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TWENTY YEARS OF RESOLVING THE IRRESOLVABLE: APPROACHES TO THE FUELWOOD PROBLEM IN KENYA

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ABSTRACT

Resolving the fuelwood problem in Kenya has been the cause of many debates. A review of the literature reveals the changing emphasis on the cause and effect of the problem. The dominant focus links fuelwood consumption with environmental degradation. This view has been perpetuated and reinforced by the 'Woodfuel Gap' theory of supply and demand differentials, based on population growth. The demand mitigation has been addressed through the 'Fuelwood Orthodoxy' approach and energy technologies. This paper shows that deforestation, and subsequent degradation, has little to do with fuelwood consumption as much is extracted from outside the forest. Therefore, costly interventions of afforestation programmes have had little impact in addressing the issue. The locale-specificity of the fuelwood problem means there can be no simple, technical solution. The local nature of shortages means that national projections cannot capture the complex socio-economic and cultural issues. Such complexity and diversity of rural contexts demand that the rural energy problem cannot be treated in isolation from the equally pressing issues of poverty, labour, food, culture and values. Copyright © 2001 John Wiley & Sons, Ltd.

KEY WORDS: environmental degradation; fuelwood; Kenya; Woodfuel Gap theory; gender and land use

INTRODUCTION

The majority of rural people in low-income economies rely on fuelwood as the major source of household energy for cooking and heating. Fuelwood may account for as much as 90 per cent of rural household energy consumption. The household sector accounts for 50–95 per cent of total energy consumption in subSaharan African countries (Mearns, 1995). Kenya has been the focus of much of the work. This paper will argue that in Kenya, fuelwood problems have little to do with environmental degradation and much to do with poverty.

A review of the literature documents the changing emphasis in seeking to address the fuelwood issue. The review has three main phases, the last of which considers factors beyond the fuelwood problem. The phases are summarized as follows.

(1) The period between 1971 and 1979, when the problem was identified, but not seriously pursued until around the onset of the second OPEC price rise of 1979 which impacted significantly on subSaharan economies.
(2) The period between 1979 and 1990, focusing on the problem by addressing the issue of energy supply and demand frameworks with a growing realization that it was not the forests, but trees outside it that power the household economy.
(3) The period from the early 1990s, when the focus was on gender issues and an integrated land-use approach. There was a realization that there could be no simple, technical solution to the fuelwood problem due to their locale-specificity. Although the landscape changed with increased biomass, there was a parallel decrease in access to wood, especially by women. Land use became the dominant reference instead of fuelwood.

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Table I. Accessible sustainable fuelwood supply (thousand m^3): national projection, 1995–2020 (numbers in parentheses are percentages)

Source	1995	2000	2005	2010	2015	2020
Indigenous forests	116	1143	1120	1098	1076	1053
	(6·4)	*(5·8)*	*(5·3)*	*(4·8)*	*(4·4)*	*(4)*
Woodlands and bushlands	10 585	10 508	10 430	10 352	10 274	10 196
	(58)	*(53)*	*(49)*	*(45·2)*	*(42)*	*(39)*
Farmlands and settlements	6146	7746	9418	11 079	12 947	14 731
	(33·7)	*(39·1)*	*(44·2)*	*(48·4)*	*(52·5)*	*(56)*
Forest plantations (Forest Department)	354	416	352	361	380	443
	(2)	*(2·1)*	*(1·7)*	*(1·6)*	*(1·5)*	*(1·7)*
Total	1 8 251	19 813	21 320	22 890	24 677	26 423

Source: KFMP (1994). Reproduced by permission of ETC International.

The following discussion draws on the 1996–97 fieldwork conducted by Mahiri (Ph.D research) in Nyando Division, Kisumu District.

WOODY BIOMASS IN KENYA

In Kenya, it is estimated that 71 per cent of annual energy consumption is fuelled by wood, mainly as fuelwood for cooking and heating in rural areas, and as charcoal in urban areas (Bess, 1989; KFMP, 1994). This biomass is drawn from a variety of sources, not necessarily from forests (Table I). Agriculture has contributed much to forest area decline. It is estimated that Kenya's total forest area declined by 1 per cent in one year alone, from 1674 thousand hectares in 1988 to 1657 thousand hectares in 1989, largely due to the reduction in the area planted under indigenous species and the progressive conversion of forest land to agriculture (Republic of Kenya, 1990). Total firewood consumption in the whole country was 7·98 million tonnes annually (Republic of Kenya, 1990).

Projections show the increasing importance of the extension of farmland settlement, (i.e. trees outside the forest become more, not less, important as a wood supply). Senelwa and Hall (1993) developed a biomass energy flow chart for Kenya, which gave an assessment of the total biomass energy potential. It incorporates agriculture, forestry and grasslands. Domestic fuelwood dominated harvest categories and biomass fuel dominated end use. Senelwa and Hall (1993) provided a total biomass balance to parallel the total energy balance originally drawn up by O'Keefe *et al.* (1984). The problems of interpretation of these balances is not with the balance itself, but with projections based on those balances which imply that a 'gap' will develop between supply and demand and use that 'gap' to justify programmes of investment.

WOODFUEL GAPS AND FUELWOOD ORTHODOXY

'Woodfuel Gap' theory is based on the projection of woodfuel consumption, usually in direct proportion to population growth. Calculations are made of the resulting tree yield consumed each year against stock. The woodfuel gap that appeared from such calculations produced a call for the enhancement of the wood supply in order to mitigate the apparently looming fuelwood 'crisis' and an emphasis on improved efficiency through the diffusion of improved stoves. The crudest version of this was the 'Fuelwood Orthodoxy' approach.

The Fuelwood Orthodoxy approach, frequently promoted by top-down planning institutions, associate fuelwood consumption with deforestation (see Anderson and Fishwick, 1984; Timberlake, 1985; Anderson, 1986). The orthodox solution is to call for large-scale plantations, but such supply options rarely provide accessible fuelwood supplies. Deforestation and consequent degradation have little to do with fuelwood consumption because much of the fuelwood is extracted from outside the forests. Land clearance for agriculture has been identified as a principal means of forest depletion (ETC, 1987; Leach and Mearns, 1988). The general assumption of the Fuelwood

Orthodoxy school relates fuelwood scarcity to lack of trees. For fuelwood demands to be met, large areas of forests much be cleared, and massive afforestation programmes must be undertaken, to maintain fuelwood balances. In Tanzania, for example, the fuelwood scarcity in many regions of the country encourages intensive afforestation efforts for fuelwood production. From 1975–81, planting increased from 3280–12 050 hectares (IBRD, 1984; Simoes, 1984). In Mozambique, in 1977 a plantation programme targeted to cover 24 000 ha with eucalyptus to service Maputo's wood requirement had managed to plant only 3200 ha by 1988, at a cost of US$2·5 million (O'Keefe and Munslow, 1989). In many countries in Africa the projected gap between supply and demand provided the rationale for many forestry projects.

More sophisticated projections were made of wood supply and demand balances that indicated, on a business-as-usual assumption, rapid depletion of existing supplies, for instance, Zimbabwe (Hosier, 1986), Malawi (French, 1986), Tanzania (Nkonoki and Sorensen, 1984), and Kenya (O'Keefe, 1984). Such planning exercises justified programmes of tree planting and afforestation. These exercises avoided the simple, single solution of the fuelwood orthodoxy and still projected a woodfuel gap. Several of these exercises were conducted using the LEAP model – the LDC Energy Alternative Planning System (Raskin, 1986). This was developed to evaluate the impact of different energy policy and planning initiatives. However, these analyses of the 'woodfuel gap' tend to exaggerate and to obscure the scope of the problem. According to Dewees, the 'LEAP analysis leaves us with more questions than it answered' (1989:1160).

O'Keefe (personal communication) argues that there was a distinct difference between the 'Fuelwood Orthodoxy' approach and the 'Woodfuel Gap' approach because in the case of the former, projections were assumed to be true while in the latter case, utilizing LEAP, projections were used to test cost-effective interventions. That other commentators sought to confuse the two very different uses of projections was a 'deliberate misreading of the lack of science behind the 'Fuelwood Orthodoxy' approach in contrast to the quality of the science behind what has been called the 'Woodfuel Gap' approach'. O'Keefe indicated that it was an isolated reading of Volume I of the Beijer Institute Series (O'Keefe *et al.*, 1984), that led to the confusion. Barnes *et al.* (1984) reviewed the detailed anthropological work that pinpointed the need for local solutions. Hosier (1984) presented the results of the first national household study (see Table II). The details of the first 'trees outside the forest' systematic survey in Volume I (Openshaw, 1982), provided data on local biomass production.

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, or residues from other uses of wood in the rural economy,

Table II(a). Domestic Fuel Consumption in rural Kenya by ecological zones: Nationwide survey, 1984. Numbers in parentheses are percentages

Fuel	High potential zone kg yr^{-1} $n=380$	Savannah zone kg yr^{-1} $n=160$	Arid zone kg yr^{-1} $n=32$	Total (%) $n=572$
Fuelwood	40 99·5 (24·8)	41 89·9 (25.4)	8209·0 (49.8)	16 498·4 (100)
Charcoal	128·2 (56.9)	61·7 (27·4)	35·6 (15·8)	222·5 (100·1)
Kerosene	54·7 (45·8)	43·1 (36·1)	21·7 (18·2)	119·5 (100·1)

Source: adapted from Hosier (1984). Reproduced by permission of R. Hosier.

Table II(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). Reproduced by permission of R. Hosier.

Table II(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 min	92 min	84 min
Time/kg	3·9 min	7·8 min	3·6 min

Source: adapted from Hosier (1984). Reproduced by permission of R. Hosier.

as well as using crop residues and animal dung. Building on work by O'Keefe and others, several commentators have noted the importance of trees outside the forest (Barnard and Kristoferson, 1985; Agarwal, 1986, 1995; Wisner, 1987; Millington *et al.*, 1994; Hill *et al.*, 1995).

O'Keefe also argues that the design of the original Kenya Woodfuel Development Programme (KWDP) led the way in local level planning with an emphasis on gender (Kruks, 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 high potential area agroforestry.

The business-as-usual scenario produced using the LEAP model was open to criticism. One major criticism was the use of demographic data to capture future demand. Fuelwood issues are vastly more complex and do not follow population growth alone (Bradley *et al.*, 1985, Leach and Mearns, 1988; Bradley, 1991; Mortimore, 1992; Holmgren *et al.*, 1994; Tiffen *et al.*, 1994). A number of these factors were found to be involved, such as socio-economic and cultural issues (Chavangi, 1984; Bradley *et al.*, 1985; Chavangi *et al.*, 1985; Ngugi, 1988).

In many areas, rural people are already responding to increased woodfuel demands in innovative and imaginative ways which involve far lower economic costs than many project interventions (Dewees, 1995). 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 generalized, extrapolated linear pattern.

Tiffen *et al.* (1994) suggest that solutions to a long-perceived woodfuel scarcity and a sustainable woodfuel programme lie not in the effectiveness of government initiatives in forestry development, but in an autonomous development of smallholder tree management or indigenous agroforestry by local people.

O'Keefe (personal communication) accepts these criticisms but points out that, in the absence of energy consumption data related to reliable income data, it was impossible to accumulatively measure elasticity and thus explore changes in household fuel-technology combinations.

A second criticism was one of scale. LEAP, as a national accounting system, missed the localized variations of patterns of energy demand and supply. 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. Pasztor and Kristoferson, 1990; Hall *et al.*, 1993; Senelwa and Hall, 1993).

The local nature of shortages means that national projections do not capture this complexity and national solutions, e.g. the use of plantations cannot address the fuelwood problem because of transport costs and therefore price implications (Kerkhof, 1990).

Between 1983–1995 the KWDP had an expenditure of approximately US$16 million, in this time it produced two notable results. Firstly, the research work led by Bradley (1991) indicated that there was an increase in biomass in areas of high population density, which contradicted the 'Fuelwood Orthodoxy' approach that suggested environmental degradation in these situations. Secondly, the models established for agroforestry extension, in the context of a collapse of both agricultural and forestry government extension services, proved to be repeatable in and beyond Kenya (Van Gelder and O'Keefe, 1995).

Ongoing research (Mahiri, unpublished research, 1998), using an analysis of the 1967 aerial photographs and the 1986 SPOT image, covering Nyando Division, showed both spatial and temporal change in the woody biomass. There is a general shift of the woody vegetation from the original bushland to concentrations around settlements. The change was noted particularly in Kochogo, which was one of the study sites. Much of the natural bush has disappeared, giving way to increased settlements and an expanding agricultural frontier. The situation in the 1967 photographs depicted a sparse distribution of the woody vegetation and a dotted pattern of settlements and farmlands. The scene in 1986 appeared to have changed dramatically with increased mottling of biomass patterns forming curvilinear bands around settlements. The concentration of people seems, in certain circumstances, to increase woody biomass.

The third phase of the woody biomass–wood energy debate has moved to different themes. At a policy level, the focus is increasingly on woody biomass for carbon sequestration, a resource to address the issues of climate change. Ironically, the focus shifts back to the arid and semiarid areas where the spatial extent of savanna means that the total woody biomass resource is higher than the potential area resource. Only if Joint Implementation goes ahead, will this be translated into an income stream to Kenya. (O'Keefe *et al.*, 1997)

At the level of implementation, the emphasis is on the local. This occurs partly as a result of financial expedience and partly because the efficiency, effectiveness and sustainability of wood-growing programmes are best demonstrated at local level. The financial expediency argument recognizes that, from both donor and national agencies, there are decreasing funds available to conduct national surveys even if the results could be used for much more than broad policy formulation. This is an approach that would suggest that at the present moment, back-of-the-envelope calculations are preferred for developing energy supply and demand balances rather than detailed scientific work such as that undertaken to build energy models (O'Keefe *et al.*, 1984).

The emphasis on a cost-effective public service, in times of fiscal austerity has also seen decreasing monies available to government functions, notably the agricultural and forestry extension system (cf. Mahiri, unpublished research, 1998). The erosion of the extension system and an emphasis on cross-sectoral programmes with private and voluntary (NGO) sectors has led to an emphasis on local development which uses participatory methods, not least to identify local ecological opportunity (Mahiri, 1998a; 1998b). This approach is more sensitive to a range of social factors associated with poverty rather than one which relies on aggregate economic data of dubious merit. (Soussan and O'Keefe, 1985; Soussan *et al.*, 1992).

FUELWOOD CONSUMPTION

In fuelwood studies that focus on the consumption characteristics and trends within households and communities, various factors other than distance to the resource location have been raised. When analysing consumption, a distinction is usually made between domestic (household consumption) and commercial (non-household consumption).

The characteristics and trends of fuelwood consumption have normally been analysed by invoking prevailing theories and/or models, such as a Malthusian correlation with population dynamics or like Von Thunen concentric zones or 'ripples' of fuelwood exploitation (Moss and Morgan, 1981; Nichol, 1990). Fuelwood consumption is not a linear function of Malthusian 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 interpretation 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 generalized relations among various empirical objects and events themselves, and not abstractions about what produced them' (1995 Hetch, 1995: 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, a view that underlies the 'Fuelwood Orthodoxy' approach outlined earlier.

Inequalities in the exploitation of 'common forest resources' are also often evident. Commercial overexploitation 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). It is therefore inappropriate to explain forest resource depletion with simplistic, blanket phrases such as 'slash-and-burn', 'massive clear-cutting' or forest 'mining', simply due to population pressure. Disaggregated data on local-level contexts are necessary (e.g. Mahiri, unpublished research,

Table III. Residential energy use by household income: Urban Kenya, 1980

Income group	% of total for each income group				
(thousands K sh)[1]	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 (%)	22·6	48·62	12·2	5·12	11·48

[1]K sh = c. US$0·013 or c. GB£0·009
Source: adapted from Leach and Mearns (1988).

1998). Recent local studies undertaken in Kenya have yielded results which have overturned the Malthusian school of thinking (e.g. Bradley, 1991; Mortimore, 1992; Holmgren *et al.*, 1994; Tiffen and Mortimore, 1994; Tiffen *et al.*, 1994).

When considering the Von Thunen pattern of fuelwood consumption, there are several underlying factors to examine which determine the nature of distribution in the consumption characteristics within and between varying household groups and communities, as in cities and urban centres. Several studies in Nigeria established that factors other than distance are responsible for determining the fuelwood 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. There is a general paucity and inadequacy of reliable information (cf. Moss and Morgan, 1981: 21; Foley, 1988). 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.

In Kenya, the early studies of domestic energy consumption included works by Western and Ssemakula (1979), Hosier (1984) and O'Keefe *et al.* (1984). Hosier (1984) showed, however, that the consumption of fuelwood tends to vary significantly across ecological zones.

Such variations, mostly based on substantial changes in ecology, have areas with fuelwood in abundance, while neighbouring areas are in difficulty (Soussan *et al.*, 1992). The variations may also be attributed to local socio-economics and seasonality (Brokensha *et al.*, 1990). Local diversity, which is a prime element of project design, is an element that deserves attention in national fuelwood surveys, for example the socio-economics of households (Table III).

Rural household energy consumption in Kenya can be linked in part to socio-cultural complexity, which renders overarching generalizations of consumption, based on national level-survey data, inappropriate and futile for local project design (cf. Hill *et al.*, 1995). Several small-scale studies have, however, been undertaken in different locations, normally ranging from district down to village level (Brokensha *et al.*, 1990; Mwangi, unpublished thesis, 1992; Ngugi, unpublished thesis, 1992; Aloo, unpublished dissertation, 1994;). Despite their limited coverage and limited usefulness in terms of extrapolation and generalization (see Sayer, 1992), the trade-off is their deep qualitative insight which can help to evaluate and inform relevant project design.

WOOD-SAVING TECHNOLOGIES

Fuel-saving or demand-reducing technologies have been widely promoted in low-income countries. Among poor households, the main focus of promotion, has been 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 10–50 per cent (see Foley *et al.*, 1984; Foley and Moss, 1984).

Such results are reached under laboratory conditions, which raises the question of whether worthwhile savings would also occur in practice. Results can vary extensively, depending on circumstances. In practice, differences in efficiency between improved stores 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 Jones *et al.*, 1988; Thrupp, unpublished thesis, 1983; Clarke, 1985). 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 also because the majority of rural people cannot afford them (Namuye, 1989; Kammen, 1995). The 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, culture and values.

On-going research (Mahiri, unpublished research, 1998) shows the Upesi Jiko(1) as one of the well-known brands of the wood-saving stoves in region. *The stove is claimed to be a simplified and affordable variant of the Ceramic Jiko, it has not been adopted by many households. The Upesi Jiko is known to burn fuel more efficiently, with savings of between 40 and 50 per cent, and gives smoke reduction of 60 per cent. Three main disadvantages have been noted: it 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 that the stove is especially unsuitable for the wide pots 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 of both technology and fuel (OTA, 1992). The underlying issue is poverty. One of the United Nations Environment Programme's documents neatly summarizes the issues thus: 'In the real world, energy technologies are only likely to get used widely if they are technically efficient, finally viable, economically profitable, culturally acceptable – and environmentally benign' (UNEP, 1991:51). The environment is the last consideration – the first three are issues of poverty.

What does this mean? O'Keefe (personal communication) argues that the original dispute between 'Fuelwood Orthodoxy' and the 'Woodfuel Gap' approaches parallels the debates about food resources and famine (Sen, 1981). This is another resource debate with two contrasting positions: 'Food Availability Decline' (FAD which is equivalent of the supply-side Fuelwood Orthodoxy) and Entitlements (a demand-side strategy which parallels the approach to the science behind the Woodfuel Gap). O'Keefe accepts that the poor quality of data and the scale factor can lead to misinterpretation of the Woodfuel Gap model but insists that the Kenyan work follows in a tradition of land-use planning at household level Wisner and O'Keefe, 1978). In many senses the KWDP and its associated debate was an integrated land-use project riding on the back of an African energy problem.

One further point is worth noting. Analysis on the ground, obvious from project documentation, seems to be at least five years ahead of academic debate. This time lag has obvious implications in the development of new project direction. Fortunately, the academy has little to do with the design of development projects.

LAND TENURE, GENDER AND FUELWOOD RESOURCES

In the past, fuelwood was treated by rural communities in Kenya as a 'free good' that was readily available and within reach. This has largely changed in recent times, due to the registration of land and transfer to private ownership (cf. Okoth-Ogendo, 1991). 'Communal sources of wood' have been eliminated (Dewees, 1991: 90–91; Ogolla, 1995), thus increasing the difficulty of free fuelwood collection for the rural land-poor.

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 landowner, instead of the customary law of 'free ownership'. Consequently, 'customary lineage land-use right holders lost usufruct to communal tree resources' (Dewees, unpublished thesis, 1991: 91). This trend has encouraged a considerable increase in the commodification of the fuelwood resource by landholders who developed individual sources.

There is a complex mosaic of user rights embedded within the household structure such as access rights, title rights and agricultural rights (cf. Chavangi, 1984; Okoth-Ogendo, paper presented at ASA seminar, 1986; 1987). Coupled with the cultural overlay of rights, which determines access to and end-use of wood resources, they create paradoxically huge 'scarcity' differentials between individual households in villages with a 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 part of Kakamega District in Kenya, for instance, there are influential cultural restrictions against the planting of trees by women (cf. Bradley, 1991; Chanvangi, 1984), or the cutting of wood from a man's tree. Questions of entitlement are involved (cf. Leach *et al.*, 1997). Leach *et al.* have explored the environmental entitlement debate in relation to the actual resource endowment. In this case, legitimate effective command of tree resources by women is the issue at stake.

On-going research in Nyando Division, Kisumu District (Mahiri, unpublished research, 1998) reveals individual households have different views regarding the issue of planting or cutting trees by women. Practice depends largely on the type of tree. For instance, it was found that trees such as *Thevetia peruvaniana* or *Lantana camara*, are planted and cut by women since both are treated as ornamental trees: both have proved to be good fuelwood providers.

The practice of use 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. Tenurial rights to land are exclusively held by men. This gives men legal rights of control of all resources including the products on such land.

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 knowledge 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. Dewees, unpublished thesis, 1991; Rocheleau, 1994). Initiatives intended to encourage farmers to manage trees and the environment should take cognizance of existing local practices. In Nyando Division, several tree management practices are being undertaken by local people. For instance, indiscriminate clear-felling of trees specifically for fuelwood is rare, unless it is being done to create farms, in which case, fuelwood 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. On-going research shows local rotation in tree harvesting which ensures that the land is not left completely bare which would encourage soil erosion.

CONCLUDING REMARKS

What conclusion can be drawn from this overview? 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 (Woodfuel Gap) balances, do not capture local complexity. Thirdly, there is a lack of data that parallels inappropriate use of data for project presentation at local level.

The fuelwood problem 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 with 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, that 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 problem will require resolution of the land issue.

*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 organization, Maendeleo ya wanawake helped to design it) was developed in mid-1980s as part of the Special Energy Project run by the Kenyan Ministry of Energy and the German government agency, GTZ.

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REFERENCES

Agarwal B. 1986. *Cold Hearths and Barren Slopes: The Woodfuel Crisis in the Third World,* Zed Books: Landon.

Agarwal B. 1995. The woodfuel problem. In *Development Studies*, Corbridge S (ed.). Wiley: Chichester; 200–215.

Anderson D. 1986. Declining tree stocks in African countries. *World Development* **14**: 853–863.

Anderson D, Fishwick R. 1984. Fuelwood consumption and deforestation in African Countries, World Bank Staff Working Paper No. 704. (World Bank: Washington, DC.)

Barnard G, Kristoferson L. 1985. *Agricultural Residues as Fuel in the Third World*, Earthscan/IIED: London.

Barnes C. Ensminger J. O'Keefe P (eds). 1984. *Wood, Energy and Households: Perspectives on Rural Kenya, Energy, Environment and Development in Africa* Volume 6. Beijer Institute and The Scandanavian Institute of African Studies: Stockholm.

Bess M. 1989. Kenya charcoal survey. Final report and annexes, prepared for the Long Range Planning Unit, Ministry of Planning and National Development and Carleton University: Nairobi.

Bhagavan MR, Grippa S. 1987. Class character of rural energy crisis: case of Karnataka. Review of Agriculture. *Economic and Political Weekly* **22**: 57–69.

Bradley PN. 1991. *Woodfuel, Women and Woodlots.* Macmillan: London.

Bradley PN, Chavangi N. Van Gelder A. 1985. Development research and energy planning in Kenya. *Ambio* **14**: 228–236.

Brokensha DW, Fleuret PC, Chaiken MS. 1990. Patterns of domestic energy utilisation in rural Kenya: an agroecological and socio-economic assessment. In *Social Change and Applied Anthropology-Essays in honour of David W. Brokensha.* Fleuret AK (ed.). Westview: Boulder, CO; 262–276.

Chambers R. 1983. *Rural Development: Putting the Last First.* Longman: Harlow.

Chavangi N. 1984. Cultural aspects of fuelwood procurement in Kakamega District. Working Paper No.4. Kenya Woodfuel Development Programme: Nairobi.

Chavangi N, Engelhard RJ, Jones V. 1985. Culture as the basis for implementing self-sustaining woodfuel development programmes. Kenya Woodfuel Development Programme: Nairobi.

Clarke R. (ed.). 1985. *Wood-Stove Dissemination*, Intermediate Technology Publications: London.

Cline-Cole RA, Main HAC, Nichol JE. 1990. On fuelwood consumption, population dynamics and deforestation in Africa. *World Development* **18**: 513–227.

Dewees PA. 1989. The woodfuel crisis reconsidered: observations on the dynamics of abundance and scarcity. *World Development* **17**: 1159–1172.

Dewees PA. 1995. Farmer responses to tree scarcity: the case of woodfuel. In *Tree management in farmer strategies: responses to agricultural intensification*, Arnold JEM, Dewees PA. (eds). Oxford University Press: Oxford; 174–197.

Ellen R. 1982. *Environment, Subsistence and System.* Cambridge University Press: Cambridge.

ETC. 1987. *SADCC Energy Development: Fuelwood.* ETC Foundation: Leusden.

Fernie J, Pitkethly AS. 1985. *Resources: Environment and Policy.* Harper and Row: London.

Foley G. 1988. Discussion paper on demand management. World Bank regional seminar on household energy planning, Harare, Zimbabwe, 1–5 February 1988. World Bank: Washington, DC.

Foley G, Moss P. 1984. *Improved Cooking Stoves in Developing Countries.* Earthscan/IIED: London.

Foley G, Moss P, Timberlake L. 1984. *Stoves and Trees.* Earthscan/IIED: London.

French D. 1986. Confronting an unsolvable problem: deforestation in Malawi. *World Development* **41**: 531–540.

Hall DO.1994. Introduction, summary and conclusion, In *Biomass Energy and Coal in Africa* Hall DO Mao YS (eds.). Zed Books: London; 1–9.

Hall DO, Rocillo-Calle F, Williams RH, Woods J. 1993. Biomass for energy: supply prospects in renewable energy. In *Renewables for Fuels and Electricity*, Johansson BJ, Kelly H, Reddy AKN, Williams RH.(eds). Island Press: Washington, DC; 583–652.

Hetch SB. 1995. Environment, development and politics, capital accumulation and the livestock sector in eastern Amazonia. In *Development Studies: A Reader.* Corbridge S (ed.). Arnold: London; 400–426.

Hill R, O'Keefe P, Snape C. 1995. *The Future of Energy Use.* Earthscan: London.

Holmgren P, Masakha EJ, Sjoholm H. 1994. Not all African land is being degraded: a recent survey of trees on farms in Kenya reveals rapidly increasing forest resources. *Ambio* **23**: 390–395.

Hosier R. 1984. Domestic energy consumption in rural Kenya: results of a nationwide survey. In *Wood, Energy, and Households: Perspectives on Rural Kenya, Energy, Environment and Development in Africa*, Volume 6, Barnes C, Ensminger J, O'Keefe P. (eds). Beijer Institute and The Scandinavian Institute of African Studies: Stockholm; 14–60.

Hosier R. 1986. *Zimbabwe: Energy Planning for National Development in Africa*, Volume 9. Beijer Institute and Scandinavian Institute of African Studies: Stockholm.

International Bank for Reconstruction and Development (IBRD). 1984. *Tanzania: Issues and Optionsin the Energy Sector.* UNDP/World Bank Energy Sector Management and Assessment Program (ESMAP). Program Report No.4969-TA. UNDP/World Bank: Washington, DC.

Jones M *et al.* 1988. *Energy efficient stoves in East Africa: an assessment of the Kenya ceramic Jiko program.* Oak Ridge National Laboratory and the Kengo Organisation: Nairobi.

Kammen DM. 1995. Cookstoves for the developing world. *Scientific American* **273**: 64–67.

Kenya Forestry Master Plan (KFMP). 1994. Development programmes. Ministry of Environment and Natural Resources, Forest Department: Nairobi.

Kerkhof P. 1990. *Agroforestry in Africa, A survey of Project Experience.* Panos: London.

Leach G, Mearns R. 1988. *Beyond the Woodfuel Crisis: People, Land and Trees in Africa.* Earthscan: London.

Leach M, Mearns R, Scoones I. (eds). 1997. Community-based sustainable development: consensus or conflict? *IDS Bulletin* **28**:

Mahiri IO. 1998a. Comparing transect walks with experts and local people. PLA Notes IIED: London; **31**: 4–8.

Mahiri IO. (1998b) (in press) The environmental knowledge frontier: transects with experts and villagers. *Journal of International Development* **10**:

McCall M, Skutch M. 1987. *SADCC Energy Development Fuelwood Study, Malawi Country Report* ETC Foundation: Leusden.

Mearns R. 1995. Institutions and natural resource management: access to and control over woodfuel in East Africa. In *People and Environment in Africa*, Binns T (ed.). Wiley: Chichester; 103–104.

Millingtron AC, Critchley RW, Douglas TD, Ryan P. 1994. *Estimating Woody Biomass in Sub-Saharan Africa.* IBRD/World Bank: Washington, DC.

Mortimore MJ. 1992. *Environmental change and dryland management in Machakos District, Kenya* 1930–90. ODI Working Paper No.63. ODI: London and Nairobi.

Moss RP, Morgan WB. 1981. *Fuelwood and Rural Energy Production and Supply in the Humid Tropics.* Tycooly International: Dublin.

Namuye SA. 1989. Survey on dissemination and impact of Kenya Ceramic Jiko of Kenya. In *Stoves for people. Proceedings of the 2nd International Workshop on stoves dissemination*, Caceres R *et al.* (eds.). Intermediate Technology Publications: London; 39–44.

Ngugi AW. 1988. Cultural aspects of fuelwood shortage in the Kenyan Highlands. *Journal of Biogeography* **15**: 165–170.

Nichol JE. 1990. Dynamics of indigenous fuelwood production systems: an analysis of Kano, Nigeria. *Singapore Journal of Tropical Geography* **11**: 43–55.

Nkonoki SR, Sorensen B. 1984. A rural energy study in Tanzania: the case of Bundilya village. *Natural Resources Forum* **8**: 51–62.

Ogolla B. 1995. Land tenure and conservation of environmental resources: an overview. In *Environmental Policy and Law* **l25**: 329–339.

O'Keefe P, Munslow B. 1989. Understanding fuelwood I: A critique of existing interventions in southern Africa. *Natural Resources Forum*, **13**: 2–10.

O'Keefe P, Kirkby J, Howorth C. 1997. *Addressing Global Warming: The Challenge of the Kyoto Summit.* Departmental Occasional Papers, New Series No.20. University of Northumbria: Newcastle-upon-Tyne.

O'Keefe P, Raskin P, Bernow S. 1984. *Energy and Development in Kenya: Opportunities and Constraints, Energy, Environment and Development in Africa* Volume 1. Beijer Institute and The Scandinavian Institute of African Studies: Stockholm.

Okoth-Ogendo HWO. 1987. Tenure of trees or tenure of land, In *Land Trees and Tenure*, JB Raintree (ed.). ICRAF, Nairobi and Land Tenure Centre: Madison, WI; 225.

Okoth-Ogendo HWO. 1991. *Tenants of the crown: The Evolution of Agrarian Law and Institution in Kenya.* ACTS Press: Nairobi.

Olembo RJ. 1994. Can land use planning contribute to sustainability. In *The Future of the Land: Mobilising and Integrating Knowledge for Lane Use Options*, Fresco LO, Stroosnijder K, Bouma J, Van Keulen H (eds). Wiley: Chichester; 369–376.

Openshaw K. 1982. *Inventory of Biomass in Kenya: Conditionally Renewable Energy.* The Beijer Institute, Royal Swedish Academy of Sciences: Stockholm.

Office of Technology Assessment OTA. 1992. *Fueling Development: Energy Technologies for Developing Countries.* OTA-E-516. US Government Printing Office: Washington, DC.

Pasztor J, Kristoferson LA. 1990. *Bioenergy and the Environment.* Westview: Boulder, CO.

Raskin PD. 1986. LEAP: *A Description of the LDC Energy Alternatives Planning System.* The Beijer Institute and the Scandinavian Institute of African Studies: Stockholm.

Republic of Kenya. 1990. Economic survey Central Bureau of Statistics, Ministry of Planning and National Development: Nairobi.

Rocheleau D. 1994. Participatory research and the race to save the planet: questions, critique, and lessons from the field. *Agriculture and human values* **11**: 4–25.

Sayer A. 1992. *Method in Social Science: A Realistic Approach*, Routledge: London.

Sen A. 1981. *Famines and Poverty.* Oxford University Press: London.

Senelwa KA, Hall DO. 1993. A biomass energy flow chart for Kenya. *Biomass and Bioenergy* **4**: 35–48.

Simoes JTC. 1984 SADCC: *Energy and Development to the Year 2000.* Beijer Institute and Scandinavian Institute of African Studies: Stockholm.

Soussan J, O'Keefe P. 1985. Biomass energy problems and policies in Asia. *Environment and Planning A* **17**: 1293–1301.

Soussan J, O'Keefe P, Mercer DE. 1992. Finding local answers to fuelwood problems: A typological approach. *Natural Resources Forum*, **16**: 91–101.

Tiffen M, Mortimore M. 1994. Malthus Controverted: The Role of Capital and Technology in Growth and Environment Recovery in Kenya. *World Development* **22**: 997–1010.

Tiffen M, Mortimore M, Gichuki F. 1994. *More People, Less Erosion: Environmental Recovery in Kenya.* Wiley: Chichester.
Timberlake L. 1985. *Africa in Crisis: The Causes and Cure of Environmental Bankruptcy.* Earthscan/IIED: London.
UNEP (1991) *Green Energy: Biomass Fuels and the Environment.* UNEP: Nairobi.
Van Gelder B, O'Keefe P. 1995. *The New Forester.* IT Publications: London.
Western D, Ssemakula J. 1979. *The Present and Future Patterns of Consumption and Production of Wood Energy in Kenya.* International Workshop on Energy and Development. KENGO: Nairobi.
Wisner B. 1987. Rural energy and poverty in Kenya and Lesotho: all roads lead to ruin. *IDS Bulletin*, **18**: 23–29.
Wisner B, O'Keefe P. 1978. *Landuse and Development.* International African Institute: London.

