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Caught between Energy Demands and Food Needs: Dilemmas of Smallholder Farmers in Njoro, Kenya

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Abstract
Smallholders in rural Kenya, like their counterparts in tropical Africa currently face acute shortage of fuel wood for domestic use. There has been rapid population increase in the last few decades resulting in increased demand for food crops. This has led to the expansion of area under subsistence agriculture eating into indigenous forests, the traditional source of wood fuel. This situation has been compounded by the limited access to alternative sources of domestic energy in rural parts of Kenya. The recent upsurge in the cost of fossil-derived fuels as well as in hydro-generated electricity has left the smallholder farmer with wood as the sole source of fuel. This paper therefore examines the conflicting demands of domestic fuel needs and foods. Key research questions were: What are the household domestic energy demand and constraints? What is the household food demand and constraint among smallholders? How do the smallholders reconcile these competing basic needs? The paper reflects on the constraints of smallholders in their quest to fulfill their food and energy needs. The discussed model is a result based on discussions between the researchers and focus group discussions drawn from smallholder farmers. The primary data gathered from the discussions is augmented by secondary data to draw imperative implications on domestic energy use and food needs. The results indicate an average annual per capita wood fuel demand of 1.99 m^3 and a deficit of 8.816 m^3 per household. The deficit is usually catered for through purchase of wood fuel from the market, which has an implication on the pressure exerted on the forestry resources. This paper shows that households in Njoro have turned to desperate coping mechanisms and strategies such as use of maize straw, pruning and fallen twigs. The results of this study provide insights on how the dilemma may be resolved in a smallholder setup and suggest local policy options.

Keywords: woodfuel, smallholder farmers, food demand, Kenya

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1 Introduction

About half of the world's population use fuels from biomass as an energy source in households: for cooking, lighting and heating (Brouwer *et al.*, 1997; Mahiri, 1998). The energy sources are fuel wood, agricultural residues (for example maize cobs or maize straw), charcoal or dry cow dung. In most African rural and low class urban households, wood fuel continues to be a major source of cooking fuel and plays a vital part in energy supplies of many developing countries (e.g., Mahiri and Howorth (2001); Okello *et al.* (2001). Many households in the rural areas depend entirely on this type of fuel whereas their counterparts in low class urban areas frequently use it in combination with other forms of energy such as paraffin and electricity. In Kenya, it is estimated that wood provides about 73 per cent of total energy consumption, mainly as fuel wood for cooking and heating in rural areas, and as charcoal in urban areas (Government of Kenya, 1997). The current annual supply of woodfuel is estimated to be 18.7 million tonnes. The trend of consumption of fuel wood in Kenya has been shown to vary with ecological zones (Kituyi *et al.*, 2001).

In the 1970s the "woodfuel gap theory" was first brought to the world's attention. This implied that woodfuel was being consumed on an unsustainable basis (Bradley and Campbell, 1998; Mahiri and Howorth, 2001). The "gap" indicated that woodfuel demand was larger than the sustainable supply, defined as the mean annual increment of wood biomass (FAO, 1983). It was then concluded that deforestation and forest degradation were largely due to firewood harvesting (IUCN, 1996). With mounting concerns for the woodfuel sector, national and international agencies commenced many research programs on the relationships between woodfuel supply and demand. For example in Kenya, the Kenya Woodfuel Development Programme (KWDP) developed a three-tier approach to the study of rural woodfuel energy supplies (Bradley, 1988). It involved three highly densely populated districts (Kakamega, Kisii and Murang'a) between 1983 and 1986. Some of the more important conclusions which emerged from this work include the following: (a) The integration of tree production into general farming activities is complex and deeply-rooted. Local farmers have an intimate knowledge of the benefits and weaknesses of the different trees growing in different situations on the farms. These are manifest in different ways among the sub-regions of the districts. (b) As a proportion of the total on-farm woody biomass, deliberately managed and planted woody biomass increases with increasing population density. (c) Contrary to expectations, as population density increases and farm size diminishes, the amount of land devoted to woody biomass production increases. In the southern third of Kakamega District, with rural population densities exceeding 700 per km^2, more than 20% of the land is devoted to woody biomass. (d) It was estimated that 31% of the district's farms experience a shortage of greater than 50% of needs. Only 21% have a surplus. Despite such a high proportion of land devoted to trees, the population densities are so high that these areas experience the greatest deficits.

Smallholders in rural Kenya, like their counterparts in tropical Africa currently face acute shortage of fuel wood for domestic use. There has been rapid population increase in the last few decades resulting in increased demand for food crops. This has led to

the expansion of area under subsistence agriculture eating into indigenous forests, the traditional source of wood fuel. However, the rural household energy problem cannot be treated in isolation from the equally pressing issues of food, poverty, labour, culture and values (MAHIRI and HOWORTH, 2001). This study aimed to assess the energy and food demand nexus and the coping strategies. Given that fuel wood production competes with food production for land, there is need to understand household dilemmas in meeting woodfuel and food needs and strategies of resolving the conflict.

2 Methodology

The main data for the study include woodfuel production, food production, socio-economic characteristics as well as perceptions on woodfuel and food availability. This study utilized focus group discussion as the main data collection method in two rural villages in Nakuru district, Kenya. Verifications were done through actual measurements of the firewood bales in Njoro market to estimate the volumes. Data was analyzed using descriptive methods which entail computation of averages, calculation of frequencies and estimation of food and fuel demands.

3 Results and Discussions

3.1 Household socioeconomic characteristics

Household socioeconomic characteristics The interviewees were mainly small scale farmers, 80% being women. Average land ownership was 1.38 ha, used mainly for subsistence food crop production (71.37%), pastures/ fodder crops (25.0%) and settlement (about 3.62%). The average household size was 6 persons which was slightly higher than the national average and the mean age of respondents was 45 years. Their main economic activities were farming and small scale businesses.

3.2 Household food and fuel demands: Household Dilemmas

The main source of fuel used among the households is firewood, with a few using charcoal occasionally and gas, rarely. Those who had used gas before said that they are no longer using it because of higher prices for petroleum products. Currently liquidified gas; retail at Kshs. 135.56 (1.38 Euros) per kilogram. Another frequently used fuel mainly for lighting is paraffin, with costs of about Kshs. 100 (1 Euro) a liter.

Firewood, the major fuel source for the households in the study area was usually acquired from own farm or purchased from hawkers, who transport it using bicycles from Mau forest, which is 20 to 50 kilometers away. A firewood bale[1] of about 0.17 m^3 costs Ksh. 500 (5 Euros), on the market. For a household consisting 6 members on average, which was the mean number of members per household in the study area, the annual firewood demand is 11.96 m^3 per household. Out of this, only 3.144 m^3 (26.28%) is acquired from within the farm as tree pruning or fallings, and the rest (11.95 m^3) from the market. Consequently the annual per capita wood fuel demand translates to about

[1] This is the volume of wood after provisions for air spaces, which constitute about 40% of the measured bale.

1.99 m^3. These results indicate a large deficit of wood fuel (Table 1), which is usually satisfied through clearing of indigenous and artificial forests, threatening biodiversity.

Table 1: Household supply and demand of firewood in Ogilgei, Njoro

Period	*Supply from own farm (m^3)*	*Demand (m^3)*	*Deficit (m^3)*
Monthly	0.262	0.68	0.418
Annually	3.144	11.95	8.816

Source: Authors' computation from field interviews.

The annual demand for maize per capita in the area was 118 kg, hence a family of 6 members requires 708 kg annually. Given an average yield of 1900 kg per hectare (BETT *et al.*, 2008), the household needs 0.37 ha to be food self sufficient. Given the average land allocated to food production, there is an indication that the households are producing surplus food for the market, using the income to cater for basic household needs including purchase of fuel wood. Woodfuel expenditure takes a substantial proportion of household budget. Although there is an opportunity for households to increase their own farm fuel wood production through planting of more trees, such approach would reduce the land under food crop production. Given the above scenario, the consequences of the pressure exerted on forestry resources by both food and wood fuel demands are far-reaching. Unless campaigns strengthening farm forestry strategies and other environmentally friendly strategies like agro-forestry are intensified, the crisis will get worse. This situation will further be exasperated by the current global fuel and food crisis. Poor farmers will have a higher burden, since they have to allocate their meager resources to food and fuel purchase, leaving very little if any for other basic needs. This is made worse by the fact that the area has witnessed rapid land use and land cover changes in past decade, involving vast clearance of indigenous forests to create farm land the farmers used to depend on as a source of firewood. These changes have created a food and fuel crisis in the area, forcing rural smallholder farmers in the area into a great crisis, threatening their livelihoods. In addition, food production is constrained by declining soil fertility, high fertilizer prices, erratic weather conditions and this worsens the wood fuel-food production crisis.

3.3 Survival strategies

Results ascertain the supposition that there has been a rapid decline in the mostly used wood fuels in the area: charcoal and firewood. The farmers in the discussion said that the last decade has been the worst in terms of the trends of declining wood fuel. Some of the coping strategies used by the rural poor include, purchasing of wood fuel from the market (something they never used to do before), use of alternative fuel such as small fallen twigs and maize stalks. Most of the farmers sell surplus food produce and use some of the money to purchase woodfuel. However, the strategy is not sustainable due

to erratic climatic conditions and poor, eroded soils that result in low crop yields. Other respondents indicated that they even use the fencing poles, which had been erected during the days when there were no shortages of wood products. Among the farmers, there was none with a woodlot, but the majority had trees scattered on their farms and along boundaries. The farmers cited land size as a major reason why they do not plant trees since food production is given priority. Another constraint reported was frequent rain failure, leading to very low survival rates of trees. Watering of trees cannot be sustainable in the area, since they have to buy water for household use and livestock consumption at the rate of Shs. 3 (0.03 Euro) per 20 liter container. Furthermore, even where farmers have made efforts to grow trees in order to address the problem, the growth rate of trees is too low to match the rate consumption. The average number of mature trees was 35, giving an average density of 25 trees per hectare. This density is too low considering the annual wood fuel demand.

4 Conclusions and policy Implications

The study reveals that farmers face a dilemma in allocating land for food and wood fuel production. Due to a high deficit in on-farm wood fuel production at household level; farmers resort to the market. Most of the marketed fuel wood is illegally obtained from government forests. In the long run this may not be sustainable and due to strict government control on access to forest fuel wood, the supply from this source has declined, leading to escalating fuel wood prices.

Towards mitigating these effects, the study draws imperative implications providing insights on how the dilemma may be resolved in a smallholder setup. We follow an integrated energy concept, which includes different alternative energy systems and sources, and energy efficient techniques.

First, there is need to promote *alternative sources* of energy such biogas and solar energy. Biogas is a promising alternative since most households rear livestock especially cattle. The potential for solar energy is high given that the area is located in a tropical area with about 10 hours of sunshine per day all year round. Second, *promotion of agro-forestry* is necessary. Efforts can be targeted towards promotion of fast growing agro - forestry and hedge / boundaries tree species so as to match wood fuel consumption. Also so called energy plants integrated into agro-forestry systems could be a solution. Third, farmers need to use *energy saving firewood stoves*. This is necessary in order to reduce fuel wood consumption.

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