuel-saving or demand-reducing technologies have been widely promoted in low-income countries. Such promotions, especially among poor households, have been, primarily, improved cooking stoves. Wood stoves have been found to increase efficiency of fuelwood use substantially compared with open fires (UNEP, 1991). Savings have ranged from 10 to 50 per cent (see Foley *et al.*, 1984). Such savings are secured under laboratory conditions, which raises the question whether worthwhile savings also occur in practice, in the real cooking environment. Results vary extensively, depending on circumstances. In practice, differences in efficiency between improved stoves and open fires have proved marginal (see McCall and Skutch, 1987). Furthermore, the multiple/simultaneous functions of open fires have largely been ignored. If not only cooking but light, space heating, and insect control are included, the efficiency of open fires becomes greater. Efficiency is more social than physical, and should be defined by end-user rather than by end-use.

Improved fuel-saving or demand-reducing technologies in Kenya were considered as a promising 'solution' to the fuelwood problem (see Clarke, 1985; Jones *et al.*, 1988; Thrupp, 1983). Although there have been reasonable and benign technical approaches, their diffusion has been relatively limited. This is because of the complexity and diversity of rural economies and varying value systems, and also the fact that the majority cannot afford them (Kammen, 1995; Namuye, 1989). Furthermore, these wood-saving stoves (for example, the apparently successful Kenya Ceramic Jiko) have to compete with a free alternative - the three-stone fire - still common in rural homes (O'Keefe and Munslow, 1989). Buying technology is difficult for cost reasons - the 'rural energy crisis' is a 'crisis within a crisis' (Wisner, 1987) due to 'integrated rural poverty' (Chambers, 1983). In short, the rural energy problem cannot be treated in isolation as a single 'crisis' separate from the equally pressing issues of poverty, labour, food, fodder, culture and values.

The *Upesi Jiko*[1] is another well-known brand of wood-saving stoves in the region (Abbott *et al*, 1995). The stove, claimed to be a simplified and affordable variant of the Ceramic Jiko, has not been adopted by many households. The *Upesi Jiko* is known to burn fuel more efficiently, with savings of between 40-50 per cent, and gives smoke reduction of 60 per cent. Three main disadvantages have been noted of the stove: it

[1]The name *Upesi* - a Swahili word meaning 'fast' - was adopted in the early 1990s to make the stove more marketable. *Upesi*, originally known as *Maendeleo* (after the Kenyan national women's organisation, *Maendeleo ya wanawake* which helped to design it) was developed in the mid-1980s as part of the Special Energy Project run by the Kenyan Ministry of Energy and the German government agency, GTZ.

gives out less light and heat than an open fire (the problem of multiple, simultaneous end-use); it requires small pieces of sticks to fit into the stove (the problem of extra labour for cutting); and the stove is especially unsuitable for wide pots, like the ones used by many rural households (the problem of culture).

It is commonly believed that widespread adoption of energy-efficient technologies by the rural and urban-poor households will not occur, largely due to capital costs (OTA, 1992). The bottom line is simply abject poverty prevalent in those areas. One of the United Nation's Environment Programme's documents neatly summarises thus: "In the real world, energy technologies are likely to get widely used only if they are technically efficient, financially viable, economically profitable, culturally acceptable - and environmentally benign" (UNEP, 1991:51). The use of a combination of end-use technologies should also be taken into account.

2.5 Issues of Tenure and the Use and Management of 'Common' Resources:

The use and management of local resources varies with context. In the past, 'common property regimes'[1] in Africa were governed by in-built mechanisms of control, arranged through local political institutions[2] (Ogolla, 1995). The use-rights of individuals and families were circumscribed so as to avoid overuse of common resources. Individuals or groups, by virtue of their membership in some social unit of production or political community were guaranteed rights of access to land or other natural resources (Okoth-Ogendo, 1986). Such rights were executed through customary norms, values and practices with important implications for sustainability and conservation.

Ostrom (1990) presents a number of examples where people have organised themselves, most often for management of a common resource. In her analyses of resource management within local contexts, Ostrom found a set of principles needed for successful common property resource situations. These included explicit rules and

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[1] 'Common property regimes' are defined as a distribution of property rights in resources in which a number of owners are co-equal in their rights to use the resource (Ciriacy-Wantrup and Bishop, 1975: 714).

[2] The concept of institution is here used to denote norms, rules and routines (both formal and informal) regulating common activities for more than one individual (see de Janvry *et al.* 1993: 566).

mechanisms for resource use, monitoring systems, and means of conflict resolution. Such principles are deemed necessary, as local communities[1] comprises different value systems which may exist simultaneously. Normative structures in communities are mostly unwritten, and are functional through local networks by way of common local norms (advocacy coalition)[2]. A coherence of norms is considered as one crucial precondition for sustainable resource use (Hjort-af-Ornäs, 1996), i.e., a level of co-operation and common values among different social actors. However, widening the net of 'social inclusion' results in a diversity of norms and institutional arrangements, thus presenting a greater challenge in seeking to achieve sustainable resource use.

Applying the 'common property regimes' to communal grazing, Hardin (1968: 1243) described communal grazing as the 'tragedy of the commons'. He used his paradigm to argue that deterioration of communal rangelands occurs because individual users try to maximise exploitation of the common resource and in the process degrade it. Since the full environmental consequences arising from resource overuse are shared, rather than borne by a single herder, he argued that individual herders will attempt to increase their herds at the expense of other users, often beyond the carrying capacity of the commons. Other authors (e.g., Barrow, 1990; Lane and Scoones, 1993; Lane and Moorhead, 1994, Scoones, 1996) have argued that the 'tragedy of the commons' paradigm fails to appreciate the deeper implications of ownership rights of communal resources and regulations practised by pastoralists.

During the colonial and Independence periods, the prevailing 'cattle complex' paradigm (Herskovits, 1926) blamed land degradation in the rangelands of East Africa on the pastoralists' penchant for livestock accumulation (see also Darkoh, 1996: 78). The failure by Africans to sell livestock was interpreted in terms of 'culture' and 'tradition' and the need to hold on to animals for 'prestige' and 'status' (Mtetwa, 1978). Oba (1996: 119) argued that the 'cattle complex' and the 'tragedy of the commons'

[1] The definition of 'community' in this case is not a static, idealised representations of consensual, socially and ecologically-harmonious communities, but a socially and highly differentiated meaning of 'community', with inherent political struggles and differential access to resources in contexts of uneven power relations (cf. Leach *et al.*, 1997a: 94; Li, 1996).

[2] Advocacy coalition is a union of persons with similar value systems (Hjort-af-Ornäs, 1996: 64).

paradigms were not based on scientific evidence but were purely economic models which did not necessarily apply practically (see also, Sandford, 1983).

There are, however, other cases where 'communal tenure' overlaps with private property rights. A typical example is 'open access' such as state or community land under a common use with no strictly enforced property rights of control relating to access and use. The situation is often characterised by a lack of regulatory mechanisms regarding resource use. Hardin's (1968) thesis has largely been discredited in this context, by failing to distinguish between 'open access' and 'common property regimes' (see Ciriacy-Wantrup and Bishop, 1975). The 'open access' tenure type often lacks incentives or social norms to encourage the efficient use and conservation of land resources.

'Common property regimes', generic in Africa before colonial intervention, throve under customary or traditional systems which possessed regulatory mechanisms of control with important implications for sustainable resource use and conservation (Ogolla with Mugabe, 1996: 96). In Kenya since the mid-1950s, the thrust of official policy has been to replace these customary land tenures[1] with a 'modern' tenure system through the process of adjudication or the registration of land into private ownership. This has resulted in exclusive property rights over parcels of land being conferred on individuals and corporate entities. The process has, however, been slow and expensive, and these tenure systems have continued to co-exist side by side, and in certain cases to overlap, even in areas where registration has been completed (Little, 1987; Little and Brokensha, 1987; Ogolla with Mugabe, 1996; Okoth-Ogendo, 1979). In Kenya, land tenure systems fall into three basic categories: communal or customary, private or 'modern', and public or state (see, Ondiege, 1996: 122; Ogolla with Mugabe, 1996). According to Ondiege, there is a fourth category, open access, where property rights have not been assigned or observed.

Theoretical debates on the interface between land tenure and land-use and the conservation of environmental resources have centred, until fairly recently, on the

[1] Land tenure refers to the possession or holding of the many rights associated with each parcel of land (Tengnäs, 1994).

virtues of private (individual) property rights and on the inherent vices of 'communal ownership' (Ogolla with Mugabe, 1996: 95). The perceived rationality of private property rights over 'communal ownership' for environmental/land management was propped up by the economic efficiency paradigm (Karp, 1993: 746). The reasoning behind this was efficiency and proper resource management, due to vested individual interest and responsibility. Ogolla with Mugabe (1996: 96), however, argue that this land-use theory of private property rights in land may, in the short-term, exploit efficiently the productive potential of the resource but may be inimical to the imperatives of sustainable resource utilisation and conservation.

Issues of free access and use largely operate under local, unwritten customary norms. For instance, in certain rainfed farming areas with grazed fallows, the decisions on timings of sowing and harvest are made communally rather than by individuals. This is influenced by seasonal variations, but also minimises the need for control of livestock movements during the fallow periods. Such rights of access, as opposed to rights of control[1], are normative and are tied to membership in the political community. However, the combined effect of land privatisation and the growing human population has resulted in considerable reduction of common property resources and open access land. This has led to increased conflicts in land use and resource competition, with the subsequent erosion of the regulatory capacity of customary land tenure systems, and a breakdown in traditional authority and mechanisms (Ogolla, 1995). These processes have, in many instances, transformed the common property regimes into situations of open access with adverse impacts on land use and conservation of relevant natural resources (ibid.: 131).

2.5.1 Land Tenure and Fuelwood Resources

In the past, fuelwood was treated by rural communities as a 'free good' that was readily available and within reach. This has largely changed in recent times, due to the registration of land by the government and transfer to private ownership (cf. Okoth-Ogendo, 1991). 'Communal sources of wood' have been eliminated (Dewees, 1991: 90-

[1] According to Ogolla (1995: 131), control refers to sovereignty over the area in which the relevant resources are located, and such sovereignty is for the purpose of guaranteeing access to the resources, which are spatially redistributed even among subsequent generations of the particular political unit.

91; Ogolla, 1995), thus increasing difficulty in free fuelwood collection for the rural land-poor. Due to the general poverty among the majority of Kenya's rural population, many cannot afford the alternative commercial fuels such as kerosene, gas, etc. In addition, the supply of these fuels is limited and unreliable.

The rights to free ownership and use of land which were formerly guaranteed by customary law were nullified by the *Registered Land Act (Cap. 300)* of 1963. The result was that rights of control and rights of use both became vested in the land-owner, instead of the customary law of 'free ownership'. Consequently, "customary lineage land-use right holders lost usufruct to communal tree resources" (Dewees, 1991: 91). This trend has encouraged a considerable increase in the commoditisation of the fuelwood resource by landholders who have developed individual sources.

Looking at, for example, the domain of land tenure in the household sector, there is a complex mosaic of user rights embedded within the household structure such as access rights, title rights, agricultural rights, etc. (cf. Chavangi, 1987; Okoth-Ogendo, 1986, 1987). Coupled with the cultural overlay of rights which determine access to, and end-use of, wood resources, these create paradoxically huge 'scarcity' differentials between individual households in village areas with seeming 'abundance' of wood. The effect of such imposed rights is that they tend to inhibit effective development and control of woodfuel resources and land management practices, especially by women. In parts of Kakamega District in Kenya, for instance, there are influential cultural restrictions against the planting of trees by women (cf. Bradley, 1991; Chavangi, 1987), or the cutting of wood from a man's tree. Questions of entitlement are involved (cf. Leach *et al*, 1997b). Leach *et al* have explored the environmental entitlement debate in relation to actual resource endowment. In this case, legitimate effective command of tree resources by women is the issue at stake (cf. Mackenzie, 1990).

The practice of restrictions and the issue of land tenure, when viewed in the context of cultural and property rights based on gender inequalities and power relations within the household, presents a complex scenario (see Section 7.5). Tenurial rights to land in Kenya are exclusively held by men. This gives men legal rights of control over all resources including the products on such land. Related to this is the issue of conflict between tenure of land and tenure of trees (Okoth-Ogendo, 1987). In certain parts of the country, such as western Kenya (e.g., Chavangi, 1987), the planting of trees on a piece of land is associated with putting a claim of ownership of that land (see also Section 7.2 and Section 9.2.1). Tree tenure and land tenure are treated as completely different entities altogether. Ownership of trees are not necessarily equivalent to ownership of land on which they stand.

Differences in rural economies and varied levels of procurement systems of fuelwood have often caused localised differences in the resource availability. Furthermore, availability of fuelwood in the market may sometimes be less of an issue in poor rural households than affordability of the commodity. The dynamics of fuelwood are then poverty-driven rather than resource-based. This normally leads to fuel-switch, mostly to inferior options (for example, crop residues or animal dung), or simply to changes in dietary patterns, which in essence reveal the gravity of the fuelwood problem.

Given these broad themes, the primary aim of the thesis is to refocus and evaluate the complexity and varying dimensions of the fuelwood issue. As has been stressed, the fuelwood problem has a highly diversified and patchy distribution. This often arises from demographic differentials, seasonality, socio-economics, and climatic regimes that influence, to a large extent, the fuelwood resource configurations spatially and temporally. These are potentially major explanatory variables that demand attention.

2.5.2 Woodfuel Resources and Environmental Management:

Issues of conservation and management of the environment and tree resources due to woodfuel scarcity are embedded in an array of knowledges and local practices. Prevailing definitions of woodfuel scarcity and management rarely consider the ingenuity of rural people in responding to rural situations based on their own experiences (cf. Rocheleau, 1994; Dewees, 1991). Initiatives intended to encourage farmers to manage trees and the environment should take cognisance of existing local practices. On the contrary, indiscriminate clear-felling of trees specifically for woodfuel is rare, unless it is being done to create farms, in which case, woodfuel is a secondary product resulting from expansion of the agricultural frontier. Common practices of obtaining wood for fuel from whole trees are through pollarding, pruning, or selective cutting (Plates 2.2a, b - Appendix A. 2). Local rotation in tree harvesting is normally practised everywhere in Kenya, and this ensures that the land is not left completely bare to encourage soil erosion.

2.6 Conclusion:

What conclusion can be drawn from this review? Firstly, there does not seem to be a direct linkage between fuelwood consumption and land degradation ('fuelwood orthodoxy'). Secondly, national projections, including those based on demand-supply balances ('woodfuel gap'), do not capture local complexity. Thirdly, there is insufficient relevant data from the local level, which may lead to misguided or fundamentally flawed policy development. Finally, issues of management of environmental resources are broad-based, contrary to what is often perceived by the bureaucrats. This makes popular participation by role players a vital ingredient in the resolution of problems of resource management at the local level.

The fuelwood issue is essentially a land-use problem that can be addressed directly as an energy problem. In rural areas, fuelwood is usually a by-product or part product of trees which have a different primary purpose from that of fuel. People are actively building woody biomass resources in several rural areas as settlement patterns and land-use strategies change. That problems still exist within certain sites, especially around urban areas should not be denied, because pressure to obtain fuelwood can produce indiscriminate felling and consequent environmental degradation. This suggests, however, the solution to urban household energy consumption should be addressed by alternative fuel-technology combinations. In rural areas, meanwhile, a contradiction emerges. Those who consolidate land (enclosure) have demonstrated capacity to increase their wood production; those who are not able to access land (exclosure) are impoverished with declining access to fuelwood entitlements. Resolving the rural fuelwood situation will require resolution of the land issue and/or the poverty issue which, in essence, broadens the fuelwood debate.

Widening the net of 'social inclusion' still has its own practical problems, especially the complex matrix of a broad diversity of norms and institutional arrangements. Here lies the debate on 'common property regimes'. The administration of rights within 'common property regimes' requires more of the local initiative and input than outside intervention, in order to resolve questions of sustainable resource management at the local level.

CHAPTER 3: BACKGROUND OF STUDY AREA:

3.1 Introduction:

Kisumu is the second largest of the seven districts in Nyanza province in the western part of Kenya. Kisumu District has an altitude ranging between 400 m and 800 m above sea level, the lowest being Kano Plains in Nyando Division (400 m - 1000 m) in the central part of the District, and the highest being Nyabondo Plateau (1800 m) to the south (see Figure 3.1). It is divided into eight administrative divisions of which Nyando is one. Nyando Division has six Locations (including the recent subdivision of Awasi)[1] and seventeen sub-Locations, with Ahero as the divisional headquarters. The Division has an area of 295 sq. km, 90 per cent of which is covered by farmland. The rural fieldwork for this thesis was carried out in Kochogo North and Border I sub-Locations in Kochogo and Awasi Locations, respectively.

The soils on the uplands of Kisumu District are mainly sandy, marked with residuals of brown volcanic soils, while the plains are mainly dominated by black-cotton soils. The latter constitute more than 70 percent of all soils found in Kisumu District, and particularly in Nyando Division (see Figure 3.2 and Appendix B. 2).

The mean annual rainfall in Kisumu District varies from 560 mm to 1630 mm, with Nyando Division recording between 800 mm and 1200 mm. (see Figure 3.3). The variation is markedly influenced by the physical features of the District and its periphery: altitude and proximity to the escarpment to the northeast, nearness to the lakeshore to the west, and the flatness of the central portions of Kano Plains all influence rainfall. The maximum and minimum average monthly temperatures are 30°C and 17°C.

[1] Awasi Location has recently been subdivided into two separate Locations - Awasi to the south and Wang'anga to the north.

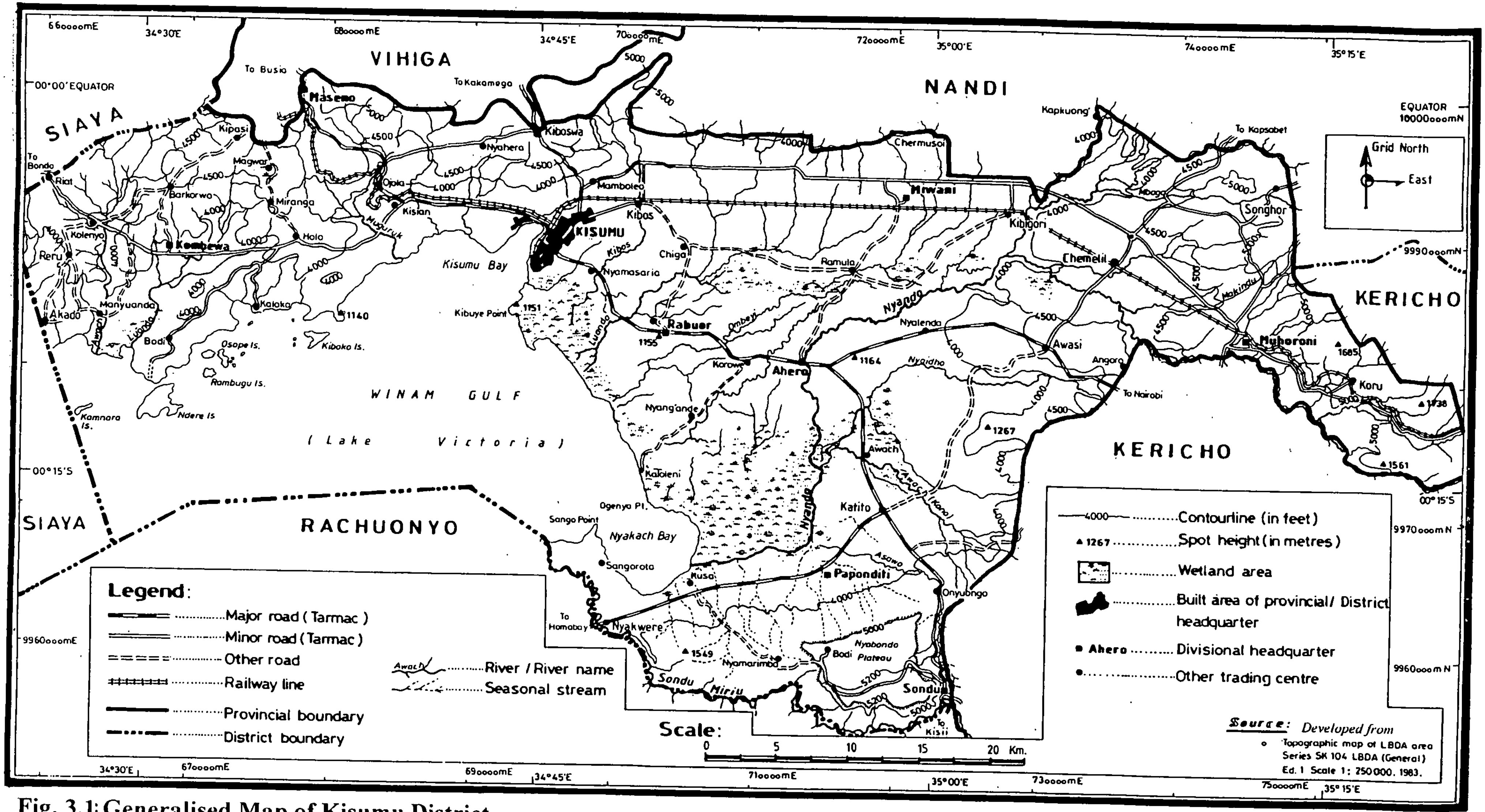


Fig. 3.1: Generalised Map of Kisumu District.

Author, 1997.

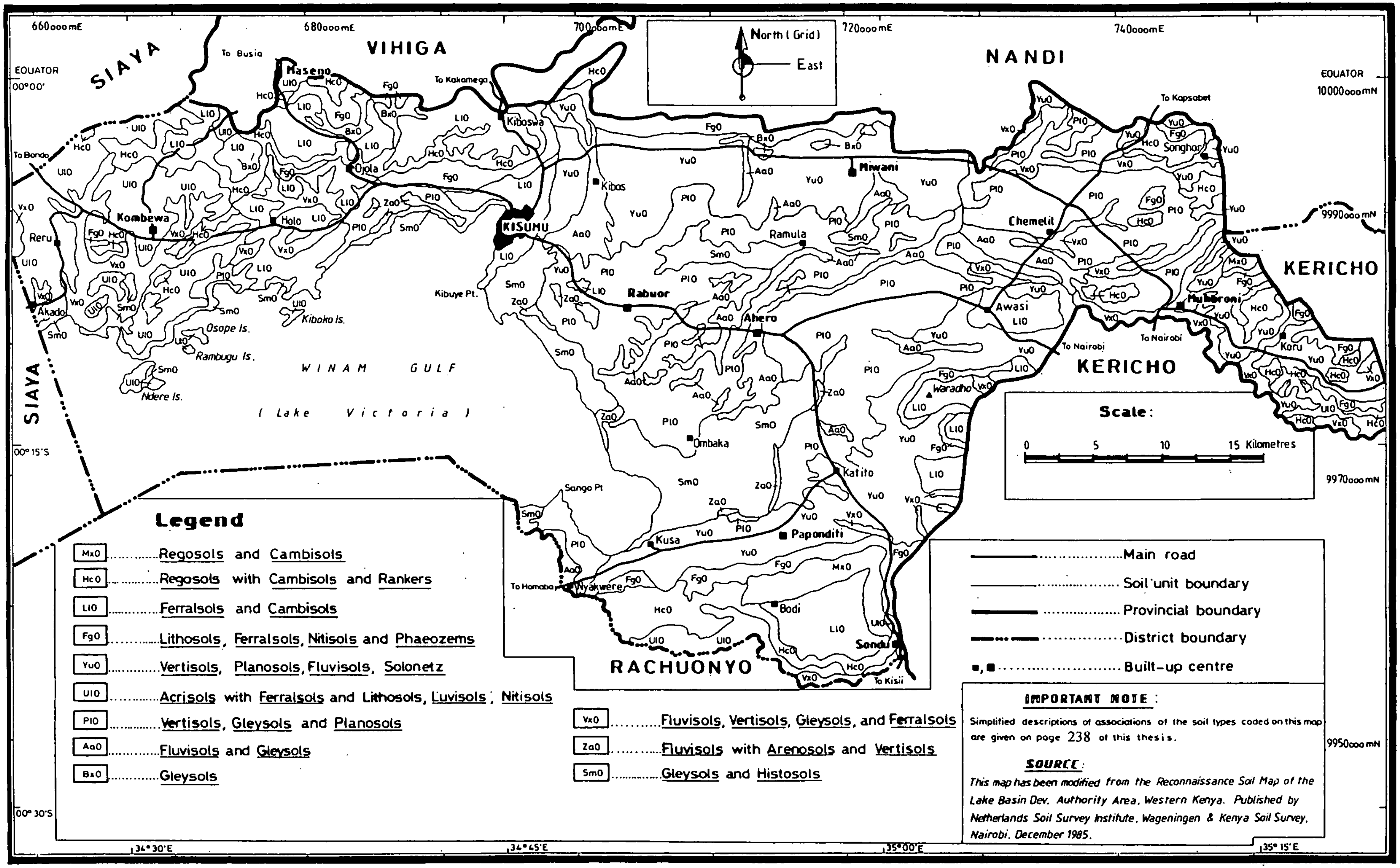


Fig. 3.2: Soil Map of Kisumu District.

Author, 1997.

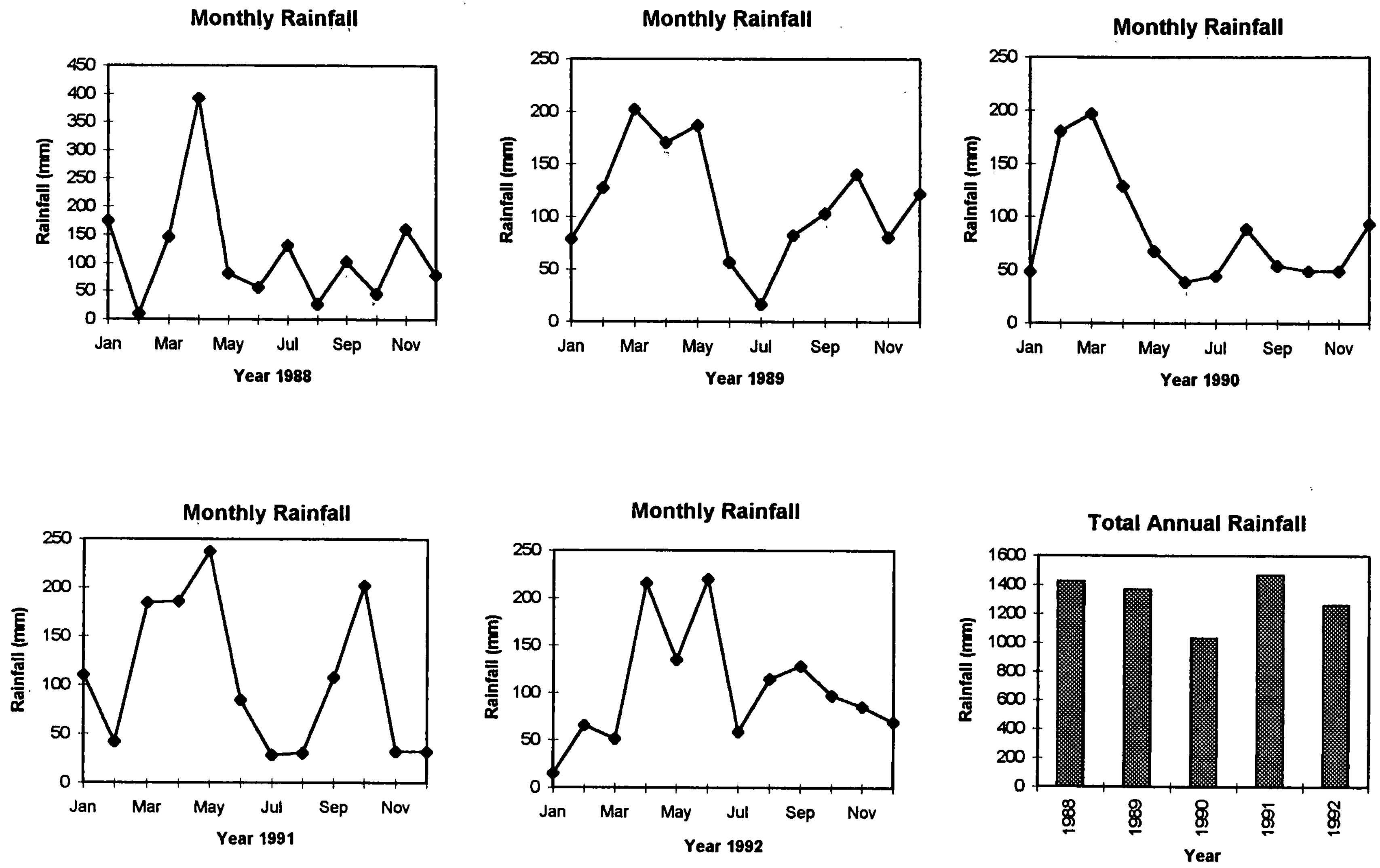


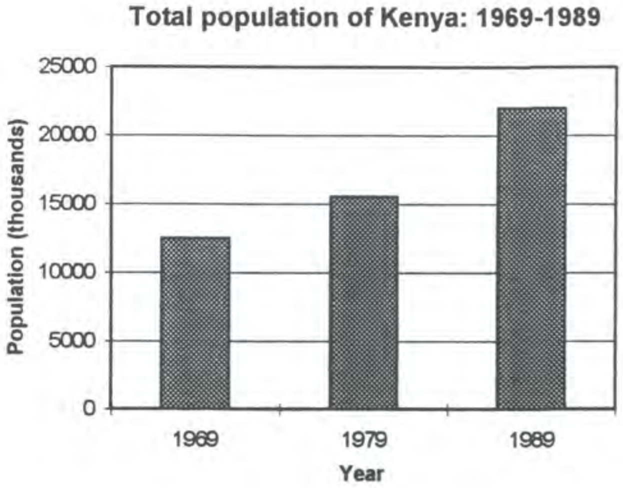
Fig. 3.3 Rainfall variation - Kisumu District, 1988-1992.

Source: Developed from KDDP (1994).

3.2 Population and Settlement

According to the census carried out in 1989, Kisumu District had a total population of 664,000, with more than 60 per cent being rural (Republic of Kenya, 1994a). This was an increase of about 65.5 per cent in two decades since the census of 1969 (Republic of Kenya, 1971) - see Figure 3.4. The annual population growth rate for Kisumu District has been estimated to be 3.35 percent (KDDP, 1994). Nyando Division accounts for about 10 per cent of the District population, with a population density of about 220 persons per sq. km. The settlement pattern in Kisumu District, and Nyando Division in particular, is mainly dispersed homesteads with fragmented and widely scattered small farms, especially for the rural land poor.

Kisumu District derives most of its livelihood from primary production in small-scale crop farming and fishing, and from industrial activities. According to the 1989 census, 53 per cent of the District's economically active population worked in agricultural/livestock production, 7 per cent in fishing, 1 per cent in mining/quarrying, 19 per cent in the informal sector, i.e., *Jua Kali* (open-air) enterprises and commercial/business activities, 5 per cent rely on industrial wage employment and 15 per cent on wage employment from the public sector (KDDP, 1994: 37). Since in Nyando Division only 6 per cent of households have high value cash crops, a majority of households are involved in subsistence-level, smallholder, agricultural production. Of the rural districts in Nyanza Province, Kisumu appears to be the least endowed with adequate household access to land. Mean size of land holding is about 2.2 acres, against the national average of 5.6 acres (Odada and Otieno, 1990). People are trapped in a vicious spiral of poverty which keeps fuelwood as the only affordable source of energy.


Total population of Kenya: 1969-1989
Population (thousands)
25000
20000
15000
10000
5000
0
1969
1979
1989
Year

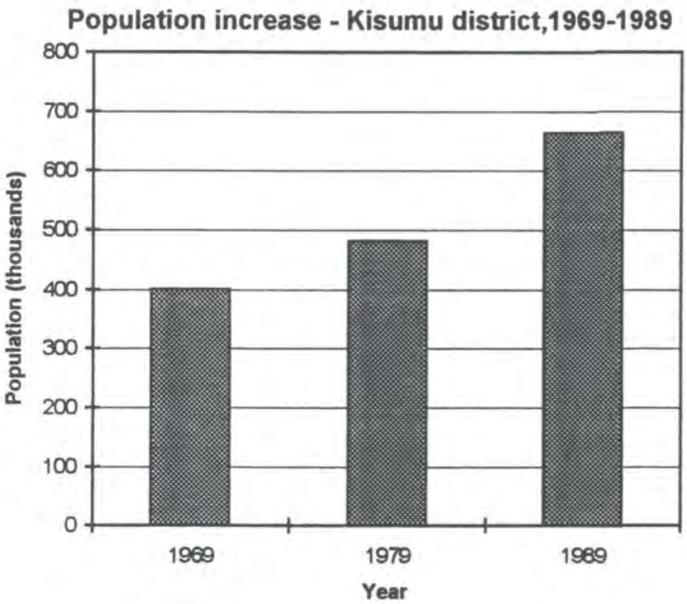

Population increase - Kisumu district,1969-1989
Population (thousands)
800
700
600
500
400
300
200
100
0
1969
1979
1989
Year

Fig. 3.4

3.3 Agriculture and Forestry

The different types of climate and soil found in Kisumu District support a range of crops including sugarcane, rice, cotton, maize, sorghum, coffee, tea, etc. Most are grown primarily at a smallholder, subsistence scale. Both sugarcane, which is the chief commercial crop, and cotton, which is the second most important, are predominantly grown in the Lower Midlands ecological zone (see Figure 3.5). Coffee and tea are grown in the Upper Midlands.

'Bad weather', which normally is associated with erratic rainfall and its bimodal variability (see Figure 3.3), has often contributed to a decrease in production of particular crops. For example, of the ten major crops grown in the District, production of six declined significantly in 1991 and 1992 (KDDP, 1994: 37). These included sugarcane, cotton, maize and sorghum, and beans. Nyando Division is dominated by the growing of rice, cotton and sugarcane, but only 6 per cent of households have high-value cash crops (ibid.: 38).

There are also fisheries and livestock production systems in Kisumu District. However, according to the District's livestock office, current livestock practices are associated with overgrazing which leads to range degradation (ibid.: 41). Fishing is an important activity in areas bordering Lake Victoria. The industry serves not only the District, but the whole region and beyond. However, the current environmental problem of water hyacinth weed on Lake Victoria is sounding a death knell for this once lucrative undertaking by many local people in this region (see Plates 3.1 a, b - Appendix A. 3).

Kisumu District has almost no forests or extensive woodlands, although bush and shrubs occupy an average of 35 per cent of the land area (bkh, 1996; Ecosystems, 1983; KDDP, 1994; Mwenda, 1984 - see Figure 3.6). The remaining area is largely agricultural, with a lesser quantity taken up by settlements and roads. Shrub-covered areas, substantially modified by human activities, were (and are) dominated by many

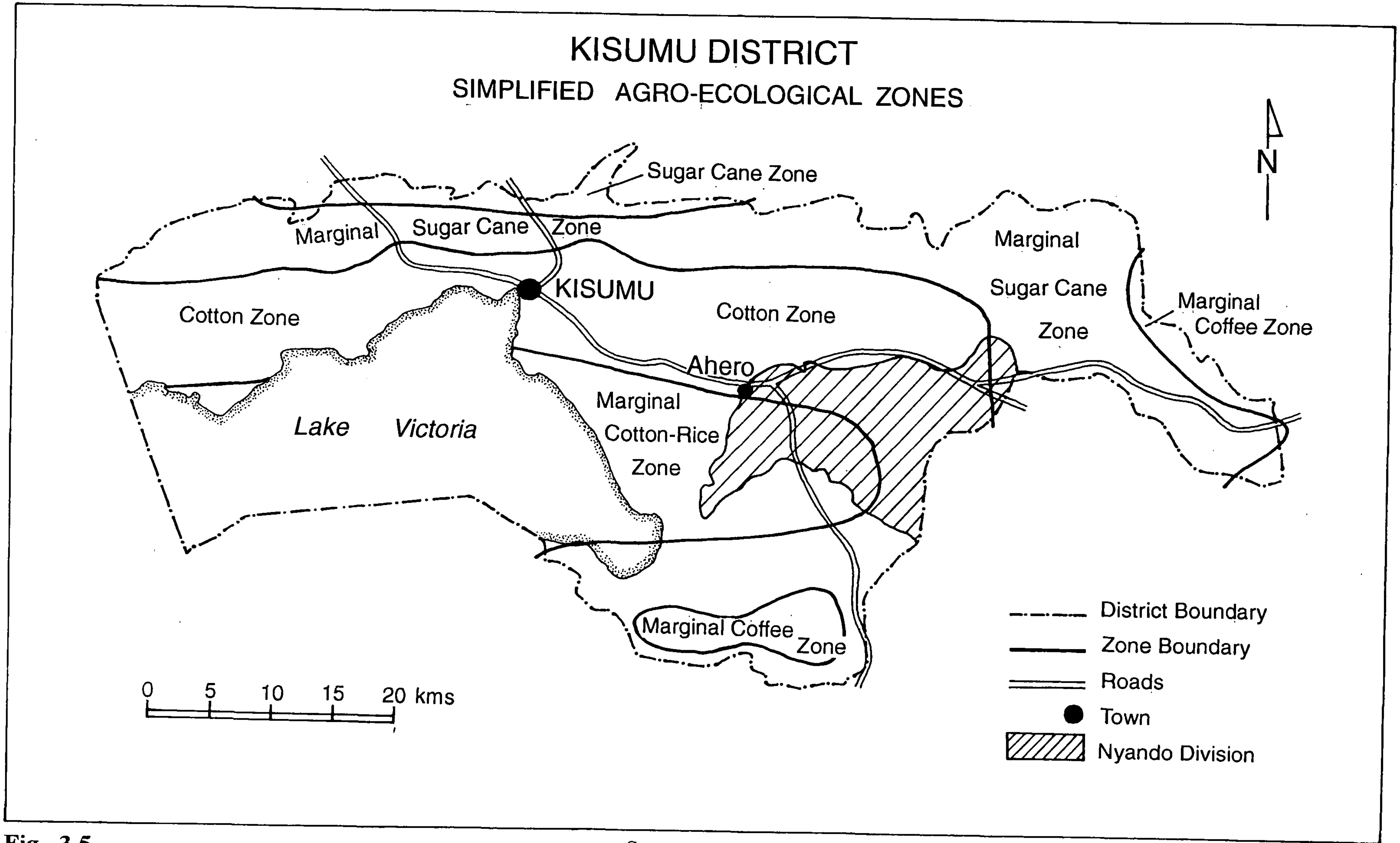
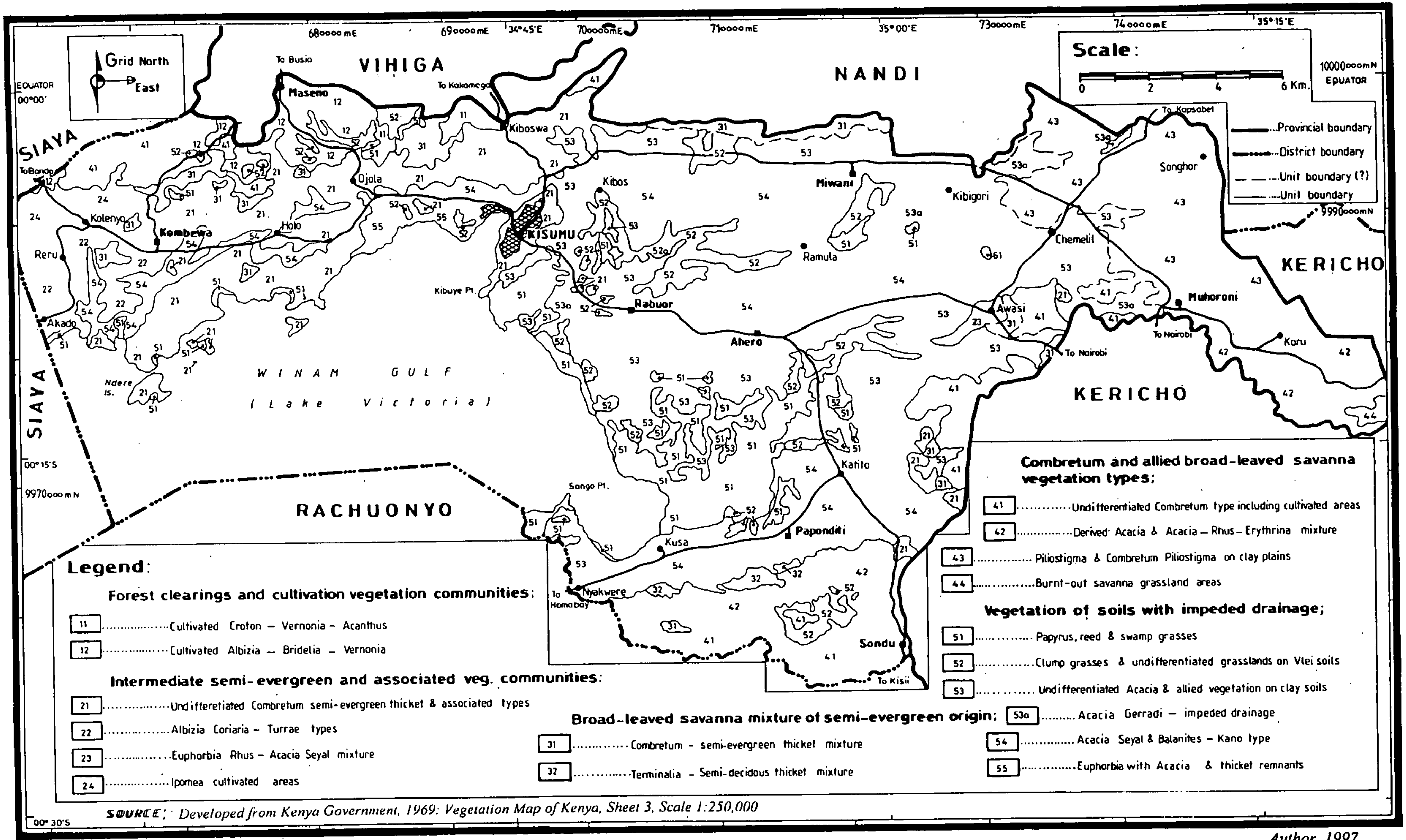


Fig. 3.5

Source: Developed from the agro-ecological map of Kisumu District (KDDP, 1994).



Author, 1997.

Fig. 3.6: Vegetation Map of Kisumu District.

species, notably *Acacia seyal* and *Cassia* spp. (Mwenda, 1984: 18). *Acacia seyal*, and other Acacia species like *Acacia campylacantha*, *Acacia drepanolobium* and *Acacia fistula* were once believed to be the 'climax vegetation' dominating, for instance, Kano Plains in Nyando Division of the district (Ominde, 1971). These tree species have thinned to remnants of savannah woody vegetation of scattered *Acacia* spp. and *Balanites aegyptiaca*. Woodlots (mainly of *Eucalyptus* spp.) are found principally in the areas bordering Kakamega District, but there are also several clusters, especially around homesteads, scattered all over the District, including Nyando.

The principal source of energy in Kisumu District, and Nyando Division in particular, is woodfuel (charcoal and fuelwood). Woodfuel and other bioenergy sources meet about 90 per cent of the energy demand in the District (Republic of Kenya, 1994b: 13). It was estimated that rural per capita domestic consumption of wood in the District by the late 1980s was about 600 kg a year, with about 280,000 tonnes of fuelwood estimated to have been consumed in 1988 alone (Odada and Otieno, 1990: 124). Odada and Otieno showed that the use of charcoal in rural areas was lower (only 50 kg per household per year) than in the urban areas (750 kg per household per year). The District forecast for woodfuel demand proposes that the consumption of woodfuel would rise to nearly 400,000 cubic metres by the year 2020 (Republic of Kenya, 1994b) - see Figure 3.7). Out of the total fuelwood consumption in the whole country, Kisumu District alone accounts for 0.27 million tonnes (KDDP, 1994). However, there has been a shortage particularly in the study area, exacerbated by the growing demand from the rising population with an ever-dwindling resource base. Widespread poverty has also made it increasingly difficult for local people to afford alternative commercial fuels such as kerosene, liquefied petroleum gas, and electricity. The problem is worsened by the irregular supply of such fuels. Kerosene is, however, used in most rural households in the District for lighting purposes (Table 3.1).

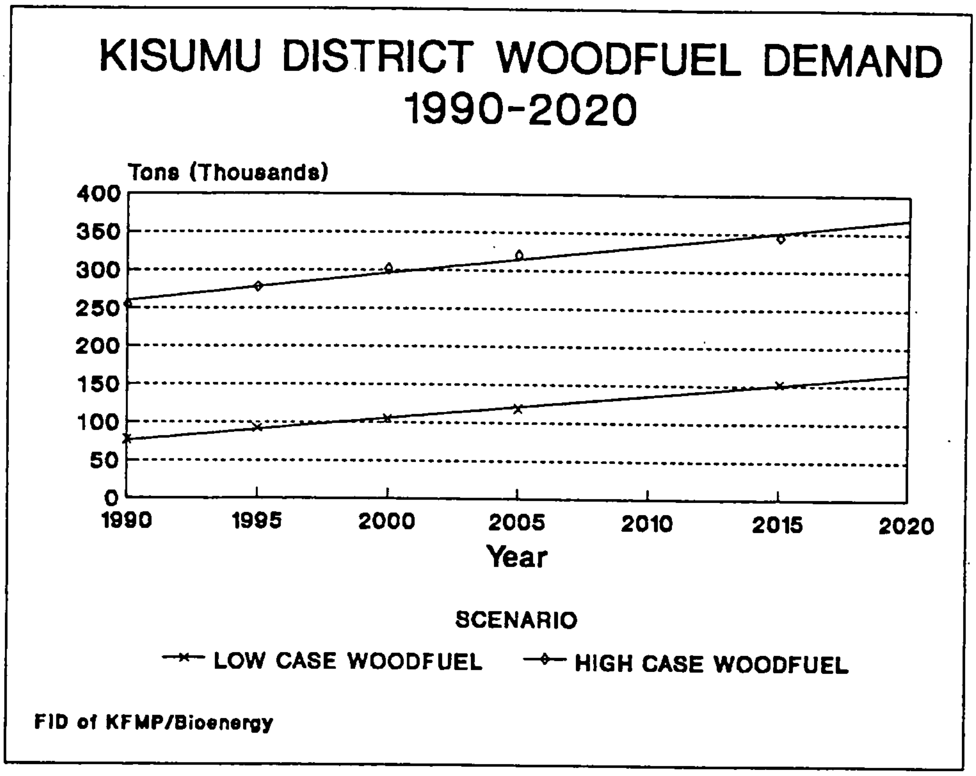


Fig. 3.7: Kisumu District Woodfuel Demand Forecast 1990-2020.

Source: Kisumu District Forestry Master Plan, Forestry Department (1994: 15).

Table 3.1 Percentage distribution of households by means of lighting - Kisumu District.

Electricity	Pressure Lamp	Safari Lamp*	Paraffin Candles*	Other
1.7	0.0	37.8	46.2	14.3

*Both use kerosene fuel.

Source: CBS, 1985.

Charcoal is supplied mainly from farm areas, forests (mostly outside Kisumu District) and open lands. Cases of under-supply of charcoal from local sources have been noticed recently due to the rapid depletion of preferred charcoal species (see Section 8.6). Although there is a rural electrification programme in the District, the exercise had benefited only some 78 rural households by the end of 1987 (KDDP, 1989).

3.4 <u>The Luo Land Tenure System and the Use of Resources</u>:

Under the private tenure type, property rights are assigned to the individual, while under a communal tenure system these rights are assigned to a group of individuals (see Section 2.5). The public sector controls the land under state ownership. Registration was therefore calculated to transform the legal status of registered land from one susceptible to multiple customary rights and interests, to individual absolute ownership. Among the Luo who occupy the study area, land was held and used as a collective asset by lineage members (*Jokakwaro*) (Ogolla with Mugabe, 1996). The grandfather of such a group was usually recognised as the land controlling authority. He allocated and oversaw different rights and scope of use. However, land-use types which required land to be shared, for example, communal grazing, were allocated and controlled by a council of grandfathers or family and clan elders (*Jodong gweng'*). Such lands were considered to be held by members of the clan as a whole, and every individual member of the clan had equal rights of access thereto. The word 'tenure' was a misnomer as far as the Luo were concerned, since land was used collectively, and it is with Luo people that this thesis deals.

The original Luo title to lands was based mainly on conquest[1], i.e., land was held by might as much as by right. Rights of occupancy were based on cultivation and use of land, as shown by individuals over recent years. An oral history recorded on 13.9.1996 in Kadhier, with Mzee Migwa (born in the 1920s), confirmed this:

> "People marked boundaries on unoccupied land by simply throwing a spear or a club, and where it landed was their boundary. This was because the land was still large and empty. Each household head threw as many times as the number of his wives, and if he was not strong enough, he chose someone else much stronger to do it on his behalf. Those boundaries were highly respected and nobody violated them, because it was believed a curse could befall one if he did".

The lands were subsequently inherited by members of the family through the male line, but in the case of plural wives, each son followed on his mother's holding. The wives were each given pieces of land by the husband from the family holding, in order to farm, though with the titles still held by him. The wife continued to use the piece of land until such a time that she would decide to split it among her grown-up or married sons. If she had several pieces scattered in different places, these would be distributed equally among her sons as and when necessary. Two or more distinct pieces were often held by the same individuals or family in different locations (fragmentation). This was preferable (as today), as an equalising and risk minimisation mechanism, especially on land which was agriculturally unproductive or only suitable for a specific type of crop. The colonial administration interfered adversely by enforcing rules and regulations regarding land-use: for example, what type of crop to be grown on which type of land. Land consolidation was therefore considered a negation of this practice, as illustrated in the following report by Luo representatives, to Mr. Michael Blundell, the Minister for Agriculture in the colonial government, on 9.7.1956[2]:

> "This is a bad thing. When the *shambas* have been consolidated, each person will be given a piece of land and he will go on tilling it forever. If the *shamba* is considered to be suitable for cotton, that person will go on planting cotton every year. He will not be allowed to plant *wimbi*, maize or any other crops that he likes".

[1] DC/KSM/1/18/30 - Land Tenure, 1931-1948, KNA, Nairobi.
[2] DC/KSM/1/18/39, 1960 - KNA, Nairobi.

The Luo land tenure system makes fragmentation inevitable. The splitting up of the holding and the allocation of separate parts to different wives, to cultivate and hold for ultimate inheritance by their sons, is one form of security which the women know and cherish. However, the widely scattered pieces makes adequate use and supervision of such land difficult, due to their distances from the homestead.

Through their sovereign authority, *Jodong gweng'* could order a change of land-use, when necessary. For the purposes of environmental management and sustainability, an area could be closed to agriculture and set aside for grazing land in order to restore fertility[1]. Nevertheless, such actions created two apparently conflicting principles of rights of control and use - community (of kinship) and individual. This power of the 'community'[2] to oversee the sustainable use of resources has been seriously undermined by the 'modern' land tenure system, which emphasises individualism. With the decline of the regulatory capacity of customary tenure, policy initiatives aimed at sustainable resource utilisation at the local level needs to be reconsidered in order to identify, revive and strengthen the traditional norms and institutions that propped-up the common property regimes (Ogolla, 1995; Lawry, 1990). Ogolla suggests that this implies rethinking the role of the state in land tenure and land-use issues at the local level.

3.5 <u>The Study Clans</u>:

In order to understand fuelwood use and land/environmental management practices at the local level, a case study of two clans and their lands was necessary. The chosen clans were Kadhier clan in Kochogo North sub-Location in Kochogo Location, and Muga clan in Border I sub-Location in Awasi Location (see Figure 3.8). The reason for the choice of the two clans was primarily their inherent micro-level contrasts relevant to this research. For the reader's convenience, both clan and area will be referred to by the same name in this thesis: Kadhier clan and Muga clan.

[1] DC/KSM/1/18/30 - Land Tenure, 1931-1948, KNA, Nairobi.
[2] 'Community' in this case means a people bound together by shared characteristics and interests, and of a local administrative unit or of a cultural or ethnic group (see IUCN/WWF/UNEP, 1991: 57; Leach *et al*, 1997a).

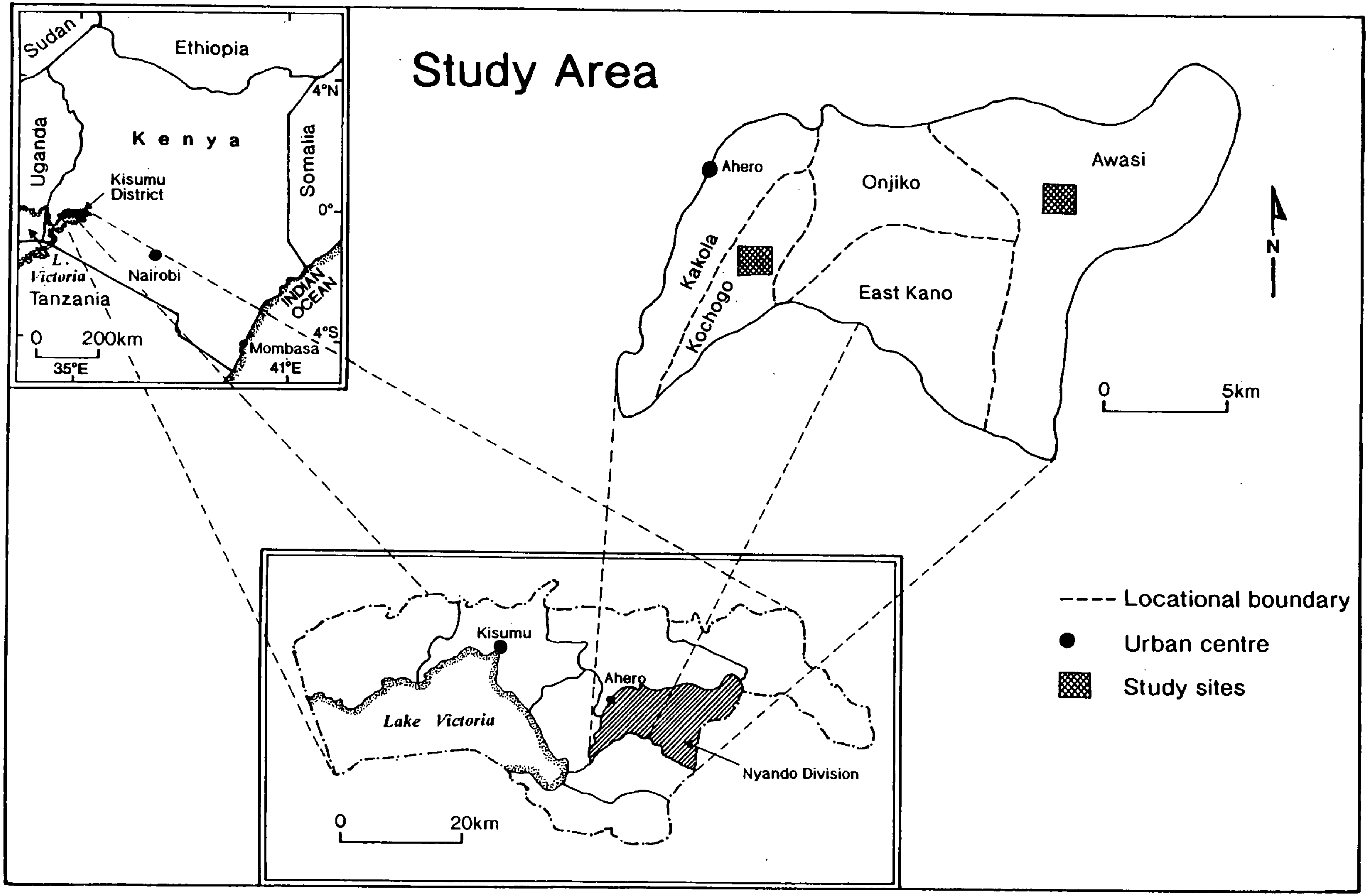


Fig. 3.8: Location of Study Area.

Source: Author, 1997.

Clans were chosen for this thesis because settlements in the two study Locations, as in most areas in Nyando Division, consist of a dispersed pattern (not wholly contiguous), with no explicit boundary demarcations separating villages. Local people identify more with clan areas than with the non-existent village boundaries. Moreover, homesteads belonging to particular clans may not always be found to be nucleated around a single spot, but are spread over and intermingled with other homesteads of different clans. In general, individual clan members rarely live beyond a distance of 4 to 5 km away.

Another important issue is that these dispersed settlement patterns share common facilities like schools, markets, health units, etc. Such facilities are not specifically identified with a particular clan, even though the facilities may be located within an area dominated by a particular clan. For example, Ahero town, although located in Kakola Location (see Figure 3.8), serves all the people in Nyando Division and beyond. Such centres are neutral grounds, normally managed by Local Government administration, and hosts independent traders from all corners of the district and beyond. It is by pure chance that some village areas in the Division are more endowed with better facilities than others.

Kadhier and Muga clans differ in both socio-economic and agro-ecological terms, providing excellent contrast in the investigation of the fuelwood issue. Livelihood systems and practices in both clans also differ in accordance with the physical contrasts. Questions of access to natural resources and facilities (economic, health and educational) are crucial to the two clan areas.

The aim of this section is to provide a description of the two clan areas to set the local context. The particularities of the local environment and livelihood systems and strategies are relevant to the social, cultural, economic and agro-ecological constraints which lead to struggles between local communities[1] over local resources (e.g., fuelwood). National issues will be explored at the micro-level. The section explores not

[1] The definition of 'community' in this case adopts that one given in Chapter two, Section 2.5.

only the particularities of the environment but also the interactive processes involved thereby. Special attention is also paid to gender roles and the wider national economic trends and concerns which play a significant role in shaping local practices.

3.5.1 Production Systems and Issues of Household Access and Control of Resources:

In order to understand the local rural context, we must understand the structural formation of the units of production and consumption, i.e., the household unit. People's access to resources and their relationship to factors of production are important in determining their farming strategies and modes of managing the environment. The system of consumption organises the use of production and the modalities of production. Understanding the household unit and its internal composition regarding the allocation of duties, responsibilities and obligations is crucial to demystifying the 'farm family' concept. As Howorth (1997: 16) states, "It is not sufficient to talk about 'farm family' because of its implications of a single unit composed of husbands, wives and children, although these do exist". Given the differences in cultural and historical factors from community to community, the position of women in relation to agricultural labour, to decision-making and to social reproduction at the household level is crucial.

In Kadhier and Muga clans, as in many other Luo communities, women play significant roles in farm production and resource management. However, the patrilineal family system gives a senior male (mainly the husband or owner of the homestead) final authority regarding all decisions (see Section 7.5). Such family structures often relegate women simply to the role of non-wage workers using family resources for the benefit of all in the household. As Shipton (1989: 19) puts it, "The Luo give a high public profile to males. Patriliny, bridewealth, and polygamy all reinforce each other". Polygamous marriages used to be commonplace, but are slowly dying out now. As encountered in some homes, married women had one co-wife or more living in the same compound. The man's wives cultivate his small landholdings and this, in essence, is not sufficient to provide the households' food requirements, thus exacerbating the whole family food problem. Women therefore resort to petty trades in order to sustain the family livelihood.

In polygamous families there is an intrinsic intra-household differential in access to and allocation of family resources, especially land. This is determined by the reproductive capacity of the wives (i.e., the number of children they bear), as is the area of land they are allocated by the husband to hold for inheritance by their sons (see Section 3.4). Land in Kadhier and Muga clans, as in most parts of Luo region, is inherited through patrilineal lineage. Some 20 per cent of marriages are polygamous. In many ways, the women sharing a polygamous household in both clans undergo keen competition over resources under the control of the husband. These include trees and/or wood resources to provide fuelwood, and benefits such as educational opportunities for their children or other family cash incomes. Such competition occurs mainly under conditions of increasing scarcity. In general, each wife separately maintains her own fields, granary, trading activities, purse, hearth and children (cf. Oduor-Noah and Thomas-Slayter, 1995). 'Households' in this thesis are defined around men with their wife/wives and children.

3.5.2 Demographic Trends in Kadhier and Muga Clans:

The Kadhier and Muga clans live in wholly dispersed settlements over areas of about 4 sq. km and 7 sq. km, respectively. Kadhier is more densely populated than Muga, as is evident from the simple fact that there remains more unoccupied land (now being turned into sugarcane farms) in Muga clan area than in Kadhier clan area.

Kadhier clan consists of about 80 households[1]. As each woman has an average of five children, taking into account households with two or more wives (about 20 per cent), the population may reach about 700. A similar situation obtains in Muga clan, which consists of 88 households, thus an overall population of about 750, including

[1] The 55 households ranked by the key informants excluded households who are currently living outside the clan area, in other rural areas, in urban areas or may be engaged in migrant labour, but still remain members of the clan. This was also the case in Muga clan.

households of two or more wives. In both communities, about 50 per cent comprises those aged 15 years and younger, which gives a high dependency ratio and a heavy burden for parents. The overall effects of high population growth on resources are well understood in the clan areas, yet this understanding seems not to shape household decisions on family size. As seen later, the more the children the higher the family status. There are very few cases of permanent out-migration, but massive temporary migration as migrant labour to all the urban areas in Kenya.

One notable feature is the purchase of land, which involves either outsiders or members of the particular clan. There are three dimensions to this: outsiders come in and buy land from some members of the clan; members of the clan buy from their fellow clan members; and members of the clan buy land outside the clan area. The purchase of land by outsiders is causing concern among certain members of the clan. For example, Joseph (aged 47 years) from Muga clan said on 13.10.1996:

> "But this piece of land which was in *Kuth Awendo* area was sold out to many people as far away as Karachuonyo[1], for sugarcane farming, and when they finally obtain their title deeds, it would be difficult to remove them. These are some of the things we are crying about, because even these trees still in Waradho Hill will soon be cut".

3.5.3 The Physical Environment and Fuelwood Resource Differentials Between Kadhier and Muga Clans.

Increasing population in the two clans is beginning to cause pressure on resources, particularly fuelwood. Kadhier and Muga clan areas have no forests and almost no extensive wood reserves. The exception is Waradho Hill in Muga clan area, a small wooded enclave in an expansive treeless setting (see Plate 3.2a - Appendix A. 4). Much of the trees and the woody vegetation on the Hill are rapidly getting depleted due to over-use, encroachment by settlements and agricultural expansion (see Plate 3.2b - Appendix A. 4). The dominant tree species currently on the Hill are isolated *Terminalia brownii*, valued mainly for their good quality building poles and thus spared so far (see Plate 3.2b). Charcoal making has led to the rapid decrease of other species such as

[1] Karachuonyo is a place in the present Rachuonyo District, one of the new districts in Nyanza Province, lying to the south of Kisumu District.

Teclea nobilis, *Rhus natalensis*, etc, which populated the Hill before. Lower down the Hill are isolated *Balanites aegyptiaca* and *Acacia* spp. (undifferentiated). These have also been threatened, as they have provided a ready source of charcoal and fuelwood for sale outside the clan area. Lower down the Hill most of these trees have been clear-felled to create room for sugarcane farms (wodfuel is, therefore, a by-product of this activity) - (see Plate 3.3a, b - Appendix A. 5). Because of this small wooded enclave, few farmers in Muga clan area maintain private woodlots or plant trees around their homes (see Table 7.4).

The case in Kadhier clan area is different. The area has no surviving natural woodlands. Most of the trees in this locality are those (mainly exotic) planted around homesteads (see Table 7.4). These trees are rarely used for fuelwood, being primarily sold as poles for building purposes. The fuelwood scarcity for this community is identified by households as a growing problem, which is a paradox, taking into account the number of planted trees. The fuelwood used by the Kadhier clan predominantly comes from Awasi Location and such places as Waswa, Agala and Kakmie (all lying between Ayweyo and Luora Ayweyo schools) which are primary supply sources (see Figure 8.3).

Although most women interviewed raised the issue of fuelwood, both singly and in groups, the severity of the problem varies with household. A few wealthier women can afford to buy kerosene, good quality fuelwood or charcoal, while a majority of the poor respond in diverse ways to this scarcity. For example, some use crop wastes (mainly stalks of maize and/or sorghum, dry sugarcane, maize cobs, etc.), cow dung, and small stickwood from weedy fallows and fencerows. *Euphorbia tirucalli*, which primarily serves as live-hedges around homesteads in this locality, has proved very handy as fuelwood in this regard for most households. The scenario in Kadhier clan is a classic case of conflict between endowment and entitlement (cf. Leach *et al*, 1997b), as there is an abundant endowment of wood for fuel but few are entitled to use enough to meet their needs.

Within Kadhier and Muga clans there are also intra-household diversities of access to and supply of fuelwood. For example, households farther down from Waradho Hill (Muga clan), as in Kadhier (see Plate 2.1 - Appendix A. 1), could be seen 'beating' dry sisal leaves, and scavenging around hedges for fuel. Nevertheless, in Muga clan I encountered no single case of a woman who has bought fuelwood from the market. This was a most striking distinction between the two clans. Siprosa from Muga clan (12.10.96) responded with laughter, when asked whether they ever buy fuelwood:

> "We people of the Hill, to buy fuelwood? We have not yet started buying. It is only people from lower areas who buy. For us, we can roam all this Hill until we get abundant fuelwood".

3.5.4 Economic Stratification and Livelihood Strategies in Kadhier and Muga Clans:

Although there are few wealthy people in both Kadhier and Muga clans, class structure and economic stratification still exist. The concept of wealth as defined by the local people themselves was elicited through a simple participatory rural appraisal (PRA) method of wealth ranking (see Section 4.2.3). The exercise was conducted separately with three key informants in each of the clans. Using the classification criteria of the key informants, households in both clans were classified broadly into the following categories:

- Relatively rich
- Average households (the majority)
- Poor households

(The specific characteristics and status of these categories differed between the clans). In both, the richest households owned the following: cattle (more than 50 in number), a large piece of land of 6-8 hectares and a permanent house. They also had an off-farm source of cash income and many children (educated to university level); ate good food, had a substantial grain reserve, owned good furniture, and used gas, kerosene, charcoal or good quality fuelwood for cooking.

In the two clans, a characteristic family of mean socio-economic status owned 2-3 head of cattle, 2-3 hectares of land, little cash but a sturdy, good house with a metal roof.

They had several children, not educated beyond secondary school level. They could not produce enough of their own food but often bought from the market. A characteristic poor household had the following: a very small piece of land (ploughing less than half an hectare), insufficient grain production which only lasts a very short time, no cattle and no money. They would often dig their farm using hoes, have a mud-walled house with thatched roof, and have many children who were not educated beyond primary school.

Based on classification by the three key informants in Muga clan, 44 per cent of households were 'poor'. In Kadhier clan, 54 per cent were classified as 'poor' (see Table 3.2 a and b). From observation, households in Muga clan appear poorer than those of Kadhier. It is, however, not easy to quantify incomes of households in either clan because incomes are often unstable and diverse.

Table 3.2 Wealth ranking by key informants in Kadhier and Muga clans, July 1996.

(a)

	Households				
Kadhier	*Rich*	*Average*	*Poor*	*Very poor*	*Total*
1st Informant	10	23	20	2	55
2nd Informant	6	14	16	19	55
3rd Informant	8	15	20	12	55
Mean	8	17	19	11	55

(b)

	Households				
Muga	*Rich*	*Average*	*Poor*	*Very poor*	*Total*
1st Informant	11	27	20	21	79
2nd Informant	16	21	18	24	79
3rd Informant	29	24	22	-	75*
Mean	19	24	20	15	78

- No ranking into this category
** Four households unknown to the informant*

Until recently, the vast majority of local farmholders in the two clans only grew (in a mono-seasonal cropping pattern) food crops such as maize, sorghum, beans, and peas for local, household consumption. This was also necessitated by the meagre farms owned by many households in these two clans, particularly by the Kadhier clan. A majority of households own 2-3 hectares of land. Farm sizes per household have continued to diminish, owing to subdivisions among male members of families resulting from the system of land inheritance among the Luo. Crop yields from these farms are limited, due mainly to the erratic rainfall pattern. Sometimes the rains fail altogether during the crop season, while at other times it rains excessively and the farms get water-logged.

The introduction of rice and sugarcane as the main cash crop in most parts of Nyando Division by the mid-1970s to early 1980s led many local farmers either to turn their small farm over to grow sugarcane, rice, or to lease the farms to relatively wealthier local farmers or in-migrants from other parts of Nyanza Province. This has happened especially in Muga clan. Other relatively prosperous households who have bought land have between 2 to 4 hectares planted with sugarcane. The change in farming system is threatening the local food situation and had increased the struggle by local people to meet immediate cash demands, such as money to buy food, as sugarcane does not provide quick returns. Many households cited this as a main problem. The sugar takes an average of 18 months to mature, and produces yields of about 40 tons per hectare at an average of Ksh.1,200 per ton (1996 prices; Ksh.1 = UK £ 0.01). Although this cash crop has good returns, it is being grown at the expense of food crops. Sugarcane is a man's crop, while food crops are dominantly women's responsibility. Very seriously, sugar has utilised women's labour time at the expense of producing their own food crops and attending to other household duties (cf. Kennedy and Cogill, 1988). Evidence from Nyando Division does not seem to support the view that there is any direct tradeoff for households between growing sugarcane and food crops. Not all sugar income is spent on food or other household needs: less food is produced and the man may divert sugar cash into personal consumption rather than paying for enough replacement food.

Due to intra-divisional agro-ecological diversities and socio-economic structures, Kadhier and Muga clans engage in different livelihood activities. Living in a more open savannah type of vegetation (except for the wooded Waradho Hill) Muga clan commonly keep livestock, as their environment suits livestock development. Agriculturally, their area has a medium to low potential. Therefore, the few rich households who own livestock (mainly cattle) keep relatively large herds. However, the sugarcane introduced is taking a toll on the open grazing land (see Plate 3.4a, b - Appendix A. 6).

Most households (with an average of five children) meet their urgent cash needs through women's creative trading in small-scale commodities such as cereals, fish, kerosene, charcoal and fuelwood. Others, particularly in Muga clan, even sell bundles of grass for thatching during market days. I met women transporting grass by donkey (and headloads) to Katito Market. These are all petty trades which provide the families with some money to buy basic necessities. Other local people, particularly men, operate small shops in their houses where they sell some basic commodities. This also saves local people, particularly in Muga clan, from walking long distances either to Awasi, Katito or Ahero markets to buy these goods.

Life in Kadhier clan is slightly different. Being close to Ahero and other small market centres such as Riat, Boya and several temporary shops along the main roads from Nairobi and Kisii, people have easy access to these centres and consequently a lot of trading goes on. For example, Jane (aged 30 years) and Cornelia (aged 22 years) - both interviewed on 20.8.1996, and Regina (aged 57 years) on 16.8.1996, all interviewed on a market day in Ahero, earn average profits of Ksh.900, Ksh.490, and Ksh.575 weekly, respectively, by selling cooked foods in makeshift structures in the market. In general, women face problems including constraints deriving from polygamy, high birth rates, and insufficient cash incomes. Many households in both study clans face increasing pressure in their struggle to meet cash needs.

Remittances are one form of livelihood strategy in both clans. Some households have members of their families in wage employment locally in Nyando Division and in other urban centres within or outside Kisumu District. A large majority of these are teachers, usually employed in primary schools within the district. Others hold various positions within local government administration as clerks and casual workers, or work as factory labourers in industries within and outside the district. The escalating cost of living has resulted in more entrepreneurship and trading activities involving both men and women. Men, besides seeking casual labour also engage in the livestock and woodfuel (charcoal and fuelwood) trades.

3.5.5 Roads and Access to Facilities:

The Kadhier clan area is close to two main roads linking Nairobi-Kisumu and Kisii-Kisumu, respectively and to urban centres such as Ahero (2-3 km away) and Kisumu (24 km away) - Figure 3.1. Local people here, therefore, travel regularly to places like Ahero, thus being involved in regular trading activities; they also have access to better educational and medical facilities.

The Muga clan area lies far within in the interior, away from the two main roads. Access is only via two earth roads, one from Ahero (15 km away), and another one passing through, linking Awasi market and Katito market (10 km and 12 km away, respectively). Local people, particularly in Muga clan, face mobility problems, as they have to walk long distances to get to the all-weather motorable roads. This problem results in the visiting of market centres mostly once a week, especially during market days.

Issues of water quality are very acute in Muga clan. Most households here get their water supply for domestic use and for livestock from hand-dug wells, the majority of which are not protected. The drinking water from these wells is rarely boiled and muddy in colour. The only river close by, River Nyaidho, is seasonal and dries up during long spells of drought. Water in Kadhier clan is comparatively better. Most households here use clean water from taps or boreholes, which are properly protected. Livestock drink either from the perennial River Nyando or ponds escavated during road construction several years ago.

3.6 Conclusion:

Although a 'modern' tenure system demands absolute and exclusive property rights, there are still cases of overlapping tenurial rights operating at the local level. The 'communal' or 'customary' tenure system has continued to co-exist side by side with 'modern' tenure. This reflects a policy gap, sounds a greater challenge for both the formulation of policy and for sustainability. Theoretical debates notwithstanding, the interfaces between land tenure, land-use and the conservation of environmental resources are critical to resource sustainability. The often perceived 'rationality' of one tenure system being 'better' than another inhibits the finding of a workable solution to the whole conflict. There is indeed a great need for a compromise.

The failure by the colonial government in Kenya to address the land tenure issue from a broad perspective contributed substantially to the land tenure problem experienced in the country today. This is one colonial legacy that has plagued the development of Kenya since Independence.

CHAPTER 4: METHODS OF DATA COLLECTION AND ANALYTICAL FRAMEWORK:

4.1 Research Strategy and Justification:

This section outlines the strategy adopted in the gathering of data, and some of the justifications. Overall, a multiple methodology approach was preferred. The main reason was that the fuelwood issue is often complex and dynamic, and comprises broader environmental matters which are both social and ecological. This complexity and the varying dimensions therefore demand a holistic, multi-perspective approach. Apart from the well-rehearsed argument for data triangulation through evidence of convergence, multiple methodology was deemed to provide the overriding advantage of both cross-checking reliability and qualitative depth. As Mitchell (1989: 36) states: "evidence based upon a variety of cross-checking methods has a higher probability of representing the reality of a problem than evidence based upon a single method".

4.2 Methods of Data Collection:

The methods employed in this research were, for the most part, broadly ethnographic and/or qualitative. These included interviews, focus groups, household case studies, archival search, oral histories, participatory rural appraisal (PRA), aerial photograph/remote sensing image interpretation, and detailed observations by way of structured reconnaissance tours through the study area. The aim of this multi-method approach was to ensure that all the different dimensions of the fuelwood problem were addressed. Many of these methods are common in participatory rural appraisal (PRA), although for this research it was necessary to practice some in a more academic form.

4.2.1 Participatory Rural Appraisal Techniques:

PRA techniques were used, such as rankings (wealth and species preference), and mapping of village areas through transect walks with 'experts' and villagers (see Mahiri, 1998a). PRA was an invaluable tool in this research because, apart from its usefulness in the activities undertaken, such as the transect walks, it helped in identifying the competing and conflicting interests and knowledges between the 'experts' and the 'locals' in overall environmental/land management, and fuelwood resource demand and use in particular. To achieve this, separate transect walks were conducted with the 'experts' and the 'locals' in each village area on different occasions (ibid.). Although a combined transect walk was previously planned to be undertaken as a check, this was not feasible due to inadequate resources and logistical difficulties in organising the transects. For instance, it took me two weeks to mobilise the team of 'experts' and bring them out in the field. The exercise was also expensive (ibid.: 7).

PRA is considered to be a suitable forum for local people to define their own problems. As Slocum *et al* (1995) explain, participatory methodologies identify issues for both the researcher/facilitator and the community, and offer tools which are formulated, operationalised and tested in rural settings. Such an approach can assist long-term capacity building and empowerment for development agencies, local communities, and the individual households and institutions within those communities (ibid.). Chambers and Guijt (1995: 6) refer to PRA as "a method intended to enable local people to conduct their own analysis and to build the process of participation, of discussion and communication, and of conflict resolution". The process grows out of the specifics of the local context. Brace (1995: 39) summarises PRA as "a way of involving communities in analysing their lives and providing information about their priorities...". For details about the origins and development of PRA see, for example, Chambers (1994b) and Guijt and Cornwall (1995: 3).

A critical evaluation of PRA is provided by Scoones (1995: 18) who notes that because of the absence of a conventional disciplinary perspective, PRA has been considered unrigorous and unpublishable, and the experimental and interactive nature of PRA has been sensed as threatening by some academics. According to Scoones (1995: 17-18), PRA has the following key features:

- the processes of participatory research are slow and difficult;

- the techniques of PRA are complex and require many other skills, especially of communication, facilitation and negotiation;
- wider issues of organisational change, management systems, ethics and responsibilities also need to be addressed when using PRA;
- PRA is based on an action-research approach, in which theory and practice are constantly challenged through experience, reflection and learning.

Despite the difficulty in using PRA techniques, they were necessary because, as Richards (1995: 14) points out, "understanding the dilemmas of the rural poor is extremely difficult because they lead extremely complex lives". PRA techniques were used in this research as convenient methods to elicit specific types of information. Cues obtained from the transect walks were particularly important in trying to explain some of the larger questions regarding the resource base, its sustainability, and probably the reasons for environmental stress and/or degradation. The exercise also helped in identifying indigenous local management and knowledge systems, "particularly knowledge that links livelihood to ecology" (Rocheleau, 1994: 10), referred to as "science of survival" (ibid.: 13). In the fuelwood species ranking exercise, I asked women from different households to draw a list of tree species they prefer or use for fuelwood, and then rank them in the order of preference based on their own criteria (see Table 7.3).

Overall, PRA provided surrogate and/or complementary data about the overall environment quality. Due to its multi-disciplinary, holistic and participatory nature, it was also able to reveal conflicting or competing views and varying knowledges of the 'experts' and the 'locals'.

4.2.2 <u>Selection of Key Informants</u>:

Selection of key informants was made by the researcher based on the criteria of knowledge and familiarity of the setting; long-standing experience in the locality; and on the stature and respect commanded in the community. I had little difficulty in making this selection because of my own links with the area, although familiarity on my part was not uniform across the two village areas. I was more familiar with Kadhier clan (where I was born and brought up) than Muga clan. However, the good contacts I built with two residents of the latter clan paid dividends.

4.2.3 Wealth Ranking Exercises:

In order to stratify the population in the two selected village areas (see Section 3.5) on the basis of relative levels of income, a simple method of wealth ranking was conducted independently with three key informants from each clan[1] (for more details on wealth ranking see for example, Grandin, 1988; RRA Notes, 1992). The wealth ranking strategy was adopted due to lack of household-based information (which could only have been collected through extensive and expensive survey). To obtain an accurate picture of the fuelwood issue, it was necessary to explore the different levels of income within the two village areas.

The concept of wealth was based on the local people's own terms and definitions, which varied with each particular village area. Generally, wealth in both village areas was defined in terms of access to and control over important economic resources such as land holdings, livestock holdings, cash income or wage employment, type of house, grain stock, number of children and education (see Section 3.5.4). But, as the nature of economic resources varied from village area to village area, so did the specific defining characteristics of wealth (cf. Grandin, 1988: 1). Using those criteria, the informants ranked the households into four levels of wealth status, namely: rich, medium, poor, and very poor (see Section 3.5.4).

[1]Key informants were selected for their knowledge of the particular village area which may complement the researcher's observations and point towards further investigation that needs to be done in order to understand social settings, social structures and social processes (see Burgess, 1984: 75). The key informants in Kadhier were two women and one man (all above 60 years old), while those in Muga were three men (ages between 36 and 48 years old). Initial contacts with women proved difficult in Muga clan due to my less familiarity with the setting, mentioned earlier.

The wealth ranking began by drawing a list of household heads (including female-headed households) in each clan by each key informant, on different occasions. Three separate lists were generated from each clan. The lists were later checked by the researcher together with the three informants to check any gaps and/or omissions. The lists proved complementary, as names which were missing in one list were contained in another. Altogether, there were 55 households in Kadhier clan and 79 households in Muga clan. The names were each written on small cards which had identifying numbers, which tallied with the numbering system on the master list, for ease of identification and cross-referencing.

The next step was the definition of the local concept of wealth by the key informants as perceived by the community in each village area. The cards were then sorted into different ranks by each informant depending on the level of the relative wealth and status of each household (cf. Grandin, 1988: chapter 4). One key informant in Muga clan identified only the first three levels of relative wealth, as opposed to the rest who had four different groups of ranking. The ranking of names, subsequently, enabled me to select the households to be interviewed. This method ensured that all socio-economic groups were covered during subsequent interviews. In order to avoid any possible bias towards a specific class of people, I exercised considerable caution, verifying information with independent sources.

4.2.4 Individual Interviews:

The interviews, which were mainly semi-structured, were conducted with selected households and/or respondents. Altogether, 126 individual interviews (formal and informal) were conducted with respondents of varying ages and backgrounds throughout the fieldwork period in Kenya, between July 1996 and March 1997. The interviews included those with respondents in Kisumu District and in Nairobi (see Table 4.1). Formal interviews were often arranged beforehand, whereas informal ones were mostly spontaneous. Overall, the interviews ranged from those with key informants through households (men, women and occasionally girls), government officials (both at national and local level), representatives of NGOs (locally-based in Kisumu District and also in Nairobi), local fuelwood traders, and hoteliers (including open-air food vendors).

Table 4.1: Interviews conducted during fieldwork in Kenya, July 1996 - March 1997.

		Format		*Gender*		
Place	*Respondent*	*Recorded*	*Unrecorded*	*Male*	*Female*	*Total*
Kadhier	Household level	17	-	3	14	17[1]
	Focus Groups	6	-	2*	4	6
Muga	Household level	10	2	5	7	12
	Focus Groups	4	-	1	2	4[2]
Nyando Div.	Government	7	3	9	1	10
	NGOs	-	3	3	-	3
Kisumu Hq.	Government	2	2	3	1	4
	NGOs	-	2	1	1	2
Nairobi Hq.	Government	-	6	6	-	6
	NGOs/Private	-	3	2	1	3
Other	Woodfuel Traders	-	21	4	17	21
	Hoteliers	-	16	9	7	16
	Private/Informal	-	33	23	10	33[3]
Total		*46*	*91*	*71*	*65*	*137*

*Includes one group interview with six herdsmen, conducted out in the grazing field.
[1]Included here were four household case studies of energy use. The latter could not be conducted in Muga clan because of problems of monitoring. It was a common practice by several households in this clan not to have fuel(wood) stocks (see Section 7.7).
[2]One focus group here was composed of a mixed group of men and women.
[3]This includes all informal interviews during the whole of fieldwork period, and with all kerosene traders (including the six oil companies in Kisumu Town, mentioned in Section 7.7.4).

A majority of these interviews were not recorded on tape, particularly those with woodfuel (fuelwood and charcoal) traders, hoteliers and/or open-air food vendors. For these, a field notebook was used instead because the field circumstances were not conducive for electronic recording as the interviews were often conducted on open market days. Others were simply conducted along roadsides where I met some of the respondents. Interviews with senior government officials and some NGO staff could also not be recorded for several reasons, the main one being that most of these interviews developed from informal discussions while visiting their offices. Not all interviews recorded were fully transcribed. This was due to duplication of information, as well as time constraints. Table 4.2 shows a breakdown of interviews conducted in different languages.

Table 4.2: Languages used for interviews during fieldwork in Kenya, 1996/1997.

Place	*Respondent*	*Language*		*Total*
		Dholuo	*English*	
Kadhier	Households	17	-	17
	Focus Groups	6	-	6
Muga	Households	12	-	12
	Focus Groups	4	-	4
Nyando Div.	Government	7	3	10[1]
	NGOs	1	2	3
Kisumu Hq.	Government	-	4	4
	NGOs	-	2	2
Nairobi Hq.	Government	-	6	6
	NGOs/Private	-	3	3
Other	Woodfuel Traders	21	-	21
	Hoteliers	15	1	16
	Private/Informal	22	11	33
Total		*105*	*32*	*137*

[1]These included all field extension workers, all of whom were Luos. I therefore interviewed them in Dholuo, just like all other interviews in the village areas.

Questions for woodfuel traders were geared towards gaining information on sources of woodfuel, pricing, market forces and/or factors that determine the dynamics of demand and supply, systems of procurement and modes of delivery, tree development activities, wood preferences, rural-urban demand conflicts, and so on. Questions for hoteliers and open-air food vendors covered matters of foods prepared, type and quantity of fuel used, and any other end-uses.

Household interviews were conducted with the household head, wife/wives or both, the choice being governed by prevailing circumstances. In cases where the household head was unavailable due to migrant labour away from home, the interview was conducted with the wife or wives. In cases of widowhood, the surviving party became the respondent. For the type of questions asked (which were all in a check-list format) -see Appendix B. Interviews with elderly members of the household served as oral histories though they also referred to contemporary issues.

Another set of individual interviews were conducted with the same selected key informants based on criteria mentioned earlier. Questions for key informants revolved around history of the village area, trends and patterns of energy use, tree growing activities, access to fuelwood resources, indigenous knowledge systems, livelihood systems and strategies, responses to fuelwood scarcities, views on government policies (environment and/or forest). In contrast, questions for selected rural households and groups captured issues of fuelwood consumption, access, management (including of land and environment), indigenous knowledges, views on policy, land tenure and adjudication, etc. Most of such interviews were recorded on tape. These interviews were designed to illuminate the links between fuelwood consumption and rural practices, as well as assessing aspects of policy administration and various tenures. The aim was to provide insights into existing conflicts or complementarities, and also relate these aspects and trends of consumption to the other questions of tree development, management and general environmental conservation. A large proportion of those selected for interview were women, the rationale being that fuelwood is essentially a women's issue. The women's perspective was deemed crucial to this research.

Interviews with representatives of NGOs and Government officials both at the national and local level covered varying issues depending on particular areas of involvement and activities being undertaken. There was flexibility in the structuring and subsequent administration of the questions to allow sufficient room for further exploration and probing (cf. Sayer, 1992).

4.2.5 Household Case Studies and Detailed Observations:

Four household case studies were conducted in Kadhier clan. It was initially proposed that the same number of case studies would be conducted in Muga clan, but this was not possible for practical reasons, the main one being that most households in this village did not maintain fuel(wood) stocks. They collected fuelwood from the Waradho Hill as and when required (see Section 7.7), or simply scavenged for dry sticks ('rubbish') around the homestead. This made systematic monitoring difficult.

Monitoring was carried out by systematic weighing (using a spring balance), particularly of fuelwood and/or charcoal, three times a day for two separate weeks per household, before the start of cooking of each of the three meals a day (breakfast, lunch, and supper) (cf. Silviconsult, 1991)[1] The remaining woodfuel was weighed again after the end of each cooking session. Cases of kerosene used were just noted in the comments but not weighed. Parameters considered in the monitoring process were:

- Foods cooked;
- Type of fuel;
- Species of fuelwood;
- Quantity of woodfuel (or weight);
- Number of people eating the food;
- Other uses of the fire; and
- General comments.

Data from the case studies were aimed at providing supporting information on other aspects of fuel(wood) use and management, and an illustrative, intra-house comparative analysis. The individual households monitored were also interviewed separately on

[1] Week 1 was in August 1996 and Week 2 in January 1997 (see Section 7.10).

different occasions as a means of cross-checking and verifying the data obtained through the fuelwood monitoring. The interviewees were all women.

Detailed observations of the individual households, and a general assessment of the environment were also conducted alongside the process of data gathering to supplement other forms of information. Detailed observations, particularly of the environment, involved structured reconnaissance tours throughout the study area, plus transect walks; while those of households were non-participant observation.

4.2.6 Focus Groups:

Focus groups are a more academic version of the discussion groups used in PRA. The focus groups, which were pursued in tandem with the other methods mentioned above were loosely structured around a series of key questions and topics in order to provide a reasonable degree of flexibility and probing[1] (see Appendix B). Cook and Crang (1995, p. 59) state that:

> "Focus groups are a key means through which researchers can study...processes by setting up a situation in which groups of people meet to discuss their experiences and thoughts about specific topics".

The focus groups were intended to capture information relating to aspects of culture, attitudes and perceptions regarding farming practices, tenurial 'laws' of land rights, tree access and development activities, land/environmental management, and fuelwood issues such as use and differences between households (cf. Bradley, 1991; Chavangi, 1984, Ngugi, 1988). Other features that were to be teased out here were relevant indigenous knowledges and/or traditional innovations and impacts of prevailing relevant state policies and legislation.

Numbers in the focus group discussions ranged from between five and seven people per session (see Table 4.1 for total number of focus groups conducted). Although repeat sessions were originally planned, these were not possible due to logistical difficulties encountered in organising the groups. As most rural people were busy with their day-to-

[1] For detailed account of the practicalities of the method, see, for example, Cook and Crang, 1995.

day livelihood activities, it became difficult to muster a group of them together even once. The sessions we had were made possible through the initiatives of my key informants. Due to those difficulties, the original plan of having homogenous groups, based on relative socio-economic classes was not possible. The planned groupings would have avoided bringing together group members with possibly varied priorities and opinions, based on relative class differences. This could result in overlooking particular groups of the community, thus leading to partial accounts of the research problem. This notwithstanding, I managed to achieve reasonably balanced group dynamics during the ensuing discussions, by exercising strict moderation to ensure everyone contributed. It was not, however, an easy task as certain members of the groups tried to dominate the discussions.

It should be noted that gaining access to existing local societies and/or village area self-help development groups proved helpful as a means of organising the groups. I discovered that 70 per cent of the focus groups were composed of members of either a women's group or a church organisation. In order to obtain a gender balance, I had one men's group in each of Kadhier and Muga clans. The one in Kadhier involved a group of young men, while that one in Muga involved elderly members of a local church. In addition, there was one mixed group of men and women in Muga clan. This was used to provide a counter-check on the all-male or all-female groups. One advantage of having specific, all-female groups was to enable them to air open views regarding various issues, and vice versa for the all-male groups. The focus group sessions ran for an average duration of one-and-half hours.

4.3 Ancillary Methods:

4.3.1 Archival Search:

The archival research for this thesis involved two areas, namely forestry-related issues and colonial and post-colonial forest and energy policy and land-use legislation. The research was conducted mainly in the Kenya National Archives (KNA) Library in Nairobi, but also in the Forest Department and the Ministry of Energy and Regional Development libraries, also in Nairobi. Interpretation and selection were carried out hand in hand, towards the process of building linkages between issues that emerged, through a systematic reconstruction of the historical chronologies and configurations (see Hill, 1993; Stieg, 1988). Spatio-temporal chronologies - matrices of socio-historical events - were documented to achieve this goal.

It was not possible to extend the search to the Public Record Office and other UK archives, due to time and resource constraints, unfortunately. Nonetheless, the Kenyan material provides an important complement to historical material obtained through oral histories.

The archival search was conducted concurrently with other field activities in Kisumu District. The arrangement was such that I spent at least one week in the archival libraries for about every two weeks spent in Nyando Division. Such a schedule enabled me to link some of the preliminary findings from the archival search with field interviews including oral histories. This helped to refine both activities.

4.3.2 Interpretation of Aerial Photographs and SPOT Imagery:

Use was made of aerial photographs and SPOT imagery in a time-series analysis, to document change in the woody vegetation, and map the relative fuelwood abundance in Nyando Division over time (see Chapter 8). Stereoscopic pairs of the 1967 photographs and the 1986 SPOT imagery were interpreted, and the woody vegetation/biomass spatial coverages delineated (cf. Tiffen *et al*, 1994: 67-75). Coverage maps were then generated for 1967 and 1986. Visual comparisons were later made to detect both temporal and spatial changes (detailed accounts of the steps followed are given in Chapter 8).

Manual interpretation of the remotely-sensed data was carried out while I was still in the field in Kenya, with the help of a hired photointerpreter. The interpretation maps were then used for field-check and 'ground-truthing', and subsequently used in interrogating and explaining possible trends and impacts on the woody vegetation over time, to complement other historical forms of data such as oral histories, and in charting aspects of environmental change. Results from the analysis of the remotely-sensed data were to be used primarily as a mutually corroborative tool, that is, for triangulation to minimise data inconsistency.

4.4 Data Analysis:

Data analysis occurred to some degree in tandem with data collection. Alongside data collection, there was constant theoretical reflection and probing. The research questions strongly influenced the selection of materials that were recorded, i.e., "theoretical sensitivity" (cf. Strauss and Corbin, 1990: 42). For example, analytic notes and/or memos, as Burgess (1984: 174) states,

> "can form the core of the preliminary analysis. Such memos may include summaries written at the end of a day in the field in which the researcher indicates themes that have emerged, and concepts that can be developed, together with preliminary thoughts about the analytic framework".

The data collected were eventually analysed using various methods. Tape recordings of qualitative data such as focus groups, semi-structured interviews, etc. were on occasion fully transcribed and analysed. By reading the transcripts and listening to the tape recordings, preliminary themes were developed. Such emerging themes from the data were written down as a series of analytical memos which formed the core of preliminary analysis. The same procedure was followed for both individual interviews and focus groups. I found that focus groups provided a considerable amount of information about behaviour, attitudes, beliefs and values in general, due to the kind of arguments which were sometimes involved. From these memos, and further rereading of transcripts, it was possible to classify and categorise behaviour/cultural patterns, social processes and personality traits; to isolate their similarities and differences; and to conceptualise them appropriately.

Ian Dey (1993: 7) identifies a range of procedures which can be followed for managing qualitative data, namely, reading and annotating, categorising, linking data, and connecting categories. Categorising in other texts is variously described as 'tagging', 'labelling', 'coding', etc. (see for example, Strauss and Corbin, 1990). Strauss and Corbin refer to the initial labelling or categorisation of data as 'open coding', which "is the part of analysis that pertains specifically to the naming and categorising of phenomena through close examination of data" (ibid.: 62). This is the process where the data are broken down and conceptualised into discrete parts, closely examined, and compared for similarities and differences with other constituent parts. Other types of coding include 'axial coding' (linking data) and 'selective coding' (connecting categories).

While developing the set of categories (or codes), I employed both 'emic' ('in vivo') and 'etic' coding systems (see Agar, 1980: 191; Cook and Crang, 1995: 82; Strauss and Corbin 1987: 3), that is, using the language and ideas of the interviewee and that of the researcher, respectively. A detailed reading of the transcripts line-by-line helped in identifying and formulating words and phrases for the coding process. Selected utterances were identified and highlighted and observations recorded in short notes on the margins of the transcripts (cf. Glaser and Strauss, 1967; McCracken, 1988). It was from these notes on the margins that I started the actual writing up, while in the process linking similar categories across interviews, and thus developing arguments around key points. Salient, dominant phrases were supported by verbatim quotations from interviews or group discussions, with the respondent, date and place of interview being identified appropriately. This writing was treated as preliminary, since the accounts were later reviewed and adjusted as new information emerged from the rest of the data.

Since a variety of methods was deployed in this research, such preliminary accounts were linked across the board with similar occurrences from other forms of data. For instance, diary accounts from direct observations and relevant historical data were interrogated and assimilated during the process of analytic theoretical sampling of the data. Other forms of perception, attitude or preferences that emerged from the PRA exercises (transects and rankings) also provided a strong basis for fruitful inferences. Interrelatedness and congruency across these classes of data helped to complement and complete the historical configurations. The same was valuable for building scenarios as well as in drawing appropriate conclusions.

CHAPTER 5: COLONIAL FOREST POLICY AND THE HISTORICAL EVOLUTION OF FUEL USE AND FORESTRY IN WESTERN KENYA, 1920s - 1960:

5.1 Introduction:

The aim of this chapter is to trace the historical evolution of forestry in western Kenya from the early colonial era, with specific reference to Nyando Division in Kisumu District. The merits and demerits of colonial policy and local rural practices are examined. The first phase of the analysis of forestry in western Kenya covers the period between the mid-1920s and 1939, and the second, from 1940 to around 1960; the third, the time of the last phase of European settlements in colonial Kenya before Independence in 1963. This chapter draws on a wide range of sources, including archival records from the Kenya National Archives in Nairobi, oral histories, policy documents, remote sensing and interviews. It provides an important back-drop for the analysis of contemporary fuelwood issues in the region discussed in ensuing chapters. The analysis moves from the national to the regional scale.

5.2 Kenya's Colonial Forest Policy Examined:

During the Sixth British Commonwealth Forestry Conference held at Ottawa in 1952, representatives unanimously affirmed the imperative for each country to have a definite Forest Policy (Colony and Protectorate of Kenya, 1955). The colonial government of Kenya had a Forest Policy under consideration for a number of years, but it was not until the mid-1950s that it defined and publicly issued an authoritative national Forest Policy.

The succeeding sections will outline and critically analyse the trends and dynamics of Kenya's colonial Forest Policy, based on the published Forest Policies in the colonial period, on broad range of formal sources, and on interviews conducted in Kenya in 1996/97. Some traditional uses of wood and crop waste will be traced through to the present.

5.2.1 <u>The Epoch of Colonial Forestry:</u>

In Kenya, the approach to forests as industrial commodities originated with the inception of the colonial regime in 1888. This resulted in a dualism in social and economic approaches to life and to natural resources. Dualism was also manifested between traditional cultures and that dominated by monetary economy, which upheld a utilitarian view of resources (Burnett, 1985: 26).

The epoch of creating Forest Reserves in African Areas in Kenya began in the coastal Mangrove forests in 1891 (see Burnett, 1985). Table 5.1 shows the area of the colonial forest reserve between 1953 and 1963 (see also Section 6.4.1). That Reservation of Forests sealed the ambition of the British for restrictive and exclusionary economic exploitation of Kenyan forests. Deliberately or otherwise, this move denied Africans access to forest products, and converted forest resources to industrial commodities. It marked the birth of the Eurocentric hegemony over indigenous forestry in Kenya, and the entry of 'new' forestry doctrine, the latter being methodically institutionalised by the creation of the Forest Department in 1902. Through the introduction of plantation forestry in the 1920s, and later the Forestry Training School, the 'new' forestry dogma was popularised and reinforced. By 1962 (just one year before Independence), 85.7 per cent of Kenya's forests were Reserved, a higher proportion than any other East African country (Burnett, 1985).

Within the context of the 1901 Lands Order-in-Council, forests and native reserves were declared as 'Crown Lands', the latter being defined as "all public lands within the East Africa Protectorate which [were] subject to the control of His Majesty by virtue of any Treaty, Convention or Agreement or by virtue of His Majesty's Protectorate and all lands which [had] been or [might thereafter] be acquired by His Majesty under the Lands Acquisition Act, 1894" (see Okoth-Ogendo, 1991: 12). 'Native Reserves', according to the 1902 Ordinance, were "areas where Africans [were] grouped into definite reserves far removed from European centres or any lands likely to be suitable for European settlements" (ibid.: 30).

After the creation of the Forest Department in 1902, the British targeted the forested highlands where they settled and from which they removed Africans to restricted Reserves. Between 1890 and Independence in 1963, the colonial government progressively alienated land from the indigenous population for European settlement, and then entrenched European private property rights as a buffer against impending African rule (Okoth-Ogendo, 1991).

Table 5.1 Forest reserves in Kenya, 1953-1963

	Crown		Native		Total	Private
Year	Gazetted	Other	Gazetted	Other	'000 ha	Forest †
1953	1179	304	202	106	1791	-
1955	1178	344	219	172	1913	103
1957	1426	103	276	113	1918	113
1958	1419	49	309	85	1862	119
1959	1417	48	335	56	1856	118
1960	1373	6	351	73	1803	333
1961	1366	7	363	61	1797	128
1962	1369	19	366	42	1796	188
1963	1374	25	370	23	1792	206

*Figures for 1954 and 1956 were not available.
†On non-African farms only.

Source: Statistical abstracts, 1961 and 1964.

5.2.2 The Evolution of Colonial Forest Policy:

In the mid-1930s, the colonial government of Kenya proposed a Forest Policy for Native Reserve Forests. The Policy put all the important forests of the Colony on Crown Lands and in Native Reserves under one control. The management of these forests, and all permanently reserved forests in Native Reserves was under the control of the Forest Department. Small forests of not more than 600 acres, which had no climatic importance, were not big enough to warrant saw-milling operations, and only important for the supply of fuel and building poles to the local inhabitants, were to be managed by the District Commissioner and the Local Native Council[1].

The thrust of forest management by the colonial government involved mainly protection and control for economic ends. Forest officers were given the mandate under colonial

[1] PC/NZA/2/10/4, 1931-44.

rule to manage forests on behalf of native communities, with complex arrangements for sharing the proceeds. The colonial forest officer was given immense powers by the Forest Ordinance to determine the destiny of African forests (see Section 5.2.3).

Forests were managed for conservation and to *maintain in perpetuity* (whatever that meant to the colonialists) a sustained yield of the types of forest produce required. Every endeavour was made in each forest to improve the quality and quantity of forest produce. As a means of spreading forest benefits equitably among the local tribes, it was suggested that the best general policy was to charge for all produce taken from the forest, and for grazing allowed within the forest boundary. The strategy raised stiff opposition from Africans, until it was proposed that bona fide natives of particular Reserves be allowed to remove dead wood for fuel, free of charge. With such exceptions, ordinary rules under the Forest Ordinance, like those on Crown Land, were to apply.

In the General Rules, no person was allowed to fell, cut, take, work, burn, injure or remove any tree on Crown Land. These rules resulted in limited access to forests by local communities. Fuelwood was not an automatic benefit, and was not entirely provided by the government. Individual households shouldered the responsibility of supplying themselves, including buying from fuelwood traders when necessary, with also the possibility of being exploited due to the absence of a pricing policy:

> "I am informed by the Deputy Price Controller that there is no controlled price for firewood in the Reserve. This makes it very difficult for adequate pressure to be brought to bear on suppliers or middlemen"[2]

The following quotes also demonstrate that fuelwood was obtained from local private sources. The Provincial Commissioner, Nyanza, wrote to the District Commissioner, Central Kavirondo: "I should like to know the extent to which fuel supply is derived from local sources"[3], to which the District Commissioner replied:

> "Local fuel is obtained from Maragoli where there is an ample and increasing supply. A fair amount of tree planting continues in South Tiriki and Kajulu, while this year Kisumu location has had some 400 acres put in under direction of the Agricultural Officer and about a further 200 acres by individual effort"[4]

Another letter from the Provincial Commissioner stated:

[2] Letter by the District Commissioner, North Kavirondo, to the Provincial Commissioner, Nyanza, dated 28.3.1949 - PC/NZA/2/10/6, KNA, Nairobi.
[3] Dated 21.2.1939 - PC/NZA/2/10/6, KNA, Nairobi.
[4] Dated 6.3.1939 - PC/NZA/2/10/6, KNA, Nairobi.

> "It is appreciable that there is a fair amount of privately owned exotic timber about, but I should not have thought too much for the needs of the local people"[5].

Historically, the legislation over restrictions on forests by the government came into force by the enactment of the original Forests Act, Cap. 385, of 1948. This protective statute was a reaction to the practice by the colonial farmers engaged in large-scale commercial farming of clearing large forest and bush areas. The practice threatened the sustainable use of the forest, and put into question the original objectives of the Forest Policy. It was also antithetical to the survival of the sophisticated pre-colonial forestry management cultures practised by indigenous peoples of using forest resources in a more holistic fashion than purely for timber production. For the colonial government, it was politically expedient to promote a policy that conceptualised indigenous forest management as 'backward' and 'inefficient' (cf. Mackenzie, 1995b; Drinkwater, 1989).

5.2.3 <u>The Forest Policy of 1957 and its Management</u>:

This was the document representing the first authoritative Forest Policy for colonial Kenya, and was a product of the Ottawa Conference of 1952 (Colony and Protectorate of Kenya, 1955, 1957). The objective of the Policy was primarily to lay down basic guiding principles towards the development and control of forests in Kenya for *the greater common good of all* (my emphasis). In colonial Kenya, forest estate was a valuable national asset for wood production and a revenue earner of high potential.

The main policy statements included Reservation of existing forests with a view to conserving the climatic and physical conditions of the environment, apart from increasing forest produce. Due to the limited total area of forests reserved under the Forest Ordinance, it was the government's firm policy to increase and demarcate the area under forest. On conservation the Policy stated (Colony and Protectorate of Kenya, 1957: Section 1):

> "To maintain or provide sufficient forest cover wherever necessary and practicable, to guard against further soil erosion, to arrest it where it has started, and to assist in creating conditions for restoring fertility to the soil where erosion has already caused a deterioration of fertility".

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[5] Letter by the Provincial Commissioner, Nyanza, to the District Commissioner, Kisumu, dated 19.2.1948 - PC/NZA/2/10/6, KNA, Nairobi.

In developing the economic production of sufficient forest to satisfy the requirements of the community and to provide for exportable surpluses, it was the government's responsibility that the needs of a growing population were met. One particular concern was the provision of an adequate supply of fuel.

On protection, the Policy was mainly focused on fire and grazing. It was government policy to end grazing in catchment forests, and where damage was caused to trees and undergrowth, although limited grazing was allowed. Concurrently, however, there were other private rights held by white settlers in the Forest Estate which were a negation of this rule (op. cit.: Section 2).

In theory, the management of forest was based on the principle of 'sustained yield', which was similar to the clause on Reservation, since both served the climatic, protective, and productive purposes of the forest. Quoting from the policy statement (op. cit.: Section 3):

> "It is a basic principle of the Government's policy that all forests shall be managed in accordance with specific plans. These plans shall be approved by the Minister and any deviation of importance from an approved plan shall only be undertaken with the express approval of the Minister".

The Policy vested unilateral powers in the minister regarding management of forests. There were no provisions for vetting committees to ratify any decisions that he made. The Policy is also silent about any participation of local communities, despite the statement to the effect that: "In certain areas it may be necessary to manage forest and grazing under a dual purpose forest and range management plan" (op. cit.). The statement lacked clear guidelines on procedures for involvement by communities, to ensure equitable and sustainable use of the facilities. It is not clear how such rights could be efficiently secured without local representation.

Management of forests in 'African Areas' by the colonial government was ambivalent, as such management applied only to forests which were gazetted as Reserve Forests. No due regard was paid to any other forests, until later in the Policy section dealing with private forests and other forests outside state control, as seen below (op. cit.: Section 8):

> "It is the Government's policy to encourage and assist in the management of existing private forests and the establishment of new ones...and to influence their proper management and usage and to impose measures of control should this be necessary in the public interest to prevent deterioration".

This was a veiled attempt to alienate private and communal forests which had been managed by pre-colonial societies under their own definitions of what constituted forests. The corollary was that the introduced new form of forest management was 'superior' to the traditional African way (cf. Mackenzie, 1995b; Drinkwater, 1989).

Research and education were effective instruments used to advance the colonial government's ideals of the supremacy of new over traditional forms of forestry. Science, education and research became their prime tools in effecting this change (op. cit.: Section 10): "...to foster by education and propaganda a greater understanding among the people of Kenya of the value of the forests to them and their descendants".

The Forest Policy postulated the necessity to make provision for high level scientific research and training of forest staff. The government did this by establishing and maintaining a training school. In a nutshell, policy became a key instrument to oil and turn the wheels of change by inculcating the 'new' doctrine of forestry.

The scheme by the colonialists to acquire land from the forest estate followed, when illicit felling occurred, contrary to the declared Forest Policy. The policy statement was thus reduced to a hollow bureaucratic rhetoric. Despite the low population densities of the time, loss of forest was evident, as illustrated by a letter (referring to the formative draft stages of the Forest Policy) by the colonial Provincial Commissioner for Nyanza, Mr C.H. Williams, to the Secretary for Forest Development, Game and Fisheries, dated 24th October 1955: "...I find it difficult to reconcile the Statement of Policy on page 4 with the recent excision of 12,000 acres at Timbilil. Perhaps you can explain"[1].

The involvement of industry, as the main consumer of forest produce, with the Forest Department was a move in the right direction. Secondly, the imperative of sufficient and stable financial allocation for long-term forestry operations was equally commendable, as the colonial government proposed to constitute a Forest Reserve Fund. Without funds for forestry operations, all other relevant initiatives are in vain. However, implementation of the Fund was hindered by the effects of a State of Emergency in Kenya in the early 1950s.

[1] PC/NZA/3/11/1, KNA, Nairobi.

5.2.3.1 Implications of the 1957 Forest Policy:

In the 1957 Forest Policy, it was unjust for the colonial government to propose demands of payments by local natives to finance the cost of managing forests even in areas with forests which, due to regional climatic conditions, brought no cash returns. Oblivious to regional variations and diversity, the colonial government found it convenient to have uniform (forest) policy regarding payments in all Reserves. As some tribes had more profitable forests in their areas than did others, this arrangement was unrealistic and impractical. The sad implication was that some tribes paid for maintenance of forests they never saw, let alone enjoyed.

The 'control and protect' strategy of colonial management was overly repressive to the Africans (the situation has changed slightly today). To implement this object of policy, this study suggests, demanded an organised policing system. It was therefore necessary for the colonial government to put in place mechanisms to protect the forest from 'outsiders'. This government practice was extended to the management of forests in the African Areas and the practice obviously presented forest as something not for the community, although within the community. Being denied their due privilege of enjoying basic services offered by the forest, local people obviously developed a resistance to and negative view of the whole idea of forestry. They came to view forest as *that government property* (oral testimonies, 1997). Forests and forest officers therefore acquired a stigmatised label, and both were branded enemies of local people.

All colonial effort towards afforestation and management was directed to 'organised' institutional structures such as African Local Authorities which were largely run by carefully selected collaborators, effectively given the 'mandate' to manage forests in African Areas according to strict Eurocentric 'new' rules of management. Despite the fact that forests had specific votes of financial allocation by the Central Government, no funds were made available for management of African forests, perhaps because 'unorganised' African forestry projects guaranteed no economic gains to the colonial exchequer. The only profitable route was to deny Africans financial resources for improving and increasing production of their forests, and consequently to usurp forest management responsibilities from Africans on the pretext of poor management (see Section 5.2.3).

This study argues that there was a subtle, veiled scheme to acquire and control African forests. The question of derelict forest did not arise since Africans had their own style of management practice, particularly under communally-organised management systems. To further press forward their expansionist, acquisitive intentions towards African forests, the colonialists stated in the Policy that: "If such lands cannot be acquired, it may be necessary to strengthen legislation to control the form of usage" (Colony and Protectorate of Kenya, 1957: Section 8).

The purported benefits to Africans in the form of grazing rights, etc., were in themselves vague, since management of the forests was not inclusive. It would have been logical to include Africans, as purported beneficiaries, in the management practice but I argue that normative institutional frameworks for corporate management were paramount. The general curtailment of grazing rights in the forests by the colonial policy was contradictory, as such rights were still held by some white settlers (ibid.). This could have cast doubts in the government's resolve to implement that policy objective. Overall, the management of that policy would have been jeopardised in the event of some of those rights being allowed to continue.

5.2.4 Commercial Exploitation of Forests:

As already stated, it was the colonial government's policy that all forest produce be paid for, in order to spread the costs incurred in the management of these forests. The spirit of this policy was never strictly observed, least of all in the industrial exploitation of forests for commercial purposes. Discrimination occurred in issuing licences for that activity. In particular, aspiring African entrepreneurs were treated with doubts as to their skills and technical capability in, for example, undertaking the running and efficient management of a sawmill enterprise. Many of the colonialists believed, with the Conservator of Forests, that:

> "...the time has not yet come to allocate licences to inexperienced Africans.... When the Department was persuaded to grant...a sawmilling licence to an African outfit, ...the whole concern was run with unexampled inefficiency and ended in the most disappointing failure....It seems to me that the North Nyanza

Local Native Council's anxiety to have Africans running sawmill concessions is one more example of the too prevalent idea that an African can be taught to run before he is able to walk"[1]

That letter clearly revealed the disdain with which the colonial authorities viewed enterprising Africans. Matters were complicated by the licensing issue, which became highly contentious. The colonial government introduced a chain of stringent rules, including interview by the Forest Utilization Officer prior to issuing of licences for cutting rights for sawmill concessions. These conditions, arguably, acted as a security safeguard, but in practice, dampened the hopes of aspiring Africans of obtaining a licence because their ultimate chances of success proved to be almost zero.

According to the Conservator of Forests, the job of running and managing a sawmill "require[d] great skill and technical knowledge of a high order"[2]. He further stated that,

> "youths in Britain [with] the usual ten to twelve years of compulsory elementary education wishing to enter the trade, have a period of five years or more training to undergo before they are considered fit for even a minor position in a mill" (ibid.).

These notional requirements excluded most Africans.

Sawmill operations within government forests were equally exclusive. The colonial authorities were not keen to allow Africans to operate sawmills in designated government forests:

> "In any case the Conservator would wish to give most sympathetic consideration to applications from natives for the establishment of sawmills in their own Native Forest Reserves"[3]

The letter implies that the colonial government was reluctant to concede access to state forests to Africans. Restricting their activities to the Native Reserve Forests was contradictory as many Native Reserves had no forests, let alone timber of significant marketable value. But, even in the Native Reserve Forests, there were restrictions in place. Certain trees were treated as 'protected' and could still not be felled. In fact, all 'plantation trees' were protected, as in North Kavirondo:

> "The list of protected trees is a long one but all the species mentioned *as marketable as timber* and should therefore be protected (sic). There are a sufficient number of *species of secondary importance* which have been excluded from the list, to supply

[1] Dated 9.12.1949 - PC/NZA/10/18, 1942-1951, KNA, Nairobi.
[2] Dated 9.12.1949 - PC/NZA/2/10/18, 1942-1951, KNA, Nairobi.
[3] Conservator of Forests, 9.12.1949 - PC/NZA/2/10/18, 1942-1951, KNA, Nairobi.

all reasonable demands for building poles. You will note that 'all plantation trees' has been included in the list of protected trees"[1] (my italics).

In practice, the only 'privileges' left for Africans were those which gave them least access to *marketable timber.* Such privileges included limited access to fallen dead wood for fuelwood, and temporary access to 'free' building poles, which later became chargeable in order to generate revenue for the Local Native Council.

5.3 Colonial Forestry Activities in Western Kenya and People's Voices:

Western Kenya (see Figure 5.1) had a mixed history of tree growing during the colonial era. For example, Nyanza Province (in which Kisumu District falls) has no history of major forest reserves, for several reasons. Firstly, and of special significance, was the region's diverse ecological character, marked by varied rainfall distribution patterns and magnitude; secondly, macro-economic and political issues; and finally, because Nyanza was not settled by the Europeans (Kojwang, 1993). Tree growing in the region also varies from place to place. For example, Kisumu District, in spite of its reasonable rainfall and good soil, had no significant or major forestry activities during the colonial era (or today), apart from communal and individual farmers' trees[2]. The District was, and is, considered one of the treeless districts in Kenya: "...this is not a heavily bushed district; in many parts trees are quite sparse..." (1933)[3]. Yet the District has the potential for forestry, particularly in hilly areas like Maseno, Kajulu, and the Nyakach plateau (ibid.: 47).

5.3.1 Tree Growing Activities, 1920s - 1939[4]:

Tree growing programmes in western Kenya by the colonial government began and continued on a note of compulsion. For instance, after the approval of Resolution No. 4/27 of 3rd August 1927, compulsory planting of trees was effected in Kisumu District. The Resolution stated:

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[1] Mr. G. Honore, the Divisional Forest Officer, Eldoret, 17.4.1950 - PC/NZA/2/10/18, 1942-1951, KNA, Nairobi.

[2] There were no significant changes even in the early post-colonial period, particularly when assessed against the objectives of the Forest Policy of 1968.

[3] Conservator of Forests, 28.9.1933 - PC/NZA/2/10/6, 1931-51, KNA, Nairobi.

[4] Names of plants used in this thesis are based on two sources: Kokwaro (1972) and ICRAF (1992).

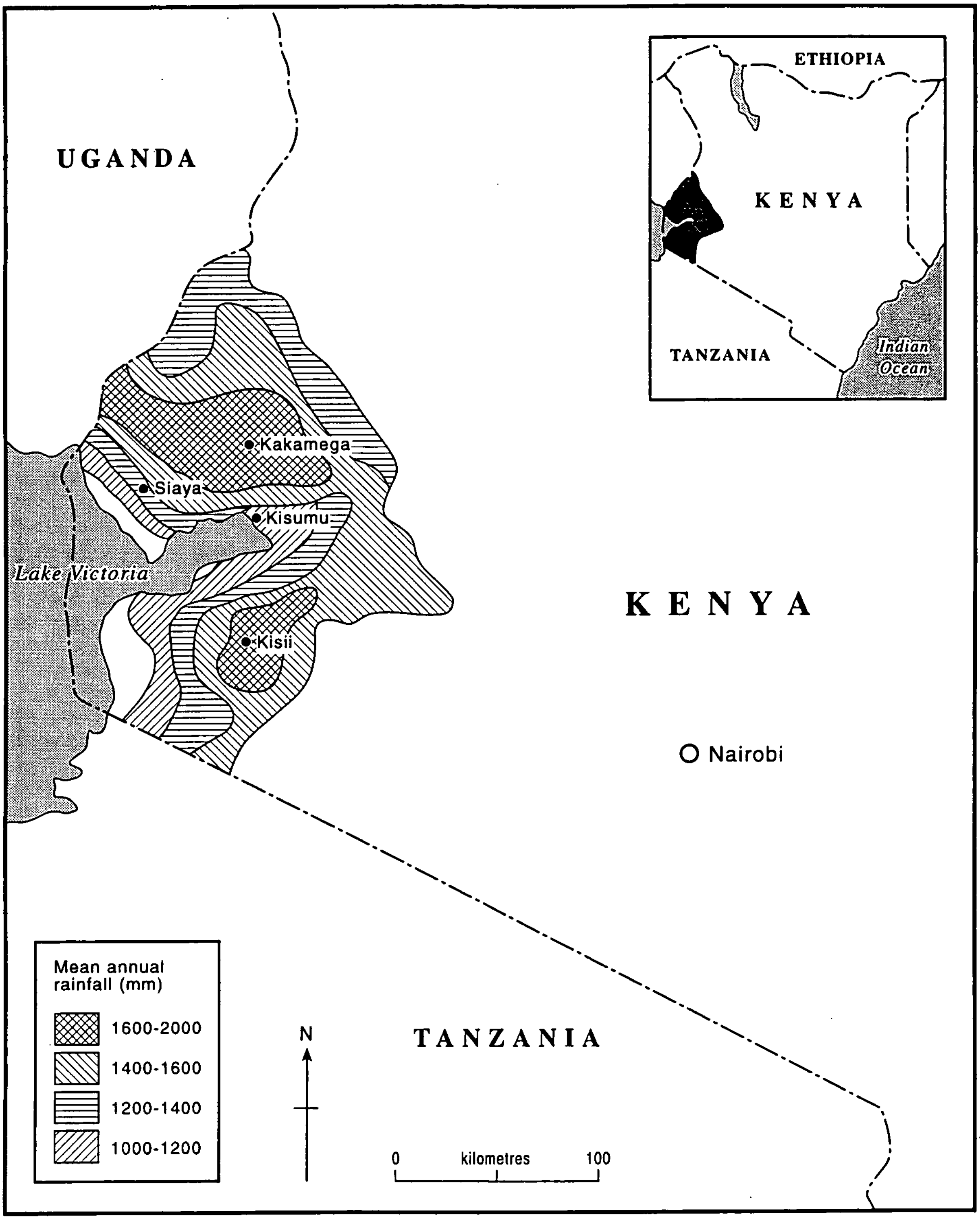

Figure 5.1: Western Kenya

> "That the head of every village in any Location within the District of the Central Kavirondo[1] shall on or before the 31st day of December in each year plant ten trees of such kind or kinds in such place and in such manner as the official Headman[2] under the instructions of the District Commissioner, Central Kavirondo District shall direct and shall keep such trees in a proper state of cultivation"[3].

Under this Resolution, which mainly applied in the African Native Reserves, local Chiefs were instructed to fine those who violated this rule. The Resolution therefore set the tone for the powers of the colonial government over Africans. Tree planting was to be on Locational Communal Blocks as well as individual farms. However, in other parts of western Kenya such as North Kavirondo[4], local people already kept and managed some forests and trees prior to this time. For example, the extensive Kakamega Forest covered 50,000 acres, and there were many indigenous free-standing farm trees in the Native Reserves: "Siala (*Markhamia platycalyx*) is a yellow flowering tree, very like Tekoma, which is found along the roads and around villages in Kavirondo"[5]. "...there are many small native plantations scattered through the Reserve but they are being felled...they will not necessarily disappear as most of them will shoot up again from the stumps"[6].

In spite of the aggressive campaign by the colonial government, no meaningful tree planting or plantations had begun in Central and North Kavirondo by 1933[7]. The tree planting programme in the Native Reserves in the whole of Nyanza Province faced three major problems[8]:

- drought (with white ants as a minor problem)
- uncontrolled grazing
- lack of co-operation by the "natives"

Lack of co-operation became a major issue across the province. There were an obvious apathy and reluctance on the part of Africans towards tree planting (cf. Scherr, 1995). Through archival records and oral histories, my study identified three main reasons for

[1] This was the colonial name of the district which included the current Kisumu and Siaya districts in Nyanza Province of Kenya today.
[2] Headmen were direct appointees of local Chiefs, but later sanctioned by the local government authority.
[3] PC/NZA/2/10/4, 1931-1944, KNA, Nairobi.
[4] Included the current districts of Kakamega, Vihiga, in Western Province of Kenya.
[5] Agricultural Officer, Nyanza, 20.12.1932 - PC/NZA/2/10/12, 1931-1951, KNA, Nairobi.
[6] Conservator of Forests, 28.2.1933 - PC/NZA/2/10/3, 1931-40, KNA, Nairobi.
[7] The two districts of Central and North Kavirondo, together with South Kavirondo and Kisii districts comprised the then Nyanza Province which at Independence only included Kisii, Kisumu and Siaya districts.
[8] Assistant Conservator of Forests, 14.5.1940 - PC/NZA/2/10/12, 1931-51, KNA, Nairobi.

this. First, was the militant, forced nature of the operation; secondly, questions of ownership (of land and trees) on communal tree blocks were vague and unresolved; and finally, there were restrictions on the free use of tree products. These issues were widespread throughout Nyanza Province, and caused great concern in the minds of local people. For example, during early 1931 in Kisii and South Kavirondo[1], which were considered to be two of the most densely populated and treeless districts in the Colony, Africans refused to set aside any land for tree planting: the scheme which was started there made no progress[2]. Here, the issue was largely one of ownership and uncertainty over the fate of their land after it was put under trees[3]. The same happened in Maragoli in North Kavirondo[4]. In all these cases the unresolved issue was whether the trees, and the land on which they stood, belonged to the previous local 'owners' of the land, the Local Native Council (L.N.C., a quasi-government body) or the Europeans. This concern applied particularly to areas which were treated as Protection Forests[5]

By 1933, there were twenty-seven government tree nurseries in South Kavirondo District with *Eucalyptus* spp. being the main tree[6]. However, a certain amount of *Cassia florida* and *Grevillea robusta* were also grown in the Location nurseries for distribution to the people. *Eucalyptus* spp. were killed readily by white ants, while *Grevillea robusta* was resistant, and *Cassia florida* and *Markhamia platycalyx* were immune to the pests which were quite a menace in the area by then:

> "Conditions for tree planting in Central Kavirondo are undoubtedly difficult largely owing to white ants and I do not think any extensive planting should be attempted until an experimental plantation has been established"[7]

Despite the Local Native Councils in Nyanza Province providing the original capital expenditure in terms of tree seedlings, there were, nevertheless, doubts by the colonial authorities over the seriousness of the Luo tribe in tree planting:

> "A lot has been done and thousands of seedlings have been issued but there is some

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[1] Later known as South Nyanza at Independence.

[2] Conservator of Forests, 15.1.1931 - PC/NZA/2/10/5, 1931-51, KNA, Nairobi.

[3] This was later the case in the neighbouring Kericho District when in 1947, the Kipsigis, like all tribes vehemently opposed the setting aside of areas for forests (save in the Chepalungu) - 15.4.1947, PC/NZA/2/10/11, 1952-56, KNA, Nairobi.

[4] Dated 13.11.1954 - PC/NZA/3/11/1, 1952-56, KNA, Nairobi.

[5] These were forests planted on hilltops and slopes too steep for cultivation as a means of combating soil erosion, etc., e.g., the hill north of Kisumu town; and also included those trees planted on strips of land for windbreaks, e.g., on the Kano Plains in Nyando Division, 24.3.1950 - PC/NZA/2/10/5, 1931-51, KNA, Nairobi.

[6] District Commissioner, Kisii, 16.10.1934 - PC/NZA/2/10/5, 1931-51, KNA, Nairobi.

[7] Chief Conservator of Forests, 28.2.1933 - PC/NZA/2/10/3, 1931-40, KNA, Nairobi

doubt if the Luo (especially in South Kavirondo) take sufficient interest in the business. I know Dawson is doubtful if the Luo are really doing anything"[1].

Although the L.N.C. passed rules to the effect that each family should plant a certain number of trees each year, these were not strictly observed even in areas where such Resolution was in force[2]. The colonial government, therefore, through its local agents, subsequently exercised great force to ensure that the Resolution was followed to the letter. Various arms of the government and other law enforcement authorities were mobilised to achieve this goal. The action was intended, among other things, to complement the efforts of local Chiefs and Headmen who were the most involved in the exercise. The Provincial Commissioner for Nyanza, therefore, issued the following instructions to the District Commissioners for Central, North and South Kavirondo districts:

> "As large a number of Tribal Police and Agricultural instructors as can be spared to supervise the digging of *shambas* for trees in selected areas by heads of villages is most necessary and they should remain, if possible, to see the actual seedlings planted"[3].

Foreign Christian Missions also became an extended wing of this colonial tree planting campaign. Teachers in Mission Schools and Centres were used to establish tree nurseries, alongside their Christian gospel vocation. They more or less took on the gospel of the 'new' forestry doctrine: "...the Church of God Mission...have 8,000 tree seedlings ready for issue in the Spring, and the Church Missionary Society (C.M.S.) usually have some seedlings".[4] This information was corroborated during one focus group in Kadhier clan in January where Jenipher (born in 1923) had this to say:

> "When we were still young there was one white woman who used to tell us that we should tell our parents to plant trees...I told her that one day I will take her to my father so that she could tell him to plant trees, and she just laughed. The woman was a Christian who used to preach around villages and also telling people to plant many trees".

The colonial forestry and tree planting programme was, indeed, an expensive undertaking. Substantial resources were expended on its realisation; and the exercise was deemed necessary due to its obvious prospects for the settler economy. Other reasons, such as gains for the Africans, were secondary as long as British goals were ultimately realised. Thus, the apparent obsession with legality was simply a hollow

[1] Report by a senior colonial government officer, 13.9.1934 - PC/NZA/2/10/3, 1931-1940, KNA, Nairobi.
[2] Dated 31.10.1934 - PC/NZA/2/10/3, 1931-40, KNA, Nairobi.
[3] Dated 31.10.1934 - PC/NZA/2/10/3, 1931-1940, KNA, Nairobi.
[4] Agricultural Officer, Nyanza, 16.2.1932 - PC/NZA/2/10/12, 1931-1951, KNA, Nairobi.

ideological justification for this venture. Okoth-Ogendo (1991: 18) states this quite succinctly:

> "Law did not simply become the primary instrument in the definition and execution of public policy: its content reflected little more than a synthesis of the political objectives of the settlers and local administrators on the one hand and British and capital interests on the other".

He further states that, "the thrust of this instrumentalism was essentially directed at the African segment of the protectorate society, if only because the success of the European economy depended almost exclusively on systematic raids into the African sector for labour and revenue" (ibid.: 18; see also Van Zwanenberg, 1972 and 1975).

5.3.2 Post-planting Tree Management and Protection:

Alongside the problem of lethargy from the bulk of Luos in tree planting, there was, as today, the associated problem of lack of maintenance of planted trees. The colonial government faced serious difficulties, especially in Luo country, of getting the people to accept the importance of looking after the young trees, and the lack of weeding round young trees resulted in many tree deaths. As today, damage to trees of all ages caused by cattle and goats was a common problem throughout Nyando Division[1] (cf. Scherr, 1995; Tengnäs, 1994). Many prosecutions helped to assist in reducing this kind of damage[2]. The first requirement was that every community tree block and trees belonging to individual farmers be fenced to give complete protection from cattle and goats. Whenever possible, sisal fence was planted closely round the whole perimeter and built up with thorns or other locally available material until they grew into a proper fence.

Unpaid, communal, forced labour led to more neglect and lack of enthusiasm by Africans and, in many parts of Africa, mounting pockets of resistance aimed at sabotaging the whole operation (cf. Adams, 1988; Mackenzie, 1995; Mortimore *et al.*, 1990; Pred and Watts, 1992; Watts, 1983). Defiance of colonial rules and regulations in Kenya was exacerbated by another policy protecting forests/trees in the Native

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[1] Dated 3.3.1933 - PC/NZA/2/10/3, 1931-40, KNA, Nairobi.
[2] Letter by Forester, Maseno to Divisional Officer, Nyando, 12.10.1956 - DC/KSM/1/13/6, 1952-58, KNA, Nairobi.

Reserves, which came into force in the mid-1930s[1]. The policy gave full protection to trees in forest areas. The latter were protected under the provision of Crown Land[2], on which no person was allowed to fell certain kinds of trees which were deemed to be *more important trees* for the Colony. The Governor was empowered to make rules for the protection of trees and regulate fellings, etc. on such lands.

For the removal of timber or other forest produce from any part of the native lands not covered under Section 3 of the Forest Ordinance, it was only the Chief Native Commissioner or officers appointed by him (e.g., village Headmen) who were authorised to issue licences[3]. The powers of protection given to Headmen were further extended to include soil erosion activities. According to the Central Kavirondo Local Native Council Resolution on Soil Erosion Control of November 1939[4], the Headman could forbid any person in an area suffering from soil erosion to:

- cultivate any such area
- cut down any tree, bush or other vegetation growing thereon, or
- pasture cattle, sheep or goats thereon.

The restrictions also included cultivating land or removing grass cover within 5 yards of the bank of any river or within 1 yard of the bank of any stream without the permission of the Headman. For the purpose of preventing soil erosion, the occupier of any sloping land, used or intended to be used for cultivation was, if directed by the Headman, to carry out such measures with regard to terracing, stone-walling, strip-cropping, contour ploughing, etc. (cf. Hill, 1991; Korir-Koech, 1991; Mackenzie, 1995a, 1995b).

Control of soil erosion was declared to be communal service for able-bodied men, enforced, of course, by the Headman. Controls included[5]:

1. Afforestation or planting with grass of denuded areas;

[1] This was executed under Chapter 149 of Forest Ordinance, Section 3 - PC/NZA/2/10/4, 1931-1944, KNA, Nairobi.
[2] Crown Land in this case was defined to include "lands dedicated to or reserved for the use of any native tribe or community" (see also Okoth-Ogendo, 1991).
[3] This rule was executed under the Native Lands Trust Authority Ordinance No. II of 1937, Section 8 (g) which empowered Headmen (or local administrative agents at village level) to issue orders from time to time regulating the cutting of timber and prohibiting "wasteful destruction of trees". This rule was akin to the infamous Chiefs' Authority Act, Cap. 128 of 1937. The orders obtaining therefrom applied only within the local authority's area of jurisdiction.
[4] November 1939 - PC/NZA/2/10/4, 1931-44, KNA, Nairobi.
[5] November 1939 - PC/NZA/2/10/4, 1931-44, KNA, Nairobi.

2. The construction and maintenance of dams and water supplies after the regulation of the use thereof;
3. The protection and prevention of gullies and the construction and maintenance of terraces, contour banks and other controlled works.

5.3.3 Why Protection Measures?

One of the reasons given by the colonial administration for the promotion and protection of forests/trees was to ensure increased supply of fuel and building materials and possibly extra income for Africans, which the colonialists stressed would be an enormous boon to the native population. This was a classic case of "protecting an ignorant people against themselves" (Cline-Cole, 1996: 126) and reflects a comprehensive ambition to control forest resources, if not land (see also Grove, 1994).

The pursuit of these visionary goals put unnecessary burdens on Africans who, apart from being productively involved in their realisation - and for free - later had to pay for using forest produce and services. These charges were levied by the colonial government in order to cover the expenses incurred. The charges were periodically increased, and included grazing licence fees for local people who wished to graze their stock on forest meadows (see Section 5.2.3). This rule applied to most forest areas throughout the Colony as indicated by this letter from the Chief Conservator of Forests, Mr H.M. Gardner to the Colonial Secretary:

> "I propose that all forest produce shall be paid for... Obtain[ing] direct benefit from the forest is by sharing in the cash revenue or by seeing that as much revenue as possible is obtained to reduce taxation that may be required to pay for the protection and improvement of the forest"[1].

It is ironic that protection of forests from local people proved such an expensive undertaking.

[1] PC/NZA/2/10/3, 1931-1940, KNA, Nairobi.

5.3.4 The Influence of Mining on Plantation Establishment:

The promotion of plantations in western Kenya in the 1930s was influenced by mining, as wood was required for mineral smelting. For example, in Nyanza Province, many companies were involved in gold mining. The two main gold mining sites in the province were located in Kisii and Kakamega districts. Central Kavirondo District (the present Siaya and Kisumu Districts) had no known mineral resources and lacked the significant amount of timber required for mineral smelting activities. The important role played by mining activities was exemplified by the directives of the Provincial Commissioner for Nyanza to all the DCs in the province:

> "It is essential that an intensive tree planting campaign should be started... in order that the natives may take advantage of the large amount of timber which will be required for mining activities and other industries in your district"[1].

Some initiatives to this end were purely based on prospective mines, as illustrated here:

> "A month or so ago I saw an area that I thought might be suitable for a plantation on a large scale to serve mining in Central Kavirondo. When the possibility has been investigated thoroughly I will let you know....It is of course possible that a mine might be discovered nearer the Uganda Border but as there is no means of determining where, it is not possible to site a plantation and it would [serve] to make individuals tree-minded and to induce them to grow suitable timber..."[2].

In other cases, mining sites took advantage of existing forest resources within the vicinity. For example, the mining activity in Bukura Ridge, North Kavirondo, took advantage of the existing Kakamega Forest which was within close range (ibid.).

Mining was a dual economic boon to the colonial administration. Apart from benefiting from mineral extraction, the government also realised, through the associated plantations, a big boost towards its original goal of ensuring increased timber production. The timber export thus increased the revenue generated for the central government and the semi-autonomous Local Native Councils. Mining and plantations were, therefore, mutually supportive and complementary.

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[1] Dated 31.10.1934 - PC/NZA/2/10/3, 1931-40, KNA, Nairobi.

[2] District Commissioner, North Kavirondo, 9.11.1934 - PC/NZA/2/10/3, 1931-40, KNA, Nairobi.

5.4 Tree Growing Activities, 1940 - 1960:

The increased investment by the colonial government in tree nurseries in Nyanza Province achieved little success in regard to the art of tree-growing by local people, with the exception that it introduced a new style of growing trees, as seen later. For instance, by the early 1940s there were sixty nurseries in South Kavirondo alone, which produced many thousands of *Eucalyptus* spp. seedlings[1], preferred for fast growth, though vulnerable to termites or white ants. Overall, the response by local people to the planting programme was poor and, in May 1940, about 6 acres of poor *Eucalyptus saligna* were the only plantations on the Kano Plains (Nyando Division, Kisumu District)[2]. In the whole of the Kisumu area, Kajulu Hills had the biggest acreage planted with trees - about 100 acres of *Cassia florida* and *Eucalyptus citriodora* (ibid.).

No tree planting had yet been undertaken in places like Nyakach in the southern part of Nyando Division. Instead, the ground was reported to consist mainly of a series of rather bare ridges and valleys, with few trees and a fair amount of scrub and bush, mostly *Acacia* and *Grewia* spp. (ibid.). However, by 1943, there was a marked improvement, with some 500 - 600 acres of plantations established since 1939 in communal blocks (but divided into individual plots) (ibid.). In the individual plots, but under supervision, the owner undertook the necessary land preparation, collecting and sowing of seeds, weeding and tending of the trees for the first year, and harvesting. The choice of trees was mainly confined to the white-ant-proof species such as *Cassia florida, Eucalyptus citriodora* and a local tree called 'Manera' (*Terminalia brownii*). The entire recompense for all the work done by each man was the free collection of fuelwood. Surprisingly, this phase of tree planting in Central Kavirondo was moderately successful. This was attributed to the influence and personal commitment of the Agricultural Officer in the District, Mr. G. Gamble, along with the District Commissioner for Central Kavirondo and the Local Forester[3].

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[1] PC/NZA/2/10/6, 1931-51.
[2] Assistant Conservator of Forests, 14.5.1940 - PC/NZA/2/10/12, 1931-51, KNA, Nairobi.
[3] E.W. Carroll, Temperate Forester, Kakamega, 27.4.1943 - PC/NZA/2/10/12, 1931-51, KNA, Nairobi.

Mr. Gamble was, apparently, particularly instrumental because he took a very persuasive approach while working closely with local sub-Chiefs and the agricultural instructors who directed the field operations (ibid.). His scheme targeted mainly land unsuitable for food crops, such as wasteland. He also enforced strict post-planting management with tree tending and protection, and assigned a special officer stationed in Kisumu to ensure constant supervision of the entire operation. Mr. Gamble's successful role was corroborated during one oral history in Kadhier by Mzee Dan (born in 1918) on 12.8.1996, who stated:

> "The Agricultural Officer, *Bwana* Gamble, with his team of instructors came into the villages and visited each and every sub-Chief who first took them round to every locality in the villages where places were set aside for planting trees on communal blocks. After that, they entered homesteads, where they required every home to have as many trees as possible".

According to Mzee Dan, each local person who planted any trees had to fence them all to ensure their protection. Despite all these efforts, Mzee Dan was critical because one was required to seek permission from a local sub-Chief before being allowed to cut any mature tree for one's own use, and the sub-Chief was even to specify which trees to fell.

Many seedlings for planting were provided by the colonial government from local government-owned tree nurseries, and normally collected from centralised common points. Local people also had their own indigenous practices for raising tree seedlings. On the one hand, they ploughed sites and sprinkled seeds of various types of trees, which they later transplanted to other land already prepared; while on the other hand, they simply transplanted wildings of species of their own choice, as explained by Mzee Dan during the interview on 12.8.1996.

Mzee Dan in another oral testimony (14.8.96) traced the beginning of tree growing in Nyando Division back to 1936, emphasising that much of it was through the initiative of the colonial government. The colonial administration brought a whole new practice, according to Dan, of tree growing where they chose the tree species to be planted, and how and where to plant them. *Eucalyptus* spp. was their most preferred species, and the trees were planted on communal tree blocks (under a group management system) in specific regular patterns. The practice was a significant departure from local people's experiences with mainly indigenous trees. According to Mzee Dan, the group management plan limited the opportunities for individual local people to use the trees as they wanted. Although the procedure of obtaining permission from the local sub-Chief was so bureaucratic, Dan felt it was a good control mechanism to limit misuse of those trees by local people.

Nonetheless, neither these nor other measures of tree protection could prevent unrestricted, wandering stock from damaging the trees. This problem resulted in the Assistant Conservator of Forests suggesting that a section of each tree belt be put under the charge of a village Headman, or else paid guards be assigned to, and made responsible for these sections, and that owners of trespassing stock be fined[1]. There were several cases of utter neglect of tree blocks, involving a range of local people including some Headmen (*Murukas*). Arsonists were reported to have burnt one tree farm in Chiga, in West Kano Location in Nyando Division[2]. This prompted the DC, Central Nyanza[3] to issue a stern warning.

The Divisional Tree Overseer (DTO)[4] in one monthly report cited other cases of defiance by five different Headmen who failed to improve their tree farms[5]. These had earlier provoked a reaction from the DC:

> "I have seen the Divisional Tree Overseer's report that *Muruka* Andrea Okal has not done anything in the areas of his sub-Headmen. I want to know the reason why...I need a report from you immediately"[6].

The date for the introduction of trees in Nyando Division was corroborated by Mzee Migwa (aged 74 years) in Kadhier (13.9.96):

> "Tree planting started much later around 1936/37 by *Bwana* Gamble, around Kisumu Town, at a place known as Wang'poyi, where there was a prison. It was the prisoners who were first deployed in the tree planting. After that is when *Bwana* Gamble started planting trees at Kachok, also near Kisumu Town".

Mzee Migwa stated that, when 'modern' techniques of tree planting was later introduced in their local area, local people witnessed for the first time trees being planted in regular patterns, by using tape measures to lay out planting holes. The exercise was carried out by agricultural officers from the colonial government. Both

[1] PC/NZA/2/10/3, KNA, Nairobi.
[2] 13.8.1953 - DC/KSM/1/13/6, KNA, Nairobi.
[3] This was the new name for Central Kavirondo which comprised the present Siaya and Kisumu Districts.
[4] The DTO was appointed by the District Commissioner from a group of nominees by local Chiefs, to oversee all tree farms in the division. A Mr Nicolaus Ogosa was the DTO for Nyando Division by 1953.
[5] Dated 4.8.1953 - DC/KSM/1/13/6, 1952-58, KNA, Nairobi.
[6] District Commissioner, Central Nyanza, 15.2.1954 - DC/KSM/1/13/6, 1952-58, KNA, Nairobi.

Dan and Migwa, however, stressed that no serious tree planting (particularly exotic species) existed in the area (particularly Nyando Division) prior to its introduction by the colonial administration. *Euphorbia tirucalli* and other indigenous (spontaneous) trees such as *Acacia* spp., *Balanites aegyptiaca*, etc., were the commonly known trees in that locality by 1936/37. Such were the trees local people used for building their houses.

In the Muga clan, oral history stated that dense natural bush covered many areas in the 1930s. The exception was the Waradho Hill, mainly populated with trees of such species as *Terminalia brownii*, *Teclea nobilis*, *Rhus natalensis*, *Tamarindus indica*, etc. Lower down the Hill was densely vegetated with such species as *Acacia* spp., *Balanites aegyptiaca*, *Combretum molle*, *Grewia bicolor*, *Euphorbia candelabrum*, etc. in tall grass. Such natural bush was widespread, and there were no planted (exotic) trees around, as Joaness (aged 67 years) in Muga clan stated (13.10.96): "A long time ago, this area used to be covered by dense natural bush, but without a single planted tree, unlike now when we find a few homesteads dotted with trees". Regarding the density of the bush, Joshua (aged 65 years), also from the Muga clan, stated (13.10.96):

> "I was born in 1931; and when I reached the age of herding cattle, we could not even enter the bush when animals strayed in there, because it was very dense and we were afraid. One could not even walk alone on footpaths passing through such areas without being escorted".

This gives the same picture as that describing the '*Kuth Awendo*' which covered much of the Muga clan and beyond within Awasi Location (see Section 8.5.1.3). Although the tree-planting activity started by the colonial administration in Nyando Division in the mid-1930s also covered this locality, it appears the exercise was not successful or widespread.

5.4.1 <u>Tree Species, Functions and Patterns of Use</u>:

Trees served basic functions in the local rural economy such as providing building poles and fuel, as wind-breaks, and for soil conservation. Of the commonly preferred species, *Cassia* spp. was occasionally used for temporary buildings, and was fairly termite-resistant. Nevertheless, in the market it suffered in comparison with *Eucalyptus saligna* in its inferior straightness, shorter lengths, and small size generally. Among the Eucalyptus species, *citriodora* and *maculata* were moderately drought-resistant, fast and straight growing, although their poles were not as durable as *E. paniculata* and *E. crebra.* The two were both slower than *E. citriodora* or *E. maculata. Eucalyptus crebra* is the most drought-resistant, but may not grow so straight as *Eucalyptus paniculata.* Meanwhile, *Grevillea robusta* was not as strong a building material as *Eucalyptus saligna*, but had the advantage of being lighter and not smelling. Its fuel was also found not satisfactory for domestic purposes, though reported to burn fairly well in furnaces[1].

In general, the following species were planted in Nyanza Province around the 1940s: *Euphorbia tirucalli*, *Eucalyptus citriodora*, *Cassia florida*, *Ficus* spp., *Grevillea robusta*, *Markhamia platycalyx*, *Albizia* spp., *Cordia holstii*, *Croton megalocarpus*, *Kigelia aethiopica*, *Vitex* spp., *Baulinia* spp., *Erythrina tomentosa*, *Dodoma viscosa*, *Funtumia* spp., *Pygeum* spp., *Cordia* spp., *Antiaris* spp., etc. (ibid.). Fruit trees such as Oranges, Mangoes and Bananas were also planted.

Of the species chosen for wind-breaks, *Euphorbia tirucalli* was valued most. It had the multiple function of forming excellent hedges, owing to its extra height, and could, if felled, provide fuel and building poles, as secondary uses (cf. Scherr, 1995). In Luo rural practice, *Euphorbia tirucalli* was normally planted round homesteads in a close configuration or interstitial pattern. The practice is still common today. Trees such as *Ficus* spp. and *Cassia siamea* provided good shade and shelter belts.

The chief user of fuelwood in the region then was the railway, though most of its supply was from Londiani, Kedowa and Elburgon, outside Kisumu District, in the present Rift Valley Province. The majority of users in Kisumu District acquired fuel locally, with supply varying from place to place. Places such as Maragoli and Kakamega in North Kavirondo District had ample and increasing supply, potential supply often being larger than demand. This imminent abundance caused the colonial authorities to stimulate the use of fuelwood in the rural household economy, in competition with fuels such as cow dung and crop residues, by introducing price concessions. This was a deliberate attempt, in the words of the Provincial Commissioner for Nyanza, to ensure that "manure was not being put to a wrong use".[2]

[1] Assistant Conservator of Forests, 14.5.1940 - PC/NZA/2/10/12, 1931-51, KNA, Nairobi.
[2] Dated 19.2.1948 - PC/NZA/2/10/6, 1931-1951, KNA, Nairobi.

It was estimated that the railway paid out close to £200 per month for fuelwood 'imported' from outside Central Kavirondo District[1]. The district became a net importer of fuelwood[2], with shortages all over:

> "The Municipality of Kisumu is concerned about its supplies of wood fuel, as this is required for domestic purposes, the manufacture of bricks, firing of boilers and for a number of industrial enterprises"[3]

5.4.2 <u>The Use of Traditional Fuels</u>:

The use of traditional fuels in the rural economy is generally considered as a vital component in overall energy provision. In the past, these fuels (including wood from indigenous trees) were freely obtainable within reach, and sustainable. People neither bought nor travelled long distances to look for them. The major local fuels in the study area included cow dung and crop residues[4] (see Plates 5.1 and 5.2 - Appendix A. 7). The use of these fuels was so prevalent that it raised complaints from the colonial government, since the bioresources were not left on the land to improve soil fertility as in most high income countries. By the 1940s, it was officially estimated that the annual loss of organic manure in Kisumu and Siaya Districts (formerly Central Kavirondo) arising from the burning of cow dung by rural communities would approach half a million tonnes[5]. The local colonial administration concluded:

> "Should this custom continue as at present, there is nothing more certain that the day will come within the lives of the children, when the land of the Luo people will cease to bear more than half its present human and stock population" (ibid.).

They suggested that fuel plantations be established at strategic locations, even using blocks of arable land, but, the proposal was not feasible in the Native Reserves due to the complex traditional forms of land tenure (see Section 3.4).

The pattern of use of crop residues in the past was systematic. Households started with stalks of maize, which were less durable, before moving to stalks of sorghum which were more durable and could last longer before rotting, even up to the next harvest. Due

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[1] District Commissioner, Central Kavirondo, 6.3.1939 - PC/NZA/2/10/6, 1931-51, KNA, Nairobi.
[2] The situation has hardly changed even now, but instead worsened to the extent that the importation is not only for industrial uses but includes the household sector, as was established from interviews and direct observations (see Chapter 7).
[3] Dated 16.2.1943 - PC/NZA/2/10/12, 1931-1951, KNA, Nairobi.
[4] Crop residues in this case mean stalks of maize, sorghum, and recently, sugar cane.
[5] 15.7.1949 - PC/NZA/3/11/2, 1931-51, KNA, Nairobi.

to the abundance of crop residues at harvest time, women relied on them for fuel. It was generally considered unreasonable for women to request their husbands for trees for fuelwood. After harvests, many bundles of crop residues were stored by women, and used till the following harvest. Some women still do the same today (see Plate 5.1 - Appendix A. 7). Dan, interviewed in Kadhier on 4.8.1996, said that "women did not ask for any other fuel such as wood because they did not need it, since bundles of crop residues were piled away". The use of crop residues has recently been boosted by the availability of dry sugar cane stalks that fail to reach processing plants for one reason or another. Phoebe observed during a focus group in Kadhier on 12.1.1997 that, "Even sugar cane, if it fails to go to the machine and be turned into sugar, then we turn it into fuelwood instead" (see Plate 7.3 - Appendix A. 11).

The widespread claim that cow dung fuel smells on food was denied by many respondents on the grounds that dry cow dung (locally referred to as *ong'ata*) does not produce much smoke, which is believed to cause the smell. Wind also helps to fan the smoke away so that it does not linger around the pot, which must be properly covered, as it must to keep dust particles out while burning crop residues. Several households added that cow dung cooks very gently, especially good for foods like dry fish, dry meat, and a mixture of maize and beans (*nyoyo*), all of which require several hours of cooking. Although the use of cow dung has decreased in recent times, poor households still prefer it to supplement fuelwood while cooking the above foods. Cooking with cow dung is normally done outside the house. Households using the fuel collect and store sufficient quantities during the dry season for other times. Unlike now, they also used to collect wet dung, which was made into cakes and dried in the sun; or simply plastered against the outside wall of traditional granaries and left to dry, only to be peeled off when needed (see Plate 5.2 - Appendix A. 7). This similarly acted as storage.

The ecological argument that the burning of crop residues for fuel deprives the soil of invaluable organic matter was supported in three focus groups and five individual interviews in Kadhier. The consensus was that its use deprives the soil of the most needed nutrients, adding that the removal leaves the soil bare and increases the risk of erosion, the situation being exacerbated by livestock freely roaming the farms after harvest (see Section 7.3).

5.4.3 The Fuelwood Trade: Historical Perspectives:

The high consumption of fuelwood within the urban sector in the early 1940s arose mainly from local industrial and manufacturing enterprises, and domestic uses in Kisumu Municipality. This resulted in fuelwood shortage, thus encouraging a market in wood, particularly within the Municipality, which increasingly pressed on the available tree stock. The Town Clerk, Mr. Thomas Anderson, expressed his concern in a letter to the District Commissioner for Central Kavirondo in 1943:

> "My Committee is also concerned regarding the visible supplies of fuel... plantations are being cut out promiscuously with little regard to the maturity, and considers that the time has come to control this activity"[1].

Due to the profitability of the trade, there arose within the ranks of traders primary and secondary suppliers. The latter purchased fuelwood from primary suppliers in the Reserves and transported it to Kisumu for sale at a slightly higher price. The trade throve well. By 1943, the approximate monthly consumption of fuelwood in Kisumu Municipality was 1,100 tons, of which 600 tons were for domestic use and 500 tons for industrial purposes[2].

The lack of fuelwood in Kisumu, particularly within the Municipality, became so worrying that the idea of fuelwood plantations was mooted in the early 1940s. The primary aim was to ensure that Kisumu had its own adequate and inexpensive fuelwood supply. Systematic planting of trees suitable for fuelwood was proposed on the hillsides to the north of Kisumu, the plantation to be owned by the Local Native Council and managed by the Forest Department. The Provincial Commissioner for Nyanza wrote the following letter to the Conservator of Forests: "...I suggest that the fuel situation in Kisumu and neighbouring Locations merits a survey and a plan of production for some years ahead...."[3]

The fuelwood trade in western Kenya at this time was a fairly complex, yet lucrative undertaking, intricate in its mechanisms of delivery and pricing structure. Different prices were quoted by various suppliers for the same weight of wood, depending on the

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[1] Dated 6.2.1943 - PC/NZA/2/10/12, 1931-1951, KNA, Nairobi.
[2] District Commissioner, Central Kavirondo, 24.12.1943 - PC/NZA/2/10/12, 1931-51, KNA, Nairobi.
[3] 30.11.1942 - PC/NZA/2/10/12, 1931-1951, KNA, Nairobi.

stage of delivery and source of supply[1]. Forming this chain of supply and delivery was a hierarchical level of dealers, from the owner of the tree, to the primary supplier, and finally to the secondary supplier who delivered to the large-scale end-users - mainly in Kisumu Municipality. The price structure purported to allow some profit, and covered various expenses incurred in obtaining and delivering the fuel to its next destination:

Table 5.2: Fuelwood price structure

Source of supply	*Cost (Ksh/ton)*
a) Primary suppliers' price	20
b) Secondary suppliers' (transporters) price delivered at Kisumu:	
i) Cost of fuelwood, as above	20
ii) Transport, expenses and profit	28
Total	48

Source: Modified from PC/NZA/2/10/6, 3.5.1949, KNA, Nairobi.

The local tree farmer was clearly disadvantaged all the way. S/he must have received less than the price quoted by the primary supplier, but often met the labour expenses of felling the trees. The story was different where the source of supply was a government-owned forest. The poor returns to the local tree farmer arose from the lack of a price control policy, as demonstrated by this letter by the District Commissioner for North Nyanza[2] to the Provincial Commissioner, Nyanza:

> "I am informed by the Deputy Price Controller that there is no controlled price for fuelwood in the Reserve. This makes it very difficult for adequate pressure to be brought to bear on suppliers or middlemen"[3]

The exploitation of local farmers by outside fuelwood contractors was not eased by the issue of a legal order demanding procurement of a licence for anyone involved in the cutting of timber for purposes of sale as fuelwood. The licensing condition instead

[1] The Deputy Price Controller, Kisumu, 16.5.1949 - PC/NZA/2/10/6, 1931-51, KNA, Nairobi.
[2] This was the new name for the former North Kavirondo District.
[3] 28.3.1949 - PC/NZA/2/10/6, 1931-1951, KNA, Nairobi.

helped to entrench the monopoly of influential and well-connected fuelwood contractors. As most licensees were the influential Indian traders in the region, they formed a monopoly cartel, doubling as middlemen and directors of large urban-based companies, like Messrs Roadways (Kenya) Ltd, which were key players in the wood trade. Such arrangements acted as elaborate, strategic chains for the maximisation of profit at the expense of wood producers. As already mentioned, the sellers of the timber had to meet the cost of felling and chopping the trees into convenient lengths. The small sizes were demanded by the railway to fit their locomotive fireboxes, as a major end-user of fuelwood. Sugar companies and brick industries in Kisumu also used fuelwood in their local industries.

Table 5.3 shows the price structure of buying and selling fuelwood by Messrs Roadways (Kenya) Ltd within Kisumu region between 1939 and 1948. The selling price margin incorporated transportation charges, which were pegged at an average of Ksh.1.95 per mile per 3 ton load (1 ton not being less than 70 cubic feet of stacked wood) for deliveries beyond 2 miles from the supplier's store.

Table 5.3: Prices of fuelwood for Roadways (Kenya) Ltd.

	Price per ton (Ksh.)		
Year	*Buying*	*Selling*	*Gross profit per ton*
1939	6.00	14.00	8.00 *
1945	13.70	16.00	2.30
1946	14.00	17.00	3.00
1948	14.30	19.00	4.70

*Wood was collected by the buyer from the Reserve (farmer).

Source: Developed from Roadways (Kenya) Ltd, 16.5.1949, PC/NZA/2/10/6, 1931-1951, KNA, Nairobi.

Fuelwood contractors greatly benefited from the trade. In 1939 the profit margin was more than double later levels as the traders by-passed middlemen; in 1948 the profit margin improved because of price adjustments effected in 1947. Generally, prices in Kisumu were high relative to other major municipalities in the colony (see Table 5.4).

Table 5.4: Comparative fuelwood prices in various municipalities

Municipality	*Selling Price (Ksh/ton)**
Eldoret	19.50
Nanyuki and Nyeri	16.30
Nakuru	22.25
Kisumu	31.10

Source: Developed from Deputy Price Controller's Records, Nyanza Province, 16.5.1949, PC/NZA/2/10/6, KNA, Nairobi.

*Average price is based on the type and size of wood, and includes price adjustments for transport costs.

Contractors' profits provoked widespread complaints from farmers and the District Commissioner for North Nyanza suggested that a Price Control Order be issued regarding fuelwood prices, particularly in Native Reserves outside Kisumu Municipality[1]. The colonial administration, however, anticipated difficulties in implementation.

As the fear of excess profits in the fuelwood trade loomed, Messrs Roadways (Kenya) Ltd lobbied vigorously and struck an agreement with the Deputy Price Controller for Nyanza, to the effect that they had contracted an Indian who undertook to supply them with 200 tons of wood a month at an average price of Ksh.14.30 per ton[2]. The poor farmer was still left at the mercy of those traders. Similar situations obtained in other parts of the colony: "Much of the timber is sold to middlemen for sale outside the Reserve and it is time to consider whether the destruction of trees for present profit...should continue"[3].

There was also fuelwood trade by local people, particularly in North Kavirondo, selling in the vicinity of Kakamega township[4]. This group comprised both men and women holding temporary permits to sell. The trade was not common in Nyando Division,

[1] Dated 3.5.1949 - PC/NZA/2/10/6, 1931-51, KNA, Nairobi.
[2] The Deputy Price Controller, Kisumu, 16.5.1949 - PC/NZA/2/10/6, 1931-51, KNA, Nairobi.
[3] Conservator of Forests - PC/NZA/2/10/4, 1931-1944, KNA, Nairobi.
[4] District Commissioner, North Kavirondo, 12.8.1936 - PC/NZA/2/10/6, 1931-51, KNA, Nairobi.

especially in the Kano Plains as a majority used dried cow dung and crop residues for fuel: "It must be remembered that fuel for cooking is a necessity and that people are not going to pay for this or travel long distances to collect it if they can utilise dried cow dung instead"[1]

5.5 Conclusion:

British colonialism in Kenya, which resulted in alienation and expropriation from Africans, introduced the Western style of forestry which emphasised the practice of plantations in preference to traditional African systems. The Western and African systems were based on divergent administrative and management philosophies and goals. The Western, 'new' forestry doctrine upheld a utilitarian, economic view, as opposed to the holistic view of traditional methods. The colonial administration set in place legal structures as primary tools for realising the goals of establishing and exploiting African forests. Unpaid, communal forced labour was ultimately imposed on Africans, and laws were used to deny them access to good land and forests, and to perpetuate the Eurocentric "carefully-contrived hegemony over indigenous forestry" (Cline-Cole, 1996: 126). For example, the policy of Reservation of forests was part of an overall extractive and exclusionary scheme by the British, designed to benefit the British economy at the expense of Africans.

The protection laws never took into account the crucial role local people had initially played in providing free labour on the tree/forestry project. Therefore, the project, at best, failed to serve local farmers' interests and proved unimportant to them. The colonial administration was insensitive to the needs of local people for timber and fuel. Viewed critically, the move by the colonial administration to ensure increased supply of fuel and timber and possible extra income for Africans, was neither a resource safeguard nor a philanthropic gesture towards the Africans, but an interlocking geopolitico-economic manoeuvre whose primary aim, I would suggest, was to provide the much needed feedstock of timber for colonial industrial activities (especially mining) and for export (cf. Scherr, 1990). The same goals dictated the choice of land to be put under plantations. This could explain why, for example, Kisumu District and Nyando Division, in particular, with no mineral resources, had no plantation forests established

[1] Senior Assistant Conservator of Forests, 24.3.1950 - PC/NZA/2/10/15, 1931-51, KNA, Nairobi.

under the initiative of the colonial settlers. Fuelwood was not an immediate issue here as, very exceptionally in this region, the common fuels were crop residues and cow dung[1].

The ordeal of obtaining a licence to remove forest produce or cut trees was itself an exercise mired in much bureaucracy, although licensing to operate sawmilling could have been a possible economic empowerment of local people. This fuelled the fire of defiance by local people and resulted in a decline in morale and a general increase in silent resistance.

The move to institute the policy of 'protected trees' both in government forests and in the Native Reserves was a further indication of the undeclared, British manoeuvre of securing sole rights to the economic exploitation of marketable timber, including that from African Reserves. The instrument of law was used as a simple justification tool to realise the economic and political objectives of the British settlers. This imitated the medieval European feudal idea of *dominium eminens*. I would argue that the procedure and manner in which the whole idea of forestry was conceived and implemented cast doubts in the minds of local people as to its rationale. This largely set the negative tone which culminated in pockets of resistance aimed at sabotaging the whole operation. Blinded by their vested economic interests of obtaining timber for mineral smelting and export, the colonial authorities underestimated the level of support from local Africans required for the success of this venture. Therefore, in spite of substantial investment in time and resources, the forestry project in western Kenya achieved little. Two legacies of the colonial administration are that it played an important role in shaping forest policy, administration and management in post-colonial Kenya, and in continuing local attitudes to government intervention over trees.

[1] PC/NZA/2/10/6, 1931-51, KNA, Nairobi.

CHAPTER 6: POST-INDEPENDENCE POLICIES AND LAW AND THE ENVIRONMENT IN KENYA:

6.1 Introduction:

The development and subsequent management of environmental policies and laws in Independent Kenya was shaped, and largely influenced by the colonial policy framework (e.g., forest policy) analysed in the preceding chapter. Viewed on the background of colonial policies, post-Independence policies and laws provide a clear picture of the continuity and/or legacies of the colonial administration in post-colonial Kenya, which the contemporary policy framework seems to perpetuate. Therefore, the analysis of the sectoral conflicts and duplications, and people-environment interaction at the local level should be viewed in this light. The analysis draws on published policies and laws, archival records, oral histories and interviews, among others.

The scene for global concern for environmental conservation and management was set during the 1972 United Nations Conference on the Human Environment held at Stockholm, Sweden. This culminated in the establishment of the United Nations Environment Program (UNEP) in Nairobi, Kenya, in 1972. Since the early 1980s, there has been a resurgence of this concern, with the World (Brundtland) Commission on Environment and Development (WCED) being formed in 1987. The WCED rekindled the Stockholm spirit with an alternative agenda of 'sustainable development'. The 1990s has seen growing concern over global warming, thought to result from 'enhanced' greenhouse effect - a warming of the Earth's atmosphere and surface. This led to the 'Earth Summit' in Rio de Janeiro in 1992, the United Nations Conference on Environment and Development (UNCED), which adopted '*Agenda 21*', the global plan of action, outlining those policies and strategies on environment and development, intended for action as the global community enters the 21st century. The Rio Declaration involved global initiatives to formulate principles which reflect a universal range of state consensus and practice in environmental law. However, environmental conservation and management in individual countries has a longer history.

In Kenya, before Independence, the colonial government developed and implemented policies governing environmental management and conservation. These policies were enforced through compulsory legislation. For example, indigenous people were forced to plant trees and build terraces as a measure for soil conservation and environmental management (Mackenzie, 1995a, 1991; Korir-Koech, 1991). In Independent Kenya, the earliest policy on the need to conserve the environment was contained in the Sessional Paper No. 10 of 1965 on 'African Socialism and its Application to Planning in Kenya'. This policy framework set the basis for Kenya's national planning in subsequent years. The policy position taken by the Paper was as follows:

> "The heritage of future generations depends on the adoption and implementation of policies designed to conserve national resources and create the physical environment in which progress can be enjoyed" (GOK, 1965: 39).

Concern for the environment gained momentum when the Government, in April 1971, set up an *ad hoc* Working Committee on the Human Environment to review the state of environmental problems and to identify possible solutions. The formation by the Government of the National Environment Secretariat (NES)[1] in 1972 added impetus to the growing official concern over environmental issues. This was followed by the location of the NGO, Environment Liaison Centre International (ELCI), in Nairobi in 1975.

The Kenya government played a vital role in championing the course of environmental issues in the 1980s, by being involved in global environmental networks and/or conferences, etc. (Korir-Koech, 1991; Moi, 1986). This could perhaps have influenced the trend of environmental policy and development in the country. Also, the presence and location in Nairobi of many environment-oriented organisations, such as ICRAF, UNEP, UNDP, ACTS, etc. could be a possible spill-over of such activity, or vice-versa.

The concept of environmental conservation has been consistently emphasised in Kenya's National Development Plans. In the 1974-78 Development Plan, there was a full section on the environment and its conservation. The emphasis has continued in recent National Development Plans. For instance, in the 1994-96 Plan, the Government launched a 'permanent commitment' towards the transition to long-term sustainable development. Provisions of Chapter 9 of this Development Plan entitled 'Environment

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[1] NES was an institution under the Ministry of Environment and Natural Resources, established following the recommendations of the Stockholm Conference on the Human Environment in 1972.
One of its main functions was to co-ordinate state policy on the management and utilisation of the environment.

and Resource Management for Sustainable Development' underscored the importance which the Government attached to the imperatives of environmental resource management. The commitment was concretised in two policy documents, 'Sessional Paper on Sustainable Development', 1993, and the publication of the 'Kenya National Environment Action Plan (NEAP) Report' in June 1994.

The NEAP is a comprehensive policy document on the long-term protection and management of the national environment and natural resources. Its launching was, perhaps, in response to the need for a single legal framework to co-ordinate the conservation and management of environmental resources, which prior to its inception were managed by various sectoral statutes under different ministries. According to Okidi (1996: 199), "It is the process designed to guide the canons of environmental protection for sustainable development". Above all, NEAP was an agenda of the international environmental bureaucracy, pushed mainly by the World Bank. In the National Development Plan, 1997-2001, environment and development issues have been recognised as integral, and the statement made that "the [Government] will co-ordinate the development of strategies aimed at the sustainable utilisation of resources, taking into account the need to manage and conserve them on a sustainable basis as the country moves towards higher levels of industrialisation" (Republic of Kenya, 1997: 210). The integrated instruments, however, still do not exist. This exemplifies clearly the difference between policy and practice, or the gap between the declared intention and actual action.

6.2 <u>Law and Environmental Management</u>:

The process of implementing environmental management requires a combination of both policy and law (cf. Kabeberi-Macharia, 1992). According to Kabeberi-Macharia:

> "Law...can be used as a tool for transforming policy formulations into practice...and that law assumes a three dimensional role in environmental management. First, law provides for the allocation of natural resources and the regulation of their exploitation and management. Secondly, law provides the set standards which have to be met, failing which, sanctions are provided. Lastly, law establishes the mechanism for controlling the impact of human activities on the environment. This is carried out through the establishment of institutions which are empowered to undertake adequate measures to ensure environmental protection" (p. 92).

All these functions of the law towards environmental management and their institutional operationalisation sum up the concept of environmental governance; which is "the use of governance mechanisms (law, policies and institutions) to influence the management of the environment" (Field-Juma *et al*, 1995).

Sound environmental management demands clear policy, law and the infrastructure to facilitate its implementation. The implementing institutions, formal and informal, are crucial to effective environmental governance. It seems to be accepted that the state's most effective device of control is the law. However, the law should find expression through positive institutional response to policy action. Juma (1991: 58) observes in Kenya that: "There is [still] a disjunction between political pronouncements and institutional response. Although the country has numerous laws which deal directly with environmental conservation, their implementation has remained largely poor", as my field research confirmed.

Currently, Kenya has about 77 statutes relating to the management and conservation of the environment. The statutes, which are found in scattered legislation, sessional papers, ministerial statements and development plans, cover diverse aspects. There is, however, no comprehensive statute on the environment. Included in the 77 statutes are such aspects as land law and land use, agriculture, forestry, water, marine, and wildlife, among others. According to the Kenya National Environment Action Plan (NEAP) Report of 1994[1], the above laws have not been adequately enforced by the relevant authorised institutions (GOK, 1994). The non-enforcement is due to a number of reasons, namely:

- poor or weak administrative structure;
- absence of provisions to specify standards of performance;
- inadequate deterrents and inadequate incentives;
- generally low levels of active/participate awareness among a majority of the population;
- preference for short-term gains at the expense of more sustainable alternatives in policy making and planning;

[1] NEAP Report was the product of an interdisciplinary and participatory process carried out by nine task forces whose membership included a broad representation of institutions and sectors including public, private, NGOs and local communities.

- gaps and overlaps in the institutional responsibilities making enforcement difficult; and
- poverty which promotes unsustainable use of resources.

The approach to environmental management has been largely a 'protect and control' mechanism. It is the hallmark of present statutes to emphasise rules and prohibitions, with few or no incentives to motivate positive action from local communities. As UNEP stated, Kenya's legislation on environmental conservation and management was primarily 'rule-oriented' rather than 'management-oriented' (UNEP, 1976: 16). It is still generally argued that the laws have no provisions for public participation in conservation (see, Okidi, 1996: 209; Ogolla, 1995). The legal structure for free public participation in resource management and conservation activities may be a necessary prerequisite but, this study argues, its absence is not the principal barrier to public participation. The negative attitude of the public has more to do with lack of proper incentives, and the relics of colonial legacy in some statutes touching on the environment such as the draconian Chief's Authority Act, Cap 128 of 1937 (last revised in 1988). This Act bestowed excessive powers of control on local administrative chiefs. Although recent pressure groups for constitutional reform led to the repeal of this Act in 1997, it is too early to speculate on resultant changes on the ground.

In sum, the following section analyses relevant, current laws touching on land and its resources such as The Forest Act, Cap 385 of 1942 (last revised in 1992), the Agriculture Act, Cap 318 of 1955 (last revised in 1986). The subsequent discussion seeks to show how these statutes have conflicted with or negated the spirit of good land management and maximisation of resources obtained therefrom.

6.3 <u>Land Tenure and Environmental Resource Use and Management:</u>

Fuelwood issues illustrate many features of environmental management in Kenya today. They can easily be understood in the context of the current conflicts of land-use in Kenya. Land is a vital resource which serves multiple uses depending on specific needs. It is a crucial factor in food production and fundamental to the conservation and management of natural resources (e.g., Von Braun and Kennedy, 1994). Under the provision of the Registered Land Act, Cap 300 of 1963 (last revised in 1989), "the registration of a person as the proprietor of land shall vest in that person the absolute ownership of that land together with all rights and privileges belonging thereto" (see Section 2.5). The thrust of official policy to systematically replace customary or traditional tenure systems with a 'modern' tenure system of private ownership, is more in legal theory than in practice, as this transfer of rights has not produced the intended results in certain parts of the country. For example, in many parts of Nyando Division in Kisumu District, the private property regime has had little or no effect in changing certain customary systems of land use; for instance the grazing of livestock. In some parts of the Division, there is a confusing 'mix' of private rights to land and 'common property regimes', as communal grazing on private land in this area is almost seen as a norm (see Section 7.3). Nevertheless, communal grazing has far-reaching implications for effective and sustainable use of land.

At the national scale, rules governing private property rights must, in my view, be seen in the broad context of national goals such as self-sufficiency in food production, and rational use of land resources. The uses of private land should ideally be compatible with the legitimate social and economic needs of the country. In contemporary Kenya, private rights to land have "encourage[d] accumulation and speculation thereby withdrawing land resources from productive use" (Ogolla with Mugabe, 1996: 103). A large share of arable land, estimated at 35 per cent, is lying fallow and is being held for speculation (Juma, 1991: 66)[1]. Bringing this land under production would ideally provide adequate food for the domestic market and for export, a linkage which Maxwell and Wiebe (1998) argue is rarely empirically demonstrated (see also Bruce and Migot-Adholla, 1994). In recent times, there have been increasing instances of absentee landlords. The status quo is anathema to the general populace, considering recurrent food shortages experienced in Kenya. However, the land tenure/food security nexus remains a tenuous linkage, and this poses the main policy question and area for further research.

[1] The prevailing legal practice of 'willing buyer, willing seller' frustrates interests of agricultural entrepreneurs who might want to buy such land, despite the fact that a majority of the population are poor and cannot afford them.

In its recent agricultural policy, the Kenya government has underscored the paramountcy of food security, and aimed "to accelerate agricultural growth, increase small-holder productivity, and...maintain a strategic maize reserve stock" (GOK, 1996: 24-26). However, this policy position may never be realised in light of the above, with the increasing number of absentee landlords tying up large tracts of agriculturally productive land for speculation. This is because access to food derives from opportunities to produce food directly or to exchange other commodities or services for food (cf. Maxwell and Wiebe, 1998: 7). Because a majority of the people are poor and cannot easily afford to buy, they could instead produce food for themselves given access to land. Access to and utilisation of land are therefore key factors in production. These opportunities, described by Sen (1981) in terms of entitlement, are based in turn on access to resources, production technologies, environmental conditions such as weather, and market conditions such as prices. Access to food via exchange depends on market factors such as wages and food prices; but, access to resources may be uncertain if tenure systems are insecure (Maxwell and Wiebe, 1998). Another related problem that may militate against farmers producing their own food is, in my view, the substantial deregulation in the domestic market for most agricultural commodities and inputs, which is the hallmark of a liberalised economy. This presents enormous difficulty particularly for the small-holder farmer to meet the cost of production and to compete favourably in the market, due to escalating prices of farm inputs and a slump in the price of farm produce resulting from the flooding of the market with cheap imports.

The worsening food security situation demands that the government urgently addresses both land tenure and land-use policy, in order to increase agricultural productivity and food security. Alternatively, existing legislation on land should be reactivated. Lease agreements between land owners and willing users should be encouraged. Such a move would clash least with the legal provision of private property rights. The Registered Land Act is explicit on lease agreements, though consent lies entirely with the private title holder and/or the prospective lessor of the land. If it becomes necessary, the government has several avenues within the legislative machinery to circumvent possible impediments. The government can exercise residual sovereign powers pertaining to property rights, for example '*police power*'[1] (Ogolla with Mugabe, 1996), or invoke

[1] According to Ogolla with Mugabe (1996: 108), *police power* refers to the sovereign power of the state to regulate land use in the public interest.

legislation such as the Land Acquisition Act, Cap 295 of 1968 under the provision concerning 'public benefit' to repossess un(der)utilised land; or the Agriculture Act, Cap 318 under the provision of Sections 184 and 185; the Local Government Act, Cap 265; and The Chief's Authority Act, Cap 128, all of which enforce the 'proper use of land'. Although the implementation of these Acts by the government would be a classic case of *police power*, it may be necessary in such circumstances.

The exercising of power by the government on the basis of statutes cited above should, of course, be under the aegis of the national Constitution. For instance, Section 75 of the Constitution prohibits compulsory acquisition of private property by the state, but still offers relevant qualifications for such action. It could be in the best interests of the state and civil society that such legal instruments be invoked. In addition, present land policy needs to be reviewed in order to take account of cases of un(der)utilised land.

The Agriculture Act, Cap 318, is the principal legislation on agricultural use of land, soil conservation and fertility: "to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry". The legislation gives wide ranging powers to the Minister to make rules towards the general development of agricultural land. Its functions include afforestation, promoting soil conservation and improved fertility, and prohibition of grazing. However, the legislation has remained largely inactive, to the detriment of the environment. "...soil conservation measures [were] largely neglected. No policy or directive has proved sufficiently meaningful, in its end product, to outweigh official apathy and human desperation" (Republic of Kenya, 1986: 5). The situation is the same today.

Despite the legal mandate vested in the Minister by the Agriculture Act for soil conservation and afforestation, another non-statutory body, the Permanent Presidential Commission for Soil Conservation and Afforestation (PPCSCA), was established in 1981. Broadly, the functions of PPCSCA was to co-ordinate soil/water conservation and afforestation programmes (see Moi, 1986). It could generally be assumed that the PPCSCA was to provide complementary efforts alongside other government sectors.

Nonetheless, its establishment was an unnecessary duplication of mandates, when the re-activation or strengthening of the enforcement mechanism of the Agriculture Act would have been more effective. Okidi (1996: 211) writes: "It is simply not clear why the President opted for the Commission which lacks the statutory powers to mobilise the public rather than directing that the provisions under the Agriculture Act be enforced". In the absence of collaborative programmes of action, there is unavoidable duplication of efforts and initiatives. The functions of the Agriculture Act and the PPCSCA on afforestation obviously overlap with those of the Forest Act, Cap 358, (see Section 6.6.1 and 5.2.2). In practice, the massive conversion of forest land to agricultural use leads to the depletion of forests, though also providing the needed woodfuel as a necessary by-product.

Livestock-keeping is one use of land which has arguably contributed to environmental degradation, especially in cases of overgrazing and overstocking[1]. Although the provision of the Crop Production and Livestock Act, Cap 321 of 1928, empowers Local Authorities to make bye-laws prohibiting the grazing of cattle on agricultural land, regulating the number of livestock to be kept and the compulsory reduction of livestock, the bye-laws have not been effective.

6.4 Forest Policies for Independent Kenya:

6.4.1 The First Forest Policy of 1968:

1968 marked the first forest policy for Independent Kenya. It came slightly over a decade after the first and last policy of the colonial government and has now served the country for over two-and-half decades. Within that period, the Forest Estate experienced a significant change in area, from about 1.4 million in 1955 to about 1.7 million, an increase of about 20 per cent (Republic of Kenya, 1968) - see also Table 6.1.

[1] Other authors argue otherwise (see, for example, Sandford, 1983).

Table 6.1 Forest reserves in Kenya, 1968.

	Forest	classification		Total
Year	Central government	Trust land	Tribal land	'000 ha
1968	1332	368	222	1922

Source: Honore (1969).

The new Policy repeated almost word for word the policy objectives of the colonial government, thus being replete with relics of the colonial legacy. The significance of this policy document is that it can be used as the basis for interrogating the forest situation in Kenya even up to the contemporary period, since the new Forest Policy of 1994 is yet to be operationalised. The latter Policy is analysed in a later section.

With the euphoria and enthusiasm that accompanied political Independence and self rule came ambitious plans and pronouncements by the new government. For example, provision was to be made for supplying townships with fuelwood and charcoal, and no further excision of forests was to be allowed for human settlements:

> "In an effort to achieve [its] objects and in view of the fact that the Forest Estate, and in particular the areas available for plantation, is small in comparison to the needs of the country, it is intended not to allow any further excisions for human settlements" (Republic of Kenya, 1985: 5).

Unlike the colonial Forest Policy where the Minister was the sole authority, this policy is silent about which authority shall approve plans for management of forests and leaves an ugly vacuum in accountability for any management plans adopted. With regard to industrial use, forest products such as timber long served as primary feedstock for specific industrial enterprises. Before 1968, much of this activity was in the hands of non-Africans. It was therefore a positive step for the post-colonial government to increase participation by Africans in the timber-using industries by giving priority to the indigenous people. Just as the colonial government recognised the imperative of adequate financing of forestry activities, the government of Independent Kenya appreciated the fact that implementation of Forest Policy would depend greatly on adequate funding. The Policy, however, never mentions any special fund purely set aside for forests.

The Policy recognised the importance of promotion of trees on private land, and intended to encourage and assist with necessary advice. The Policy stated that "farm trees enable a farmer to grow his (sic) own fuel and poles, and trees to meet other functions like shade, windbreaks, and soil stability". The Policy statement on Public Amenity and Wildlife is:

> "The government recognises the value and importance of the forests of Kenya as areas of public amenity, and intends...to develop and use [them] to fulfil the needs of the public amenity and recreation, and to preserve their natural flora and fauna" (ibid.)

(Further discussion on the implications of this clause is given on Section 6.6.1). On Research and Education, this Policy reiterates the stance adopted by the colonial government Forest Policy of making adequate provision for high level scientific research and training of forest staff and, in applying the results of research. The post-colonial government outlines a third goal, thus: "For the training of Kenya citizens in various aspects of forest exploitation and timber utilisation and sales" (ibid.: Section 10c).

6.4.2 <u>The New Forest Policy of 1994</u>:

Since the statement of policy in 1968, several changes have taken place which warrant a new policy. Due partly to overlaps in other policies touching on forest-related issues and partly to sectoral conflicts in implementation, the government decided to harmonise some areas by creating a broad-based, national forest policy. Perhaps most notably, forestry is no longer seen as a sectoral issue, but as requiring integrated efforts. Integration was initially underlined during the Policy preparation using inputs from an interdisciplinary team of experts and local communities. The new Policy was officially approved by the government in June 1994, but is yet to see its full force realised (see KFMP, 1994). It prioritised three major problems:

- The indigenous forests must be conserved, both as important reservoirs of biodiversity and for the sake of other benefits they provide.
- The stock of trees and the production of wood must be increased in order to close the supply-and-demand gap arising out of the shortfall in wood production.
- Management of the fast growing exotic conifer plantations must be improved.

Table 6.2 shows the forest estate between 1985 and 1993. From the colonial period to the present, the forest estate only covered less than 3 per cent of the country (see Figure 6.1).

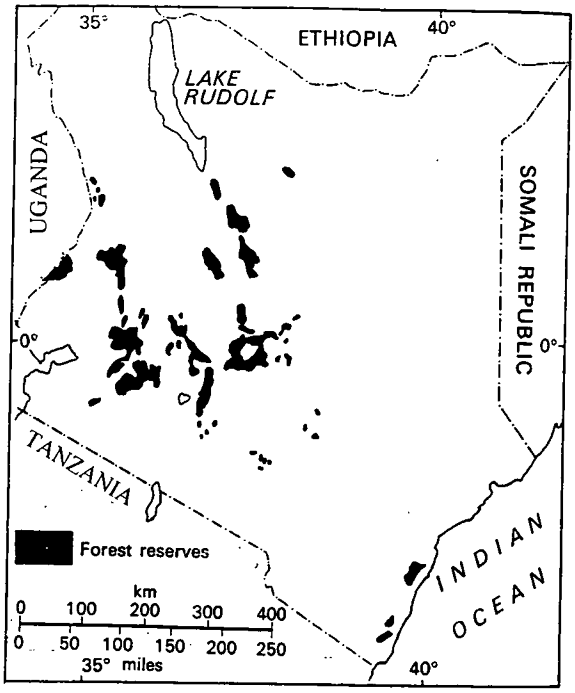
Table 6.2 Forest reserves in Kenya, 1985-1993.

Year	Central Government Gazetted	Central Government Other	County Council Gazetted	County Council Other	Total '000 ha	Private Forest
1985	1337	1	354	58	1750	124
1986	1337	1	354	58	1750	124
1987	1337	1	354	58	1750	124
1988	1337	1	354	58	1750	124
1989	1337	1	354	58	1750	124
1990	1337	1	354	58	1750	124
1991	1339	1	354	58	1752	124
1992	1339	1	354	58	1752	124
1993	1339	1	354	58	1752	124

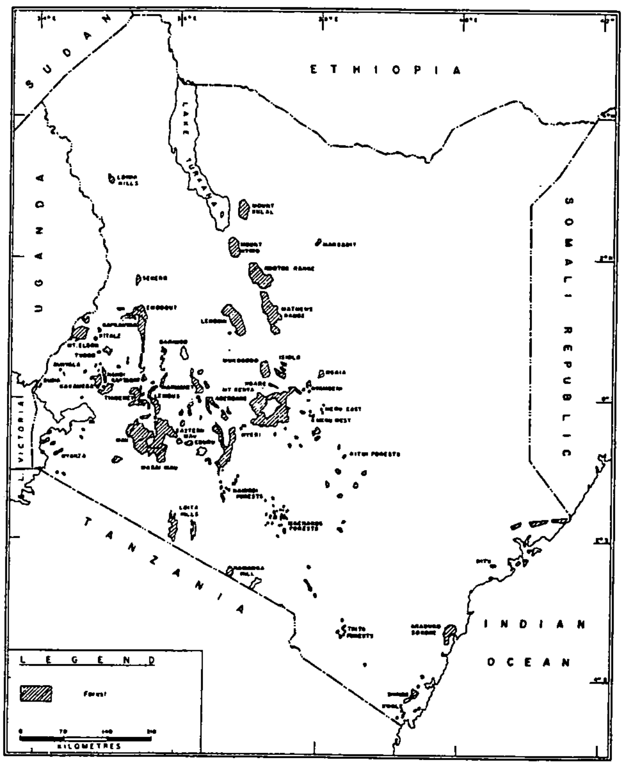
Source: Statistical abstract, 1995.

Prior to 1994, the government played an overwhelmingly dominant role in forestry activities, by monopolising forestry management. Since farmers have made significant contribution in promoting farm trees, their crucial role should be recognised, and they should be integrated in overall forestry management activities. At last the government has recognised that it should increasingly entrust its responsibility as forest manager, both for production and conservation, to private enterprises, tree farmers or local communities. The old management strategy of 'protect and control' has more or less failed. Consequently, there is a management shift towards a partnership approach, involving co-operate management. This, therefore, calls for a new and all-embracing policy. The strategy is aimed, among other things, at lessening the financial burden on the government, a programme strongly supported by the World Bank and the International Monetary Fund (IMF). In brief, a review of the 1968 Policy became necessary because of the changing practical realities of forest-related issues.

The new Policy covers several new areas not considered in the first two forest policies in (colonial and post-Independence) Kenya. These include conservation of biodiversity, multipurpose management, social and farm forestry, commercial, social and environmental aspects of forest management, capacity building, etc. Outlined below are the objectives of the new Forest Policy:



(a) 1968 *Source: Honore (1969).*



(b) 1994. *Source: Okowa-Bennun with Mwangi (1996).*

Figure 6.1: Forest Reserves in Kenya, 1968 and 1994.

- Increase the forest and tree cover of the country in order to meet the basic need of the present and future generations.
- Conserve the remaining natural habitats and the wildlife therein, rehabilitate them and conserve their biodiversity.
- Contribute to sustainable agriculture by conserving the soil and water resources by tree planting and appropriate forest management.
- Alleviation of poverty and promotion of rural development through employment and forest-based income generation, and promotion of equity and participation by local communities.
- Efficient and sustainable management of forest resource for economic, environmental and value benefits.

Broadly, the policy considers four main areas:

- Land management for production and conservation forestry.
- Forest products and industries.
- Supportive institutions.
- Other concerns related to forestry development.

The policy statement on land management for food production and conservation forestry is very clearly articulated. It takes cognisance of the role forests and on-farm trees play in management and conservation of soil and water. To underline the importance of this, the state proposes in the new Forest Policy to provide financial support to the management of areas kept for soil and water conservation purposes, and to vigorously promote all forms of farm forestry. The latter will be accomplished by providing forest-based products and services, mainly locally on a subsistence basis, and encourage community participation. The new management strategy plans to consider context-specific features such as climate, soil, tree species, socio-cultural aspects, all of which could contribute to a more workable and realistic forestry management.

In its prioritisation of forest products, the Policy identifies the role played by forests in the supply of rural energy in the form of fuelwood and charcoal. These are still major basic needs of people in Kenya, and sustainable supply of these products will, says the Policy, "meet the rural energy demand". In addition, the Policy underscores the need to view the productive functions of forests within an integrated holistic approach, which considers its social, cultural, ecological, alongside economic aspects. The Policy therefore recommends organisational restructuring in the forestry sector; by delinking forestry authority from forestry enterprise functions, and broadening the scope of forest management. In other words, reducing the red tape in order to facilitate co-operate management.

The Forest Department is charged with the task of developing and managing wood resources. But as the forest estate serves other forest-related functions such as conservation of the environment, wildlife habitat, and the provision of energy, there is perforce need for co-ordination and policy harmonisation with other relevant government sectors. It is therefore the resolve of this new Forest Policy that, while preparing or revising other policies related to forests, proposed measures should be harmonised with those included in the present policy, and vice versa. In order to avoid policy overlaps and/or conflicts between different related government ministries, the state proposes to harmonise all land-use policies. Certain land-uses such as converting forest land into settlement have adverse consequences for the survival of the forest ecosystem. To end such practices, the new Forest Policy states that excisions in gazetted forest will be discontinued except in cases of public utility, as to be decided by the government.

Gender issues have (in theory) been properly addressed by this new Forest Policy. As noted earlier, in previous policies the role of women in forest and tree resource utilisation and management had not received due attention. The new Policy has taken a positive stance by considering the central role of women in forestry activities, especially at the community and local level. As the Policy points out, women are "key agents for innovative development of the rural forestry sector, including the growing, harvesting, processing and marketing of fuelwood, domestic construction wood and industrial wood" (op. cit.: 13). Issues of gender and resource tenure are, arguably, highly contentious world-wide (cf. Agarwal, 1994; Rocheleau and Edmund, 1995; Schroeder, 1993)

It is also commendable for the new Forest Policy to link the benefits of conservation and management of national forest resources with international gains in mitigating the enhanced greenhouse effect which may lead to global warming. This is a much broader vision which is an attempt to fit the nation-wide forestry concerns within the broad global framework in the spirit of '*Agenda 21*' of the United Nations Conference on Development (UNCED).

In brief, the new Forest Policy of 1994 has covered multiple issues of significance to the forestry sector, together with a holistic agenda touching on various interest groups with a stake in the forest. This is viewed by donors as the best way forward (Marter and Gordon, 1996); thus providing a systematic link between the local and the global.. However, the ideal of popular participation is an increasingly difficult and contentious issue (Porter and Young, 1997). The mechanism or framework for community participation have not been clearly defined in this policy. Most of the areas tackled in this Policy are of great importance to the sustainable management of the forest estate, both as a national resource with multiple functions, and for the general benefit of all that depend on forests. The document was a product of a wide, participatory and multidisciplinary consultation which drew on expertise of various professionals as well as local communities. The document is, however, yet to be fully implemented, due to bureaucracy, so its plausibility and effectiveness have not been tested.

6.5 Energy Policy and National Development:

Woodfuel issues in any one locality in Kenya can only be understood in the context of national energy policy. In 1979, the growing challenge of energy for national development led to the creation of the Ministry of Energy (MoE). The ministry, which later merged with that of Regional Development in 1983 to form the Ministry of Energy and Regional Development (MoE&RD) was charged, *inter alia*, with the task of policy formulation. Being at the centre of national development, sustained energy supplies are crucial to overall national economic growth.

By 1983, the total primary energy supply amounted to 7.5 million tonnes of oil equivalent (*toe*). Woodfuel (fuelwood and charcoal) provided the main source of energy and accounted for 73 per cent of energy used; followed by petroleum fuels (22 per cent), electricity (3.3 per cent), coal (1.27 per cent), and ethanol (0.08 per cent) (Republic of

Kenya, 1985). The domestic sector (rural and urban) accounted for the largest share of energy consumption, 59 per cent, followed by industry 16 per cent, transport 11 per cent, agriculture 10 per cent, and commerce 4 per cent (op. cit. 1985: 8). Energy demand is expected to increase in proportion to population growth and enhanced socio-economic and industrial development. Kenya's total demand for industrial and commercial energy has risen steadily from 2.6 million tons of oil equivalent (toe) in 1991 to over 3.0 million toe in 1995 (Republic of Kenya, 1997: 97). Presently, main sources of energy in Kenya are petroleum fuels, electricity, woodfuel and, to a lesser extent, solar energy, wind, ethanol, coal and biogas. Petroleum fuels and electricity are currently the major sources of commercial energy.

The industrial demand for energy is predicted to increase exponentially following the establishment of Economic Processing Zones (EPZs), and the government-projected goal of industrial transformation by the year 2020 (Republic of Kenya, 1996). With such increase in commercial and industrial activity, conservation policies will have little or no effect on overall energy use. On the domestic front, industry consumes a significant proportion of petroleum products in Kenya, second only to transport. There is, however, an expected decrease in demand for energy, premised on two factors, namely, that industries effect conservation measures; and secondly, on substitution of coal for fuel oil. However, the measure may prove counterproductive in an environment of expanded private, commercial and/or industrial consumption, the latter being inevitable for any growing economy.

Economic management of developing enterprise generally favours increased production and sales even in the face of existing conservation measures. Industrial development policies which encourage energy-intensive industry negate the principle of overall energy conservation. Policy options should therefore prioritise and be in conformity with other national development goals. Stated policy objectives should try to be complementary and mutually-supportive, such that the promotion of one policy objective does not negate prospects of realising objectives of other related policies.

Coal has not found real acceptance as a practical substitute for petroleum fuel in either commercial or industrial production, perhaps because it is a 'dirty' fuel. In addition, there are no proven coal reserves in Kenya. Although coal is much cheaper than oil on an equivalent energy value basis, its use is associated with technical problems, infrastructure requirements, and cost of conversion. An Industrial Survey conducted by the MoE&RD in the mid-1980s found that most boilers in Kenya were not designed for solid fuel (op. cit., 1985).

The key role energy plays in national development presents a great challenge to the government to formulate an energy policy that is both responsive to changing national needs and eases the present constraints without having deleterious effects on the environment; in other words, an energy policy for sustainable development. The purpose of the following section is to review and analyse the national energy policy, drawing on the experiences of local communities on the one hand, and policy makers on the other.

6.5.1 The Energy Policy Objectives and Practical Implications:

Overall policy objectives as spelled out by the government are as follows:

- Ensure adequate supplies of energy in line with National Development needs, efficiently and at reasonable cost.
- Promote conservation of all sources of energy.
- Intensify the search for indigenous fossil energy particularly oil.
- Continue rapid development of hydro- and geo-thermal power for electricity generation.
- Increase wood production both on-farm and on plantations. Increase efficiency of woodfuel utilisation at the point of extraction and end use.
- Encourage wherever possible domestic fuel substitution.
- Introduce non-conventional energy sources to broaden the national energy mix and lessen dependence on imported energy.

Details about the demand and use of all forms of fuel in the national as well as the local, domestic economy, as outlined in the energy policy framework, are given in Appendix D. These include petroleum fuels, electricity, and wood and other renewable energy sources. The rural energy supplies (including non-conventional energy sources and their potential adoption) are also examined.

6.5.2 Rural Energy Supplies:

The imbalance between woodfuel demand and supply came to the fore with the rise in oil prices in 1973/74, which caused an awakening to the stark reality of the rapid depletion of Kenya's wood resource base. The combined effects of economic and population growth with low conversion and end-use efficiency exacerbated the situation, with concomitant environmental effects.

Direct use of fuelwood in its primary form is more energy-efficient than converting it to some secondary fuel such as charcoal, because of the losses associated with intermediate conversion processes (see Hall and Mao, 1994). In the traditional three-stone hearth in most rural homes, there is an average efficiency of 8 per cent, which by all standards is low, but the hearth can utilise a range of fuels as well as satisfying other needs such as light, space heating, and insect control (see Section 7.10). Many innovative designs for stoves are fuel-specific, thus limiting source material. Fuelwood also serves in informal rural industries as a cheaper alternative to imported fuels.

The bulk of Kenya's charcoal is produced in traditional earth kilns with an average conversion efficiency of about 12 per cent. Sustained charcoal production is mainly a function of the insatiable urban demand, as charcoal is mainly consumed by the urban populace (Tiffen *et al*, 1994; Bradley, 1993; Hankins, 1987). Regional demand for charcoal may therefore be linked to the size and nature of existing urban centres, but there are pockets of seasonal consumption within the traditional rural sector.

6.6 Implications of Post-Independence Policies and Visions Beyond:

6.6.1 Implications of Forest Policies:

Viewed broadly, the Forest Policies (including those of the colonial period) only served as instruments in guiding a macro-level framework for national development and planning with limited practical value at the local level. This argument is supported by the pervasive ignorance expressed by the local communities of what the Policy entails. A former senior staff member of the post-Independence Forest Department now working with a local NGO in Nairobi (24.1.1997) said, "Forest policy is such a broad document which only helps to satisfy us as a country and also our donors. The only thing that is recommended is an effective district development machinery".

On the involvement by industries, policy analysis this thesis proposes that industrial consumers of forest products, particularly timber, should have been productively involved, right from the colonial period, in forestry activities, in order to supplement government efforts towards increased wood production. A flexible policy was needed, to involve private industries, who are by and large the primary consumers of forest products, in production. Such efforts would enhance the expansion of forest estate with minimum financial input from the government.

The Policy objective on forest excisions proved an elusive goal even with the colonial government (see Section 5.2.3). Historical evidence in pre-Independent and post-colonial Kenya attest that such statements of policy have often failed the test of time. There are multiple reasons in the failure to implement them. Of particular importance is the resettling of the country's growing population. This has been suggested by the present government as the main reason for excisions from forest land by the state. Moreover, achieving the forest estate expansion plan has presented an even more arduous task due to multiple reasons. These together, reduce such policy statements to hollow bureaucratic rhetoric, as witnessed also in the 1957 Forest Policy. The issue of landlessness in the face of a growing population is a tenuous one and demands careful attention. During the early post-Independence period - for example, between 1963 and

1971 - a total of 48,000 hectares (118,608 acres) of government forest land was converted to agricultural settlement through official excisions under the Forests Act (Ogolla with Mugabe, 1996: 104) .

In general, policy has often ignored the centrality of women in matters of environmental management and national development generally. In their multiple roles, women are literally the custodians of the environment (Nzomo, 1992). Consequently, any environmental policy planning and implementation should be explicit on gender roles. Despite the apparent "gender neutrality of the law" (Kabeberi-Macharia, 1992: 97), women's agricultural work and constant interaction with the environment has been often underplayed or totally ignored. Male labour tends to be more emphasised. For example, in the forest estate in Kenya women are crucial actors, and constitute a sizeable number of workforce. Therefore, phrases in the 1968 Policy like 'resident forest work*men*', are chauvinistic and gender insensitive. In fact, the phrase should have read 'resident forest work*force*', to reflect gender neutrality.

Past mistakes in previous forest policies of excessive centralised decision-making in matters of forest management led to serious overburdening of the government's fiscal budget for forestry operations. For instance, in the fiscal year 1992/93 the revenues (mainly from sales of plantation timber) only amounted to 29 per cent of the total government expenditures for forestry administration (MoE&NR, 1994: 9). The 1994 Policy is not explicit on the practical mechanisms of implementing the new model of participatory management. Neither does it mention the proposed gains by local communities from the forest estate. Nevertheless, the idea of a broad-based institutional representation in forestry activities is a milestone towards participatory forestry development.

It is one thing for the government to encourage farmers to grow trees to supply specific markets, and another for the markets to be made available. The current market is organised around the tree farmer and the buyer, which functions simply on mutual private agreement between the two. There is, indeed, a disjunction between policy and practice. Lack of stable markets for tree produce probably creates a disincentive for growing trees (cf. Chambers, 1993). If the Forest Policy could go out of its way to support this market by putting in place active institutional structures and official marketing mechanisms, farmers could, perhaps, start treating trees as economic goods right from the time they are planted. This will encourage more purposeful silviculture.

The need to preserve forests as areas of public amenity, recreation and for natural flora and fauna, as advocated in the 1968 Forest Policy, has contributed to the preservation of the present natural state of the environment for the latter's own benefit and for the benefit of national posterity. Because the government of Kenya recognises this goal, it has used laws as main instruments in articulating the policy objectives into real action. Kenya's forest laws are encapsulated in the Forest Act, Cap. 358 of 1948, which prescribes the legal structural framework through which forest policy can be implemented (see Section 5.2.2). However, in recent times the policy objective of preservation has been flagrantly flouted. Places of public amenity and natural flora and fauna have been systematically acquired by a powerful elite, with utter disregard of the function of the law to protect such environments. The 'land grabbing mania' eventually results in loss of the flora and fauna, whether for amenity, posterity or for biodiversity and scientific study. This poses long-term national economic consequences as plants which are currently sources of pharmaceutical products grow wild in some of these habitats and may be lost altogether (Juma, 1991).

Coupled with this is the recent emergence of administrative conflicts between management and protection of the flora and fauna in forest areas which double as Natural Reserves (or National Game Parks). This has become more pronounced in natural forests with large stocks of game. The touristic value of wildlife has created conflict between conservation of wildlife and biodiversity. The wildlife emphasis has often resulted in confrontations between local communities living adjacent to national parks, national reserves or local sanctuaries; with the communities complaining of destruction of their crops by stray wildlife[1]. The legal provisions in place have exacerbated matters for the complainants. According to the Wildlife (Conservation and Management) Act, Cap. 376 of 1976, protection is provided for animals and vegetation in areas adjacent to national parks, national reserves, or local sanctuaries. Some of the adjacent areas may not legally fall within the strict jurisdiction of wildlife or forestry

[1] Western Kenya in general, and Kisumu District in particular does not face such conflicts, due to the fact that the region has no known wildlife game reserves.

legislation. The result is an inevitably complex jurisdictional mosaic of competing and conflictive domains. That legal mix could be positively applied to conserve the genetic resources in threatened habitats which fall outside the strict jurisdiction of wildlife or forestry legislation. Although it can be argued that there exists the Plant Protection Act, Cap. 324 of 1937 for the protection of local plants, its legal provision covers mainly protection against diseases and pests. The statute has no explicit clause articulating the potential hazards to plants such as destruction by animals or wildlife.

Policy has narrowly presented forest mainly as a resource to be exploited for economic profit (see Chapter 5). This skewed view has been faithfully perpetuated by national forestry training institutions through their curricula. The curricula of the then sub-professional Kenya Forestry Training School (now Kenya Forestry College), and also that of universities, until lately, promoted the economic, productive aspects of forests. The perspective has given little attention to other multi-functional, socio-cultural aspects of forests such as a myriad of cultural and traditional uses by local communities.

6.6.2 National Energy Policy and its Potential Impact on Rural Communities:

It is the government's policy that overall wood consumption can be substantially reduced through efficiency improvements in kiln technology, improved charcoal *Jikos* and wood stoves. Efforts are also being made to correct the imbalance in supply and demand and to ensure a future of sustainable wood supply while at the same time avoiding environmental degradation. The government proposed to do this through a joint collaboration between the MoE&RD and the Ministry of Environment and Natural Resources (MoE&NR), by promoting fast growing trees on on-farm wood production (Republic of Kenya, 1997: 102). In addition, the MoE&RD will continue to promote efficient use of woodfuel by encouraging widespread use of efficient *Jikos* and charcoal production kilns (ibid.: 102). It is not clear how either measure will help the very poor rural landless people to whom fuelwood is least available.

This study established that wood is commonly used by most rural people in the study area for energy, with fuelwood being the predominant source within the household traditional sector. Interviews conducted with rural households show that charcoal is mostly used during the rainy season when the weather does not suit scavenging for fuelwood from local sources. As the use of charcoal in the house requires stoves, low-income households cannot afford it. They therefore prefer to use wood directly as fuelwood.

Charcoal is not produced from 'sustained yield' plantations, but largely from isolated trees and shrubs on range and bushland by rural households striving to earn an off-farm income. Once undertaken, such actions are often carried out in a more sustainable manner[1]. Proximity to road networks for cheap transport to consumption centres encourages production. The national woodfuel policy of establishing appropriate pricing of charcoal is inevitably prone to difficulties of aggregation given the varied regional demand and supply patterns. Such variation, being a function of price differentials countrywide, frustrates government efforts towards price control. The diversity of localities further makes policy generalisation problematic.

Agroforestry schemes have been identified as another strategy to increase wood resources in Kenya, and receive wide support within policy circles, as one way of addressing the rural fuelwood issue. Penetration and adoption of agroforestry in the rural sector seems an obvious 'solution'. However, viewed critically, it is a potential tool for perpetuating already extreme rural inequalities (cf. Thomas-Slayter and Rocheleau, 1995; Field-Juma, 1996; Redclift and Sage (in press)). The potential for increase in wood resources through agroforestry depends largely on the sizes of farms. This automatically tilts the resource scale against the rural land-poor. The landed-elite or more prosperous farmers can already afford better energy alternatives and experiences no critical need for fuelwood. They will end up with surplus wood while the rural land-poor faced persistent shortages. These surpluses could be kept off local markets by allowing trees to remain on farms to curb soil loss and to improve its fertility. The price is not high enough to attract such prosperous farmers to sell. Increased commoditisation of fuelwood in the rural economy would exclude the poorest from access to it (cf. Goodman *et al*, 1988). Land demarcation into private ownership, has widely extinguished common access rights, as in the study area (see Chapter 7).

[1] For instance, Plate 6.1(a) shows a local farmer in Kakmie making charcoal for household use and for sale, with the wood obtained through lopping off some branches of the tree (*Balanites aegyptiaca*) on Plate 6.1b - Appendix A. 8.

Issues of tenure and gender also hinder the progress of agroforestry practice. These vary from society to society. Insecurity of land and tree tenure, caused by the slow processes of land adjudication, creates a considerable lack of interest in tree growing. Any agroforestry interventions should fully focus on these issues, and involve all parties concerned in order to make the best use of the available resources. Another critical issue in agroforestry which came out clearly during interviews with rural households was education. There still exists considerable lack of awareness about agroforestry practice; though some farmers have been practising it unconsciously in some measure.

The knowledge gap is normally a product of the communication gap. This applies in the area of knowledge transfer by 'experts' to the 'locals' and vice versa. Knowledge transfer is a very precarious area which demands strong commitment from the holder of knowledge. It is a real problem because it actually involves empowerment (cf. Watts, 1993; Sachs, 1992; Chambers, 1994a) and engenders a sense of loss of authority for the 'experts'. The latter issue was encountered during interviews with some government officials. One senior officer of the FD (21.2.1997) said, "The problem of empowerment is a real one because the professionals want to hold information to themselves because of the threat that they would never be consulted". These words speak volumes about what may be transpiring in the area of farmer education. Although the words come from a senior officer who rarely interacts with local farmers, they raise concern over what may be happening in the realm of interaction between field extension staff and local farmers.

The use of kerosene as a possible fuel alternative for rural households is hindered by the pervasive problem of poverty which makes the poorest segment of the society unable to afford it. Poverty becomes almost ubiquitous as one moves into the interior village areas. Kenya has major income inequalities reflected in patterns of access to basic resources (cf. Republic of Kenya, 1997: 151-152). The distribution of income is becoming even more unequal, and a majority of Kenyans are getting poorer. Another problem with kerosene is the lack of regular supplies. In several households studied, quantities bought weekly are not enough for cooking, supporting the statement by many households in the survey area that they use kerosene mainly for lighting (see Section

7.7.4 and 7.10). Other practices such as style and mode of cooking may also contribute to the marginal use of kerosene in a majority of households. Many use big pots and cook types of food which require several hours of cooking, for example, a mixture of maize and beans (*nyoyo*) which would require a lot of kerosene. Most households possess no kerosene stoves. The initial investment in purchasing kerosene stoves ranges from Ksh.350 to over Ksh.1,000, depending on the size and quality.

The goal of the Rural Electrification Programme is to enhance rural-urban balance in commercial and industrial activity, among others, by making electricity available to rural users. This consequently encourages consumption, attracts private sector investment and may reduce the demand for wood felled for rural informal industries. The projects completed under the grid are a manifestation of the important role electricity plays in development (see Appendix D. II). Kenya's rural electrification programme recorded an annual growth rate of 21 per cent in the 1980s which was one of the highest in the world (Energy Digest, 1989). Despite this impressive record, electricity consumption in the mainstream rural sub-sector amounts to less than 4 per cent (see Appendix D. II).

The use of coal in the household sector would mean new coal stoves, and its widespread use requires extensive infrastructure as well. Transport costs would make it uncompetitive in rural areas even with kerosene, despite the fact that coal seemed a likely candidate over petroleum fuels, due to its price competitiveness. Its acceptability has to be tested, and more importantly, coal has possible negative environmental and human effects (Hall and Mao, 1994).

6.6.3 Developing a New Energy and Forest Policy for Kenya:

If new policy formulation does not take account of prevailing local circumstances, then effective implementation or real policy action may be altogether elusive. Institutional co-operation between government agencies and local communities is a point of departure for policy formulation and implementation. The national and local decline in biomass resources in Kenya could reasonably be attributed to the stance taken by the authorities and the present policy position.

In theory, environmental policies and legislation seek to facilitate the rational and sustainable use of environmental resources. Without good institutional capacity (in both government and local communities) and framework for implementation, policies will remain simply paper pronouncements, however good. Ideally, success in managing local resources depends on a management strategy that is inclusive and which integrates the multiple concerns and interests of stakeholders. Such a management approach is likely to address, among other issues, the broad, interlinked problems of local communities. The lack of such an inclusive management system may be attributed to deficiencies and weaknesses in current legislation and to lack of political will. Provision for a requirement in public participation could help the policy move away from the general statement of intent to effective implementation at the local level (cf. Juma, 1991).

The understanding of rural livelihood systems should be central to national policy formulation and effective implementation. The creation of an enabling environment, both political and economical, would provide a great impetus to, for example, increased tree production. This could be through improved wood-marketing structures and incentives for enhanced on-farm tree production, which could eventually improve the use and conservation of woody biomass.

6.7 <u>Conclusion</u>:

In sum, many argue that environmental legislation should seek to facilitate the rational and sustainable use of environmental resources in support of the priorities of environmental conservation and management ideals. I argue that these ideals can be achieved through clearly defined policies and laws, together with a good institutional framework and good implementation in collaboration with the communities concerned. There is a need to develop an integrated management strategy which encompasses multiple concerns and interests of stake holders. This is a touchstone for the success of management of local resources, including forests, since such management strategy addresses the broad, interlinked major problems of the local community as well. Overall, this study states that the local people's basic-needs questions cannot be delinked from the environmental questions. The two have catastrophic global ramifications if left unchecked.

Kenya's environmental laws are well-articulated in the statute books, but lack a concomitant commitment to practical implementation. There is a dearth of both institutional capacity and relevant resources. The laws are consequently rendered simply good paper pronouncements. There is also a lack of collaboration with communities at the local level to strengthen and promote the benefits of rational use of resources and sound environmental management. The lack of community involvement may also be attributed to weaknesses in the law for having no requirement for public participation (see, Ogolla, 1995: 339; Okidi, 1996: 209). I suggest that the sharing of responsibility with local communities could mark a key revolution and significant watershed in the history of forest management in Kenya. The practice stands to draw on a wider local perspective on the multiple role of trees in farmer strategies contrary to the monomania of timber production (cf. Arnold and Dewees, 1995). Several scholars have made constructive criticisms of the status of environmental law and practice in Kenya (Ogolla, 1992; Ojwang, 1992, 1993; Okidi, 1993a). There is need for the policy to move beyond the general statement of intent to serious enforcement by authorised institutions, particularly at the local level (cf. Juma, 1991). Bureaucratic and jurisdictional overlaps have clearly exacerbated problems of effective implementation in this regard. In addition there have been 'silent' sectoral rivalries among the different line ministries, with no collaborative efforts and clear-cut framework to avoid duplication.

CHAPTER 7: PEOPLE, LAND AND FUELWOOD: EXPLORING THE REALITIES, CONFLICTS AND CONTRADICTIONS.

7.1 Introduction:

Access to fuelwood depends on access to trees. In Nyando Division, these belong to the owner of the land, but access is mired in immense complexity. There are six main issues: ownership of land and trees in general, access to land by young men, uses of land which may threaten trees (which mean that agroforestry requires consolidation of holdings), other conflicting interests such as country homes, and hostility to agroforestry. The gender issue is of access to trees, but will be discussed separately because it has complexities of its own. The aim of this chapter is to examine people-land interaction in the study area, in the quest for household energy provision. Issues of tenure, access (including gender disparities) and usufruct of land/tree resources are presented and discussed.

7.2 Ownership of Land and Trees (Tenure):

First, a minority of land is registered under a private title. The registration of land by the government into private titles began in Nyando Division in 1968, around Awasi but by 1996, only two sub-locations out of seven have been completed. According to the Divisional Land Adjudication Officer (DLAO) for Nyando and Miwani (3.2.1997), the slow process may be attributed to three main factors: firstly, the slow and complex registration procedures; secondly, the numerous court cases seeking to determine the true owners of certain parcels of land; and finally, the flood problem from the River Nyando, which hinders access to certain areas in the Division. Another, secondary issue concerns conflicts between tree and land tenure, particularly during the process of change of ownership. Land registration (also referred to as adjudication or consolidation) in Nyando Division, according to the DLAO, has generally been hampered by the strong allegiance of the Luo community to customary laws relating to land. Unlike other areas of Kenya such as Meru and Kikuyu, a majority of Luos are unwilling to leave their ancestral land in exchange for other parcels elsewhere, in order to facilitate the process of land consolidation. The exchange is necessary owing to the scattered and fragmented nature of individual parcels.

Although privatisation should ideally transfer the rights of ownership and use of land to the title holder, this is not the case in many parts of the study area. There are conflicts over use. Different rights to a single piece of land may not all be held by the same person. In this Division, informal rights of use by other members of the community still exist. Apart from eliminating free fuelwood collection areas, privatisation has encouraged the purchase of most open-access lands by wealthy people who have subsequently fenced them off and totally cut off access. The combined factors have left land-poor families with no open access land for either free fuelwood collection or for grazing. Some of these areas belong to absentee landlords who are not utilising them agriculturally, but apparently hold them for speculative purposes (see Section 6.3). The statement by Lucia (aged 42 years) in Kadhier clan (11.1.1997) clearly captures this:

> "Since the onset of land registration, the fuelwood problem has been compounded. Unlike before when we could collect fuelwood freely from anywhere, now if you enter someone else's plot, you may even be cut with a machete when found. First, he will take the fuelwood you have collected, and also wants to cut you".

The second source of conflict and contradiction involves the role of young men in tree planting. Focus groups with the young men in both Muga and Kadhier clans on 5.9.1996 and 15.1.1997, respectively revealed that they are less enthusiastic and committed to tree planting activities. This is due to the real and highly contentious issue of tree tenure, while the young men are still in their parents home. As tenure of land includes ownership of all resources on that land (including the trees), young men are not motivated to plant trees on family land because they have no legal basis of claiming ownership of them. This, according to them, discourages them from participating actively in tree planting. Joaness (aged 67 years) in Muga clan stated (13.10.1996):

> "Young men, for example, know the goodness of orange trees, but they don't plant them in their fathers' home because, when the oranges ripen, anybody will be free to pick them. So, they know the techniques, even able to teach others, but they don't do it themselves, saying they will plant in their homes".

The situation is compounded when parents are also still living in the homestead of the young man's grandparents. An additional reason which they gave is rural-urban migration after completing their education. When asked about the lack of building poles for their own houses, they argued that they are not obliged to plant trees for building their houses because they can easily buy poles. Conversely, some fathers are reluctant to allow their sons to plant trees on any vacant piece of their land. Acceptance is construed to mean granting a future claim on that piece of land by the young man, on the strength of his trees. Joaness responded to my question about who owns the trees planted by the son at his mother's request:

> "You also being a Luo know that everything planted in the home belongs to the old man. Even these trees you see here were planted by my sons, but they cannot bring someone over here, claiming they have trees to sell. How can you start cutting trees in another person's home? Whatever a son prepares in the parents home belongs to the parents and not him. Even when a woman asks her son to plant all the trees in the home, these all belong to the old man".

7.3 Rights of Use (Usufruct):

The third contradiction is the use of land and threat to trees. For example, farm land which is cultivated and 'owned' by an individual family may be communally grazed after harvest. Such communal grazing is normally regarded as a right the neighbours have to the land, in spite of the formal individual right of ownership. This practice is an apparent contradiction of the 'absolute right' by the registered owner, and a negation of the relevant legal requirement (see Section 2.5). The informal communal grazing right, though practised after the harvest has, nevertheless, created real or perceived insecurity of tenure and discouraged farmers from initiating any long-term investments on the land like planting trees in an agroforestry system (cf. Juma, 1989; Tengnäs, 1994). As livestock roam freely on the farms after harvests, it would be particularly difficult to protect farm trees, a concern expressed by a majority of respondents in Kadhier. Regulatory policies, such as the Agriculture Act and the Chief's Authority Act, have not proved useful in helping control the status quo (see Section 6.3). The initial shortage of common grazing land began with the onset of land privatisation, and was exacerbated by the intense pressure from settlements and agricultural expansion.

On the other hand, an interview with a group of five local herdsmen in Kadhier village area (15.1.1997) confirmed that grazing on 'private' farms after harvest is encouraged by lack of common grazing land; they add that they experience problems during the crop season, even over access to the river to water the animals. These problems, among other socio-economic issues, have resulted in substantial reductions in the number of animals. The herdsmen felt that the only way of resolving the issue is by owners of animals coming together to find a solution; otherwise, livestock raising in this area is at risk. In such a situation where unclear individual right to land prevails, and often merges with communal rights, no initiatives like agroforestry can succeed. First, the local community needs to be sensitised more to the legal implications of private ownership of land.

The practice of agroforestry is another contradiction. I established in Nyando Division that rural people sometimes tolerate certain types of trees with crops on the same farm. This normally happens where the trees are found to be growing on the farm, because they claim such trees do not interfere with the crop, and some improve soil fertility. Table 7.1 shows examples of trees found tolerated with crops in the study areas.

The contradiction is that such trees are only tolerated when already growing on the farm. There is no deliberate attempt to grow any of them with crops on the same farm. Interviews in the study areas showed strong opposition to the planting of trees with crops, although people are effectively managing trees already found growing with crops. Examples like *Markhamia lutea* and *Sesbania sesban* in Table 7.1 are quite popular agroforestry trees in Siaya, Kakamega and Vihiga districts (Scherr and Alitsi, 1990; Scherr, 1995; Muturi *et al*, 1991).

Table 7.1 Examples of trees tolerated with crops on same farm by local people in the study areas.

Cassia siamea	*Melia azedarach*
Combretum molle	*Rhus natalensis*
Euphorbia candelabrum	*Ricinus communis*
Ficus spp.	*Sesbania sesban*
Grewia bicolor	*Terminalia brownii*
Markhamia lutea	*Thevetia peruviana*

Source: Author's Fieldwork, 1996/97.

The effectiveness of agroforestry practice is further frustrated by the small, scattered farms[1] (see Section 3.4). Several areas in western Kenya where agroforestry has succeeded have most individual lands more or less consolidated in one place, which permits close management of all activities. This is not the case in most parts of the study

[1] Farm sizes in Nyando Division range from about a quarter to three hectares, and are too widely scattered far away from settlements to ensure effective management and supervision.

areas where people have to walk long distances to get to the farms, as illustrated by Doris in Kadhier on 12.1.1997:

> "When you wish to go and dig in the farm, you have to make such a long journey, and even become tired before ever starting to work. And because of such distance, one does not dig for long, since you need to start walking back home. But, with land consolidated in one area near the home, one would be able to work on the farm till late in the evening, for there is no thought of taking a long walk back home".

7.4 Conflicting Interests:

The fourth form of conflict and contradiction in the Division involves the purpose, and practical uses of trees by local people. Certain trees such as *Euphorbia tirucalli* are traditionally planted in the area as live-hedges around homesteads, as boundary markers, and as windbreaks. In addition, they serve the equally important function of providing fuelwood. The same multiple function applies to other trees. The multi-function approach to tree resources arises out of the ingenuity and adaptive indigenous practices of local people, when faced with uncertain ecological and environmental conditions. This is innovation as a rational response to prevailing circumstances. For example, *Acacia* spp., primarily known for its woodfuel use, also serves other functions such as reinforcements of hedges and/or fences (particularly its thorny branches), soil stabiliser to prevent erosion, browse for small ruminants (especially goats), and the use of its wood for household implements. Other *Acacia* species like *Acacia albida* are good leguminous trees which are compatible with crops, as the roots fix nitrogen and improve soil fertility.

This multiple-function status sometimes creates conflicts and contradictions in the rural landscape, with some functions being mutually antagonistic. One such example involves, first, the planting of *Euphorbia tirucalli* as a hedge around a homestead. Secondly, the hedge is reinforced by thorny branches of *Acacia* spp., but, since both trees are providers of fuelwood in this locality, their initial function of providing a sustainable hedge or fence will be compromised in the long run. Women will steal the dry branches of *Acacia* spp. and sticks from the fence in the process of foraging for fuelwood, as was stated by many women in the study areas. For example, Maria in Kadhier (22.8.1996) observes: "It takes one a long time to search for free fuelwood in this area because it is difficult to find. The quickest way therefore is to break the old man's fence and take the dry bits of wood". This practice, together with occasional selective felling of Euphorbia trees for fuelwood eventually creates gaps along the hedge[1] and undermines its original purpose. Although all the functions are equally important, they lead to a vicious circle, with the attendant difficulty of refilling the gaps in a Euphorbia hedge. Local experience has proved that new plantings of *Euphorbia tirucalli* to refill gaps in the mature hedge rarely grow. The only alternative is to establish a whole new line of planting next to the old hedge.

Another related issue concerns the younger generation who set up homesteads in the village area, while continuing to live in towns. These people normally hire caretakers to look after the homes, and also plant trees. However, most of the trees preferred by such owners are ornamental and aesthetic (e.g, *Terminalia mantaly*), which produce no good quality wood fit for poles, etc. This trend is likely to create a shortage of more economically valuable trees in the very near future, if owners of such homes do not change their practice.

7.5 Gender Disparity and Tree Resources:

In many areas in western Kenya, the debate about cultural traditions and tree planting by women is well rehearsed (e.g., Bradley and Huby, 1993; Chavangi, 1987). In all the different reasons advanced for the prohibition on women cutting trees, which range from expected consequences such as death of the husband to barrenness of the wife (e.g., Chavangi with Adoyo, 1993: 66), none has been authenticated as a real outcome. These two authors call them 'myths', or what I would refer to as cultural manipulations primarily designed to perpetuate local male chauvinism. The situation in Nyando Division is characterised by divergent and diametrically opposed views which vary with households. For example, those at one extreme of the argument believe that trees planted by women do not grow, while the other extreme believe that trees planted by women grow better than those planted by men. Each side of the divide consists of both men and women. Those supporting the idea of women planting trees, however, qualified it by stating that it should be done under special circumstances such as the death of a husband or his long absence from home due to migrant labour.

[1] *Euphorbia tirucalli* does not normally regenerate (regrow) after being felled.

It is generally assumed by local people that once the husband is dead, the widow is free to plant or cut trees, especially if she has no grown up sons living with her. One elderly widow in Kadhier, Jenipher (aged 74 years), said (11.1.1997): "Since I am alone in the home, nobody can ask me why I am felling my tree. Therefore, if I have no fuelwood, I just cut my tree". In circumstances where the husband lives far from home on migrant labour, and no grown-up male is around within the home, local expectation is that male labour should be hired to plant or cut trees. Matters become complicated, as women are still expected to obtain authority from their husbands (cf. Muturi, 1992), but, some women during a focus group in Kadhier (12.1.1997) said they often go ahead without such authority. Women on the opposing side believe that all they can do is to weed the trees planted by men, but not plant, prune or cut the big trees without permission from their husbands. The view was raised, for example, in another women's focus group in Kadhier (11.1.1997) and one individual interview in Muga (13.10.1996).

The whole tradition which excludes women from work with trees is mired in controversy. It is the older generation who strongly adhere to cultural traditions, but with no clear reasons. Views are also polarised around type of tree. Apparently, there is less rigidity on fruit and ornamental trees, although some men still wield the power in decision-making. Under this tortuous arrangement lies the potential for family feuds and conflicts, in the event that the couple fail to agree. Elsa in Kadhier (11.1.1997) illustrated this point during the women's focus group, when asked what power she had over the trees she claimed to have planted: "The old man knows those trees are mine and I can cut them whenever I want to. I am even the one who takes care of them". The same woman, however, maintained that trees are not usually felled for fuelwood. This is because the latter can still be obtained as a by-product from other more economically valuable uses of trees such as building poles or timber.

The cultural traditions and superstitions, held mostly by the older generation, have been perpetuated by them and passed down through time. Such traditions and beliefs vary from one tribe to another. As stated above, these superstitions and beliefs are generally accepted without question. There is a perceived and unproved fear that a curse may befall one if they contravene these customary traditions.

It is clear from both sides of the debate that planting trees by women and their ownership by women are two different things. Women may have the liberty to plant, and yet no right of use. Phoebe in Kadhier (12.1.1997) claimed to have planted trees in their homestead while her husband was away on migrant labour, "I planted trees in order to use for fuelwood. I watered them...and when they became big, they are no longer mine. Things have changed. He is now the one having a say over them" (see Section 3.5.1). Despite polarised views on restrictions on the use of trees by women, there is a school of thought which believes that giving women complete freedom to use trees for fuelwood would lead to their rapid depletion, because the wood would be shared with friends and relatives (Chavangi with Adoyo, 1993: 67). This sentiment was echoed by Phoebe in Kadhier:

> "We, women are wasteful people. Even with trees, we shall just be felling regularly and splitting for fuelwood, claiming that we are the ones who planted them. Therefore, someone should be there to control it. So, men are doing a good job to refuse sometimes".

It should be noted that the local control by men over trees is not an isolated case, though it is stronger in Luoland. In many other areas of Kenya, men are generally known to have overall control over family resources (Asamba and Thomas-Slayter, 1995; Bradley and Huby, 1993; Mackenzie, 1990: 118; Ngugi, 1988). In such cases, women are naturally expected to seek consent from their husbands before utilising any family resource. Nevertheless, other women were critical of men's overarching oversight over family resources, particularly trees to provide fuelwood. Doris in Kadhier complained (12.1.1997):

> "Even though men control tree resources, we suffer a great deal as women. The man does not go looking for fuelwood, he does not cook, nor has any idea how this is done, yet he wants ready food to eat, and a warm bath. At the same time, he has refused with the trees, and does not even give money to buy fuelwood".

Many women complained that the tradition is really hurting them, since it overloads them with too much responsibility within the household. They added that it is such pressure which drives them to take dry wood from the fence (or sometimes the wooden structure used to build the granary). It is widely argued by the womenfolk and others that the matter needs a radical attitudinal change, or something close to a revolution. The following account highlights the latter point. During my transect walk with the 'experts', the Kisumu District Soil and Water Conservation Officer narrated an experience they encountered in Kakamega District during their agroforestry survey in the area. Entering one home, they found the woman had abundant fuelwood, while her neighbours had nothing. When asked why, she replied:

> "My husband used to come home and demand food which was hot, and bathing water which was hot. Since I had no fuelwood, I was prompted to destroy a few of the wooden chairs we had in the house. I used the wood to cook hot food for my husband, and provide him with bathing water which was hot. When he later realised what I had done, he directed me, from that time henceforth, to set up my fuelwood woodlot in one section of the farm. That is how I succeeded having this much fuelwood".

The above episode is not far from a revolution. There is a pervasive gender rigidity and exploitation that needs to be broken if there are to be any positive changes. Tree planting by women is not, in itself, the 'solution'. One forester argued during the transect walk that (23.9.1996):

> "It is not the planting of trees which is important for women but the felling, because you get fuelwood from felling a tree, not by actually planting one. Therefore, if you plant and cannot fell, then you will still fail to get fuelwood".

The whole issue revolves around tenure as well as culture, which makes the debate much wider than attitudinal change or cultural transformation. There is the additional national question of reforming the land law, to encompass rights by women as an important part of the family fabric. But, before the state moves in, it is incumbent upon the Luo community to discard some of the outdated cultural values and beliefs touching on gender-environment interactions.

The counter argument is that this is tantamount to setting in motion a whole cultural revolution which is likely to cause ripples and chain reactions which might be difficult to contain. The same school of thought argues that the cultural transformation is akin to dismembering the entire Luo society. Nonetheless, it is widely agreed that there needs to be a point of departure. The other argument in favour of the planting of less economically valuable trees by women, for example, *Sesbania sesban*, *Calliandra calothyrsus*, *Leucaena leucocephala* (i.e., agroforestry trees), still has to confront the issue of land, as mutual agreement between the couple would be essential. With the current stress on land and the ubiquitous general poverty, it is arguable that men would rather prefer to have resources of high economic returns, the least of which is fuelwood, which still shifts the burden back to women.

The rural sociologist during the transect walk with 'experts' (23.9.1996) felt that the battle should be waged more by the womenfolk, since they are "the ones who know where the shoe pinches most" (see Mahiri, 1998a). They need to be actively involved in the whole cultural debate, which is not currently the case. During women's focus groups in the two village areas, there was a great sense of helplessness and an air of hesitancy among women in discussing matters of culture. This is perhaps one of the main stumbling blocks. One forester observed during the transect that, women in the Luo community are apparently not free or comfortable to discuss culture. According to him: "Culture is left for men to discuss, review, and come up with alternatives. So, if you ask women to talk about culture, it is as though you are treading on a sacred ground".

Issues of culture and traditions seem to be so embedded in the minds of a majority of the Luos that they merge with superstitions and myths and make the situation too complex to decipher. Some of these superstitions, for instance, have been linked to the growing of certain species of trees within the homestead. One example I encountered during my fieldwork involved *Terminalia mantaly.* This species is planted in many homesteads in western Kenya, as an aesthetic and ornamental tree, due to the systematic, radial nature of its branching and beautiful flowers. However, by the early 1990s, rumours began circulating around most of Luoland that the presence of this tree in the homestead was causing deaths in families; though many members of families were still alive, even in homesteads where the trees were not interfered with. It was being claimed that, as the tree started the third radial branching, then someone in the family would die. This resulted in a number of the trees being felled, in spite of the fact that the claim could not be proved. The claims actually affected sales of the tree seedlings, as was verified by records obtained from the Kisumu District Forest Office (see Table 7.2). The decline was quite consistent from 1993 onwards, until campaigns were mounted by a former senior officer of the Forest Department hailing from Luoland, and others, to counter this superstition. It was stated by the Divisional Forest Extension Officer (DFEO), Nyando (21.9.1996) that the senior officer wondered why local people attached so much superstition to an exotic tree which had no indigenous linkage with the area's past.

Table 7.2 Seedling production of Terminalia mantaly in Kisumu District, 1992/96.

Year	*No. of seedlings produced*
1992	20 724
1993	23 197
1994	20 837
1995	10 622
1996	21 261

Source: Compiled from records in the District Forest Office, Kisumu, January, 1997.

7.6 Contradictions in Fuel Usage:

The greater use of crop residues and cow dung in the past in Nyando Division was an unexpected trend in the dynamics of energy use and an apparent contradiction of the dominant orthodoxy which explains fuel transition based on the energy ladder concept of switching from superior quality fuel to inferior quality with increased scarcity (see Hosier and Dowa, 1988; Leach and Mearns, 1988) - see Section 7.8.2. Households started with inferior quality crop residues and cow dung when fuel was less scarce, and switched to wood when the 'scarcity' was more apparent. This is attributed to aspects of social, economic, and environmental change, leaving wood as the main source of fuel. In the past, local households sometimes complemented crop residues with cow dung; now crop residues are used with fuelwood to make the latter go further. When used alone, crop residues require the cook to sit constantly by the fireplace to ensure the fire does not go out.

The 'scarcity' of wood seems another paradox because it occurs in the midst of relative 'abundance', since planted trees have increased substantially (see Table 7.4). This is a paradox which can largely be explained by the fact that trees have assumed a much higher economic value within the rural economy than was the case before. Therefore, increased woody biomass is not synonymous with the supply of fuelwood, or the alleviation of fuelwood 'scarcity' (cf. Bradley and Huby, 1993; Bradley, 1991; Dewees, 1989). This is also the reason why many fuelwood projects tend to have less than anticipated impact in alleviating the physical scarcity of fuelwood. The use of trees for fuelwood is considered less profitable than other uses like building poles, splitwood, etc. (cf. Dewees, 1995: 182). Chavangi with Adoyo (1993) found that cutting planted trees for fuelwood, especially exotic species, is not generally regarded as a wise use. These exotic species are commonly planted for use as cash crops, or as a form of investment (Chambers and Leach, 1987).

7.7 Local Responses to Fuel(wood) Issues in Nyando Division and the Dynamics of Demand and Supply over Time:

It is generally argued that, as fuelwood becomes more scarce, households switch to lower quality fuels (see Section 7.8.2 and 7.6). Such an argument seemed not to be tenable in Nyando Division. From aerospace remote sensing techniques, archival records and oral histories, the dynamics of fuelwood demand and supply in the whole Division can be summarised in three main phases from the beginning of the colonial era to the present (see Section 7.7.3). Presently, there is a proliferation of planted trees around most homesteads in the Division, though the area still suffers from problems of fuelwood 'scarcity'. This varies with every locality in the Division (see below Section 7.7.3).

Rural women, who shoulder much of the responsibility of fuelwood provision in the household, respond in diverse ways in the face of this paradox of scarcity. In most cases in Kadhier clan, they rely on purchasing more than collection. Experiences in Muga clan were different. Many women here, particularly those living close to, and having plots of land in Waradho Hill said they had never purchased fuelwood (see Section 3.5.3). The common practice I observed while camping in the village was that they collected fuelwood from the Hill, once every two to three days. Sometimes I saw others run to the Hill to gather small sticks when they were about to start cooking. The use of 'rubbish' (dry leaves, grass and twigs) was also popular here as in Kadhier. This was used, at times, to supplement fuelwood, and start the fire, or when they had no time to run up the Hill and collect fuelwood.

Obtaining fuelwood (including purchasing), in most cases, is women's own responsibility. Dan in Kadhier (4.8.1996) said, when asked about who gives women money to buy fuelwood: "They know how to obtain that money. Sometimes they have to sell their grain to find money to buy fuelwood". Joseph in Muga (13.10.1996) said to me, when I explained to his group the purpose of my visit: "I wanted to know why you came to talk to us about fuelwood which can be answered only by women; and we also see them using dry wood, most of which are difficult to know their names". Expenses on fuelwood purchasing varied from household to household, but with an average of Ksh.20 worth of fuelwood per day (see also Section 7.10). Despite these difficulties in obtaining fuelwood, most interviewees in Kadhier (both men and women) agreed that they would not miss a meal just for lack of fuelwood. Dan added:

> "People cannot go hungry because there is no fuelwood. No, that is where the women are so determined. They would rather scavenge around hedges and get dry leaves and twigs to cook the food".

While Phoebe (12.1.1997) responded as follows:

> "A woman cannot sleep hungry because of the fuelwood problem if she has food. She will have to look everywhere and find something to use in cooking, even collecting 'rubbish' or *chung*'".

At other times, women from the two village areas forage for 'rubbish'. They also 'beat' dry leaves of sisal plants (see Plate 2.1b - Appendix A. 1), use wastes from certain parts of crops such as husks of maize cobs (see Plate 7.1a, b - Appendix A. 9) and husks of gleaned heads of sorghum - locally known as "*chung*".

Another mechanism for coping with the fuelwood scarcity is by adapting less economically valuable trees such as *Thevetia peruviana* and *Lantana camara* for fuelwood. The two are normally used in this area as ornamental live-hedges, and women can easily plant or cut them (see below and Section 7.5). Both species, being self-propagating, are both widespread and common here. *Thevetia peruviana*, for instance, was highly recommended by women for its good quality fuelwood, and the tree does well in diverse environments and coppices heavily when pruned. It was found to grow faster, with straight stems, when planted near the Euphorbia live-hedge. Its fuelwood is rated in the class of hardwoods like *Acacia* spp. and *Balanites aegyptiaca* (see Table 7.3), though with the disadvantage of drying slowly after felling. Since men do not yet attach as much economic value to them like *Eucalyptus* spp., which is the best-known in the area for providing straight building poles, women are free to use them for fuelwood.

Jenipher in Kadhier (11.1.1997) said that, she had planted *Thevetia peruviana* around the house to provide shade, but is now using them for fuelwood. One way women are sustainably managing *Thevetia peruviana* is by pruning it in order to encourage coppice and produce straight boles.

7.7.1 <u>Ways of Conserving Fuel(wood)</u>:

The scarcity of fuelwood has forced women, particularly in Kadhier to adapt their cooking. Some women extinguish half-burned fuelwood sticks with water so as to use them later. In light duties like warming food or boiling water, they prefer to use embers from the burned wood instead of using new fuelwood sticks. Additionally, small pieces of charcoal dust which remain unused are mixed with cow dung and made into cakes which are then dried in the sun and re-used. These "burn just like real charcoal" (Doris in Kadhier, 12.1.1997), and are preferred for cooking foods such as '*nyoyo*' (a mixture of maize and beans) which take so much fuel and time. One strategy is to soak the bean mixture in water prior to cooking, to save fuel.

Another way of conserving fuelwood is by using it simultaneously with cow dung, in a kind of synergistic fashion. This is done particularly while cooking outside the house, due to the problem of smoke. Women from both clans stated during interviews that the cooking must therefore begin early before dusk. Dry cow dung is placed round the pot on the back side of the three-stone open hearth, while only a few fuelwood sticks are fed into the fire from in front.

There were other claims by respondents in almost all women focus groups in Muga and Kadhier that the mode and style of cooking has changed considerably. The change has two sides to it. The present style of cooking is alleged to use more fuelwood: quite a variety of foods may be cooked in a single day (see Table 7.12). In the past, foods like porridge were prepared in large quantities and stored in big pots to be used cold when people wanted. This applied also to sweet potatoes, "*Kuon*" (a strong paste made from corn flour mixed in boiling water), vegetables, etc. Local people maintained that ill-health had not resulted. The current preference for warm food is attributed to changes in society and modernisation. Oral histories confirmed that the whole idea of warm food began with the advent of Christian Missionaries in Kisumu District. On the other hand, cooking has also changed to conserve fuelwood. Women said they nowadays tend to fry foods like "*omena*" (small, dry fish) and vegetables, instead of boiling them for hours as before (when cow dung was commonly used).

Fuel-saving technologies have been some of the measures adopted to increase the efficiency of fuelwood use. However, complexities in rural socio-economic and cultural conditions, including poverty, have generally limited their popularity. Interviews in Nyando Division revealed *Upesi Jiko* as one of the well-known brand names of the wood-saving stoves in the region (see below and Section 2.4), but women using the stove stated that it is unsuitable for wide pots, though it greatly conserves fuelwood (see Plate 7.2a, b - Appendix A. 10).

My interview with the West Kenya Intermediate Technology Development Group (ITDG) Stoves Project Co-ordinator (13.1.1997) revealed that a total of 30,000 stoves were produced and disseminated by 1994, after starting a vigorous marketing strategy in 1992. However, most market outlets in the region are located in major towns such as Kisumu, Siaya, Kakamega and Migori. Supplies to local markets are minimal, and most respondents expressed concern over the stove's availability, as well as cost. *Upesi Jiko* retails for between Ksh.100-500, depending on the type and quality and this does not include the cost of installation[1]. Although most respondents were dissatisfied with its ability to cope with big cooking pots, among other disadvantages, they are impressed with its substantial saving of fuelwood. Doris in Kadhier said (12.1.1997) "when I buy fuelwood worth Ksh.20 (about 12 sticks), and using open hearth, it takes me one day. But, the same can last two days when I use *Upesi Jiko*".

7.7.2 **Preferences of Fuelwood Species**:

Preference of fuelwood species by local women was mainly based on characteristics of wood, such as heavy wood with slow burning, strong fire, and long-lasting embers. These comprise mainly species in groups 1 and 2 in Table 7.3. A large majority of

[1] Most rural people have no steady monthly income to afford this, as their main occupation is small-scale subsistence farming (see Section 3.5.4). Installation of *Upesi Jiko* can be either on permanent fixture or on a movable one.

species in the two groups, with the exception of *Thevetia peruviana*, are indigenous and found in natural woodlands.

Table 7.3 Fuelwood species grouped in order of preference by local people.

Group 1	*Group 2*	*Group 3*
Acacia spp.	*Albizia zygia*	*Eucalyptus* spp.
Balanites aegyptiaca	*Albizia coriaria*	*Cassia siamea*
Teclea nobilis	*Thevetia peruviana*	*Markhamia lutea*
Combretum molle	*Rhus natalensis*	*Euphorbia tirucalli*

Source: Author's Fieldwork, 1996/97.

As shown in Table 7.4, these were more commonly found in Muga village area than in Kadhier. *Acacia* spp. and *Balanites aegyptiaca* were the only ones available in Kadhier though in a limited number. Since most of the preferred species are already in short supply, particularly in Kadhier village area, this rules out free choice or preference. Local people are, therefore, forced to use whatever is available locally, which included mainly those in group 3; though ranked poorer in fuelwood quality by local women. The preferred species take longer to mature and are difficult to propagate. Best known charcoal species in the area, *Terminalia brownii* (more common in Muga village area) was also identified by local people as a good quality woodfuel species. However, its use for fuelwood is limited because the 'locals' preferred it for building poles instead, due to its straight wood and being termite-free. It is also slow drying.

7.7.3 <u>The Dynamics of Fuelwood Demand and Supply</u>:

The dynamics of fuelwood demand and supply in Nyando Division may be periodised in three main phases. The summary which follows was compiled from various sources, which included archival records, oral histories, aerospace remote sensing analysis, interviews, direct observations and recall (having been born and brought up in one of the study village areas).

First, in the early and mid-colonial era, up to the 1940s different parts of Nyando Division experienced different trends. In Kochogo Location in the mid-west of the Division (see Figure 8.3), the main fuels were crop residues and cow dung. Other areas to the south, southwest, south-eastern, and eastern, which included Magina, Apondo, Agala, Waswa, Katolo, Wang'anga, and Awasi, respectively, had quite different practices. These areas had varied endowments of woody vegetation in all of them, but, use of crop residues and cow dung was minimal. Magina and Apondo, near the estuary of River Nyando into Lake Victoria to the southwest, had plenty of the swamp vegetation such as *Aeschynomene elaphroxylon* ('*omburi*' or '*orindi*'), *Cyperus papyrus* ('*ohundho*' or '*togo*'), and *Sesbania sesban* ('*Asawo*'). By contrast, Agala, Kakmie, Waswa, Katolo, and Wang'anga (around Waradho Hill), *Acacia* spp., *Balanites aegyptiaca*, and other native species were abundant during that period. Katolo and Wang'anga, for instance, were the areas covered by the famous *'Kuth Awendo'* (see Section 8.5.1.3).

The second phase lasted from the 1950s to early 1960s. Areas around Kochogo continued to depend largely on crop residues and cow dung, but later shifted to natural bushes and *Euphorbia tirucalli.* The latter proved very prolific and quite sustainable, due to its interstitial, closed pattern of planting as live-hedges around homesteads. Sustainable use was managed through selective felling, and its use was supplemented by crop residues and cow dung. The situation in other areas of the Division remained almost the same, due to the abundance of the natural vegetation of indigenous trees.

The third and ultimate phase was the period beginning around Independence in 1963, when most of these resources started to decline from over-use, partly due to increased population and the accompanying pressure of settlements and the agricultural frontier on the original natural vegetation and scrubby bushes. Although crop residues and cow dung were still in use, most respondents in both village areas told me that their popularity was waning. This was partly due to changing local practices, including a general dislike people started developing towards the use of such fuels. This period marked a critical point in the dynamics of supply and demand because it was when land privatisation set in (see Section 7.2). The combined scenario led to commoditisation of fuelwood resources, and reduced access to communal collection areas. The rural land-poor who depended solely on these common resources gradually began to experience difficulties in getting fuelwood, as vast inequalities in resource endowments and entitlements emerged. Many households had little alternative but to purchase fuelwood. Phoebe in Kadhier argued (12.1.1997) that land registration, which has reduced the availability of free fuelwood, has brought little gain in Nyando Division in its primary objective of giving farmers access to credit facilities, contrary to Okoth-Ogendo's (1993: 43) argument in favour of its benefits. This is because parcels in this area are so small and fragmented that their title deeds do not provide sufficient guarantee as collateral for worthwhile bank loans. This was particularly pronounced in areas around Kadhier. The situation is hardly improved to date.

The scarcity of free wood is also affecting areas of the Division which had abundance, because these areas are now sources of fuelwood for the market. Such areas include Kakmie, Agala, Katolo, and parts of Awasi and Wang'anga (see Figure 8.3). Kochogo, Kakola, and Onjiko, with more exotic (planted) trees (see Table 7.4) also provide limited supplies, especially by those who occasionally fell their trees to sell as fuelwood. Despite the large number of planted trees, the supply of fuelwood is limited due mainly to the higher prices obtainable for the same wood for other purposes (see Section 7.5).

During the third phase, residents of Kochogo had a brief respite from the fuelwood problem somewhere between the early 1960s and 1970. This period marked peak flooding seasons by the River Nyando in this region. During such flooding, the river brought huge loads of dry trees from the highland catchment area in Nandi Hills to the north-eastern edge of Nyando Division. Women in three different focus groups explained that they pulled the trees ashore and split them into fuelwood, thus providing massive quantities which lasted until the following year, when the seasonal flood recurred[1]. Sometimes women stored large quantities of fuelwood, often in the form of unsplit logs.

[1] Hailing from the area myself, I witnessed this phenomenon during my early teens. The trees were many and big, with some having trunk diameters as great as 92 cm.

Table 7.4 Comparison of trees in 22 homesteads each in Kadhier and Muga clans, September 1996.

(a) Planted trees

	Planted	Trees		
Species	*Kadhier*	*%*	*Muga*	*%*
Cassia siamea	*2653*	*(27.9)*	*64*	*(0.7)*
Citrus limon	*44*	*(0.5)*	*35*	*(0.4)*
Citrus sinensis	*13*	*(0.1)*	*22*	*(0.2)*
Croton megalocarpus	*34*	*(0.4)*	-	-
Delonix elata	*13*	*(0.1)*	-	-
Eucalyptus spp.	*1099*	*(11.6)*	*120*	*(1.3)*
Grevillea robusta	*13*	*(0.1)*	-	-
Jacaranda mimosifolia	*26*	*(0.3)*	*3*	*(0.03)*
Mangifera indica	-	-	*8*	*(0.1)*
Markhamia lutea	*117*	*(1.2)*	*1*	*(0.01)*
Melia azedarach	*12*	*(0.1)*	*18*	*(0.2)*
Sesbania sesban	*82*	*(0.9)*	-	-
*Terminalia brownii**	*13*	*(0.1)*	*89*	*(0.9)*
Terminalia mantaly	*31*	*(0.3)*	*4*	*(0.04)*
Thevetia peruviana	*4758*	*(50.1)*	*220*	*(2.3)*
Total	*8908*	*(93.7)*	*584*	*(6.2)*

* Occurs naturally in Awasi, while planted in Kochogo.

(b) Spontaneous trees

Species	*Spontaneous*		*Trees*	
	Kadhier	*(%)*	*Muga*	*(%)*
Acacia gerrardii	-	-	*23*	*(4.9)*
Acacia previspica	-	-	*2*	*(0.4)*
Acacia seyal	*36*	*(7.7)*	*36*	*(7.7)*
Albizia coriaria	*39*	*(8.4)*	*2*	*(0.4)*
Aphania senegalensis	-	-	*5*	*(1.1)*
Balanites aegyptiaca	*21*	*(4.5)*	*36*	*(7.7)*
Carissa edulis	-	-	*5*	*(1.1)*
Combretum molle	-	-	*26*	*(5.6)*
Erythrina excelsa	-	-	*3*	*(0.6)*
Euphorbia candelabrum	-	-	*3*	*(0.6)*
Grewia bicolor	*22*	*(4.7)*	*13*	*(2.8)*
*Psidium guajara**	*30*	*(6.4)*	*6*	*(1.3)*
Rhus natalensis	-	-	*1*	*(0.2)*
Teclea nobilis	-	-	*149*	*(30.0)*
Zizyphus mucronata	-	-	*8*	*(1.7)*
Total	*148*	***(31.8)***	*318*	***(68.2)***

* Sometimes planted deliberately, but often grows naturally.

Source: Author's Fieldwork, September 1996.

7.7.4 The Use of Charcoal, Kerosene and Other Commercial Fuels:

The use of purchased fuelwood, particularly in Kadhier, technically makes fuelwood a commercial fuel. Women in this locality have to make a rational decision on which type of fuel to use, based primarily on practical implications of using such fuel; for example, the initial costs in technology. Fuels such as charcoal, kerosene, gas and electricity all require some investment.

The use of charcoal in the rural households in the study areas is quite limited. Several respondents confirmed that it is mainly used during the rainy season, when the ground is wet and even foraging is not possible. The price then rises from its normal Ksh.200 for a 34 kg-bag. A few rural households use charcoal mainly for ironing clothes which, in essence, takes very little fuel. Certain households use charcoal when they have many visitors and thus need more fireplaces (see Section 7.10). Charcoal stoves are used in this case. Charcoal is becoming scarce in the study areas because the preferred tree species for charcoal are almost exhausted. Muga village area still has limited supplies, although much of this comes from the neighbouring Kericho District.

Of the clean commercial fuels, kerosene, gas, electricity, and solar power are used in the study areas. Kerosene, for example, was used by almost all households in one way or another. Some used it for cooking in stoves, the majority in lamps for lighting, and others for lighting the fire. Only two respondents from both village areas used other commercial fuels: one household used mains electricity for light, the other used solar energy for light and television. Both (from Kadhier) occasionally used gas for cooking, especially for fast foods such as tea or porridge. Due to this light use, one said that a 15 kg-cylinder (costing Ksh.750) could last her three months. This same household had installed solar power, in 1987 at a cost of Ksh.30,000. The woman saw the solar system as quite economical: compared to mains electricity they had not incurred any expenses on it since installation, apart from replacing batteries once. Mains electricity cost about five times as much to install (Ksh.137,000) before ever considering running costs.

There is widespread use of kerosene, particularly for lighting, by rural households, but its use in cooking is limited by cost[1]. Prices rise quite frequently, and supplies are rarely consistent. Depending on the mode and frequency of cooking, many households claimed that Ksh.150 worth of kerosene lasted them between one week and one month. For instance, Phelesia in Kadhier (11.1.1997) stated that kerosene costing Ksh.50 lasts her less than a week, although used only for lighting.

[1] Offical price per litre was Ksh.23.40 by late 1996. However, unofficial pump price even sells for as much as Ksh.30 per litre.

Reliable data on kerosene use is not easy to obtain, and I had difficulties extracting information from petrol station dealers selling this fuel. The information is treated with much secrecy, perhaps due to competition. This forced me, at one point, to use covert means to obtain the information. I camped for about two hours near one pump selling-point in Ahero town and noted all purchases, to verify information from interviews with purchasers. Sales could then be compared with the overall district supply. One petrol station claimed to sell between 300 - 400 litres of kerosene in a day, with more on market days when many people come from far away to buy fuel. During the two-hour covert approach, sales indicated a total of about 28 litres, and purchases were mainly in small quantities (see Table 7.5).

Since it proved difficult to obtain information on kerosene sales from a wide range of petrol stations, I decided to visit the regional oil distribution headquarters based in Kisumu town. There, I managed to obtain relevant information on monthly deliveries by the six oil companies to all petrol stations and other outlets throughout Kisumu District. All the district outlets received a total of about 1,883,000 litres of kerosene monthly. A large proportion of this is sold through petrol stations in Kisumu town[1]. Ahero, which is the headquarters of Nyando Division and a major distribution point for all the surrounding divisions, received a monthly supply of about 100,000 litres from all the six oil companies, or about 5 per cent of the district total. The large quantity of supply to Kisumu town is partly attributed to the fact that about 80 per cent of the town's population are poor slum dwellers who mostly rely on kerosene and charcoal for fuel. Additionally, as a key transit point to many destinations within the region, Kisumu also acts as a supply source for other places.

[1] Records from two oil companies alone showed total deliveries of about 203,000 litres of kerosene in October 1996 alone. Oil companies which provided information were Agip, Caltex, Esso, Kobil-Kenol, Shell-BP, and Total.

Table 7.5 Patterns of purchase of kerosene from one pump station within a duration of two hours monitoring.

Amount worth of kerosene bought (Ksh.)	*No. of litres equivalent**	*Frequency (N)*	*Total (litres)*	*(Ksh.)*
3.00	0.13	1	0.13	3
4.00	0.17	6	1.02	24
5.00	0.21	10	2.10	50
6.00	0.26	2	0.52	12
7.00	0.30	1	0.30	7
10.00	0.43	6	2.58	60
15.00	0.64	3	1.92	45
20.00	0.85	3	2.55	60
50.00	2.14	1	2.14	50
60.00	2.56	1	2.56	60
300.00	12.82	1	12.82	300
Total		*35*	*28.64*	*671*

		Ksh.
Mean amount worth of kerosene bought	=	*19.00*
Median	=	*6.00*

* The adopted price per litre was Ksh. 23.40.

Source: Author's Fieldwork, 20.11.1996.

Apart from big-time dealers selling from petrol stations in the urban areas and local markets, there were a number of petty traders selling in village areas and at roadsides who bought varying quantities depending on the nature and size of their trade. Quantities ranged from as little as 1 litre, though they still sold at some profit. For example, Elida (aged 66 years) selling from her house in Kadhier (19.11.1996) bought kerosene worth Ksh. 30 (about one-and-a-quarter litres) which she sold for about 16 per cent profit, besides using some of it in her lamp. Jane (aged 26 years) selling by the roadside near Ahero town (15.12.1996) bought kerosene worth Ksh.150 (about six litres) per week, and sold at a profit of over 30 per cent weekly. Her customers are mainly those living in rented, commercial residence within the fringe of Ahero town, who normally use it as fuel for cooking and lighting. Jane explained that they buy quantities ranging from Ksh.12 to 24 after every one to three days, adding that her other customers hailing from the surrounding village area generally buy quantities worth Ksh.7. Such trends of purchasing, and the pattern shown in Table 7.5 confirm the fact that kerosene is not often used as fuel for cooking, but mainly for lighting. The skewed nature of purchases in Table 7.5 was attributed to the isolated cases of the few village and roadside traders who bought large quantities compared to most local people. As is evident from the Table, most households bought quantities of less than 1 litre and bought frequently, while large amounts were bought less often.

7.8 Fuelwood Trade: The Contemporary Situation:

The aim of this section is to explore the fuelwood trade in Nyando Division, drawing on data from interviews with fuelwood traders, direct observation, and assessment of the woody vegetation dynamics over time using aerospace remote sensing techniques.

The fuelwood trade in Nyando Division is a recent phenomenon which has evolved with the commoditisation of this resource due to its increasing physical scarcity and the reduced entitlements of many (Leach *et al*, 1997b). The scarcity is generally attributed to agricultural expansion and increase in settlements, both of which have impinged on natural bush, which formerly supplied most of the rural fuelwood. The situation is compounded by privatisation of land which has reduced areas of free fuelwood collection. All these factors have contributed to and encouraged the fuelwood trade (see Section 2.5.1). Privatisation of land is a key factor because it promotes inequalities in access to land resources. This specifically affects land-poor households. Commoditisation of environmental resources such as fuelwood which is a "transformation of use values into exchange values" seems to be the end result (Redclift, 1987: 119). Other authors argue that fuelwood trade is partly a result of "specialisation and exchange" arising from time constraints for household members engaged in the labour market to collect fuelwood and thus they resort to purchasing it (Dewees, 1989: 1168). This argument could well apply in highly monetized communities such as Murang'a District where Dewees' study was undertaken. Under certain circumstances, as in Nyando Division, the decision to purchase may be the only available option.

Interviews with fifteen fuelwood traders and six charcoal traders (September and October 1996) in the urban area of Ahero, local markets (off-road/roadside) and village areas revealed that the fuelwood trade is vibrant. The majority of fuelwood traders were women, with fewer men and children, and their ages ranging from 15 years to 58 years.

The period they had been in the trade varied between one and six years. Three-quarters of the traders had been selling fuelwood for a period of more than one year, while the rest sold occasionally in order to meet certain financial needs. For example, one female trader had fuelwood worth Ksh.90 which she was selling to raise money to buy medicine and kerosene for her sick mother. Another respondent was selling so as to raise financial capital to start another business. The two respondents clarified that they are not regular fuelwood traders, and that they felled trees from their own farms for this purpose, using their trees as a bank for emergencies (cf. Chambers and Leach, 1987).

The predominance of women in the fuelwood trade in Nyando Division, for example, may initially suggest that this activity is associated with other responsibilities of women, rather than as a source of income. Alternatively, it could be that men do not attach any economic importance to the fuelwood trade. The traders obtain their supplies from different sources, purchasing trees from local farmers, buying ready-cut fuelwood from villages (which they sell in the market at some profit) or occasionally felling trees on their farms.

7.8.1 Fuelwood Pricing and Mode of Transportation:

Fuelwood prices varied markedly. Differences in price were noted by locality, market and season. Prices are generally higher during the rainy season when supplies to markets are limited, partly due to shortage of sun for drying. By contrast, prices were lower during the hot, dry season (cf. Silviconsult, 1991: 59). A range of prices was noted during the interviews (Table 7.6). The differences in prices were governed, among other factors, by the size of the individual fuelwood sticks and the species, the latter also determining the weight. Species such as *Acacia* spp. were heavier and weighed on average 2.0 kg per bundle.

Table 7.6: Varied prices of fuelwood bundles according to size and weight[1]

Weight (kg)	*No. of sticks*	*Average size (cm)*	*Price (Ksh)*
2.0	3	98.5	5.00
1.3	5	92.5	5.00
1.5	2	95.8	3.00

[1] Due to varying quantity, which was governed by size and weight of individual sticks, it was not easy to know the cheapest bundle, and the bundles were not categorised into specific groups of species preference.

Source: Author's Fieldwork, 1996/97.

Table 7.3 shows examples of species that were being sold. These are grouped in descending order of preference in each category, with group 1 comprising the best and most preferred species by local people. This order of ranking also varied, with each village area depending on separate common fuelwood species communities.

Also sold in markets were crop residues such as stalks of sorghum and maize as well as dry sugar cane that fails to reach the processing plants (see Plate 7.3 - Appendix A. 11). These were sold in bigger bundles than fuelwood, although at the same average price of Ksh.5 per bundle. In one market, a bundle of fuelwood and an equivalent bundle of crop residues being sold for Ksh.5, each interestingly had the same weight. The crop residues are mainly bought by women cooking foods in makeshift structures in the market (appearing in the background - Plate 7.3), who use them to start the fire and also to supplement fuelwood. The crop residues are largely of dry sugar cane.

Fuelwood is transported to markets by headloads, donkeys, wheelbarrows, bicycles, and trucks, depending on the source of supply or the scale of the trade (see for example, Plate 7.4a, b - Appendix A. 13). However, most women traders interviewed used mainly headloads, or hired bicycles at a minimal fee. Most men used their own bicycles. Women traders who were living close to local markets most often carried headloads themselves, unless they had too much to transport. Deliveries by donkeys were sometimes from as far away as 15 km. Traders also paid a fee to local market authorities to be allowed to sell their fuelwood. These expenses, both in transport and council fees, determined, to some extent, price differentials among various traders. Comparatively, prices in village areas were cheaper (since sellers incurred none of the above expenses), particularly for the same size of individual fuelwood sticks. The latter could later be split again to produce smaller pieces before being resold in the market. Other expenses involved the felling and splitting of trees, especially for those traders who purchased whole trees from local villagers (see Plate 7.5 - Appendix A. 12).

Distance from the urban and market centres was one critical factor determining the overall fuelwood price. In order to avoid expenses in transport and other overheads, certain traders preferred to sell their fuelwood locally, or along roadsides and footpaths running close to their dwellings. This was another way of maximising gains. The other factor involved differentials in the endowments of the natural woody vegetation. Certain areas, such as around Awasi market and Waradho Hill, have more natural wood resources, thus fuelwood was sold at low prices. Prices were found to be lower by almost 100 per cent in the neighbouring Kericho District, close to Awasi market, as compared to Ahero town.

7.8.2 <u>The Fuelwood Trade and Tree Planting Activities</u>:

Few traders interviewed planted trees of their own specifically to sell as fuelwood. Those with trees on their farms did not plant them with fuelwood sales in mind, though occasionally they felled them to sell as fuelwood. Trees were found to be planted for various purposes such as building poles, shade, to reduce soil erosion, and as windbreaks and shelterbelts. Fuelwood provision was not considered as a very important reason for planting. As noted earlier, the fuelwood trade thrives in this region largely in response to the physical 'scarcity' of, or a real lack of access to that resource. This is an apparent contradiction considering the number of trees planted by men around homesteads, particularly in Kadhier village area (see Table 7.4). Nonetheless, the sale of crop residues is a strong indicator supporting the view of fuelwood 'scarcity', being the simple lack of access to existing farm trees.

According to the 'energy ladder' concept, a household will switch from a low to a more technologically advanced fuel as its income rises (Hosier and Dowa, 1988; Leach and Mearns, 1988). This switch becomes partial due to the frequently erratic supplies of non-wood fuels. Alternatively, the same concept can be applied to the fuelwood market, by arguing that traders will switch to a low quality fuel such as crop residues in order to supply a market experiencing physical scarcity of preferred fuelwood species. The switch in this case may also be a partial, automatic response by consumers to conditions of market instability, and they will likely settle for whatever is available instead of the preferred species (cf. Leach and Mearns, 1988). Studies undertaken in Asia and in other African countries indicate that supply problems are sometimes the main reason why households switch away from better quality fuels, e.g. kerosene (Brouwer *et al* 1997; ETC, 1987b; Leach and Mearns, 1988: 275; Leach, 1987: 36). Fuelwood markets are likely to behave in the same way in the face of scarcity of the resource. Margaret (born in the 1920s) in Kadhier clearly encapsulated this (11.1.1997):

> "In a situation where almost every household gets their fuelwood supply from the market, we are left with no alternative but to purchase whatever is available, including crop residues. The problem becomes even more acute during the rainy season when supplies to the market dwindle".

Lucia (born in 1955) in Kadhier put it succinctly (12.1.1997): "The previously free fuelwood collection from open access land is now being done from the market instead, as such lands are no more". The situation is exacerbated by the fact that local educational and medical institutions, which normally depend on contract suppliers for their wood, also resort to the market as their supplies become unreliable during the rainy season. Commoditisation and pricing of natural resources are therefore theoretically attributed to their increasing scarcity (Pearce and Turner, 1990: 299). Hosier and Milukas (1990: 8) also ascribe "broader economic variables" such as the trends in incomes of households as crucial determinants of levels of fuelwood prices. Additionally, the absence of government policy on fuelwood prices in Kenya may contribute to instability or fluctuation in prices, which may eventually result in a self-regulating market. Moreover, the lack of such policy may also create a disincentive among local people to grow trees to meet local fuelwood demand.

7.9 <u>The Rural-Urban Fuelwood Flow</u>:

Urban demand for woodfuel (fuelwood and charcoal) from both lower-income households and institutions, or small industries, can be considerable. For example, evidence from Rwanda indicated that urban dwellers used over three times as much wood-equivalent as rural people due to the poor conversion efficiency of wood into charcoal (Hall and Mao, 1994: 9). It is generally estimated that it takes about 4 kg of wood to produce 1 kg of charcoal by most conversion processes.

Accurate assessments of fuelwood flow from rural to urban areas are riddled with methodological constraints and/or problems of aggregation. Ideally, all end-users and uses of wood flowing into the urban sector need to be examined. However, such an approach is costly, cumbersome and time-consuming, particularly due to the multiple end-uses and users of wood resources within the urban area. Constraints in time and resources are major drawbacks to such surveys. In addition, monitoring the wood inflow into the urban sector also becomes problematic. There is often a high level of reticence in those supplying woodfuel to the urban market (Silviconsult, 1991). Many suppliers are reluctant to be interviewed. It is easier to interview the end-users than suppliers.

This analysis adopted the end-user approach, focusing on the hotel industry and related users as one dominant area of urban fuelwood consumers. The end-user approach was considered important here because it illuminates the point of actual consumption. End-use "starts with the people or organisations using energy rather than with supply" (Hill *et al.*, 1995: 82). Being the "worm's eye view of the energy problem" (ibid: 83), it can lead to a more accurate assessment of actual consumption.

A total of sixteen interviews were conducted with hoteliers, sellers of cooked foods, and related end-users in Ahero, Awasi and other local markets in Nyando Division in September/October 1996 (see Table 7.7). Interviewees had ages ranging between 27 years and 56 years. Periods in business ranged between nine months and twenty-three years. The majority were male. For the purposes of this study, woodfuel (fuelwood and charcoal) was mainly considered, though other forms of fuel such as, kerosene, gas and electricity were also being used, particularly in the established hotels. Charcoal was explored in some detail, as its use was common among hoteliers, and because it is a wood product which causes significant impact on wood resources and the environment in general.

The daily consumption of fuelwood by hotels and related end-users interviewed ranged between 10 kg (0.01 m^3) and 80 kg (0.08 m^3), depending on the nature of the enterprise and types of food prepared. Some hotels consumed low quantities of fuelwood because they used it alongside charcoal, while others used only charcoal. Overall charcoal consumption per day ranged from 4 kg (0.004 m^3) to 68 kg (0.07 m^3) - see Table 7.7 for more details.

Table 7.7 Amount of woodfuel used by hotels and related end-users per day in the study area.

Type of fuel	*Total per (Kg)*	*day (m^3)*	*Mean (kg)*	*Median (kg)*	*Total (n = 16)*
Fuelwood	350	(0.35)	26.9	21.3	13
Charcoal	236	(0.24)	21.5	17.0	11

<u>*Note*</u>: *Number using only fuelwood (n = 5)*
Using only charcoal (n = 3)
Both fuelwood and charcoal (n = 8)

Source: Author's Fieldwork, 1996/97.

7.9.1 <u>Sources of Fuelwood Used by Hoteliers</u>:

Although many hotel owners interviewed claimed that they planted trees, such trees are not often used to supply fuelwood to their hotel businesses. Fuelwood was bought from other sources. There was more fuelwood around Awasi market than Ahero town (each of these centres falling in one of the survey sites). Hoteliers in Ahero who bought fuelwood as far away as Awasi market (about 15 km) transported it by public transport vehicles. The overall cost was still reasonable due to the low prices there. Other hoteliers maintained specific contracts with traders to supply the fuelwood, while those who had no contracts with suppliers depended largely on the market, as did those in

Awasi, with more stable supplies. Alternatively, some hoteliers preferred storing sufficient fuelwood instead of buying everyday (see Plate 7.6 - Appendix A. 14).

Seasonal variations were commonly cited as affecting the supply of woodfuel. For example, during the rainy season some hotel owners had to go looking for wood themselves from different sources as regular supplies dwindled. They stated that such decline had negative impacts on their businesses and resulted in losses. This was given as one reason why they prefer having enough stock to take care of such periods. Others resorted to the use of charcoal.

Interviewees had varying opinions concerning the use of fuelwood as against charcoal. The choice was determined, first and more importantly by the price, and secondly by the style and mode of cooking. For example, women traders selling cooked food in temporary makeshift structures preferred fuelwood (because it was cheaper and because they use open hearths), whilst most big hotels used both fuelwood and charcoal. Big hotels mainly cooked with big metal woodfuel stoves but others used only charcoal for its cleanliness and ease of cooking (see Table 7.7 and Plate 7.7 - Appendix A. 14). As stated earlier, crop residues were used, particularly by women in the makeshift structures, primarily for starting the fire.

A range of foods were prepared by the hotels and those in the makeshift structures. Foods such as beans, a mixture of maize and beans, and beef (particularly internal organs, locally known as '*Matumbo*') were identified as those that take a lot of time and fuel to cook. Others claimed that this sometimes affected their profit margins. Women selling from makeshift structures sometimes supplemented fuelwood with crop residues, with the attendant problem of ash particles blowing onto the food; nonetheless, this conserves fuelwood and maximises profits.

7.10 Household Case Studies in Kadhier Clan:

Case studies were conducted of fuel(wood) use in four households in Kadhier clan, for two sample weeks, one in August 1996 and one in January 1997 (see Section 4.2.5). The households were each based on a woman, Alice, Elsa and Risper being co-wives sharing the same husband, and all four, including Grace, were economically categorised under 'average households' (see Section 3.5.4). The selection of co-wives for this exercise was instructive since it clearly illustrates intra-household differences in energy use: the households, particularly of the co-wives, differ considerably in their socio-economic structure. Alice, aged 53 years, has seven children, four of whom are married or in wage employment in urban centres. Four children (including those from families of relatives) are living with her at home[1]. She is a teacher in a local primary school. Elsa, aged 59 years, had nine children, one of whom is dead. All of Elsa's children, except one still in secondary school, are living and working in urban areas. Elsa trades in cereals in Ahero town. The third household was that of Risper, aged 76 years; she had seven children, three of whom are dead (one being Grace's late husband). Due to her age, Risper does not do any trading, but depends entirely on her children, who are all in wage employment, for financial support. She lives with none of her children, except three from families of relatives. The husband of the three co-wives is a retired businessman aged 79 years, who also relies on the financial support from his sons and daughters, apart from a small rent income from a shop he built in Ahero town about four decades ago. The fourth household was that of Grace aged 42 years and with seven children most of whom are still dependent on her. She is also a teacher in a local primary school (like her late husband who died recently in 1998). All four households are also small-scale farmers.

Table 7.8 (a) and (b) show differences in fuel(wood) consumption per day and per capita in the four households monitored. Results in this study compares closely with other

[1] It should be noted that household size in all the four households monitored did not always reflect the true nature of the household number of own children living with them at the time. This is because in most Luo traditional practices it is a common tendency that children from other families of relatives often come to stay with their relatives, even attending school in their areas. Therefore, households with adult family members who have all left their parents and living on their own, still have children of other relatives living with them.

studies, for example, Silviconsult (1991); Obonyo and Franzel (1994) for Siaya District; and Bradley (1991) (Table 7.9a, b). Week 1 (August) is school holiday and crops have also just been harvested from the farms; while Week 2 is the school term when children are back in school. Differences between the households were dependent on a number of factors, which included varying sources of income, patterns of fuel use, cooking practices, and household size. For example, Alice and Grace, being teachers, can afford to buy good quality fuelwood and/or charcoal. In general, the quantity of one type of fuel increases when no other fuel supplements are used at the same time. For example in Table 7.8, Elsa appears to use a lot of fuel in Week 2 because she uses only fuelwood, while Risper uses more crop wastes in Week 1, thus is low on fuelwood and charcoal. One reason noted for Risper's pattern of use was that she heated water for bathing almost every morning and consequently had a higher proportion of crop wastes.

Regarding the use of charcoal, Alice consumed more than the rest because she cooked *Mandazis* (buns) every morning to sell in school to fellow staff and pupils during school term and to fellow villagers, particularly during holidays, to earn extra cash. This is why there is little change in the quantity of charcoal used in Week 2, despite the comparatively small household size. Charcoal was mainly used in circumstances demanding simultaneous cooking, requiring different fire-places. This occurred when the households were pressed for time to prepare the food, particularly late in the evening or on occasions of many visitors. In this case, charcoal acts as an alternative fuel, used as and when necessary. Apart from that, charcoal is also used for ironing clothes.

The overall reduction in the household size between Weeks 1 and 2 is explained by the fact that the school term is in session by Week 2, and children in boarding schools stay at school (in Week 1, the household sizes for all the four households was larger, as children were on vacation). Such seasonal variations underscore the importance of monitoring household fuel use at different times of the year, in order to capture such variations. However, variations caused by climatic factors were not considered in this study, due mainly to resource constraints (time and money).

*Table 7.8: **Household consumption and per capita daily fuel(wood) use: case studies in Kadhier clan.***

(a) Week 1 (19.8.96 to 25.8.96, vacation)

Household	*Household size**	*Type of fuel (Mean kg/day)*			*Mean (kg/person/day)*	*Total Mean (kg/day)*
		Fuelwood	*Charcoal*	*Crop wastes*		
Alice	7.4	4.3	2.4	2.6	1.3	9.3
Elsa	6.1	4.5	-	4.6	1.5	9.1
Grace	7.6	9.9	1.4	0.5	1.6	11.8
Risper	6.5	2.0	1.3	8.1	1.8	11.4
Mean	*6.9*	*5.2*	*1.3*	*1.6*	*1.6*	*10.4*

(b) Week 2 (13.1.97 to 19.1.97, school term)

Household	*Household size*	*Type of fuel (Mean kg/day)*			*Mean (kg/person/day)*	*Total Mean (kg/day)*
		Fuelwood	*Charcoal*	*Crop wastes*		
Alice	4.4	4.0	2.1	2.1	1.9	8.3
Elsa	4.8	6.2	-	-	1.3	5.8
Grace	5.8	6.5	0.9	-	1.3	7.4
Risper	3.6	5.1	0.6	0.6	1.8	6.3
Mean	*4.7*	*5.5*	*0.9*	*0.7*	*1.6*	*6.9*

**See, for example, Obonyo and Franzel (1994) and Silviconsult (1991) for calculation of household size in decimals.*

Source: Author's Fieldwork, 1996/97.

Table 7.9 Per capita daily woodfuel (including crop wastes) consumption data.

(a)

Source	*Locality*	*Consumption (Kg/person/day)*
Hosier (1984)	Kenya	2.20
Mung'ala and Openshaw (1984)	Machakos	1.84
Arnold *et al* (1962)	Kenya	1.44
Strebel (1987)	Laikipia	1.37
Ellis *et al* (1984)	Turkana	1.10
Ensminger (1984)	Galola	1.06
Jensen (1984)	Maasai	0.97
Beijer/KWDP	Kisii, Kakamega	0.79

Source: Bradley (1991: 195).

(b)

Source of fuelwood	*n*	*Household size*	*Mean (kg/day)*	*Mean (kg/person/day)*
On-farm experiment	10	7.0	9.2	1.3
On-station experiment	1	8.0	8.6	1.0
Local market	4	7.5	9.0	1.3

Source: Obonyo and Franzel (1994).

Household size was a key determining factor of the quantity of fuel used. Household size varied at every meal time: apparently there were more people in the house at breakfast and supper time than at lunch time, when some members of the family were away, engaged in trading in the market, in the farm, or in school. Such daily variations, therefore, meant the use of varying quantities of fuel (see Table 7.10a, b). Due to the changing household size, accurate assessments of household per capita fuel consumption becomes cumbersome. Nevertheless, mean per capita for both weeks seems fairly accurate.

Table 7.10: Mean daily consumption of fuel and number of people per household per meal

(a) Week 1 (19.8.96 to 25.8.96, vacation)

Household	*Household size*	*Mean kg/day*			*Mean (kg/day)*
		Breakfast	*Lunch*	*Supper*	
Alice	7.4	3.6	2.0	3.6	3.1
Elsa	6.1	2.3	2.1	4.7	3.0
Grace	7.6	3.6	2.2	6.0	3.9
Risper	6.5	4.0	3.0	4.4	3.8
Mean	*6.9*	*3.4*	*2.3*	*4.7*	*3.5*

(b) Week 2 (13.1.97 to 19.1.97, school term)

Household	*Household size*	*Mean kg/day*			*Mean (kg/day)*
		Breakfast	*Lunch*	*Supper*	
Alice	4.4	4.2	1.6	2.4	2.7
Elsa	4.8	1.9	2.0	2.3	2.1
Grace	5.8	2.8	1.9	2.8	2.5
Risper	3.6	1.7	2.1	2.5	2.1
Mean	*4.7*	*2.7*	*1.9*	*2.5*	*2.4*

Source: Author's Fieldwork, 1996/97.

Fuel-saving practices by the households, such as extinguishing unburned fuelwood with water, were taken into account during the monitoring. Such remaining fuelwood was re-weighed by the researcher after cooking sessions, and the weight deducted from the previous recording taken before the start of that cooking session. Another very common practice among households was the multiple use of fire, for example, glowing embers were used for space heating, and to warm water for washing hands and used dishes. The technique employed in this study of regular monitoring contrasts with traditional techniques such as relying on interview recall data, and the practice of supplying fuelwood to be used by case-study households while measuring consumption. Neither of those techniques produces accurate results since firstly, a household will rarely try to conserve fuelwood that has cost it nothing to obtain; and secondly, fuel-saving practices and multi-purpose uses of fire are not taken into account.

7.10.1 Patterns of Cooking and Fuel(wood) Use:

Table 7.11 (a) and (b) show the different fuelwood species and crop wastes used by the four households. There is a marked difference, particularly in fuelwood diversity, between Week 1 (August 1996) and Week 2 (January 1997), illustrating the fact that households tend to use whatever is offered in the market by the fuelwood traders. The larger quantities of crop wastes utilised in Week 1 than Week 2 clearly reveal the seasonal patterns of use. Week 1 is when crops have just been harvested from the farms, and households have gleaned maize grains from the cobs. The latter, plus maize and sorghum stalks, therefore, provide ready cheap fuels (see Plates 7.1a and 7.4a).

Table 7.11: Daily consumption of fuelwood and crop wastes.

(a) Week 1 (19.8.96 to 25.8.96, school vacation)

	Fuelwood species (Mean kg/day)			*Type of crop wastes (Mean kg/day)*		
Household	*Acacia*	*Eucalyp.*	*Euphor. tiruc.*	*Maize cobs*	*Maize stalks*	*Sorg. stalks*
Alice	4.0	-	0.3	2.6	-	-
Elsa	3.6	0.9	-	4.6	-	-
Grace	7.0	2.9	-	0.5	-	-
Risper	2.0	-	-	-	4.3	3.9
Mean	*4.2*	*1.0*	*0.1*	*1.9*	*1.1*	*1.0*

(b) Week 2 (13.1.97 to 19.1.97, school term)

	Fuelwood species (Mean kg/day)								*Crop wastes (Mean kg/day)*		
Hh.	*Aca.*	*Cass.*	*Euc.*	*Euph.*	*Grewia*	*Lant.*	*Rhus*	*Thev.*	*M. stalks*	*Sisal*	*S. stalk*
Ali.	1.4	-	-	2.0	-	-	-	0.7	0.4	-	1.7
Els.	1.1	-	0.6	1.6	1.0	0.1	1.7	-	-	-	-
Gr.	3.9	0.2	1.5	0.8	-	-	-	-	-	-	-
Ris.	2.9	-	0.5	1.7	0.1	-	-	-	-	0.6	-
Mn	*2.3*	*0.1*	*1.8*	*1.5*	*0.3*	*0.03*	*0.4*	*0.2*	*0.1*	*0.2*	*0.4*

Source: Author's Fieldwork, 1996/97.

The prevalent use of *Acacia* spp. (undifferentiated) by the households underlines the importance of preference of fuelwood species, thus helping to identify tree species under threat due to heavy demand for fuelwood. Although availability of *Acacia* spp. is dwindling fast, women prefer to buy it whenever it is available in the market, simply due to its qualities mentioned earlier. The other preferred species (see Table 7.3) are, however, not as common in this locality as in Muga area. The commonest species (mainly exotic) in Kadhier area are *Cassia siamea* and *Eucalyptus* spp. Although *Cassia siamea* was not recorded in Table 7.11 (a), figures given in Table 7.11 (b) do not reflect the frequent usage of the two species by the four households monitored. This clearly emphasises the question of entitlement and the paradox of 'scarcity' and 'abundance' in Kadhier area.

The type of foods prepared by the four households varied slightly. There seemed to be a systematic pattern and frequency among the four in cooking certain kinds of foods and food combinations (see Table 7.12). The style of cooking, especially the food combinations and/or multiple foods at the same time, often required that two fire places be operated simultaneously.

Table 7.12: Number of occasions over two weeks on which specific households cooked certain meals, snacks or drinks.

Foods and food combinations	*Frequency*				*Mean occasions*
	Alice	*Elsa*	*Grace*	*Risper*	
Ugali + Vegetables	18	16.	15	20	17.3
Tea	14	14	12	14	13.5
Mandazi	14	-	-	-	3.5
Ugali + Veg. + Beef	4	2	3	2	2.8
Sweet potatoes + Tea	1	3	2	-	1.5
Nyoyo + Tea	2	-	3	1	1.5
Ugali + Fish	-	2	1	3	1.5
Rice + Beans Stew	1	-	3	1	1.3
Ugali + Veg. + Fish	-	3	1	1	1.3
Porridge	-	3	2	-	1.3
Ugali + Veg. + Chicken	1	3	-	-	1.0
Porridge + Groundnuts	-	2	1	-	0.8
Rice + Peas Stew	1	-	2	-	0.8
Tea + Porridge	-	-	1	-	0.3
Mean occasions/day	*4.0*	*3.4*	*3.1*	*3.0*	*3.5*

Source: Author's Fieldwork, 1996/97.

All the four households generally cooked three times a day. Expenditure on fuels was as shown in Table 7.13. Although quantities of fuelwood and charcoal used by the households varied over the two weeks, all the households used an average of 5.4 kg/day of fuelwood and 1.1 kg/day of charcoal, at a cost of Ksh.14.40 and Ksh.6.70, respectively. This resulted in the household mean total expenditure of Ksh.21.10, confirming statements from individual and focus group interviews, that many households spend about Ksh.20 per day on fuelwood and charcoal. Such expenditure on fuelwood and charcoal would mean that the households monitored spend an average of 13.6 per cent of their incomes daily on these fuels, as most of them solely rely on the market for their supplies (Table 7.13).

Table 7.13: Households' daily expenditure on fuelwood and charcoal

Hh.	*Fuelw. Wk. 1*	*(kg/day) Wk. 2*	*Mean (kg/d)*	*Cost[1] (Ksh)*	*Charc. Wk. 1*	*(kg/day) Wk. 2*	*Mean (kg/d)*	*Cost (Ksh)*	*Total (Ksh/d)*	*% of[2] income*
Ali.	4.3	4.0	4.2	11.3	2.4	2.1	2.3	13.6	24.9	8.4
Els.	4.5	6.2	5.4	14.6	-	-	-	-	14.6	9.7
Gra.	9.9	6.5	8.2	22.1	1.4	0.9	1.2	7.1	29.2	12.5
Ris.	2.0	5.1	3.6	9.7	1.3	0.6	1.0	5.9	15.6	23.6
Mn.	*5.2*	*5.5*	*5.4*	*14.4*	*1.3*	*0.9*	*1.1*	*6.7*	*21.1*	*13.6*

[1] Average price of 1 kg of fuelwood and charcoal in local markets during the 1996/97 fieldwork was Ksh.2.70 and Ksh.5.90 respectively.
[2] The daily incomes of the households were calculated on the following criteria: remittances were pegged at an average of Ksh.33 per worker; wage employment for a school teacher was pegged at Ksh.180; and income from trading was estimated at Ksh.85 per household.

Source: Author's Fieldwork, 1996/97.

The incomes of the households varied considerably. Alice had the highest daily income: possible remittances by any of her three members of the family in steady wage employment; trading in *Mandazis*; and her teaching job would together bring in a total of Ksh.298; making her percentage daily expenditure on the two fuels 8.4 per cent. Elsa, who relies mainly on trading in cereals, and two possible remittances by any of her four family members in wage employment (a total of Ksh.151 per day), spends 9.7 per cent on fuelwood. Grace, relying mainly on her teaching job and a possible subsidy of about 30 per cent from her husband (up to his death) (a total of Ksh.234 per day) had expenditure of 12.5 per cent of her total income. Risper, probably due to her age, does not seem to engage in any trading activities, and is thus totally dependent on two possible remittances by any of her three children (a total of Ksh.66). She therefore spends proportionately highest daily income on the two fuels. Remittances by members of the family in wage employment are neither guaranteed nor stable. This creates painful uncertainties and increases the struggle to buy fuel(wood), especially for those who are not engaged in any form of income generating activities, and have no sources of free fuelwood collection. Land privatisation has diminished all open collection sources.

This raises the issue of distance travelled to fetch fuelwood. Contrary to some findings in previous surveys that distance travelled to fetch fuelwood has increased as a result of scarcity, this study found that distances travelled to collect fuelwood have actually *decreased* over time (cf. Table 2.2c). This finding agrees with the survey conducted in Siaya District (Muturi, 1992). The decrease in distance is probably attributable to the process of land privatisation, which now restricts households to collection of fuelwood on their own plots of land within close range of the farmstead.

7.11 Conclusion:

Various aspects of social, economic, and environmental change have resulted in wood being the main source of energy for most rural people, unlike the situation in the past when many households could fall back on crop wastes and cow dung. Increased woody biomass around homesteads is not synonymous with the supply of fuelwood, and is not alleviating the paradox of 'scarcity'. One attractive option seems to be the promotion of less culturally restricted and economically valuable trees such as *Thevetia peruviana*, which has been widely accepted by many households in the study area. However, questions of land and tenure must be explicitly addressed to achieve this goal.

Of great importance is the gender issue of access to, and usufruct of, land resources which is currently mired in much controversy. Agroforestry could be a viable option in this regard, but only when the prevailing state of ambivalence on individual rights to land is resolved. Women, in the meantime, continue to depend on the market for their fuelwood provision, thus encouraging the fuelwood trade to thrive.

The traditions which exclude women from work with trees appear counterproductive. Many of these traditions are shrouded in myth, superstition and beliefs which have no real basis in practice. Indeed, they seem to be cultural manipulations primarily designed to perpetuate local male chauvinism. Situations of open discussion and dialogue may help to demystifying some of these age-old traditions to produce a sounder environmental management and equitable resource use. The fact that a majority of rural women are in constant touch with the land (sic) could afford them great opportunity to manage land resources. One main role men could play is to provide advisory support and oversight to the womenfolk, but not overarching restrictions on what should, and what should not be done. A change in land law to encompass rights by women, is a major potential strand in the solution to this pervasive gender discrimination.

CHAPTER 8: THE DYNAMICS OF RELATIVE FUELWOOD ABUNDANCE IN NYANDO DIVISION, 1967-1986: COMPARATIVE MAPPING USING AEROSPACE REMOTE SENSING TECHNIQUES.

8.1 Introduction:

The increasing demands for fuelwood in Nyando Division has led to the shortfall of woody resources which have severely disrupted the livelihoods of local people, due partly to the increase in population, diminishing sources, and institutional constraints (see Chapter 7). The dynamics of fuelwood demand and supply are influenced by multiple factors, which include socio-economic, cultural, and land-use practices. At present the main sources of fuelwood are bush/forest, savanna woody rangelands, savanna bushy rangelands and on-farm or shrubby woodlots. Trends in wood harvesting indicate an excess of depletion over replenishment, the impact of which has led to a reduction in quality of the savanna woodlands, the grasslands and the bush/forest lands, and consequently to the quality of the available fuelwood resources.

In order to determine the extent to which depletion and degradation has occurred, a retrospective study of these dynamics in the study area is needed but would involve massive investments in terms of time, personnel and financial resources. Consequently, the exercise described in this chapter is a 'least cost' approach utilizing SPOT imagery and aerial photographs.

8.2 Background: SPOT Imagery, Aerial Photography and Woody Vegetation Dynamics

Satellite images and aerial photographs (aerospace remote sensing techniques) are becoming increasingly indispensable in biomass and land degradation studies. SPOT images, for example, can provide data which offer excellent opportunities for deriving vital information concerning a whole range of earth resource features including the dynamics of fuelwood resources. In the ideal, features on the earth may be said to display distinctive patterns of spectral reflectance (sometimes referred to as 'spectral signatures') that permit specific crops, soils, or land cover categories to be recognized (Campbell, 1983: 41).

Many satellites are now in operation; however, the SPOT images offer opportunities readily comparable to those of aerial photographs due to their relatively high resolution. The SPOT satellite has been orbiting the earth since 1986 at an altitude of 832 Km (see Appendix E. 1).

SPOT images can provide a means of obtaining a synoptic view of the status and condition of fuelwood resources on a real-time basis, as their ground resolution is 20 m x 20 m. The images offer very high resolution data from which as much information can be gleaned as one would from an aerial photograph, depending on the experience and local knowledge of the interpreter.

The interpreter looks at the brightness of each pixel ('picture elements') in relation to its neighbor, and it is the use of this spatial information that permits image interpretation. The degree to which specific objects or boundaries are visible on an image is a function of the spectral, spatial, and radiometric[1] resolutions. Experienced interpreters who are familiar with the region being mapped will already have accumulated sufficient knowledge (or a 'mental map') of the area in question.

Although aerial photographs are tedious to analyze due to their panoramic deficiencies (which mean one has to deal with several photo frames for an equivalent area of one satellite image) they offer very high resolution data, sometimes up to 1m x 1m depending on the scale and altitude of photography. Furthermore, they provide a true nature imagery of the landscape below at the time of exposure, and photographic records date back into the past. This gives aerial photographs an edge over satellite images in a time-series analysis such as that implemented in this study (cf. Tiffen *et al*, 1994; Blaikie and Dahlberg, 1997; Kikula *et al*, 1990).

With experience and practice, aerial imagery can be used to document woody vegetation dynamics over time. Land cover information can be interpreted more or less directly from evidence visible on the aerial images. It is, however, essential that the interpreter applies a classification system and strategy in a disciplined, systematic, and consistent manner throughout the image. This ensures that the final map is uniform in accuracy

[1] Radiometric resolution refers to the ability of a sensor to separate varied degrees of brightness of an image.

and in representation of detail. Nevertheless, even the most thoroughly accurate interpretation requires a field check to verify the manuscript maps, and resolve uncertainties in the interpretation process.

The discussion in this chapter arose from the use of a combination of these two sources of data (aerial photographs of 1967 and a satellite image - SPOT-HRV1 of 1986) along with 'ground truth' data to generate information on woody vegetation and, ultimately, to estimate changing fuelwood resources in Nyando Division.

8.3 Applying Aerospace Remote Sensing Techniques in Kenya:

As seen in Section 2.2, remote sensing techniques have been employed in the assessment of conditions of woody biomass in Kenya, though with the attendant difficulties of low resolution of the imagery, and the drastic changes of forest type caused by rapid altitudinal changes. These general problems and/or limitations are usually encountered by those using the technique for woody vegetation/biomass assessment, unless accompanied by extensive 'ground truthing'.

Nyando Division, and Kisumu District in general has almost no forests or extensive woodlands. Scattered bushes, shrubs, grassland savanna with isolated indigenous trees, and clusters of planted trees (mostly exotic) concentrated around settled areas form dominant features. There are, however, remarkable spatial variations all over the Division. Accordingly, the woody vegetation assessment of relative fuelwood abundance undertaken in this study focused on this intra-divisional diversity. The assessment covered both broad categories of 'natural woody vegetation' and 'planted trees'. 'Natural woody vegetation' generally included bush, isolated trees in bush and open grassland; whilst 'planted trees' are those in and around homesteads, woodlots (small groups of densely-planted trees), hedges and windrows (linear woodlots). For successful delimitation of woody biomass boundaries, it was necessary also to delineate other cover type boundaries. The woody vegetation analysis covered the whole of Nyando Division.

8.3.1 <u>Objectives</u>:

The objectives of this interpretation and mapping were to:

1. Produce a map showing the general trend of change in land cover types and the anthropogenic influences on their dynamics over time, with fuelwood as a principal focus and using aerospace remote sensing techniques.
2. Estimate the rate of change relative to the standing density of woody vegetation within a chosen sample area.
3. Analyze the changes and draw conclusions from the findings.

8.3.2 <u>Initial Decisions</u>:

It was first necessary to decide:

- the base year from which the mapping would start;
- the comparative year(s);
- the season of the photography or imagery;
- the methods of analysis.

The base year of 1967 was selected on the basis of knowledge of historical characteristics of the study area. One basic assumption of local people and of government officials to be explored in this analysis was that the land had been relatively well managed during colonial days and that deterioration of cover characteristics only started some years after Independence when high population growth led to unplanned settlement and poor land management practices. The colonial era ended in 1963, and between 1960 and 1970 the only good quality aerial photographs with stereo overlaps available at the Surveys of Kenya archives in Nairobi were those taken on contract by the British Royal Air Force in January 1967.

These photographs had the additional advantageous attribute of having been taken in January: the season when the maximum possible contrast could be attained between bare ground or cultivated areas and vegetated areas; and January is the time when land preparation is under way in the study area and the contrast between vegetated areas and cultivated areas is at its maximum. The strategy of the exercise was to identify the relative woody ground cover as a percentage of the total ground cover and compare with later years to detect any changes over time.

It would have been interesting to use a middle year between the base year and the end year for stabilization purposes, but, due to financial limitations and time constraints, only the latest possible end year, 1986, was selected for comparison. The year 1986 was used because, even though there was no full coverage photography, a very good quality SPOT-HRV1 image covering the project area was available at the Department of Resource Surveys and Remote Sensing (DRSRS) in Nairobi.

Even though the 1986 image was taken during the month of September, it still provided a good option for the mapping exercise because September is a month when high contrast between vegetated areas can still be attained, because harvests have just been removed from fields. Often, such fields are converted to grazing land and cattle then graze the stubble to the ground leaving them relatively bare.

The contrast within both aerial photographs and SPOT image was important because the study adopted manual visual interpretation wherein photomorphic regions are manually delineated[1]. Such photomorphic regionalization provides a basis for initial stratification of the study area into cover types which are later verified and studied in more detail by ground survey.

[1] Photomorphic regions are those regions which by virtue of their physiographic, anthropogenic and phytological relationships appear relatively uniform in composition giving homogeneous spectral responses on the images or photographs (Anderson, 1976; Campbell, 1983; Estes, 1975).

8.4 Materials and Methods:

8.4.1 Procurement of Materials[1]:

A total of 57 very good quality black and white photographs dated January 1967 (covering Kisumu District) were secured from Surveys of Kenya (SoK) but only 35 (covering Nyando Division) were used as the others fell outside this study area. Even though the photographs were labeled (at source), as being at a scale of 1:25,000, later scale determination exercises revealed that they were at a scale of 1:40,517.

8.4.2 Initial Inspection and Classification of Image and Photographs:

Although it would normally have been important to conduct an initial reconnaissance survey of the study area to obtain basic information to enable the inspection and stratification of the area on the image and photographs, this step was unnecessary since the interpreter was familiar with the area of study. Consequently, soon after the procurements were made, a preliminary classification system was developed to focus the stratification on the theme of the study (see Table 8.1). Land cover classes were developed to indicate the relative levels of concentration of woody vegetation (see Appendix E. 3).

[1] See Appendix E. 2.

Table 8.1: Preliminary classification system for land cover types.

Class Label	*Description*
1a	Bare ground.
1b	Settled open grassland with very short grass and isolated mixed *Acacia* spp. and clump bushes.
1c	Bushed grasslands with tall grasses and clump bushes.
2a	Sparse mixed *Acacia* bushes with settlements and cultivations.
2b	Dense Acacia with tall/short grass undergrowths of savanna type.
2c	Thorny savanna thicket with *Rhus natalensis*, *Teclea nobilis*, and *Terminalia brownii* with grass undergrowths.
2d	Dense thorny savanna thicket/shrub mix as 2c.
3a	Clumped semi-evergreen thicket/shrub bushes in open grasslands.
3b	Semi-evergreen thicket/shrub interspersed with tall grassland.
3c	Clumped thicket/bushes in mixture with *Acacia* spp.
3d	Dense semi-evergreen, semi-slope thicket/shrub forest (2c) type.
4a	Sparse settlement with cultivations and open areas.
4b	Dense settlement areas.
4c	Flood plain subsistence cultivation areas.
4d	Sugarcane cultivation areas.
4e	Sugarcane, other crops and bushes of 2c type.
4f	Horticultural farms
4g	Rice fields
5a	Wetlands

8.4.3 <u>Ground Truth</u>:

The field 'ground truthing' activity was carried out on 6th of December 1996 (see Appendix E for sample methods). Once at the sample site (see Figure 8.3), observations were made of the existing vegetation (trees, shrubs, canopy, stem, signs of harvesting, ground cover etc.). Relative qualitative estimates were made of the woody vegetation cover in relation to the total ground cover. Woody vegetation cover in this context was defined as those vegetation stands with stem diameters of 1 cm and above which could be used by the local people in direct combustion to produce fire for energy. Observations and recordings were also made of the ground surface characteristics, particularly in those open areas where the bare soil surface could influence the spectral characteristics of the image and the photographs. Interviews with local farmers and

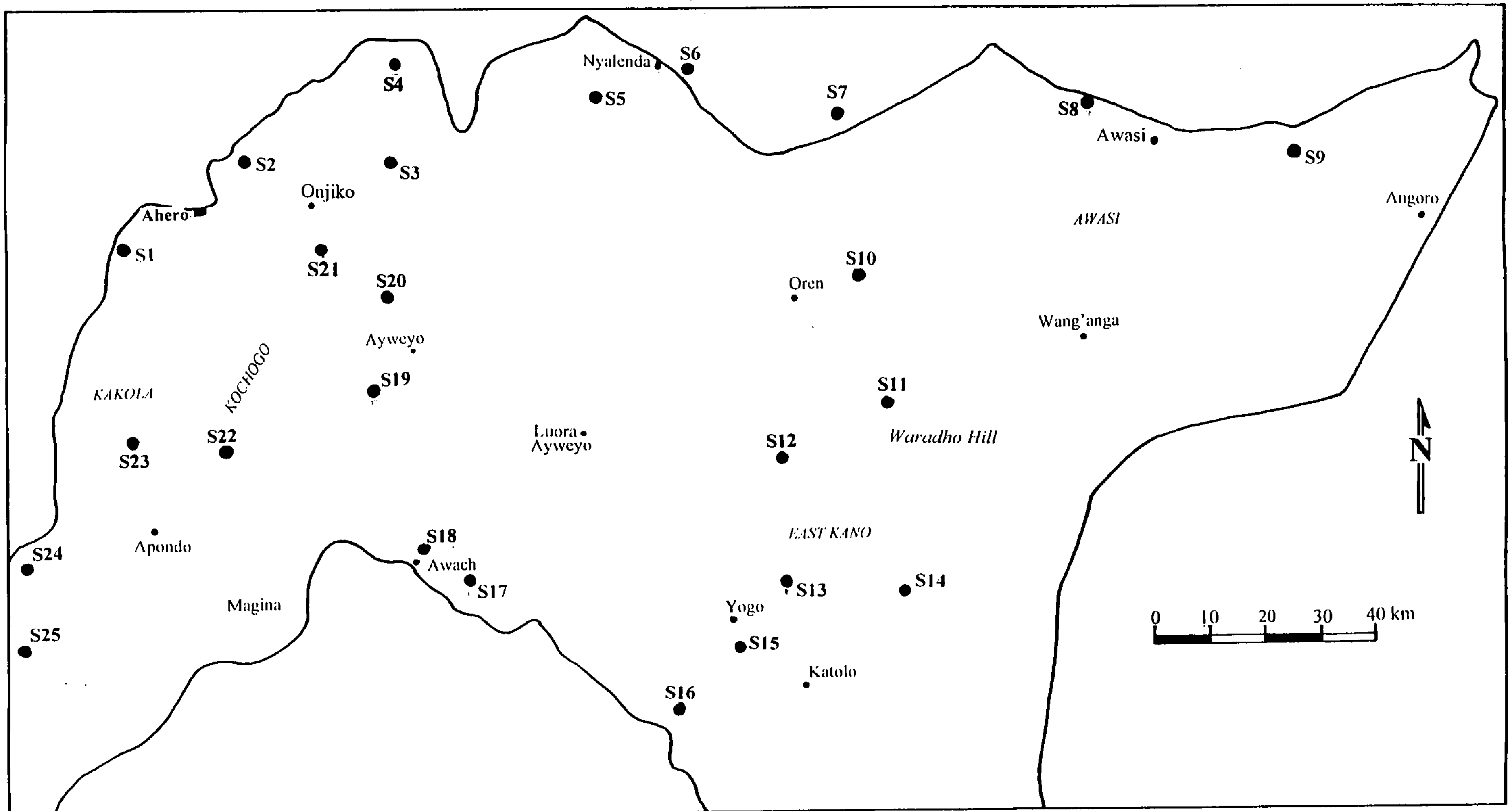


Fig. 8.3: Sample sites for 'ground truth' operations, Nyando Division.

See Chapter 3 (Awasi and Kochogo).

Source: Author, 1997.

family elders were also carried out at each sample site to seek an account of conditions in 1967 and 1986 (see Appendix E. 4).

8.5 Processing of Field Information and Final Analysis[1]:

Final maps were then prepared for 1967 and 1986. Originally, it was hoped that a manual overlay method would be adopted for analysis but, due to unconformities of scale, this was not possible. A visual comparison of the two maps with no physical overlay was therefore adopted. The visual comparison was aided by the information generated from the interviews with local land users and family elders as well as the topographic map base used during the 'ground truth' activities.

8.5.1 Results and Discussions:

The results of the above processes are the two maps shown in Figures 8.1 and 8.2. A total of 15 landcover classes can be grouped into four broad floral and structural zones (see the map legend): Bushlands/Forested areas, Savannah Woodlands, Savannah Grassland and Other Lands (settled, cultivated, barren and wetland areas). A description follows.

8.5.1.1 Bushlands/Forests (B3a - f):

The floral and structural composition of the Bushlands/Forest vegetation included a mixture of *Euphorbia tirucalli*, *Rhus natalensis*, *Acacia* spp. (undifferentiated), *Combretum molle*, *Terminalia brownii*, thicket and associated grasses occurring in densities from sparse to dense. The zone was subdivided into six sub-classes based on varying stand densities and composition.

In 1967, the spectral response of features in the zone exhibited a fine textured dark to very dark gray, denoting a relatively closed but varied stand. The area generally lies in the eastern part of the study area on the southern edge of the Nyanza rift. Being in the rain shadow of Kericho highlands, it experiences a savanna type of climate modified by

[1] See Appendix E. 5.

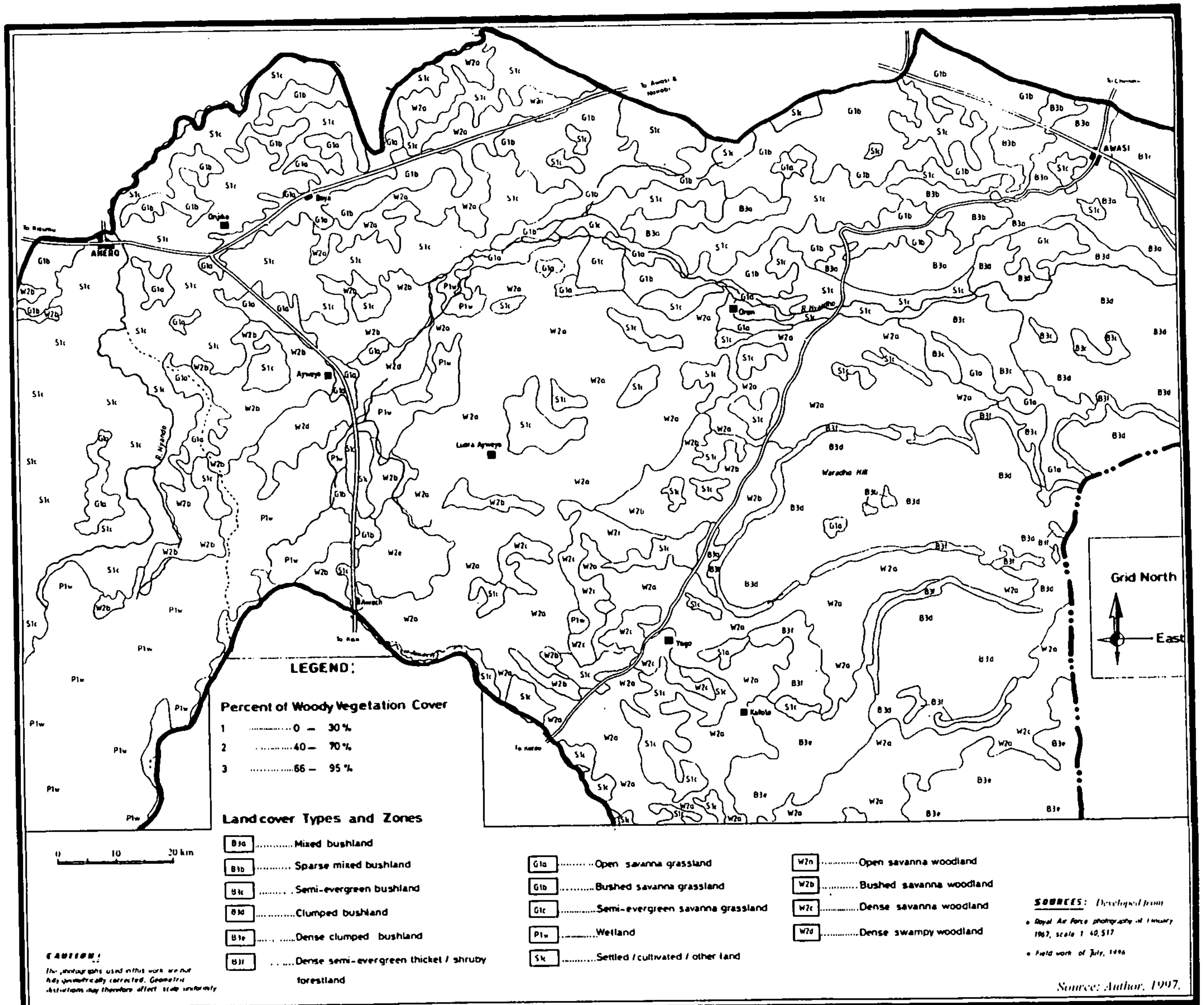


Fig. 8.1: Abundance of woody vegetation mapped as percent of land cover types in Nyando Division of Kisumu District, Kenya (1967).

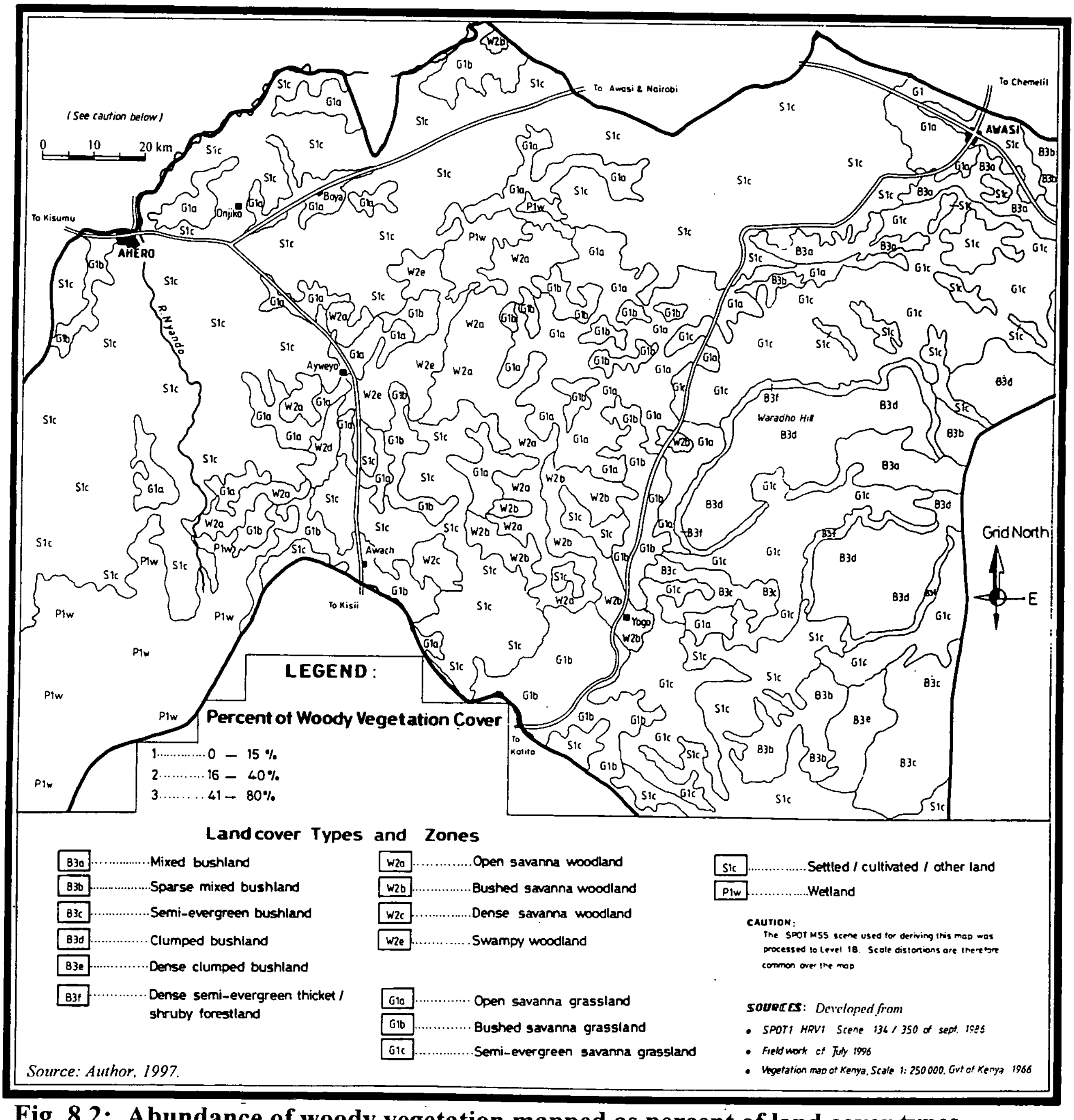


Fig. 8.2: Abundance of woody vegetation mapped as percent of land cover types in Nyando Division of Kisumu District, Kenya (1986).

the highlands. Although there seems to be no real forest in strict scientific sense, elderly land users described most parts of the zone as once actually forested. There are, however, conceptual differences between classification of the zone by local people and professional foresters attributed to density variance of the thickets, bushes and trees (op. cit.). Many local inhabitants now classify the zone as forests while professional forestry classifies it as bushland.

The zone was classified as having the highest possible concentration of woody vegetation. From oral histories and aerial photographs, the zone's woody vegetation cover (as a per cent of total land cover) in 1967 was estimated to range between 66 and 95 per cent (see No. 3 in Map Legend).

The 1986 image depicts a slightly different scenario. Some areas which in 1967 were bushland are still categorized under bushland for 1986, but the stand density appeared to have reduced, as evidenced by a fine stroke of light spectral response on the satellite image. Light reddish tones and strokes in the fine texture signify some openness which appeared to have been absent in 1967. A reconstruction for 1986 puts the estimated percentage cover of woody vegetation at between 41 and 80 per cent (see No. 3 in Map Legend).

In some cases, particularly to the north east of Wang'anga area, a drastic change appears to have occurred and an originally bushland area has generally degraded into grassland. Reduction in stand densities in this zone appeared to range between 15 and 25 per cent during the period.

8.5.1.2 Savannah Woodlands (W2a - d):

The zone occurs mainly in the central part of the Division, on the low-lying plains of the Nyanza Rift. Some patches extend south-westwards towards the River Nyando, right down to the flood plains of the river, while others can be found in the northern parts, to the northeast of Nyalenda School.

Although rainfall here is limited and unpredictable, amounts are sufficient to support tree growth and the dominant woody vegetation is canopied thorny trees such as *Acacia seyal*, *Balanites aegyptiaca* (Kano type) and associated clump bushes with thickets. Trees and other woody cover types range in spacing from scattered (in sparse situations) to close (in dense situations), spread out in large expanses of tall or short grasses. On both the satellite image and aerial photographs, detail was relatively poor with fuzzy edge gradients which only allowed the separation of five land cover classes.

Between 1967 and 1986, the Savannah Woodland zone appears to have undergone a very rapid spatial and structural change giving way to grasslands, settlement, cultivation and bare ground. In 1967, the dominant cover types appear to have been open Savannah Woodlands which gave a moderate grey tone softened by the presence of dense, tall grass cover and clumps of bushes. By 1986, there was less woodland and short grasses dominated, with open ground. The images exhibited very light reddish fine reflectance, mottled in areas and with fine strokes in other areas. Areas with such spectral behaviour depict 'mixed' situations where, because of the short grass and reduced woody vegetation cover, the spectral signatures were modified by reflectance from open ground surfaces, short grass and other features.

According to Mzee Nelson Rawo (born in 1930) interviewed 'on-site', the grasses in many areas of the woodland zone, (largely of the *Hyperemia* spp.) were so tall and the bushes so thick that they formed dens for wild animals during the 1960s. Children or women were never sent alone to other homesteads for fear of attack by wild animals such as hyenas. This seemed to confirm the spectral behaviour of the photographs and images. A reconstruction for 1967 put the estimates of woody vegetation cover in these zones at between 40 and 70 per cent (see No. 2 in Map Legend).

In later years, selective harvesting of woody vegetation for fuelwood, as well as general felling and clearing for settlement and agriculture, seemed to have rapidly created sparser woodlands and grasslands. By 1986, relative abundance of these woody cover types had reduced from between 40 and 70 per cent to between 16 and 40 per cent (see No. in Map Legend). In 1997, only isolated remnants of *Acacia seyal* trees can be seen, testifying to the size and height of these trees during those old 'wilderness' days. Most of the current *Acacia seyals* and other species are stunted secondary vegetation which appear to have regenerated under new conditions.

The reduction of stand density in the woody vegetation therefore appeared to range from between 24 and 30 per cent, between 1967 and 1986. As already mentioned earlier, percentages of woody vegetation cover quoted above are cited in relation to the total ground cover type, and not in relation to zonal spatial differences. Even though the reduction appears small, this zone has actually suffered encroachment and is at risk of further depletion if steps are not taken to allow it to regenerate.

I witnessed increased selective felling in many areas. Such felling has targeted the *Acacia seyal* and *Balanites aegyptiaca* species which provides high quality woodfuel (charcoal and fuelwood). Ahero town and the boarding secondary schools in the Division have provided a ready market for these commodities.

8.5.1.3 Savannah Grasslands (G1a - c):

The Savannah Grassland zone is now spread in patches all over the Division. Many areas which were woodland in 1967 have degenerated into grasslands and their dominance is increasing.

The zone is characterised by a dominance of grasses both short and tall, interspersed with low profile thorn trees, often gnarled and twisted with scattered clumps of drought resistant thorn bushes. In many places such grassland areas are, therefore, scrubby with tufts of grass or bare ground patches between the scattered bushes. In the bush-and-grassland areas, denser thickets in tangles with other woody vegetation are common, either in tall grasses or short grasses, with the ground surface sometimes being exposed in certain places.

On both the SPOT image and the aerial photographs, these areas give bright, whitish spectral responses. The bush-and-grassland areas however give softer 'spectral signatures' moderated by the presence of the dense vegetative cover. Woody vegetation cover as a percentage of the total ground cover ranged from 0 per cent in the G1a categories to nearly 30 per cent in the more bushed G1c categories in 1967 (see No. 1 in Map Legend). In 1986, there appears to have been not only an expansion of grassland but a reduction in stand density, characterised by increased bare ground or exposed ground surface areas. A number of areas which in 1967 were bushland, for example, to the northeast of Waradho Hill near Wang'anga, or woodlands, for example, to the west and northwest of Yogo School around '*Kuth Awendo*' appear to have been replaced with grasslands by 1986.

'*Kuth Awendo*' (local dialect) means the thorns of '*Awendo*'. It seems to have drawn its area name from the floral, fauna and structural characteristics of the area in earlier days. "*Awendo*" (Guinea fowl) is a savannah woodland bird which dwells largely in woodland areas which are quite dense with impenetrable tangles of both thickets and grasslands. Such areas are no more and the ecosystem is completely different, with only occasional tall *Acacia seyal* reminiscent of the original ecology of the area. There are no more '*Awendos*' in the area.

To the north of Onjiko Secondary School[1] and Boya areas, oral history indicates that dense savannah bushland was cleared from 1967 when the institutions began to provide a market for high quality fuelwood. It has since degenerated into grassland as shown by the moderated fine grey spectral response (G1b) to a mottled bright whitish cyan with very high reddish tonal variations (G1a) in 1986.

It would, therefore, appear that the general trend is from density to sparseness; so much so that by 1986, the SPOT image depicts a situation in the grassland zone where the standing woody vegetation cover, as a percentage of the total ground cover, is estimated at between 0 and 15 per cent (see No. 1 in Map Legend).

[1] The school, which began as a day primary school in the late colonial period, became a boarding secondary school around the mid-1960s.

8.5.1.4 <u>Others (S1c and P1w)</u>:

These zones are mainly common in the north, west, south-west and central parts of the Division. Some of these cover types are only beginning to occur in the upland east as well.

In 1967, it appears that settlements and attendant cultivation were dense mainly in the western and north-western parts of the Division. Woodlands and bushlands had very sparse human influence elsewhere. The scene in 1986 appears to have changed dramatically and on the image an increase in mottling of spectral patterns with spots of reddish, cyan and blackish 'signatures' has formed a curvilinear band in the western and northern border areas. Such an influence is also common in the Woodlands (W2a - d) and to a small extent in the Bushlands (B3a - f).

The reddish patches reflect live-hedges, woodlots of largely exotic trees and clumps of bushes in open spaces between homesteads and on fallow land. Domestic fuelwood requirements in these zones are supplied by stubble from farmlands and by grassland woody resources as well as in part from woodlands. Interviews confirmed these zones as having high rates of fuelwood purchase. In 1997, nearly 60 per cent of the Division is now settled and a critical fuelwood scarcity is emerging, directing pressure to the already fragile woodlands and bushlands particularly around Waradho Hill, Ayweyo Luora and Ayweyo R.C. areas where remnants of the woodland and bushland categories still survive.

8.6 <u>Conclusion</u>:

Historical surveys of land cover change over time can contribute to an appreciation of trends, and reveal long-term patterns of change in specific areas. Remotely sensed images lend themselves to accurate land cover and land use mapping, particularly where alternative ground survey methods would prove costly and time-consuming. Aerial imagery provides the unique capability to reconstruct previous land cover patterns by using archived images (Campbell, 1983: 57). With practice, an experienced image interpreter can easily delineate areas of relative uniformity of land cover, even though such areas may appear homogeneous. Change detection therefore requires that comparison be made of two separate land cover maps prepared from imagery acquired at two different dates, both maps having been prepared using a single classification system applied consistently at a given level of detail.

Two contrasting complexes of change are found in Nyando Division. One is on and around Waradho Hill, the Bushlands/Forests zone, where the highest estimate of woody vegetation cover was recorded, though it did not have a uniform distribution. Much of the concentration was on Waradho Hill. Lower areas were covered mainly by less dense and isolated trees with associated thickets. The skewed distribution is attributed to two main factors: Waradho Hill has suffered less human interference in terms of settlements or farming; and that areas down the Hill were specifically used for settlements and farming, and recorded few trees. Therefore, the significant decline in woody vegetation between 1967 and 1986 in areas around Wang'anga, Oren, and generally to the north of Waradho Hill was a result of the local increase of settlements and agriculture due to increase in population and in-migration. In addition, interviews established that there are less tree planting activities around homesteads in this area (see also Table 7.4).

The same impact was also recorded in areas to the northeast of Waradho Hill, and to the west and northwest of Yogo around '*Kuth Awendo*'. Most of the Savannah Woodland in 1967 had been replaced with Savannah Grassland in 1986, when there appears to have been not only an expansion of grassland but a reduction in stand density, with increased exposure of bare ground.

The sparseness and reduction of stand density were largely due to the combined effect of selective harvesting of the dominant woodfuel species such as *Acacia* spp., *Albizia coriaria*, *Balanites aegyptiaca*, and the expansion of settlements and agriculture. This condition is exacerbated by the fact that the above species have slow rates of regeneration, and by a general lack of initiatives in tree growing by local people. The situation had not changed much by 1997, and had possibly worsened. Local people have now turned to the Waradho Hill and are clearing patches for settlement and agriculture (see Plate 3.2b - Appendix A. 4). There is also selective felling of the dominant species here such as *Terminalia brownii*, *Teclea nobilis*, *Rhus natalensis*, etc. for building poles and woodfuel. Because of the rapid decline of these species, regrowth has not been allowed to grow beyond three years before being cut again. As a result, charcoal traders are now travelling farther away to the neighbouring Kericho District (a distance of 20 to 30 km) with donkeys to obtain supplies.

The failure of local people to plant trees has apparently been due to their proximity to the wooded Waradho Hill. However, mounting pressure there has led to serious depletion of wood resources. There is an impending scarcity and the threat of almost total depletion as farming and settlements are encroaching all over the Hill. Yet, I found local people were not planting trees even in their homesteads.

The second complex of change, in other parts of the Division, is marked by a general shift of the woody vegetation from the original bushland to concentrations around settlements (see Table 7.4). These regions include areas to the north, west, southwest, and central parts of the Division. These are the curvilinear bands of reddish spectral patterns in the 1986 imagery. Most natural bushlands have disappeared, giving way to the expanding settlements and the agricultural frontier. The high concentration of woody vegetation around homesteads, include live-hedges (commonly of *Euphorbia tirrucalli*), woodlots and single standing trees mainly of exotic species.

The irony in some areas, particularly around Ahero, Onjiko, and Boya, is that households depend heavily on fuelwood purchases while there are plenty of trees standing in the homestead (see Section 7.7). They also obtain their fuel(wood) through scavenging for sticks near Euphorbia hedges, clump bushes, sisal hedges, and using crop residues. This is a paradox and contradiction. Trees here mainly serve for building poles, shade, hedges, and wind-breaks. Interviews established that tree growing is mostly the responsibility of men; and though women shoulder the burden of fuelwood provision, they rarely get support from the menfolk. Men are generally unwilling to have any trees felled in order to supply fuelwood for the household (cf. Bradley, 1991; Bradley and Huby, 1993; Mearns, 1995).

CHAPTER 9 KNOWLEDGE INTERFACES AND THE MANAGEMENT OF ENVIRONMENTAL RESOURCES: PERSPECTIVES FROM THE FIELD

9.1 Introduction:

Faced with a common ecological problem such as a fluctuation in a natural resource like fuelwood, local people commonly come together through social integration and reciprocity. This results in the pooling of diverse local innovation and skills, through acts of negotiation and accommodation of each other's perspectives and lifeworlds. This seems contrary to the reality that farmers' knowledges are often fragmented and diffuse rather than unitary and systematised (see Chapter 1). It is what I would refer to as 'collective action in diversity', characterised by the re-evaluation of knowledge repertoires and the (re)construction of a common 'truth' or 'new' knowledge through a commingling of multiple realities or lifeworlds, a commingling which may be maintained and adapted through social interaction (Röling, 1994: 126). Maturana (quoted in Röling, 1994: 126) states that, "If there are multiple realities, disagreement means negotiation, accommodation, learning, and the ability to reconstruct someone else's reality". This may be referred to loosely in this context as 'plural rationality' (cf. Leach and Mearns, 1996).

This scenario underpins the *social actor perspective* advanced by Arce and Long (1992), which assumes that people or groups are social actors who are intentional and construct realities based on actual circumstances (cf. Chambers and Leach, 1987). This may be contrary to the scientific and economic approaches which obtain results by assuming objectives of policy measures and devices (Röling, 1994). The disaggregated lifeworlds of rural people differ sharply from the aggregate perspective of state policy. The concept of intentionality as opposed to the assumption of objectives underlies the disaggregation, with a diversity of conflicting goals, attitudes, values, aspirations, and standards. This eventually creates the arena in which actors negotiate, accommodate and sometimes agree, thus enhancing their level of social aggregation (ibid.) which forms the platform for 'collective action in diversity'. The foregoing argument underpins the issue of adaptive behaviour (see Section 1.5.1).

According to Arce and Long (op cit: 212), "Everyday life is dominated by the pragmatic motive [which] is essentially oriented to solving practical problems". They argue that, in order to discover different strategies of adaptation, the different category systems that individuals use to reduce the complexity of the environment and to organise their behaviour must be identified. In such circumstances the people operate in what Moore (1973, quoted in Arce and Long 1992: 232) has called 'semi-autonomous social fields' wherein, in the face of both internal and external pressure, individuals or groups possess the capacity for preserving some normative consensus and control over their own social arrangements, despite inherent environmental constraints and limitations.

The aggregation of the disparate perspectives, skills, knowledges and practices of local farmers into an explicit 'unitary' body of knowledge does not, however, reduce the highly differentiated internal specificities of their individual lifeworlds. This is what Scoones and Thompson (1994: 3) refer to as, "manifold, discontinuous and dispersed" knowledge. The process of collectivisation is often an offshoot of the local people's encounter with the realities of serious environmental resource constraints. This is what instigates collective responsibility, with acts of patronage and reciprocity sometimes being valuable spin-offs. Local people's mutually-shared pragmatic responses to local problems eventually form a common body of local (indigenous) knowledge, in what Arce and Long (op. cit.: 244) refer to as 'epistemic communities'. Such knowledge is not systematised and/or codified as 'science', but is purely tacit and evenly distributed and/or dispersed (Morgan and Murdoch, 1998). In natural resource management, Röling (op. cit.) states that as natural resources become scarcer, stakeholders perceive this scarcity as a social problem, and therefore realise their interdependence for solving it, thus coming together to agree (see also van de Fliert *et al.*, 1993).

Such is the context for this analysis of knowledge interfaces and the management of environmental resources. This multi-layered analysis encompasses the different levels and hierarchies of institutions and power from the local up to the national level, with special reference to policy and local rural practice, in the two study areas in Nyando Division (see Figures 9.1 and 9.2). The influence of the Western worldview will be examined in the light of the historical (colonial heritage) and contemporary (global forces). The analysis takes a cultural, political ecology approach. The concept of interface has been adopted as the frame for this analysis, with the 'social-actor perspective' as the instrument (cf. Arce and Long, 1992). Social interactions at these different levels of hierarchy are interrogated. These include the local community and the institutions and administrative instruments of the state.

The concept of interface entails some kind of face-to-face encounter between individuals with different, possibly conflicting, forms of knowledge, interests, resources and power (ibid.: 214). Analysis of such interface encounters seeks to bring out the types of discontinuities that exist and the dynamic and emergent outcomes arising from social interactions of actors. Although the methodology of interface studies focuses on specific social interactional processes, the analysis needs to situate these within broader institutional and power fields (cf. Long, 1989b) and not to be restricted to face-to-face encounters. "An actor-oriented approach [which] focuses upon the interplay of different social constructions of 'reality' developed by the various parties to the interface...and traces their social implications. Such an approach...is of value for analysing the production, dissemination/utilisation and transformation of knowledge" (Arce and Long, 1992: 214). This analysis focuses mainly on forestry, and addresses five main levels of social and/or institutional interactions, namely, between the local farmer in the village area, the field extension worker at Location level, the Divisional Forest Extension Officer (DFEO) in Nyando, the District Forest Officer (DFO) in Kisumu, through the Provincial Forest Officer (not studied here), to the national headquarters in Nairobi, in that sequence. Representatives from different levels in this hierarchy were interviewed in order to (re)construct these interfaces. The analysis also revisits the issue of sectoral conflicts, right from the national to the local level.

9.2 Forestry and Extension Activities in Kisumu District: Interfaces Between Policy and Practice

In Kisumu District, since there is no government gazetted forest, the main forestry activity undertaken by the Forest Department (FD) is extension. Forest staff give technical advice to local farmers on matters of forestry, and this extension is supported by 7 government and 161 private tree nurseries. Of the eight divisions in the District, only Nyando Division has no government tree nursery, usually attributed by the officers to lack of a suitable site. In Kisumu District, Koguta Hills Forest (which actually falls under County Council Trust Land[1]) is the only place where the Forest Department undertakes significant afforestation (about 324 hectares).

Koguta Hills Forest was started in 1957, but has made little progress. According to the District Forest Officer of Kisumu, the slow progress derives from the initial planting of the wrong tree species, such as *Pinus patula* and *Cupressus lusitanica* which were not adaptable to local ecological conditions. Their failure was a grim reminder of the relics of the 'new' forestry doctrine (see Chapter 5) which relied heavily on exotic species. The DFO told me on 11.9.1996, "Foresters believed on the exotic species as the main forest trees. Nevertheless, things are changing, as other species like *Terminalia brownii* (indigenous) and *Eucalyptus saligna* are doing quite well". Records in the Forest Inventory Section in Nairobi show that Koguta Hills Forest had 169.5 hectares (about 52 per cent) planted with *Eucalyptus* spp. (mainly *saligna*) by July 1995, aged between 12 and 25 years).

9.2.1 <u>The Interface Between the Farmers and the Field Extension Workers</u>:

Forestry field extension workers in Nyando Division function at the Locational level (see Figure 9.1). Here, the extension workers are expected to attend Chiefs' public *Barazas*[2] and other development meetings within their areas of jurisdiction, to explain forestry matters and seek to influence local people to plant trees. Each division in the district, including Nyando Division (295 km^2) is staffed by one forester (all male). Below that rank are the field extension workers or front-line staff (all male), each responsible for one of the five locations (recently increased to six) in the Division, with an area of about 50 km^2. Such a large area makes it practically difficult for these staff to maintain sufficient contact with the over 6,000 farm families in the Division[3].

Forest extension staff must execute their duties by interacting with local farmers, while at the same time deriving their operational mandate and legitimacy from the objectives

[1] Trust Land is government land held in trust by Local Authority Councils.

[2] *Barazas* are regular local public meetings convened by local administration officers, particularly Chiefs or Assistant Chiefs of the localities.

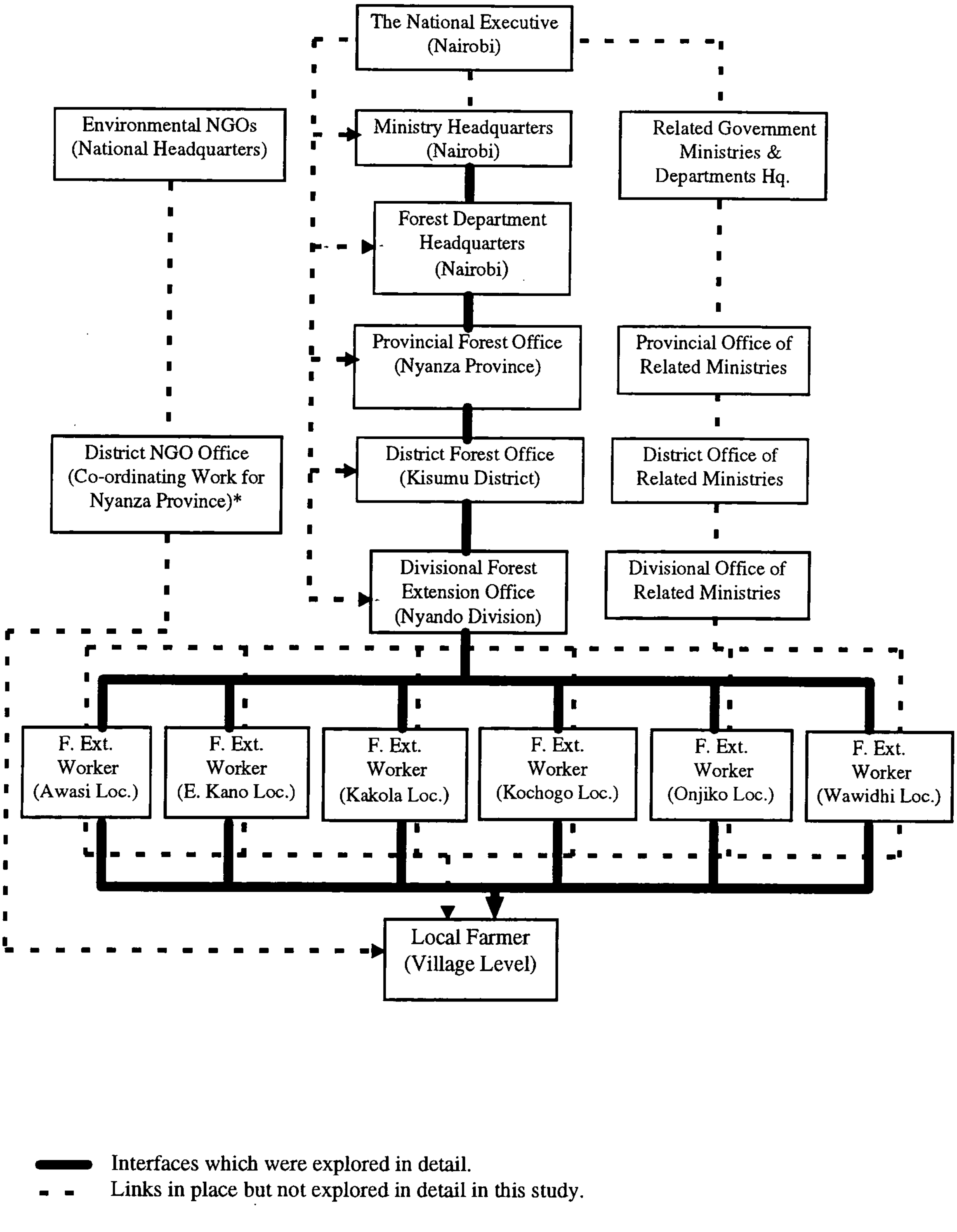
[3] This means a contact ratio of about 1:1,000. The district ratio for the Ministry of Agriculture extension staff was found to be at 1:871, which is considered the best in Nyanza Province, according to the Provincial Soil Conservation Officer interviewed on 31.1.1997. However, the problem of limited access to transport was common. For example, field staff are not provided with bicycles nor transport allowance.

of policy. The extension staff represent a different institutional lifeworld, and hold possibly conflicting worldviews from those of local farmers. The two sets of lifeworlds and worldviews often present a discordant social interaction, characterised by diversity and difference. Such a scenario sometimes results in miscommunication and/or the insufficient flow of relevant information.

The field extension worker is placed in a rather awkward operational dilemma, as he tries to bridge the gap between the farmer-perspective and that of his immediate seniors in the institutional hierarchy (cf. Arce and Long, 1992: 216) - see Figures 9.1 and 9.2. A majority of extension workers in Nyando Division hail from the area. This position is challenging because, in articulating official aspirations, rules and priorities, the extension officer also falls prey to the divergent perspective of the local farmers. He is influenced by both sides, with his legitimacy also at stake. His response in such circumstances is to try and convince the farmer to adopt his(extension worker's) official perspective. Some local farmers respond differently (see Section 9.2.2).

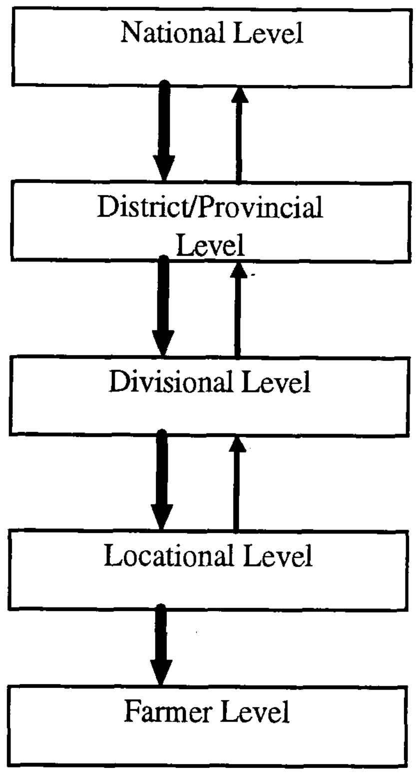
The divergent goals and priorities of extension workers and local farmers often lead to misunderstandings. While forestry staff refer to specific types of trees and their botanical names, and emphasise their scientific aspects, local people are faced with difficulties of identification and grasping the scientific names, as some species have been introduced lately. In addition, most scientific names lack equivalent common names; and names vary greatly across species and localities (see Section 9.3). The absence of proper dialogue and understanding between the two parties results in a situation of human-induced ignorance, which affects mutual interaction and communication. The forest staff, therefore, fail to identify or recognise local people's interests, skills and practices.

There seems to be no specific tree-growing programme by the Forest Department geared towards fuelwood provision in Nyando Division. The forest staff have instead capitalised on the problem of fuelwood scarcity as a means of reaching the women and popularising tree growing among them, which perhaps explains why they have been reasonably successful with local women's groups. Where men belong to groups dominated by women, differences in gender perspectives and prioritisation are clear, and



Note: (1) The arrows represent dominantly one-way communication.
(2) Lack of linkage between government ministries working in related fields.
(3) This institutional framework can easily be short-circuited, e.g., through interference by political power elites.

Figure 9.1: Policy and practice: Institutional framework focusing on the forestry sector.



Represents downward delivery of official instructions regarding institutional rules, priorities, and aspirations.
Represents upward accountability.

Note: All the different institutional levels from the national down to the local, except the farmer level, maintain a two-way interaction. Lack of upward interaction and the rigid stance adopted by extension workers deny the farmer an opportunity to share his/her view, thus the farmer often proceeds with his/her own local practices (see Section 9.2.2).

Figure 9.2: The interfaces between different hierarchical levels of institution and power in forestry activities in Kenya.

have permeated the group dynamics, leading to both conflicts and successes. According to the DFEO, Nyando (20.9.1996), two tree nurseries have failed because men always want to dominate and have priority when it comes to sharing the benefits. In other cases, men members have paid dividends, providing the opportunity to negotiate issues of land tenure and a point of contact with other men outside the groups. Land questions are critical to the success of tree growing programmes, because women often face the problem of 'where to plant' the trees they receive from group tree nurseries, as seen later.

Extension activities at the local level have been difficult for a number of reasons, particularly the shortage of trained staff, lack of transport, and inadequate funding; the local land tenure system and poor or lack of policy awareness at the local level have been other constraints (see below). Staff, transport, and funding together affect extension services and policy articulation at the local level. Such circumstances might mean that they constantly draw on their pre-existing knowledge. The existing extension workers (front-line staff) are not well trained (except through experience) to handle their duties, despite being involved in policy implementation at the local level. As the DFO explained, their only training is the occasional in-house seminars and briefings they are given when they go to collect their salaries at the DFO's office at the end of the month. These involve basic forestry matters, for example, seedling production and tree tending techniques. This background is insufficient to enable them to handle all the aspects of forestry required, although they are the key actors in forestry activities at the local level.

The local land tenure system was another major constraint faced by local extension workers, particularly in tree planting by local people (see Section 3.4). The issue featured prominently, both in farmer-interviews and interviews with local extension staff. Local people claimed that they do most planting along boundaries, particularly within homesteads, due to the land problem. Where planting is along farm boundaries, disputes arise between neighbours, especially with species such as Eucalyptus which have adverse effects on crops. The Forest Department has not been able to resolve such disputes as the Forest Act does not cover trees outside gazetted forest (see Section 5.2.2). This is a policy vacuum, yet to be fully addressed. The DFEO (21.9.1996) suggested to me the establishment of an Environmental Management Committee (EMC) at both divisional and locational levels for this purpose.

Such conflicts extend to the broader general issue of tenure of land and tenure of trees, and are common in Luo customary traditions as an old father subdivides his land among his sons. Conflicts also occur over land which has changed owners through purchase. In each case the 'new' owner starts claiming trees found on the piece of land, creating ownership disputes which are referred to the Forest Department. One officer at the DFO's office (15.10.1996) revealed that they resolve these issues by asking the previous owner of the land to harvest the original trees, while the 'new' owner possesses the regrowth.

Issues of policy and their interpretation are pertinent at the local level. For example, the policy requirement of reporting to the government authority when a farmer wants to cut many trees has drawn mixed reactions. Both farmers and forestry staff feel that the requirement is a disincentive to farmers, because people feel as though the government is controlling them on their own property (cf. Chambers, 1993: 117). This interpretation by the local people puts field extension staff in an awkward dilemma. The DFEO summed it up:

> "The problem is that local people do not actually want to be controlled on their own property. When we give somebody trees to go and plant, he assumes the trees are now his, and he has the right to decide what to do with them whenever he pleases. Now, when you come with a policy that, before he cuts the trees he should ask for permission from the government, then he feels there is no need to plant the trees in the first place".

Most extension agents cite the 'poor interpretation' or 'lack of awareness' of relevant government policy by local people as one major difficulty in implementation of policy. On the other hand, some farmers feel the government has a hidden agenda for encouraging them to plant trees. This resonates with memories of the colonial era when the government took land away from local people after having asked them to plant trees on such land. Maragoli Hills is a vivid example in this case (see Section 5.3.1). Therefore, local government agents are viewed with suspicion when they try to encourage tree growing among local people.

The social interaction between extension workers and farmers tends to be one-sided, the farmer often being on the receiving end of a prescriptive, 'teacher-pupil' relationship

(Figure 9.2). Local extension workers often treat farmers as passive, ignorant people who need enlightenment in matters concerning trees. One extension agent in Nyando Division graphically captured this kind of relationship when asked about local people's knowledge of the government policy on tree growing (22.8.1996):

> "They could not know...and that is why we are telling them now. We are like teachers who are teaching pupils in a school. When you take your child to school, he/she does not know anything, and has to be taught in order to know. So, local people could not know anything, not until we came and taught them".

The 'teacher-pupil' relation seems to be the trend. In response to a question on soil conservation, the Nyando Divisional Agricultural Extension Officer (DAEO) said (22.8.1996), "...we try to *teach* them how soil can be conserved without necessarily building terraces, which they feel is not necessary". He further explained that such measures involve things like mulching, unploughed strips, trashes (putting crop wastes down to forestall soil erosion), and retention ditches, which retain water to allow it to sink in the ground. He stated that such practices do not necessarily require a hilly area, also arguing that any piece of land has a certain percentage slope which may be liable to erosion.

To counter this notion with a local perspective, Dan in Kadhier said (14.8.1996):

> "There is not much difference between the way we and the agricultural officers conserve the soil. The only difference is that the agricultural officers often emphasise that local people have to employ their (officers') techniques. But people can use their own methods to ensure that their farms are not eroded, for we are aware of the problem that is likely to occur, e.g., our crops being washed away".

The issue here is not a real but an assumed ignorance on the part of local farmers by the local 'experts'. The sober truth is that the two groups of people tackle a similar problem in two different ways. The apparent lack of co-operation has resulted in failure to identify their complementaries and differences. Joannes, a local farmer in Muga clan, said (13.10.1996):

> "For deep gullies which have formed outside the farm, we place cactus plants (*Aloe* spp.) or sisal plants (*Agave sisalensi*) across them, to intercept the run-off and to allow soil to be deposited. When the gully starts to form inside the farm, then we avoid weeding around that very spot, to allow grass to grow in order to check further soil erosion" (see Plate 9.1 - Appendix A. 15).

Local people's prioritisation is dictated by a number of interrelated factors, which largely determine what they decide to do. This applies also to the choice of tree species to plant, which is based on multiple considerations characteristic of rural economies (cf. Chambers, 1997; Chambers and Leach, 1987).

Local farmers have to make rational decisions regarding the choice of tree species to plant. Of the trees being promoted in Nyando Division, the Forest Department staff stated that farmers tend to prefer the fast-growing trees like *Eucalyptus* spp., despite their adverse effects on the environment. Other reasons why Eucalyptus is preferred are its straight poles and multiple products (construction poles, fuelwood, and charcoal). *Cassia siamea* and *Grevillea robusta* are other preferred species. Both are also compatible with crops, and good shade trees; only fruit trees can compete. Table 9.1 shows sales returns for seedlings in Kisumu District in the month of September 1996, to illustrate this point.

Table 9.1: Monthly sales of seedlings by the FD in Kisumu District, September 1996.

Exotic	***Total***	***Indigenous***	***Total***
Aberia caffra	501	Albizia coriaria	25
Delonix regia	256	Cassia siamea	1337
Eucalyptus citriodora	1190	Croton megalocarpus	40
Eucalyptus saligna	2156	Markhamia lutea	348
Flower cutting	510	Melea azedarach	90
Fruits	1526	-	-
Grevillea robusta	319	-	-
Leucaena leucocephala	225	-	-
Terminalia mantaly	165	-	-
Others	354	-	-
Total	7202		1840

Source: Compiled at the District Forest Office, Kisumu, 1997.

Concerning attendance at Chiefs' *Barazas* by front-line staff, some local people were critical, claiming that it has achieved very little. Joram, a farmer and local teacher, said during a focus group in Muga (13.10.96):

> "They normally go to the Chiefs' *Barazas* where very few local people attend, as these meetings are associated with old men. Talking to such people will not create much impact. The extension staff seem to lack the right forum to meet with local

people...This is why implementing government policy on tree planting has failed".

There was a growing consensus among local people that extension agents lack the 'proper' approach. Joram added:

> "As a teacher myself, when you try to teach something in a certain way and people do not follow, then next time round you employ a different method. But these government agents have stuck to the *Barazas* ever since, even when nothing is happening on the ground".

According to Joram, what most local people are suggesting is a kind of demonstration plot which will serve as a showpiece. This is likely to motivate people and sensitise them on the role and importance of such projects. His suggestion agreed with separate comments by Dan and Phoebe in Kadhier.

Another issue raised by local people concerned inadequate follow-up of on-going projects. This may generally be linked to the lack of proper work plans and clear objectives for the local government extension workers. To illustrate this point: a tree plot was started in 1992 by a group of young men in Muga through a government initiative. The government donated a 5-acre plot where the local youth group, Youth Union Development Club (YOUNDE), planted over 1000 trees. The project is almost a failure, according to what I saw when I visited the site in September 1996. The reason given by the youth leader, Joshua (15.9.1996), was lack of follow-up and support by local government administration, including the Assistant Chief. Neither the local agricultural officer nor the forest officer, both of whom were directly involved in the establishment of this project, had adequate follow-up to monitor its progress. The plot now lies derelict, with only a few isolated, poor-looking trees. The youth leader said they left the plot in such state of neglect because the local Assistant Chief was not willing to support them in protecting the trees from animals belonging to the local community. There were also questions of power relations and local politics at play. Trying to protect the trees on their own put the youth on a collision course with their parents and the entire local community, with clan differences also emerging.

9.2.2 The Interface Between Extension Workers and the Office of the DFEO:

The programme and style of work by the local extension workers in Nyando Division suggests a lack of strategic, focused approaches designed by their immediate boss in the upward chain of command (see Figure 9.1). This exposes the extension workers to individual struggles to obtain contacts with local farmers in order to justify their legitimacy and continued employment. Such practices may engender acts of irresponsibility, such as failing to carry out their responsibilities as required.

The apparent scheme of work is that the extension workers travel around the Location visiting different local farmers and/or women's groups and try to promote forestry activities. Cases of interested groups and individuals are reported back to the DFEO, who then accompanies them to provide technical advice, probably because the extension workers lack the relevant technical training to address farmers' concerns effectively.

Some local farmers seem to have noticed deficiencies in the extension workers technical abilities and respond by proceeding with their own traditional practices concurrently. For example, Dan in Kadhier said (14.8.1996): "Yes, it is good to hear what the technicians have to say regarding the management of environmental resources, but that does not hinder us from proceeding with what we have been doing previously on our own". The issue here revolves around the nature of the particular knowledge base, with the attendant power relations and the competing struggle for legitimate control over environmental resources. Differences in institutional prioritisation of basic needs and the diverse lifeworlds of local farmers and forest staff are key issues that need primary consideration prior to any technical interventions from above.

I would therefore recommend that the DFEO meet with his subordinates (the field extension workers) to devise a scheme of work that will promote and enhance mutual co-operation between extension workers and local farmers. Interaction of knowledge is a vital component in such a co-operation. For example, the question of land could perhaps be one reason why the growing of *Euphorbia tirucalli* has prevailed in the study area; another being that the interstitial nature of its planting allows selective felling for fuelwood provision to take place without necessarily causing dents in the live-hedge (see Section 7.7.3). The large volume also compensates for its low calorific value, often emphasised by foresters. In response to my question on species commonly used for fuelwood in Nyando Division, the DFEO said (20.9.1996):

> "...people like growing *Euphorbia tirucalli* for live-hedge and finally use it as fuelwood, though its calorific value is very low. One would need quite a lot of it to get the same calorific value obtained from a small portion of other species like *Cassia siamea* or *Eucalyptus* spp."

One positive alternative is to promote and popularise the fast-growing and multiple-use agroforestry trees. Agroforestry is one practice still lacking in most parts of Kisumu District, particularly in Nyando Division. Apart from the benefits of improved soil fertility and increased harvests, local people also stand to obtain fuel, fodder and timber. The DFEO agreed that, once these benefits start to accrue, people will develop interest and change their current attitude towards tree planting in general. He added that this will have a ripple effect on policy implementation at the local level, as people will take care of trees which are a source of livelihood. Generation of interest is therefore the starting point in his view, followed by policy articulation, and not vice versa. These are concerns which need to be properly integrated in the current work scheme to avoid haphazard extension activities, as seems to be the case at present.

9.2.3 <u>The Interface Between the Offices of the DFEO and the DFO</u>:

The Divisional/District (Provincial) interface is characterised by conflicts and duplications. Different government ministries and/or departments are involved in activities which may be either antagonistic or complementary. These sometimes create some disagreement in their promotion of certain activities. For instance, the DFEO, Nyando (20.9.1996), feels that a lot of land has been dedicated to rice farming, which could be shared with trees:

> "The field left for rice is very big compared with the rest of the land. If it were possible, planting of trees should also be accepted within the rice fields. This would augment the trees we already have on other pieces of land. Otherwise, the land is just too big to be left for rice alone".

Although the above suggestion by the DFEO seems sound, it may not be practicable due to the related problem of birds hiding in the trees and feeding on the crop.

Under its environmental conservation programme in Kisumu District, the Ministry of Agriculture (MoA) undertakes soil and water conservation activities. These are geared towards the management of targeted catchment areas, and carried out through mobilising community participation in soil and land management activities. The initiative is dubbed 'Community Mobilisation Against Desertification' (C-MAD), according to the Provincial Soil Conservation Officer (PSCO), Nyanza. The PSCO (31.1.1997) said they first conduct a Participatory Rural Appraisal (PRA) prior to choosing project sites. One catchment area measures about 300-400 hectares. A separate interview with the Divisional Agricultural Extension Officer (DAEO), Nyando (22.8.1996) confirmed that the programme has been in operation since 1989 and is also functional in Nyando Division; the DAEO's explanation tallied with the information given by the PSCO.

The planning and layout of the conservation structures are designed by a technical team (the Divisional Planning Team (DPT)), then left for farmers to implement. Implementation consists mainly of building terraces, *fanya juu, fanya chini* (meaning, building up and down), soil fertility improvement using organic matter, etc., agroforestry interventions and tree planting. The PSCO, Nyanza, stated that they produce an average of between 700 and 10,000 seedlings per year per catchment area tree nursery, including seedlings from individual and group nurseries. According to the PSCO, each division in Nyanza province is to tackle at least three projects in one catchment each year. At the end of each year, finished projects are handed over to the division's agricultural technician and a Catchment Committee elected by local farmers, with the Assistant Chief of the area as the patron, to facilitate follow-up. Tables 9.2 and 9.3 show environmental management activities and seedling production by the MoA in Kisumu District during the 1993/1996 period. These initiatives might conflict with or complement work by the FD.

Table 9.2: Environmental management activities in Kisumu District, 1993-1996.

Activity	*1996*	*1995*	*1994*	*1993*
Catchments	24	24	36	26
Farms 'conserved'	2924	2608	2287	1488
Trees planted	43700	165560	172977	*

* No data available

Source: Compiled from records in the PSCO's office, Kisumu, January 1997.

Table 9.3: Seedling production in Kisumu District by MoA, 1993-1996.

		Nursery				
Year	*Tree type*	*Central*	*Group*	*Individual*	*Total*	*%*
1996	Fruit	*	6333	*	6333	14.5
	Forest	*	37375	*	37375	86.0
1995	Fruit	29350	16220	1560	47130	17.4
	Forest	140000	71100	12880	223980	83.0
1994	Fruit	28430	19130	2260	49820	19.0
	Forest	135400	69545	8370	213315	81.2
1993	Fruit	18488	10000	1600	30088	16.0
	Forest	110974	42000	5200	158174	84.0

** No data available*

Source: Compiled from records in the PSCO's office, Kisumu, January 1997.

The overall national seedling production, and that in Kisumu District by the FD over time, are shown in Tables 9.4 and 9.5 respectively. These were both exotic and indigenous species, and included production from private nurseries. The FD alone had a total of 350 tree nurseries country-wide by 1996. Nevertheless, figures from private nurseries are rather conservative because cases go unreported, and are unknown to the forest extension staff. Separate, complete data for Nyando Division over a period of time were available only for the month of September 1996 (see Table 9.6). Since the

Division has no government tree nurseries, the seedlings shown in Table 9.6 were produced by schools and colleges, women's groups, and individuals. Overall, nurseries of women's groups produce about three-quarters of the total.

Table 9.4: Total seedling production from national tree nurseries by the FD, 1990-1996.

Year	*Exotic species*	*Indigenous species*	*Total*
1990	56371605	13715667	70087272
1991	59341009	10332605	69673614
1992	62072753	16241915	78314668
1993	43986295	8154266	52140561
1994	34157193	6589119	40746312
1995	37511671	8304214	45815885
1996	38757931	7451519	46209450

Source: Compiled from FD records in Nairobi, January 1997.

Table 9.5: Total seedling production in Kisumu District, 1981-1995.

Year	*Forest Department*	*Others*	*Total*
1981	520955	218284	739239
1982	1065843	2237964	3303807
1983	1514218	2183088	3697306
1984	644230	*	644230
1985	600000	*	600000
1986	663432	146451	809883
1987	810584	362533	1173117
1988	166051	156350	322401
1989	878421	173181	1051602
1990	681475	696956	1378431
1991	1029947	1072428	2102375
1992	325576	628581	954157
1993	306845	901022	1207867
1994	87164	921609	1008773
1995	328377	1082961	1411338

* *No data available.*

Source: Compiled from FD records in Nairobi, January 1997.

Table 9.6 Monthly seedling production in Nyando Division, September 1996.

	Tree	Nursery		
Species	*Schools and Colleges*	*Women's groups*	*Others*	*Total*
Exotic	427	5385	1390	7202
Indigenous	180	1295	365	840
No. of nurseries	2	12	5	19

Source: Compiled at the Kisumu District Forest Office, January 1997.

Some NGOs, for example, CARE-Kenya are also engaged in environmental/land management initiatives in the region, especially through tree planting activities. This increases the level of duplication, since no structures for co-ordination at the local level exist. What is being done, according to the PSCO, Nyanza, is to cultivate friendship among themselves as key players in this undertaking. One notable difference cited by the PSCO is that the NGOs pay for every seedling produced while government ministries do not. That is, they meet the cost of seedling production. An interview with the CARE-Kenya forester in the region (13.1.1997) confirmed that the NGO is involved in tree planting with local women's groups, particularly in Siaya and Homa Bay districts, for soil conservation as well as agroforestry. The programme is adapted to farmer-research. The CARE-Kenya representative decried what he called, "the unfortunate overreliance on exotic trees in the region at the expense of indigenous ones, which are more adaptive". The main issue though should be adaptability rather than origin *per se*.

9.2.4 Questions of Policy Conflicts and the Management of Land Resources: The District (Provincial)-National Interface

Difficulties in managing land and its resources arise at the local level for government and non-governmental bodies, at the interface of policy and local practice. The leading problem is perhaps that of duplication and overlap. Although the FD is technically the key player in forestry activities, other government sectors, such as the MoA, the Ministry of Energy (MoE), Local County Councils (LCCs), etc. are also involved (see

Sections 5.4.3, 9.2 and 9.2.3). There seems to be no clear reason why the department which appears best suited to the task should not be the one to be involved. This scenario sometimes leads to administrative and jurisdictional overlaps. For instance, LCCs claim ownership of forests on Trust Land, even though it is the FD which are involved directly in their establishment and day-to-day management.

A senior officer at the FD headquarters in Nairobi (21.2.1997) suggested to me the establishment of a ministerial and/or sectoral collaboration to avoid unnecessary conflicts and duplications. Examples are the production and conservation conflicts between the MoA and the FD over forests. A senior officer of the Biomass Division of the MoE headquarters in Nairobi (24.7.1996) revealed that such collaboration was started between the MoA, MoE, and the FD in 1987, when the Biomass Division of the MoE was created. Although the move was initially embraced by all parties, differences arose later. According to this senior officer, managers at the six ecological-zone centres countrywide started placing their individual ministry interests above that of the joint mandate, to compete for donor funding for their own ministries/sectors. The officer lamented that the MoE was on the losing end, since it relied heavily on both the FD and the MoA to function effectively on wood energy.

The problem is that such collaborative ventures are negotiated and agreed at the national level, without the necessary local infrastructure or capacity for implementation. This is why there are "duplications and collisions of approaches", as described by the PSCO, Nyanza (31.1.1997). The MoA and the FD promote trees at the local level but for entirely different reasons. The MoA focuses on trees particularly for environmental conservation (through catchment rehabilitation and conservation, and over erosion-prone areas) and on-farm trees, e.g., fruit trees and agroforestry. Many of these activities duplicate those of the FD and even spill down to the divisional level, although others are mutually supportive and complementary. The issue of sectoral conflicts at the local level is very real. An antagonistic case is where the MoA promotes rice farming at Ahero Rice Irrigation Scheme in Nyando Division (see Section 9.2.3)[1].

[1] As a complementary case (or sheer wasteful replication?), I encountered both the FD and the MoA operating tree nurseries side by side at Gem Rae in Lower Nyakach Division, near the border with Nyando Division. Both nurseries have been there for 15 years, and that of the MoA had more fruit trees than that of the FD.

The second major problem is the implementation of the new Forest Policy. Policy reform, and particularly the second Forest Policy revision in Independent Kenya which culminated in the Forest Policy of 1994, were seen in the government circles as long overdue, since Kenya's previous Forest Policies were generally considered as lacking in pragmatism. After the euphoria accompanying the new Policy, there dawned the harsh reality of transforming the paper document into real action on the ground. This transformation seems not to be forthcoming. There is a growing sense of pessimism in top hierarchies of the relevant government ministries. A senior officer of the FD interviewed in Nairobi (23.1.1997) maintained that the reduced funding to the forestry sector is likely to reduce the implementation of the new Forest Policy. This is even more obvious from a technical perspective, according to the Director of the National Environment Secretariat (NES) interviewed in Nairobi (23.1.1997). As the new Policy is notionally based on a participatory management approach, including all stakeholders, it would require adequate capacity-building at the local level for effective implementation. There is also the twin problem of creating a level of awareness about the objectives of the new Policy among local people, as key actors in this 'co-management' strategy. A senior officer of the FD in Nairobi (23.1.1997) suggested that extension staff should be wholly charged with policy implementation at the local level if any meaningful success is to be realised. But I would suggest that with the current crop of technically unqualified field extension staff, little success can be expected.

9.2.5 Funding Issues:

Budget issues are pertinent and central to the present and future performance of the forestry sector. Although the sector currently operates under specific fiscal budget, the FD must justify its legitimacy for continued funding from the central government and other donors. Therefore, the FD has to outline activities and budget estimates for their annual operations. As seen earlier, such legitimation permeates throughout the whole forestry sector and filters down even to the lower hierarchies of responsibility. Table 9.7 shows the budget for items that could be linked to current efforts for policy implementation at the local level (the allocations apply to the Rural Afforestation Extension Scheme (RAES) spending Vote for Kisumu District over time).

Table 9.7: Budget allocations (in Kenyan Pounds) to the Kisumu District RAES, 1987-1996.

					K£[1]					
Vote Item	*1996*	*1995*	*1994*	*1993*	*1992*	*1991*	*1990*	*1989*	*1988*	*1987*
Transport	7000	4280	3420	2500	2500	2500	1500	1050	1200	1300
Publication and Printing	-	-	-	-	-	-	-	-	-	-
Advertisement and Publicity	-	-	-	-	-	-	-	-	-	-

[1]*K£1 is equivalent to Ksh.20.*

- *means no money was allocated*

Source: Compiled from records in Forest Department Headquarters in Nairobi, January, 1997.

Expenses for transport covered the entire District operations, including fueling two official vehicles in the DFO's office, with an additional problem of lack of spares for existing vehicles. It seems that no other media was used in propagating the forestry message and policy, apart from the Chiefs' *Barazas* and the front-line staff. The other funding possibility could be through the Local Afforestation Scheme (LAS) shown in Table 9.8.

Table 9.8: Budget allocation to the Kisumu District LAS, 1987-1996.

				K£[1]						
Vote Item	*1996*	*1995*	*1994*	*1993*	*1992*	*1991*	*1990*	*1989*	*1988*	*1987*
Transport	11752	17481	11752	2500	4800	1448	1300	1400	2000	1300
Publication and Printing	-	-	-	-	-	-	-	-	-	-
Advertisement and Publicity	2231	2231	1500	-	1300	1300	-	-	-	-

[1]*K£1 is equivalent to Ksh.20.*
- i.e., no money was allocated

Source: Compiled from records in Forest Department Headquarters in Nairobi, January 1997.

Table 9.9 gives the yearly overall budget allocation by the central government for the two Votes, which includes all items. Except for staff salaries, this is the total allocation for forestry operations in Kisumu District.

Table 9.9: Total budget allocation for Kisumu District forestry operations (excluding staff salaries), 1987-1996

					K£[1]						
Vote	*1996*	*1995*	*1994*	*1993*	*1992*	*1991*	*1990*	*1989*	*1988*	*1987*	*Total*
RAES	22200	16160	11461	8520	6720	7260	5274	3427	4857	4890	9076
LAS	27505	27505	22341	8890	12638	8391	5620	5185	5940	3940	12795
Total	49705	43665	33802	17410	19358	15651	10894	8612	10797	8830	21872

*Estimated costs of development and recurrent needs (excluding salaries) by the Kisumu District Forest Office amounts to about K£303,438 per year (KFMP, 1994: 23).

[1] *K£1 is equivalent to Ksh.20.*
RAES: Rural Afforestation Extension Scheme
LAS: Local Afforestation Scheme

Source: Compiled from records in Forest Department Headquarters in Nairobi, 1997.

The production and marketing of seedlings is the second area of concern between the district (provincial) and the national level. To some extent, political statements influence and shape both the direction of policy and practices at the district level. Some of these statements have undesirable influences on the performance of duties by district staff. For example, I was informed by another senior officer of the FD in Nairobi (23.1.1997) that the high figures for 1992 in Table 9.4 were largely due to exaggeration. The government wanted more farmers to participate in that year's tree-planting day, and therefore directed that more seedlings be produced to meet that demand (a target of 50 million seedlings was set). Districts, therefore, doctored figures to meet this requirement.

Another issue of seedlings concerns the pricing policy. The Economics Section of the FD in Nairobi sets regular price guidelines which apply uniformly throughout government-supported tree nurseries country-wide. Subsequently, the uniform prices result in seedlings becoming unaffordable in districts such as Kisumu, with high levels of poverty and seemingly little interest in trees. This pricing policy does not take account of the varied ecological and socio-economic realities in different localities. For instance, the price was increased from an average of Ksh.4 to Ksh.7 per seedling, effective 1st September 1996. Such policies, in my view, undermine the very objectives they seek to promote. The DFO, Kisumu, said to me that the increase in price would further affect purchases in Kisumu District, where seedlings were already being sold for between a half and a third of the cost of production. He felt that the new price was on the high side, particularly for districts with low potential, and suggested that price adjustments should be based on each district's potential. Seedlings from government nurseries, therefore, fail to sell.

The third area of concern between the district (provincial)-national interface is the forestry curriculum at the public universities and sub-professional colleges. The 'scientific' forestry doctrine has formed the main body of knowledge imparted to forestry graduates from these institutions. Such knowledge has not been responsive to the changed circumstances on the ground, which the new Forest Policy of 1994 is seeking to implement. The change in policy direction calls for a concomitant change of curriculum. For instance, special emphasis needs to be laid on the integrated land-use approach, which will allow foresters to gain basic interdisciplinary knowledge and a broad view of forest management. Such knowledge becomes paramount in the 'co-management' strategy involving local people and trees outside the forest. Courses such as those in plantation (monoculture) forestry management are limiting, and inapplicable in places such as Kisumu District with no forest plantations. There is need for a comprehensive reform of the forestry curriculum in order to equip professional foresters with knowledge in related fields. This would enable them to respond positively to farmers' needs, with one offshoot being the enhancement of complementarity among different sectors - government and non-governmental.

A fourth and final level of interface involves research scientists in national institutions and implementing officers at the district and the divisional levels. Research scientists normally prescribe what the DAEO, Nyando (22.8.1996), referred to as 'blanket recommendations' from their research findings which are deemed to apply in certain local contexts. However, the results of these recommendations are not always positive in the real local environment, as most of the research is conducted in controlled surroundings. Agricultural extension staff in Nyando Division, however, prove not to be blindly implementing such recommendations without validating their efficacy. Rather, a Fertiliser Extension Project conducts field tests of recommended fertilisers, before advising interested local farmers on what action to take. According to the DAEO, some fertilisers are not suitable for certain local contexts. Therefore, they first explore the exact nutrients needed for specific localities, instead of simply adopting the given recommendations.

Farmer-knowledge has also proved relevant in this exercise. One illustration involves a particular yellow-flowered shrub which normally grows along roads and footpaths in Kisumu District. Local farmers had proved this shrub to increase maize yields when allowed to grow in a farm fallow for a season before planting. The DFO, Kisumu (11.9.1996) explained to me how agronomists at the Kenya Agricultural Research Institute (KARI) in Maseno tested the leaves of the shrub and found them to be high in phosphorus. They subsequently cut its branches and placed them between rows of maize which realised high yields. Since the shrub has a high biomass turnover, it sheds leaves very fast and releases phosphorus. Such openness of 'scientists' to local farmers' knowledges is one isolated, yet commendable and significant step towards bridging the gap between the two knowledge bases. It also underlines the importance of farmer-adaptive research, which is done ostensibly to validate innovations, particularly initiatives introduced by external agencies.

9.3 The Environmental Knowledge Frontier and Policy Implications[1]:

The aim of this section is to attempt to pull together various strands of issues raised in the chapter, by interrogating the different hierarchical levels of interface. It provides a summary of the interlocking of theory and practice in relation to policy implementation at the local level.

The legitimate and sovereign power of the state to enact and implement policies uniformly is a matter subject to debate in Kenya. This becomes more contentious due to

[1] Much of this Section draws on two of my published articles, Mahiri (1998a, 1998b).

the centralised and hierarchical nature of the entire operation. The local communities who bear the brunt of the impacts of policy are often out of the picture, only later to find themselves in a complex web of struggle to maintain their livelihoods in an unfavourable policy environment. This calls for a process of policy formulation which goes beyond the preserve of the state to incorporate local perspectives (cf. Princen and Finger, 1994; Wapner, 1995). Integrating locally-based knowledges is part of the solution.

The problem is not with policy *per se*, but with the bureaucratic style and mode of its formulation and implementation. Overwhelming emphasis on the technical issues often precludes the essence of dialogue with the local communities as a necessary component (cf. Thompson, 1991). There is a common false assumption that knowledge and skills necessary for sound management of environmental resources reside entirely in the external authority, and not with local people. This is a 'scientifically given' notion that 'experts' are repositories of environmental knowledge and are 'mandated' to have the last word on all issues pertaining to the environment (cf. Chambers, 1987, 1993, 1997). This notion, alas, survives widely among scientists, professionals and policy-makers in many African countries, including Kenya (Mahiri, 1998b: 527). Nonetheless, the notion is inimical to sustainable development, and obscures a plurality of alternative and legitimate knowledges of the environment (Leach and Mearns, 1996). There is little recognition of the importance of traditional local knowledges. Ignoring such knowledges could result in policy failure at the local level, thus spelling doom for resource sustainability.

The existing relationship between government implementing agencies and local communities operates more on a 'top-down' basis, with no attempt to cultivate mutual trust and interdependence. This, combined with memories of the colonial heritage, creates insecure relations between the two parties, and results in reticence among local people. The ripple effect is the widening of the social world between the 'experts' and the local people, which leads to the failure to "link contrasting types of knowledge and the mutual generation of socially constructed systems of ignorance" (Arce and Long, 1992: 217). The apparent monopoly of knowledge by 'experts' may then lead to intimidation of local people and inhibition of their knowledges in the presence of 'experts' (Mahiri, 1998b: 528).

The PRA transects I conducted separately with groups of 'experts' and local people in Nyando Division were a means of reducing the undesirable influences arising from local power relations (Mahiri, 1998a, 1998b). Issues of power relations came up many times with households in the study area. Whenever I asked them during discussions what they did to tackle certain problems, they threw the question back to me, saying, "You experts should tell us what to do". The pursuance of such "received wisdom about environmental issues obscures a plurality of other possible views, and often leads to misguided or even fundamentally flawed development policy in Africa" (Leach and Mearns, 1996: 3). Pretty and Chambers (1994) argue that learning in universities and other agricultural institutions reinforces and promotes the undesirable aspects of professionalism. This sounds a clarion call to radical reform of the curriculum.

Ecological diversities and socio-cultural differences in different localities require us to consider a plurality of knowledges. Such a combination of knowledges can gain strength in diversity (Thiele *et al*, 1988). Achieving convergence between local and 'expert' knowledges, therefore, demands not only a pragmatic shift towards the promotion of interdependence in knowledge and mutual support, but also a change in the education system (cf. Pretty and Chambers, 1994).

The knowledge interface is complex, yet crucial to addressing issues of environmental resources in rural areas (see Box 1). For example, despite the multiple functions of *Euphorbia tirucalli* in rural economies (including provision of fuelwood), foresters still do not rate it highly for fuelwood, advocating instead tree species with a high calorific value such as *Balanites aegyptiaca*, *Acacia* spp., and *Terminalia brownii*. This sounds a logical yet theoretical proposition, because such species are already ecologically threatened and some are near depletion in Nyando Division (Mahiri, 1998a, 1998b). In addition, *Balanites aegyptiaca* and *Acacia* spp. have slow rates of growth and regeneration, and foresters admitted that they are not successful with propagating *Balanites aegyptiaca*. I learned from the local people that the tree is propagated by livestock, particularly the small ruminants which eat the fruit/seeds and then pass it out with their waste.

BOX 1: KNOWLEDGE INTERFACE

EXPERTS	VILLAGERS
1. Clear the bushes and plant trees to get fuelwood and wood for timber and building poles.	1. Retain the bushes to get fuelwood, sticks for building granaries (see Plate 9.2[1]), frameworks for walls and roofs of huts, and browse for small ruminants.
2. Plant two to three trees where you cut one.	2. Management of coppice and/or regeneration from stumps of trees that have been felled.
3. Concentrate on wood for fuel.	3. Using wood from farm trees, Euphorbia hedges, sticks from bushes, dry sisal leaves, crop residues, cow dung, etc. for fuel.
4. Standard scientific naming of trees, e.g. *Thevetia peruviana* ("Mafua" in Luo).	4. Derivative naming based on function, e.g. 'Mafua' meaning flower or ornamental, for the tree is used as ornamental hedge.
5. Soil lacks nitrogen.	5. Soil lacks manure.
6. Working on irrigation plans to provide adequate water for crops.	6. Harvesting rain water through diversion into farms by digging trenches and building wash-stops.
7. Researching on chemical weed control, e.g. for *Striga* weed.	7. Using cultural and/or traditional methods of control such as uprooting the weed.

Note: The interface is a 'gap', conflict or agreement in their own terms.

Source: Mahiri (1998: 533).

The dry stalks of maize and sorghum being stored for fuel by rural women after harvest were also condemned by the foresters for that same 'scientific' reason of low calorific value. In the words of one forester, "The most intelligent thing could be to recycle the nutrients; and moreover, it is very inferior by the way of calorific value. So, one just needs to get rid of it". Despite the 'expert' claim of better fuelwood species, the 'experts' cannot say why the villager does what he or she does. Foresters have introduced many exotic trees as alternative fuelwood to what a majority of rural people are using, but the communication gap is still great (see Section 9.2.2).

[1] See Appendix A. 15.

9.4 Conclusion:

Newly introduced inputs and external innovations need to be tested and be given meaning within local bodies of agricultural knowledge and practice. Their adoption by local farmers is likely to be a gradual and dynamic process, with slight modifications and transformations. These are farmer-adaptations which have been tried locally and found to be suitable for their own local environments.

The successful reworking of both the new and existing forms of knowledges is undertaken in order to devise workable systems that lead to viable strategies. It is both an attempt to break away from dependency, and to seek to forge interdependence and complementarity of knowledges. The clear complementarity between 'expert' knowledge and local knowledge is a potential avenue to overthrow the myth of the superiority of 'scientific' or 'expert' knowledge (Mahiri, 1998b; Richards, 1985). We need not think in either/or terms, but instead appreciate that integration of knowledge is a vital component for effective, sustainable management of environmental resources. It is not the exclusive knowledge held by 'experts' that holds the key to understanding the environment, but the mutual interdependence of both 'expert' and indigenous knowledges. But this needs to be brought together carefully, so that the dominance of 'experts' does not automatically occur. The social environment needs to be carefully considered when eliciting local knowledges through participatory methods in order to minimise possible influences from pre-existing power relations (Mahiri, 1998b: 535).

Extension activities at the local level must pay attention to the views and perspectives of local farmers, as key actors in the whole operation. Ignoring their views and experiences inevitably leads to a partial solution to local environmental problems, or to project failure at best. On the other hand, priorities set by most local people are dictated by multiple, interrelated problems, which include poverty, labour constraints, etc., and mainly determine their overall involvement in any rural venture initiated from outside.

CHAPTER 10: CONCLUSION: THE WESTERN WORLDVIEW VIEWED FROM THE LOCAL LEVEL

10.1 Introduction:

This chapter concludes my thesis. The chapter begins with the broad implications of this study for development studies in general. It outlines salient features and new findings from this study, giving recommendations and charting the way forward, while also identifying areas for further investigation. Implications for Kenya's overall development and for the study area are also presented. It concludes by re-emphasising the central issue of interface discordancies.

10.2 What Conclusions Can be Drawn?

First and foremost, fuelwood is clearly a social 'problem' before it can ever be treated as an environmental issue. Overall, we are reminded that Western images and perceptions of the people-environment interaction are shaped and perpetuated by the dominant macrocosmic worldview of the binary conceptualisation of resources, which views environmental resources mainly as economic goods for optimised utility (see Section 1.5.1). The view, which is in apparent contradiction with the local (indigenous) approach to environmental resources, is propelled and legitimised through mainstream Western orthodoxies and meta-narratives, such as the neo-Malthusian development discourse. Such legitimation is further reinforced by the predominantly 'top-down', technocratic development model which seems to cherish upward accountability, rather than empowering local people to contribute their knowledges and skills to manage environmental resources. Policy formulation and implementation in low-income countries, including Kenya, have largely adopted this Western worldview.

Secondly, the disaggregated lifeworlds of rural people differ sharply from the aggregate objectives of national policy. Despite the highly differentiated internal specificities of their individual lifeworlds, local people have shared responsibilities over local resource problems (see Section 9.3). Those local people (as individuals or in groups) possess the capacity for preserving some normative, standard practices and control over their own resources. This is achieved through social arrangements and institutions[1], and the aggregation of their disparate perspectives, knowledges, practices and skills, in spite of harsh environmental constraints. This forms the body of indigenous knowledge which is used in responding to problems of natural resource fluctuations. Informal local institutions, therefore, may serve to regulate actions in the face of the different and possibly conflicting individual interests and priorities, as seen below.

The impacts of policy in Kenya have systematically eroded these regulatory mechanisms and rendered them largely inactive. The co-existence of 'modern' and traditional tenure systems impedes co-operation (see Section 2.5). The often perceived 'rationality' of one tenure system being 'better' than another hinders the finding of workable solution to the current conflict. Although the problem is part of the colonial legacy, there is no need for retrospection. Instead, this thesis reiterates the urgent need for radical changes such as, for example, devolution of policy formulation to take account of diversity in local contexts.

Thirdly, many of the problems experienced by development agencies in low-income countries occur due to the failure, deliberately or otherwise, by 'experts' to recognise and appreciate local knowledge, initiatives, skills and practices. This is particularly true of fuelwood. Since the invaluable contribution and ingenuity of local people that underpins sustainable resource use and management has been underplayed, the complexity and varying dimensions of the fuelwood issue are not fully explored. This ties closely with the issue of intrinsic inequalities, and socially differentiated access to resources. Sustainable natural resource management practice requires a broader, inclusive participation to incorporate socially and environmentally diverse contexts (see Section 10.2), to redress questions of sustainable resource management at the local level. Compelling ecological evidence from the local level sounds a clarion call for serious consideration in bringing knowledges together.

The first three points are general issues exemplified by fuelwood problems. The following five are all specific fuelwood issues.

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[1] Institutions are understood here as regularised patterns of behaviour between individuals and groups in society, or "complexes of norms, rules and behaviours that serve a collective purpose" (de Janvry *et al.*, 1993: 566, cited in Mearns, 1995: 103).

Fourth, the 'fuelwood orthodoxy' school which associates fuelwood consumption with deforestation and subsequent 'woodfuel crisis' clearly misses the features peculiar to fuelwood demand and supply within the rural landscape, or 'fuelscape' (cf. Cline-Cole, 1998: 311). Such schools of thought are often theoretical, professional perceptions which fail to reflect local conditions. The fact that the study area for this thesis has no forests contradicts such views still mainstream in Kenya. Most fuelwood sources in the study village areas are outside the forest, from on-farm, multiple fuel/wood resources. It is clear from historical accounts (archival records, oral histories, and aerospace remote sensing techniques) that the sources and patterns of fuel(wood) use have changed remarkably over time. Environmental, socio-economic and policy factors (e.g., land registration) have been significant in this change (as seen later). Inequalities and differential access to existing fuelwood resources preclude generalisation on supplies.

Fifth, shortfalls in fuelwood based on demand-supply balances, as exemplified by the 'woodfuel gap' theory, do not seem to provide accurate projections because they fail to capture local complexities. The highly diversified local systems of fuel(wood) procurement often lead to localised differences in resource availability (see Chapter 7 and Section 8.6). The resulting difficulties of aggregation of information on energy use tend to negate predictions based on the 'woodfuel gap' theory. Data on the supply and use of biomass fuels should ideally include all forms of biomass monitored over the seasons (Hall, 1994). In the context of the household, this requires knowledge of the nature, size, and quality of biomass energy flows (see Section 7.10).

Fuel(wood) monitoring reveals characteristics and trends of consumption within households (see Section 7.10). As illustrated in this thesis, fuelwood consumption is not a linear function of household size (cf. Cline-Cole *et al.*, 1990). Overall, there was apparently little change in the amount of fuelwood used by households monitored. The amount of fuel was governed by cooking style and patterns, and by the fact that some households were involved in certain trading activities which require use of fuel (e.g., *Mandazis*). These, combined with the seasonal and/or temporal variations, cause accurate assessments of fuelwood consumption to be cumbersome and problematic. It is difficult, in practice, to capture the dynamics of household fuel consumption. Fuel supplements also need to be taken into account. In addition, multiple uses of fire and fuel-saving practices are rarely considered. These are specific underlying processes which mainstream (particularly neo-Malthusian) theories can not illuminate.

Sixth, the use of fuel(wood) and preferences for species are not always matters of free choice, but are subject to the availability of the resource and are also dynamically linked to socio-economics and seasonality. Since the 'most preferred' fuelwood species in the study area, such as *Acacia* spp., *Balanites aegyptiaca*, etc. are limited and mainly found in the market, poor households may not be able to afford to buy them (see Section 7.8.1). Income differentials, therefore, cause significant distinctions in household fuelwood preferences and/or affordability. However, depending on the season, other fuels such as crop wastes may represent obtainable supplements, or alternatives, to other unaffordable fuels, particularly for the rural poor. As stated earlier, such dynamics render overarching generalisations of consumption inappropriate and futile (cf. Hill *et al.*, 1995).

Seventh, the institutional structures that govern the allocation and use of environmental resources play a crucial role in resource management (see Sections 3.4 and 7.5). The setting of priorities and the making of choices by local people based on local circumstances, are fundamental issues of natural resource management at the local level. These priorities and choices are closely linked to the socio-cultural, ecological, and economic conditions which are varied and context-specific. Local people have their own institutional arrangements and adaptive practices to cope with fluctuations in resources and environmental uncertainties. The failure by government policies and laws to appreciate customary rights and privileges creates conflicts and confusion in the management of local resources. The best policies will derive from institutions which permit communication of policy needs between local people and 'experts' (cf. Tiffen *et al.*, 1994: 285). Development initiatives and strategies need to be in harmony with local social goals and priorities, with an agenda which is locally-based and in line with the practices and values of the communities concerned. This is because local people in their diverse localities respond differently to various environmental constraints.

The different adaptations employed locally in response to the complexity of the environment need to be documented. The lack of awareness by policy-makers of long-term changes within specific ecosystems makes partnership urgent. A new partnership call between 'experts' and villagers has been sounded by Richards and others (see Section 1.5.2). However, sensitive field methods which allow full participation of villagers and a full appreciation of local knowledges are essential if such partnerships are to be achieved (Mahiri, 1998b: 535; Richards, 1985).

Finally, the "analysis of difference" (Scoones and Thompson, 1994: 3) in the face-to-face encounters between different institutional lifeworlds and hierarchies of power and responsibility should ideally be premised on clear understanding of the internal operations within the disparate institutions. The absence of such understanding is likely to create a situation of miscommunication or a false assumption of 'ignorance' of the other party. The vantage point for a fair judgement of the authenticity of both Western and local knowledge bases is through initiating a two-way communication. As the direction of arrows in Figures 9.1 and 9.2 show, such interaction was lacking in the study area, as local extension workers generally treated farmers as passive recipients of technical advice and not as active partners in the interface. A one-sided interface impedes learning and the interaction of the two knowledges. As demonstrated in this thesis, the extension workers and/or government officials tend to be in a "powerful, controlling position, being the purveyor of 'new' knowledge to farmers" (ibid.: 6). Some farmers in the study area have, therefore, retreated into reticence and proceed with their own local practices (see Section 9.2.2). This is a question of "whose reality counts" (Chambers, 1997). Nevertheless, this thesis supports the idea that power is not absolute or unitary but varies with different levels of social interactions involving various people.

External interventions such as extension services at the local level have great potential if they provide an environment for *collaboration* over knowledges. Local farmers, who are supposedly the recipients of extension services (see Section 9.2) have, on their part, developed over the years, locally based and tested strategies suitable for their own local environments. Interdependent knowledge becomes necessary, through the forging of links and open communication, because integration of knowledges is a vital component for effective, sustainable management of environmental resources. Ignoring either knowledge base leads to partial solutions to local fuelwood issues and environmental problems.

The analysis of interface presents an arena of contrasting interests and contending worldviews that demands negotiation and dialogue for any fruitful outcome. External agencies must recognise the struggles farmers undergo to cope with complex, diverse and risk-prone environments. This thesis concurs with Scoones and Thompson (1994: 6) that the "farmers' voices need[ed] to be heard" during the process of extension. This will help to identify areas of diversity and difference.

Although collaborators in rural development in Kenya, including government and non-governmental agencies, provide some facilities and services for improved land resource management, their approach remains more 'top-down', and prescriptive than 'bottom-up'. Upward accountability holds sway. Though local people's knowledges and skills may not be sufficient, they need better support from public and private agencies through two-way communication. Such support should be geared to help them tackle multiple problems, to meet their priorities and at the same time take advantage of their opportunities. The failure to accommodate each other's social worlds sends wrong signals and inhibits the advance of knowledge and society, with serious repercussions for environmental management.

The ubiquity of poverty has made it difficult, particularly for the rural poor, to afford fuel-saving technologies and/or commercial fuels such as kerosene, gas, electricity, etc. Moreover, there are critical problems of supply of these fuels. As poverty increases among the general rural and urban populace, more people, particularly the urban poor, will shift from non-wood energy alternatives such as kerosene, gas, etc. to woodfuel, further increasing demand and pressure on the already threatened tree stock. With reliable and cheap supplies, more urban people could switch to these fuels and, thus relieve the current pressure on wood energy. The government of Kenya should therefore direct appropriate energy policies towards curbing the depletion of popular woodfuel species. They must be based on local research (like this study) within disaggregated local settings throughout the country. This is likely to identify local fuelwood species under pressure of demand, thus leading to more specific area-based interventions. There is a critical need to devolve the process of energy policy formulation in order to take account of the agro-ecological, socio-cultural and economic realities in specific local contexts. Contextually appropriate policies may then be put in place.

10.2.1 Findings in the Study Area and their Implications:

What becomes evident in this thesis about the two study clans (Kadhier and Muga) is that, firstly, they exemplify different responses from two nearby communities in different environmental contexts to a similar problem. Particularities of knowledge, perceptions and practices of resolving the fuelwood problem also differ according to locality, household and the individual within the household. This supports Scoones and Thompson (1994: 3), who state that, "knowledge is manifold, discontinuous and dispersed, not singular, cohesive and systematised". The statement does not, however, underplay the importance of the uncoded, normative community practices (see Chapter 7), which are implicit societal dynamics and norms within their various internal specificities.

The disparities in the endowments of wood/tree resources in the two study areas explain some contrasting responses as fuelwood resources diminish. Aerospace imageries clearly illustrate the rate of change and decline in stand density of the woody vegetation cover arising from the effects of anthropogenic forces (see Chapter 8). Lack of tree planting, particularly by the local community in Muga area, has increased the severity of this decline. The response in Kadhier village area seems positive, as more trees have been planted (see Table 7.4). Nevertheless, economic considerations have resulted in the shifting of priorities and value, which places fuelwood as a low priority. Therefore, a paradox of 'scarcity' and 'abundance' has emerged.

Inter-household differences in resource allocations, and inequalities in endowment of wood resources, in both village areas echo the paradox of 'scarcity' and 'abundance' found in Kadhier (see Chapter 7). This makes the fuelwood problem essentially a land-use problem that can be addressed directly as an energy problem (Mahiri and O'Keefe, in press). Consequently, the rural energy problem can not be addressed in isolation as a single 'crisis' separate from the equally critical question of land and poverty. Resolving the rural fuelwood problem will require resolution of the land issue and/or the poverty issue.

Secondly, the two contrasting complexes of change (see Section 8.6) in the study area produce critical questions of entitlement, particularly in Kadhier, which push local households to other fuel options and to trading activities to generate extra income to meet increased cash demands (including the purchase of fuelwood). This thesis stresses the need to explore such options, so that more support can be provided to strengthen them. A general lack of initiatives in tree-growing by local people in Muga village area clearly spells doom for the small enclave of the wooded Waradho Hill. It is apparent in this case that the immediate short-term gains will probably jeopardise future levels of sustainable wood supply in this locality; in other words, "selling the future to pay for the present" (Darkoh, 1996: 77).

Questions of entitlements and differential access to resources may explain the high dependence on fuelwood purchase and supplements of crop wastes, especially following harvests, in the study area. Although people try, through creative trading activities and support from remittances, to narrow the gaps in household income differentials and in entitlements, such incomes are neither guaranteed nor stable. Land privatisation has exacerbated inequalities of access to the already diminished fuelwood resources. Unexpectedly, this study found that distances travelled to collect fuelwood have *decreased* as people turn to alternative and purchased fuels, contrary to some findings of previous surveys that distance travelled to fetch fuelwood increases as a result of scarcity (see Section 2.3 and Table 2.2c). Responses to local fuelwood scarcity, particularly in Kadhier, are multiple, mainly through adaptations by local households (see Section 7.7).

Thirdly, prices of fuelwood in the study area varied with availability of the resource (see Section 7.8). Differences in prices of fuelwood were based on the type of the woody vegetation. Areas endowed with natural (spontaneous) wood resources (mainly in Muga village area) had fuelwood on sale at a lower price than the area with an equivalent endowment of planted trees (i.e., Kadhier village area). Although the general endowment of wood resources should naturally determine levels of fuelwood pricing, this was paradoxically not the case in Kadhier, with abundant planted trees (see Table 7.4). The finding mainly underlines the issue of entitlements.

The additional finding was that, with proportionately large endowments of natural wood resources, there were few initiatives among local people in Muga clan to plant trees, as they relied on these natural sources. Another dimension of the finding with reference to Kadhier was that, even with the preferred fuelwood species in short supply in the area, households still could not break away completely from such species and would prefer to obtain them whenever they could be found and/or able to be afforded (see Section 7.10.1).

Fourth, the fuelwood trade in the study area is a recent phenomenon, which has arises since about the mid-1960s. Access to open collection areas has been reduced due to land adjudication (see Section 7.2) and changing entitlements. The trade is not, however, well defined and stable, as some traders interviewed sell only occasionally and under necessity to meet urgent financial obligations (see Section 7.8). Such needs force the rural poor to transform the use values of fuelwood into exchange (Redclift, 1987), resulting in tree resources acting as their savings bank (Chambers and Leach, 1987). I would argue that the involvement of households in the fuelwood trade in my study area is more of a stopgap measure necessitated by occasional financial constraints than an income specialisation as argued by Dewees (1989: 1168). The fact that a majority of fuelwood traders in the study area were women supports this argument, because women often feel the pressure of financial obligations in the family. The predominance of women in the trade further suggests that the activity is associated with other responsibilities of women. The period they have been in the trade provides supplementary proof.

Commoditisation of the fuelwood resource, and the encouragement of its market, differed generally between the village areas. In Kadhier, women lack fuelwood because men have refused them access to the trees (i.e., the question of entitlements - see Sections 7.5 and 7.8). The impact of land privatisation, which is mostly felt by the land-poor households, who may have had usufruct to previously 'open access' sources (see Section 7.2), has worsened the situation.

Fifth, a large proportion of wood energy is consumed by the urban sector. The trend has been constant over time, since the colonial period (see Section 5.4.3; Table 7.7; Section 7.10). The disproportionate growth of the urban fuelwood market against local fuelwood production has adverse consequences for the environment. The exponential increase in urban woodfuel demand poses the greatest threat to sustainable wood production in the face of present declines in availability. For instance, there is no tree planting by hoteliers interviewed which is commensurate with the amount of woodfuel consumed. This clearly shows that present demand is eating into existing wood stock, thus exerting more pressure on the available wood/tree resources. Much of the supply is obtained from local sources within the Division, except for a large proportion of the charcoal. As agriculture also plays a significant role in the decline of wood/tree resources (see Appendix A. 5), it is imperative that a deliberate move is made towards policy harmonisation. Other development policies such as agricultural policy should take account of likely environmental consequences.

The promotion and development of alternative and affordable sources of fuel for the urban and rural poor should be thoroughly explored. This is a collective challenge for rural development agencies, government, and civil society, since subsidies by the government to encourage a switch from fuelwood to, for example, kerosene have virtually failed in other countries like Zambia and Indonesia (Mercer and Soussan, 1992; Foley, 1986). Taxation policy on alternative fuels requires careful consideration, but using such fuels requires additional investment in the necessary accompanying technology.

Sixth, the patriarchal nature of the household structure and production system in the study area (see Section 3.5.1), as in many Luo communities, is a deeply entrenched practice which covers almost all the domains of household resources. This study revealed that tree planting is not synonymous with availability of fuelwood, just as the use of cow dung and crop wastes for fuel may not always be reflective of fuelwood scarcity (see Sections 7.6 and 7.7.3). The issue is complex and difficult, and goes beyond the simple, superficial scenario, to mesh with cultural traditions, values and beliefs. In addition, tree planting by women does not free them from the yoke of local male dominion and control over household resources, because women still have no automatic usufruct to the trees, without seeking the husband's permission (see Sections 7.2 and 7.5; Muturi, 1992). (This rule seems to be nullified by the death of the husband).

Seventh, knowledge transfer and the empowerment of local people are critical areas of interface between the farmer and government officials. There is a real or perceived threat of loss of power and legitimacy to officials. This fear permeates through the whole area of local extension services and all the different hierarchies within the forestry sector (see Section 6.6.2). This thesis can safely conclude that this is a major hindrance to effective extension services at the local level.

Eighth, encouragement by the forestry extension service for the farmer to develop tree nurseries is a costly exercise, due mainly to poverty: the cost of the initial investment required is too great for the majority of local farmers[1]. This is compounded by the fact that marketing the seedlings is problematic as there seems to be no buyers and, in the case of group nurseries, seedlings given to members to plant in their own farms do not offer quick returns, due to the long time trees take to mature. People therefore prefer to devote most of their efforts to other activities such as rice and sugar cane farming, petty trades, etc., which provide relatively quick returns (see below, and Section 3.5.4). This is one hindrance to tree growing, stated separately by each of the five extension agents and the Divisional Forest Extension Officer (DFEO), Nyando, interviewed in the Division. For women, 'where to plant' raises other problems, as men always make decisions on the use of land and trees. Conflicts of interest still arise when the trees mature. Since fuelwood ranks low in men's priorities, women have little chance of using the trees for fuel. Men often evaluate the mature trees on the basis of their economic value. For example, if the tree is very straight, then it will be sold as building poles rather than be burned in the kitchen as fuelwood. Such decisions are often in disregard of any prior agreements between the couple, and may create tensions in the family.

[1] To start a tree nursery requires, first and foremost, a piece of land, then a reliable water source, good soil, wheelbarrow, spade, water cans, polythene tubes and, of course, labour.

10.2.2 Some Opportunities in the Study Area:

The high concentration of the woody vegetation around homesteads in Kadhier area includes live hedges of *Euphorbia tirucalli* and other trees not specially valued for their economic worth. This provides a possible point of intervention in the local fuelwood problem. Local households might be encouraged to improve and value these potential sources of fuelwood. The promotion of less culturally restricted and less economically valuable trees such as *Thevetia peruviana*, *Euphorbia tirucalli*, *Lantana camara*, etc. is one attractive option identified by this study to circumvent the present inequalities (including gender disparities) in entitlements and resource differentials. Due to the fact that all these trees thrive well under diverse climatic and ecological conditions, and are widely accepted as fuel by a majority of households, they could be strongly recommended as viable options for planting and improvement. For instance, *Thevetia peruviana* is a versatile tree which serves multiple functions (live-hedge, shade, ornamental, termite-free building poles, fuelwood, medicinal, etc.) within the rural landscape. It provides good quality wood, and is also proving very popular with women as a good quality fuelwood, of a level comparable to species such as *Acacia* spp., *Balanites aegyptiaca*, etc (see Table 7.3). Similarly, *Euphorbia tirucalli* is well-adapted to the area and its multiple-function status in the rural landscape is an added advantage.

Despite conflicts and contradictions in purpose and use, these less economically valued trees could provide a necessary stopgap in addressing the fuelwood problem. Unfortunately, the changing custom among the younger generation in wage employment of preferring ornamental trees for their homes rather than using Euphorbia may eventually sound a death blow to the long Luo tradition of having Euphorbia live-hedge around homesteads. This also threatens the provision of good quality wood for building poles and timber.

The question of land scarcity could be addressed by building on what local people are already doing. *Thevetia peruviana* was found to grow better (with straight boles) when planted alongside the live hedges of *Euphorbia tirucalli* around homesteads (see Section 7.7). Less land would be required, while the live-hedge of Euphorbia would be reinforced. Other functions such as its shade-provision and value as an ornamental tree would further reduce constraints in land space, as such locations can easily be created within the homestead. Secondly, the tree is compatible with crops and is never eaten by animals due to its poisonous latex (see Table 7.1). That means it can easily be integrated within the farming system. *Euphorbia tirucalli* and *Lantana camara* have almost similar functions and niches in the rural landscape which could be explored and reinforced, especially that of promoting sustainable fuelwood provision. These proposals are applicable in both the study village areas.

In sum, the conclusions to the thesis underscore the fact that local rural people systematically adapt to constraints in environmental resources by developing complex response mechanisms, which lead to the addition of new blocks to the body of local (indigenous) knowledge. Such a knowledge base is tacit and context-specific, and contrasts with the Western scientific, codified worldview, in response to similar environmental changes. Interdependence of knowledge and partnership is the likely way forward.

10.3 What is New About This Study:

Investigations of fuelwood mainly focus on consumption and production (see Chapter 2). Few studies have explored the historical and cultural dimensions of the fuelwood issue (including the different knowledges - see also, Cline-Cole, 1998), employing a multiplicity of methods (see Chapter 4). Better policy and planning in the rural energy sector demands retrospective, longitudinal analyses. This is one major achievement of this study which is a significant departure from the standard practice in fuelwood investigation.

Being people-centred, the study unveiled multiple local practices (as explained by the people) in managing environmental resources. Of special significance was the opportunity that this study created, by organising participatory rural appraisal (PRA), for the local people and 'experts' to explore the local environment through transect walks (Mahiri, 1998a, 1998b). This was also a novel departure from standard 'participatory' transects.

10.4 Implications of the Study for Kenya's Energy and Forest Policies:

The propagation and popularisation of Western forestry knowledge has been achieved systematically through the forest education and propaganda necessary for the advocates and proponents of this concept of forestry to perpetuate their agenda for change.

The binary conceptualisation of 'man/forest' interactions mainly in economic terms has reduced forests to threatened habitats (see Section 1.5.3). The counter-argument maintained by this thesis is that sympathetic forestry programmes devised by foresters and farmers together can be effectively used as instruments to help transcend the binary vision and move into a broad and more radical conceptualisation of forests (see Section 9.2.4). The relevant wings of the present government have the difficult task of transforming the forestry curriculum in the universities, by broadening their scope to encompass the strategy of an integrated approach or 'co-management' concept. It is encouraging to note that Moi University's forestry degree programme has recently been expanded to cover, to a limited degree, the integrated approach to forest land-use management, and this needs to be taken further.

The Western knowledge perspective has been manifest in interactions between forestry staff and local communities. This may be attributed partly to a disparity of worldviews (see Section 1.5.1) and partly to inadequate communication. An illustrative example is the issue of agroforestry in Nyando Division (see Section 7.3). Although the new Forest Policy of 1994 treats scientific research as a basis for sustainable development and management of forest resources (see Section 6.4.2), the lack of means to disseminate research findings to potential beneficiaries defeats the original goal of research. This study reiterates and strongly recommends that the new Forest Policy can be effective in this case through the establishment of a strong yet farmer-sensitive implementation structure to monitor and facilitate contacts between research and practical forestry at the local level.

Tied to this is the issue of collaboration of different public and private sectors with forest-related interests. The promotion of forest-related activities through extension services by different sectors in the same localities needs to be co-ordinated. This will help not only to avoid unnecessary duplication and conflict, but also to enhance holistic views of forestry for conservation, management, utilities, public amenity and biodiversity, among other purposes (see Section 9.2.4). Additionally, promotion of the multiple-function perspective of forestry will further build on awareness-creation of the multiple roles of forestry for both the general public and special groups such as private commercial and industrial sectors with interests to develop forests.

The involvement of women in tree activities, particularly in private farm forestry, needs further thought regarding its practicability in certain communities. Some communities treat the participation of women in tree growing activities with great caution and scepticism, and sometimes as a taboo, as revealed in this study (cf. Bradley, 1993; Chavangi, 1987). Cultural beliefs may hinder active promotion of tree growing by women in certain parts of the country (see Section 7.5). This study recommends the careful design of programmes to sensitise local people to the advantages of greater participation by women, through community workshops and similar means. Government and non-governmental organisations, local leaders, and other private bodies could provide positive input by giving moral and material support to realise this change (see Section 9.2.1). Propaganda through the media could also be instrumental. This responsibility cannot be left to the current crop of extension workers, without a full restructuring of the service.

Forests provide both quantifiable and non-quantifiable benefits, but contradictions occur when the two are prioritised differently by various sectors and/or institutions. This is a global issue which transcends local, national, and regional borders (Princen and Finger, 1994). There is still room for compromise from the global down to the local. Though we have different sectors with conflicting interests, they necessarily share the same resource base, directly or indirectly, from local to global level. This is a matter beyond easy comprehension for poor rural communities in their day-to-day struggles to survive. As stated in the Forest Policy of 1994, "There is a special difficulty in comparing the significance of positive or negative global effects with that of local influence" (op. cit.: 16). In other words, there are special methodological and empirical difficulties in trying to link global with local impacts, though the task is not impossible.

For Kenya, from a policy perspective, it is critically important that interventions by outside actors which affect local environmental resources be placed within a context which more accurately reflects local practices and knowledges. The local setting must be understood within a longer historic and cultural time frame. Initiatives such as extension services should recognise the long-practised local strategies, particularly "in light of what farmers have been able to accomplish in the absence of these types of inputs" (Dewees, 1991: 183). For instance, demand-mitigation and fuel-substitution policies have not had significant impact due mainly to poverty. To date, in Kenya, the use of commercial alternative fuels is associated with high income groups, which suggests that the issue of fuel-substitution should start with addressing the question of poverty. In other words, initiatives which work to raise incomes of households will improve their access to alternative fuels, thus minimising the problem of fuelwood scarcity.

10.5 Reviewing Interfaces:

It must be reiterated that sensitivity to the question of interface relations is critical in any attempt to improve forestry policy and practice. This has been illustrated at a variety of levels, for example, the interface between the field extension staff and the office of the Divisional Forest Extension Officer (DFEO) is characterised by haphazard and non-strategic scheme of work (see Section 9.2.2) which promote acts of irresponsibility and complacency. Without order and proper work schedules, accountability becomes unattainable.

The interface between the office of the DFEO and the District Forest Officer (DFO) is where sectoral conflicts begin to show clearly, because the administrative and jurisdictional sphere of activity start to broaden. The end result is the clashing of operational mandates due to lack of co-ordination and/or collaboration between the different sectors concerned (see Figure 9.1 and Section 9.2.3). Massive government resources are therefore expended on duplications which could be avoided, given some level of understanding between related sectors. This study recommends that structures be put in place to co-ordinate related initiatives and interventions, including those by local NGOs, in order to minimise wastage of resources. The effects of these sectoral conflicts are likely to create confusion to the farmer who is the target of all these interventions.

The ramifications of these interfaces at the national level are felt in the form of conflicting signals from the district (provincial) level (see Section 9.2.4). Such confusion spills over and affects the realm of policy and practice. Matters are exacerbated by political pronouncements. Political statements and duplicated mandates cannot be easily captured within the policy framework. One possible way forward is the creation of a monitoring body: alternatively, the terms of reference of existing bodies like the National Environmental Action Plan (NEAP) could be activated and enforced more effectively. Such a body must have the necessary infrastructure, both at the local and national level, to oversee the implementation of any agreed collaborative ventures. Without an expansion of funding in the forestry sector, however, none of these recommendations can be transformed into real action (see Section 9.2.4).

Other related issues at this top interface level involve policy regarding the pricing of seedlings and that of research findings and their local application. The common practice by relevant national institutions of enacting and implementing policies uniformly throughout the country, in my view, undermines the very objectives they seek to promote (see Section 9.2.4). Varying ecological and socio-economic realities need to dictate local pricing. Policy on the pricing of seedlings results in seedlings from government tree nurseries failing to sell, thus wasting government resources expended in their production (see Section 9.2.4). Similar considerations should obtain in the application of research findings which are nationally based. Their efficacy needs to be validated first in the real local environment. The general message emanating from these arguments is that centralised policy formulation does not always produce favourable outcomes at the local level. At best, they create an unfavourable environment for local people who are already struggling to maintain their livelihoods (see Section 9.3).

Finally, despite the repressive nature of the colonial policies and their administration, oral testimonies from the study area, nevertheless, confirmed that their implementation was thorough and focused (see Section 5.4). This clearly contrasts with the contemporary policy situation in Kenya today, characterised by good paper pronouncements, without the necessary capacity for implementation.

APPENDICES:

Appendix A:

1. Obtaining fuel(wood) from accessible sources, Kadhier - Plate 2.1a, b.
2. Common practices of obtaining wood for fuel from whole trees, Kochogo North sub-Location - Plates 2.2a, b.
3. The problem of water hyacinth on Lake Victoria - Plates 3.1a, b.
4. Waradho Hill and the encroachment of agricultural activity - Plates 3.2a, b.
5. The impact of agricultural expansion, Muga village area - Plates 3.2a, b.
6. Sugar cane farms have taken a toll on the open grazing land, Muga - Plates 3.4a, b.
7. The two main traditional fuels used by rural households, Kadhier - Plates 5.1 and 5.2.
8. Making charcoal from an isolated tree in Kakmie, near Kadhier - Plates 6.1a, b.
9. The use of husks of maize cobs for fuel in Kadhier - Plates 7.1a, b.
10. An Upesi Jiko, Kadhier - Plates 7.2a, b.
11. The fuelwood market, Ahero town - Plate 7.3.
12. An interview with a local fuelwood trader who bought a whole tree from a local farmer; and a team of 'experts' from Kisumu District who were on a transect walk in Kochogo North sub-Location (see Section 9.3).
13. Different ways of transporting fuelwood - Plates 7.4a, b.
14. The use of fuelwood and charcoal by hoteliers - Plates 7.6 and 7.7.
15. Local practices - Plates 9.1 and 9.2.

1. Obtaining fuel(wood) from accessible sources, Kadhier (see p.27).

Plate 2.1 (a): Children gathering dry sticks near a Euphorbia hedge.

Plate 2.1 (b): Young girls 'beating' dry leaves of sisal plants.

2. Common practices of obtaining wood for fuel from whole tress, Kochogo North sub-Location (see p.41).

Plate 2.2 (a): Pollarding (species of *Albizia coriaria*).

Plate 2.2 (b): Selective cutting (species of *Cassia siamea*).

3. The problem of water hyacinth on Lake Victoria (see p. 45).

Plate 3.1 (a): Local volunteers pulling the weed off the lake.

Plate 3.1 (b): Fishing vessels are trapped by weed at the shore.

4. Waradho Hill and the encroachment of agricultural activity (see p. 53).

Plate 3.2 (a): The wooded enclave of Waradho Hill.

Plate 3.2 (b): A small farm of cassava on Waradho Hill (with isolated species of *Terminalia brownii*).

5. The impact of agricultural expansion, Muga village area (see p.54).

Plate 3.3 (a): Species of *Balanites aegyptiaca* felled to create room for a sugar cane farm.

Plate 3.3 (b): Charcoal making is a by-product from trees felled to create room for farms (species of *Balanites aegyptiaca*).

6. Sugar cane farms have taken a toll on the open grazing land, Muga (see p.58).

Plate 3.4 (a): Extensive sugar cane farms in the background, viewed from Waradho Hill.

Plate 3.4 (b): Sugar cane farms have severely impinged on open grazing field.

7. The two main traditional fuels used by rural households, Kadhier (see p.99).

Plate 5.1: Bundles of dry sorghum stalks stored for fuel after harvests.

Plate 5.2: Dry cow dung peeled from the walls of traditional granary.

8. Making charcoal from an isolated tree in Kakmie, near Kadhier (see p.129).

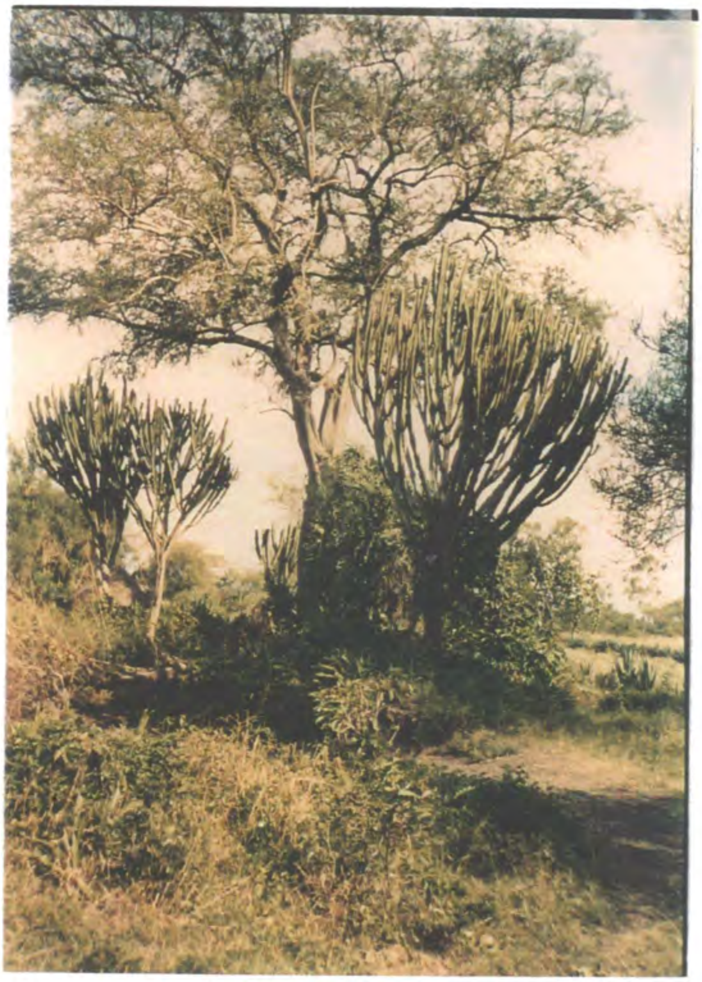

Plate 6.1 (a): A tall tree of *Balanites aegyptiaca*, from whose branches the charcoal below was made.

Plate 6.1 (b): Making charcoal 'on site' from branches lopped off an isolated tree above.

9. The use of husks of maize cobs for fuel in Kadhier (see p.146).

Plate 7.1 (a): A polygamous family gleaning maize grains from the cob.

Plate 7.1 (b): Husks of maize cobs used for fuel in a traditional rural kitchen.

10. An Upesi Jiko, Kadhier (see p.148).

Plate 7.2 (a): An Upesi Jiko (with scale ruler on top) frame without the bottom mounting.

Plate 7.2 (b): An Upesi Jiko being used inside a traditional rural kitchen. Note the characteristic 'two sticks' and small pot.

11. The fuelwood market, Ahero town (see p.159).

Plate 7.3: Women selling fuelwood and dry sugar cane stalks.

(see p. 160).

12. Plate 7.5: An interview with a local fuelwood trader who bought a whole tree (*Eucalyptus saligna*) from a local farmer. Listening is a team of 'experts' from Kisumu District who were on a transect in Kochogo North sub-Location (see Section 9.3).

13. Different ways of transporting fuelwood (see p.159).

Plate 7.4 (a): Women carrying headloads of crop residues from the farm after harvest, Kadhier.

Plate 7.4 (b): Men loading fuelwood on a wheelbarrow, Kisumu Municipality.

14. The use of fuelwood and charcoal by hoteliers, Ahero town (see p.164).

Plate 7.6: A stock of fuelwood stored by the hotelier.

Plate 7.7: Using charcoal in a metal woodfuel stove.

15 (a). Local practices, Nyando Division.

Plate 9.1: Local soil conservation (see p.197).

15 (b). Local practices, Nyando Division.

Plate 9.2: Granary woven from supple twigs (see Box 1, Section 9.3 , p.214).

Appendix B: Check-lists of Questions for Interviews:

Check-list of points were used during interviews with different sets of people. The order and sequence of asking the questions did not follow the schedule. Rather, questions were pursued and explored as and whenever leads to specific items on the check-list evolved. Certain lines of questioning found to be redundant were subsequently dropped as interviews progressed, while issues that emerged were pursued. The final check-lists given below include these additional points. Unplanned, informal meetings were based on pertinent issues which also fell within the broad framework of the check-lists below.

I. Interviews with Key Informants:

1. Name and personal details.
2. History of living in the village area.
3. Opinion of the village area.
4. Livelihood systems and strategies.
5. Views on energy issues in the village area.
6. Tree-growing activities and access to fuelwood resources.
7. Responses to fuelwood scarcity and suggestions as to its resolution.
8. Views on government policy on environment and forestry.
9. Views on local officials and forestry workers.
10. Participation by women on issues of tree resources.
11. Impact of land registration on fuelwood resources.

II. Household Interviews[1]:

1. Name, and personal details of the household.
2. History of living in the village area.
3. Fuels used, and preferences.
4. Talk about fuelwood.
5. Access to and sources of fuelwood, and how or who obtained them.
6. The history of fuelwood in the area.
7. Fuelwood consumption and management strategies.

[1] Interviews with elderly members of households also served as oral histories.

8. Cooking patterns and types of food prepared.
9. Expenditure on fuels (fuelwood, charcoal, kerosene, gas, etc.) and fuel-saving strategies.
10. Sources of income.
11. Views on tree-growing activities and resolution of the fuelwood issue.
12. Participation by women on issues of tree resources.
13. Impact of land registration on fuelwood resources.
14. Land-use management and practices.
15. Views on relevant government policy.
16. Views on local officials and forestry workers.

III. <u>Oral Histories</u>:

1. Name, personal details, and a brief life history.
2. Relevant historical background of the village area and Nyando Division in general.
3. The history of land-use and tree-growing activities in the area and the Division in general.
4. Views on colonial government policy on land and its resources.
5. Historical background of fuel(wood) in the area.
6. Suggestions for addressing the fuelwood issue.

IV. <u>Focus Groups</u>[1]:

1. Personal introduction.
2. Historical accounts of the fuel(wood) use in the village area.
3. Access to and sources of fuelwood.
4. Expenditure on fuel(wood) and fuel-saving strategies.
5. Land-use management and practices.
6. Participation by women on issues of tree resources.
7. Views on relevant government policies.
8. Views on local officials and forestry workers
9. Impacts of land registration on fuelwood resources.
10. Suggestions for addressing the fuelwood issue.

[1] Although other group interviews were included under this sub-heading, questions to specific groups were carefully selected based on the issues at hand.

V. Household Case Studies in Fuel Use:

1. Name and personal details.
2. Fuels used, and preferences.
3. Fuelwood consumption and management strategies.
4. Sources of fuelwood and views on land privatisation.
5. Tree-growing activities.
6. Expenditure on fuels (fuelwood, charcoal, kerosene, gas, etc.).
7. Cooking patterns and foods cooked.
8. Number of people eating the food.
9. Fuel-saving strategies and responses to fuelwood scarcity.
10. Sources of income.

    Suggestions for resolving the fuelwood issue.

VI. Interviews with Government Officials and Representatives of NGOs[1]:

1. Name and personal details (where applicable).
2. Functions and responsibilities and how these were executed (with the relevant issues explored sufficiently).
3. Difficulties encountered while carrying out responsibilities.
4. Knowledge of relevant government policies.
5. Views on such policies and their implementation at the local level.
6. Government policy on wood/tree resources.
7. Constraints hindering the implementation of government policies and how they could be resolved.
8. Views on local people and land-use management practices at the local level.
9. Views on the use and management of local environmental resources.

[1] These interviews generally covered the items listed on the check-list, but the format and order of questions were tailored to the specific area of responsibility and activities undertaken by the respondent. The points applied from the local level to the national.

Appendix C:

1. Description of Soil Types in the Study Area:

Soil No.	*Map Code*	*Soil Group*	*General characteristics*
1.	MX	Regosols and Cambisols	Well drained, shallow to deep, dark reddish, brown to dark brown, friable to firm, very stony and bouldery with gravelly clay loams and an acid humic top soil.
2.	HC0	Regosols with Cambisols and Rankers	Excessively well drained, shallow dark red to brownish sandy clay loams to clay with varying consistence and texture.
3.	LI0	Ferrasols and Cambisols	Well drained to very deep, dark reddish to brown to dark red friable sandy clay loams to gravelly clay developed on low plateaux.
4.	Fg0	Lithosols, Ferrasols, Nitisols and Phaeozems	Well drained, shallow to moderately deep, dark yellowish to reddish brown, friable, stony sandy clay loams to gravelly sandy clay developed on foot slopes.
5.	YU0	Vertislos, Planosols, Fluvisols and Solonets	Imperfectly to poorly drained, deep to very deep, dark greyish brown to very dark grey, mottled friable and very firm in places, cracking clay with calcareous and slightly sodic deep sub-soil which in many places are stratified and developed on piedmont planes.
6.	UI0	Acrisols with Ferrasols and Lithosols. Pockets of Luvisols and Nitisols	Well drained, generally deep and in places shallow, dark yellowish, strong brown to reddish, firm and friable in places generally and sandy clay soils developed on uplands.
7.	PI0	Vertisols, Gleysols and Planosols	Imperfectly to poorly drained, moderately deep to very deep, very dark grey to black, firm to very firm, sodic cracking clay developed on mudtones normally in flood plains.
8.	Aa0	Fluvisols and Gleysols	Moderately to very well drained, dark greyish brown to yellowish brown, friable stratified sandy clay loams to clay; in places mottled firm clay on river lurches and flood plains.
9.	Bx0	Gleysols	Imperfectly to poorly drained, deep to very deep, dark grey to greyish brown mottled, firm sandy clay to cracking clay; in places with peaty top soils while in places with calcereous sub-soils.
10.	Vx0	Fluvisols, Vertisols, Gleysols and Ferrasols	Moderately to imperfectly drained, deep dark brown to very dark-greyish brown which is friable to firm and stratified sandy loams to clay developed in minor valleys.
11.	Za0	Fluvisols with Arenosols and Vertisols	Poorly drained, deep to very deep, very dark grey to brown, mottled soils of varying consistence and texture which are stratified in places.
12.	Sm0	Gleysols and Histosols	Very poorly drained, very deep, dark grey to black, half ripe clay developed in swampy areas.

Appendix D: A Brief Review of Kenya's Energy Policy:

I. Petroleum Fuels:

Petroleum fuels currently dominate energy use in the modern sector in Kenya (i.e., transport and large-scale industry), accounting for 83 per cent of its energy needs. The transport sector consumes more than half of all petroleum fuels used in the country (1,210 thousand tonnes of petroleum products, which accounted for 65 per cent of total domestic sales in 1988) (Energy Digest, 1989: 12). By 1995, the demand for petroleum products in Kenya had grown to 2,067 thousand tonnes per annum. The bulk of this demand comprised sales to retail pump outlets and the transport sub-sector, tourism, industrial and commercial enterprises, which altogether consumed over 94 per cent of the total demand for petroleum fuels during that year (Republic of Kenya, 1997: 101).

The entire petroleum requirement is met through imports, as Kenya does not produce petroleum domestically. Currently, imported petroleum fuels account for about 67 per cent of the country's total consumption of industrial and commercial energy (ibid: 101), with electricity supplying most of the balance. The demand for petroleum products is projected to grow at 3 to 5 per cent per annum based on estimates of population growth. The dominance of petroleum fuels makes oil an essential factor of production for national economic development. Imports of oil continue to use much foreign exchange due to non-availability of suitable energy substitutes. This has strained the country's meagre foreign exchange earnings.

II. Electricity:

Since Independence, national electricity consumption has grown steadily. For example, electricity generation increased from 2,160 Gigawatt Hours (GWH) in 1984/85 to 3,866 GWH in 1994/95 (Republic of Kenya, 1997: 99). In five years alone, electricity sales increased from 2,784 GWH in 1990/91 to 3,223 GWH in 1994/95, a growth rate of 3.7 per cent per year. Of this, large commercial and industrial consumers account for almost two-thirds of total sales. Domestic and small commercial consumers take 32 per cent of total sales. Sales by the Rural Electrification Scheme (i.e., consumption in the rural sector) for domestic consumption account for about 4 per cent. The total installed generating capacity at the end of 1992/93 stood at 784 MW, of which 76 per cent was hydro-electric, 18 per cent conventional thermal and 6 per cent geo-thermal. By 1995, installed power capacity in Kenya was 822 Megawatts (MW), including a supply of 30MW from Uganda (Republic of Kenya, 1997: 98).

Electricity is supplied through an integrated system, that is, generated from hydro-thermal and geothermal plants. Over 85 per cent of energy generation is from hydroelectric sources including limited imports (5 per cent of total supplies) from Uganda (MoE&RD, 1996: 2).

Alongside the development of national generation capacity is the construction of an extensive grid network, established to facilitate easy distribution of power. Today, the National Grid covers the major population centres throughout the country. Kenya Power and Lighting Company (KPLC), the majority shareholding of which is held by the government, is responsible for electricity distribution. From 1965, the government saw the need to expand electrification to rural areas; about 100 schemes were completed by 1988 under the programme, at a cost of 600 million Kenya shillings (Energy Digest, 1989: 13). Urban areas in Nyando Division and western Kenya in general are relatively well served by this electricity network. The Division is fortunate to have two major trunk roads, that linking Nairobi-Uganda and that between Kisii and Kisumu both pass through the Division. The main power lines run alongside these two roads. Therefore, a number of wealthier local people living within the proximity of the two roads have tapped mains electric power into their homes.

III. Wood and Other Renewable Energy Sources:

The traditional sector is dominated by woodfuel (charcoal and fuelwood) which is the major source of energy in the country. Woodfuel is mainly used in poor rural and urban households as fuelwood and charcoal, respectively, and in informal rural industries.

The intensified search for substitutes for wood and petroleum led to the examination of non-conventional energy sources such as wind, solar, biogas, producer gas, and power alcohol (Republic of Kenya, 1985: 5). However, their introduction has been plagued by all sorts of difficulties, notably cost, social acceptability, diffusion, immaturity of the technologies, and so on.

IV. Non-Conventional Energy Sources and their Potential Adoption in Rural Kenya:

The non-conventional energy sources such as wind, solar, biogas, power alcohol and producer gas are not yet widespread. Biogas, like producer gas, is a medium-energy combustible gas derived from organic materials. Its success is undoubtedly a function of a number of often unique factors. Production of useful quantities of biogas requires a large volume of feedstock of wet manure and crop residues. The number of biogas digesters in Kenya increased from 1 in 1957 to about 250 by 1987 (Hankins, 1987), the first digester being built by a European farmer, Tim Hutchinson. The reported success of biogas in places like China is due in part to factors such as population density, strong extension services, and use of pig manure (ibid.). Such factors, combined with current stock inventory should determine whether family or community-size bio-digesters are desirable for Kenya. Another pertinent problem is that the majority of animals graze far away from village areas for a good part of the day, leaving only their nightly droppings as easily collected.

Wind power in Kenya faces the additional investment in technical back-up facilities, including conversion equipment from D.C. to A.C. These together add substantially to installation costs, thus making the overall capital cost too expensive for a majority of the population.

Solar energy in Kenya shows great promise due to the fact that the country lies astride the equator, with its entire land area, 5 degrees north and south latitude, receiving high and evenly spread solar radiation throughout the year. This makes any area in Kenya a high potential solar area. However, economic feasibility of using this source of energy depends on efficient collection and application techniques. The contribution of solar energy is minimal at present. The most promising application for the solar thermal collectors is water heating for residential, commercial and industrial purposes. The energy is also used for crop drying. Solar electricity is considered appropriate for rural areas, where it can enable households far from the power lines to get electric power. High initial investment cost has been the dominant constraint; despite the government's solar energy strategy of exemption from import and sales taxes on solar energy components, an average initial investment still runs between Ksh.35,000 and 70,000. Out of 29 household level interviews in Kadhier and Muga clans, this study encountered only one household using solar energy, mainly for lighting, television and water heating (see Section 7.7.4). Other work in the two village areas revealed no further cases.

Other policy incentives which the government proposed (and most of which have not been implemented) as a measure to alleviate the constraints on using solar energy were (op. cit., 1985: 49):

- support programmes to install solar energy systems in suitable government institutions, buildings and in all appropriate government centres in the rural areas;
- draw up legislation with a view to making it mandatory for all new hotels and hospitals requiring hot water to include solar water heating systems as part of their permanent fixtures;
- provide incentives such as tax refund or relief schemes to consumers for retrofitting solar heating systems; and
- support exportation of locally produced solar energy systems through the export compensation scheme.

Ethanol or **power alcohol**, made from agricultural products such as sugar cane, cassava, maize and potatoes, is an attractive substitute for fuel oil. However, its production competes directly with food production and Kenya, like many other low-income economies, has a severe food deficit. Sugar cane is noted as the best raw material for ethanol production because not only does it have the highest yield, it also provides its own direct energy source in the form of bagasse[1].

As the food situation in Kenya becomes more pressing, it is difficult to devote thousands of hectares of rich agricultural land to ethanol production. The success story

[1] Bagasse is the fibrous material which remains after the extraction of the juice from sugar cane.

of such countries as Brazil, which adopted the policy of ethanol production several decades ago, was four-fold: it had a large area of relatively unused land which could be devoted to sugar production; its existing level of sugar production was high; it already possessed ethanol manufacturing complexes; and it was relatively self-sufficient in food (Hankins, 1987) in terms of effective demand.

Kenya's venture into power alcohol has a chequered history, consisting of one plant out of two going into production and a third proceeding no further than the study stage by 1987 (ibid.). The high capital cost in plant and equipment for power alcohol distillation is a major constraint since these have to be imported at very high cost. Moreover, there are large opportunity costs associated with ethanol production (O'Keefe and Shakow, 1981). First, molasses is a strong foreign exchange earner, and it may not be realistic to consider burning it as petroleum. Second, there is strong demand for molasses in cattle and pig production. Two alternative sources of feedstock for ethanol production are cassava and sweet sorghum, but their applicability in the Kenyan case remains yet to be explored since both provide food, especially in the arid and semi-arid areas of Kenya, their use as an energy source is doubtful.

Kenya's energy policy on significant ethanol production is simply an exercise in futility. Apart from the high capital costs involved in the production of ethanol, the project seriously conflicts with the country's pressing problem of food production. With recurrent problems of food shortage and few ostensible reasons for ethanol production, it makes no sense to devote large agricultural areas to energy crops. Moreover, no amount of zoning of land between energy and other crops will justify the promotion of ethanol production, which will finally serve only a few people at the expense of food which will serve many (ibid.).

Appendix E: Technical Appendix for Chapter 8:

1. It is equipped with two identical HRV (High Resolution Vidicon) instruments which operate in a multi-spectral (MSS-HRV1) and panchromatic (SPOT Pan) modes. In the MSS mode, information from three sub-spectral zones (500 - 600 nm; 610 - 680 nm;

790 - 890 nm) are recorded with ground resolution of 20 m x 20 m, and the Pan mode with a resolution of 10 m x 10 m resolution.

2. One quarter scene of SPOT-HRV1 (MSS) False Colour Composite (FCC) image, scene 134/350 taken in September 1986, was obtained from the Department of Resource Surveys and Remote Sensing (DRSRS), Nairobi, Kenya. The original image was at a scale of 1:200,000. A clipping was therefore made and blown out to a working scale of 1:61,014 and printed on cibachrome paper. This rather odd scale was arrived at as a result of technical faults at the processing laboratory. The requested extent of enlargement was to a scale of 1:50,000. It would therefore appear that technical capabilities of the photolab at DRSRS were questionable as even the hard-copy image product from the enlargement was much darker than the original.

Furthermore, the image was pre-processed to level 1B which means that the image is geometrically and radiometrically corrected (Anderson, 1976). Level 1B pre-processing does not include bidirectional corrections on the basis of ground control points to match the image to a particular cartographic projection. Neither does it consider distortions due to relief influences. The implication of this is that scale uniformity over the entire image and its derivatives is a misnomer. Nevertheless, this is the basic level for image interpretation and thematic analysis tasks.

3. This classification system was then applied to both the image and the aerial photographs, and the aerial photographs suggested a more detailed classification system as many more units could be identified. This temptation was avoided as much as possible and generalization principles were implemented to bring both results to the same level for comparative purposes.

On the basis of image and photo-interpretation elements (tone, texture, pattern, shadow, association, shapes, sizes and site), coupled with several interpretation strategies, preliminary mapping units were defined and assigned relevant class labels on image and photographic overlays. For aerial photographs, stereo-pairs were prepared and viewed under a WILD ST4 mirror stereoscope. The major task in respect of the interpretation was to separate distinct aerial units that are characterized by specific tones and textures to identify edges or boundaries between separate areas at a photomorphic level and assign them appropriate class labels. Manual interpretation was preferred in this case because of lack of facilities for alternative methods and, more importantly, to gain the opportunity to carry out 'ground truthing' while on this one-off fieldwork in Kenya.

<u>Sample Selection and Design</u>:

Accurate stratification and description of the area into suitable vegetation classes and the characteristics of such classes in terms of relative fuelwood concentrations required visits to representative class sites in the field.

The preliminary mapping units defined above therefore provided a basis for the selection of sample sites for the 'ground truthing' excursions. A total of 25 sample sites each measuring 2 km x 2 km were selected for 'ground truth' operations (see Figure 8.3). Such a large sample size was preferred because the study team did not have precise navigation equipment to ensure that the team was always located at the exact sample location. Large as the sample was, crude navigation methods such as use of topographic maps and vehicle speedometer, would still ensure location of the team within the sample area. Besides the tonal and textural characteristics, the sample sites were selected with due consideration given to accessibility and were generally well spread over the study area. Only two sample points (Numbers S14 and S22) were not accessed due to muddy conditions (see Figure 8.3).

4. The aim was to identify the combined influence of all these checked factors and the resultant information on spectral patterns observed on the image or photographs. It would thus help to determine if specific photomorphic regions match classes as delineated in the preliminary classification. Boundary adjustments were made in circumstances where stratification on the basis of photomorphism was found to be delusive in the sense that they were essentially the same structural and floral zones merely influenced by other factors, as corroborated by interviews with local farmers 'on-site'.

5. The information obtained in the field were then added to the overlays for each situation and also used to modify the final map legend. Consideration was also given to the time difference between the date of the aerial images and of the 'ground truthing'.

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