# THE RELATIONSHIP BETWEEN SEASONAL FUELWOOD AVAILABILITY, HOUSEHOLD FOOD CONSUMPTION, AND WOMEN'S TIME ALLOCATION

By

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**The relationship between seasonal fuelwood availability,**

**food consumption, and women's time allocation**

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**(ABSTRACT)**

A study was conducted in 1993/94 on a group of 45 women clustered into the Hill, Lake, and Town regions of Kasgunga West sub-location in Homa Bay district, Kenya to assess women's perceptions of problems and solutions related to fuelwood availability, household food consumption, and women's time allocation for daily activities, and the relationships between time allocation, fuelwood availability, and household food consumption. Results obtained from the qualitative part of the study showed that 35, 23, and 22% of the respondents perceived that fuelwood collection, child care, and farming activities, respectively, were the most strenuous and time consuming activities of women in the Homa Bay district. The most obvious fuelwood availability problem was inadequate supplies. This caused a shift in the size of collected fuelwood (from large to small and increased usage of agricultural residue for fuel). According to the study, inadequate food is produced in the area and this results in approximately 91% of the staple consumed being bought from the market. The total time spent by respondents for collecting fuelwood was positively correlated with the amount of fuelwood collected ($r=0.69$) and earnings derived from sale of charcoal ($r=0.61$).

## DEDICATION

**Christian Nyawade Komengo Awich**
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## TABLE OF CONTENTS

## LIST OF TABLES

Chapter One

Chapter Two



Chapter Three

## LIST OF FIGURES



## LIST OF APPENDICES

## Introduction

The geographic location of this study, Kasgunga West sub-location, Mbita Division of Homa Bay District, lies in the rain shadow and is characterized by low, unreliable, bi-modal, torrential rainfall. Consequently, subsistence crop yields are low and natural tree and other vegetation cover sparse, leading to low agricultural and forestry productivity. The major occupations in the region are farming and fishing in lake Victoria.

Hence, the low income levels. Population density is high, and people are almost totally dependent on trees as a source of fuel for cooking. Unfortunately, despite the reduced levels of biomass, fuelwood still forms a major source of income particularly in the sale of fuelwood and charcoal.

Previous to land demarcation, women were able to collect fuelwood as a free resource but fuelwood has since acquired monetary value because of its scarcity and the restrictions limiting people to only collect on their tracts of land. The only other available land is the state land which is also restricted. In addition, there is limited alternative sources of energy in the region. Therefore, women spend more time collecting fuelwood for cooking and for sale. This in turn may affect the time spent on farming and other household activities.

Therefore, this study was conducted to investigate the relationship between seasonal fuelwood availability, household food consumption and women's time.

## Chapter One.

### Women's Perceptions of Problems and Solutions Including Coping Strategies of Fuelwood Availability, Household Food Consumption, and Time Allocation


### Abstract

A study of women's perceptions of problems and solutions, including coping strategies of fuelwood availability, household food consumption and time allocation was conducted on a group of 45 women. The respondents were randomly selected and clustered into the Hill, the Lake, and the Town regions of Kasgunga West sub-location in Homa Bay district - Kenya. The three problems and solutions for time allocation, fuelwood availability, and food consumption - with the highest ranking from each group were weighted on a scale of 1 to 3: where; the first ranked was given a score of 3, the second 2, and the third 1. Thirty-five percent of the ranked and weighted responses showed that respondents perceived fuelwood related activities as the most strenuous and the most time consuming, followed by childcare (23%), and farming activities (22%). The biggest fuelwood availability problem as perceived by respondents was inadequate supplies. Respondents complained that fuelwood collection took too much time (nearly 17%), and that the distance to collection points was great (11%). Fifty-three percent of the ranked and weighted responses indicated that respondents perceived planting trees as their number one solution, a second solution was having money to purchase alternative fuels (11%). Nearly 54% of weighted responses of food consumption problems were

agriculture related. Coping strategies for fuelwood scarcity were the use of little fuelwood (35% of responses), and that of crop residues (nearly 19%). To cope with a hypothetical food shortage, 33% of the weighted responses indicated that respondents would opt to borrow flour as the preferred solution, while others (19%) would go hungry.

**Introduction**

In Kenya, as in many developing countries in Africa, women are responsible for agricultural production and two of the most time-consuming activities -- woodfuel collection and cooking. Studies have indicated that women who spend more time in woodfuel collection have less time available for agriculture or family support and childcare. In addition, if more of the household's income has to be spent on woodfuels, less is available for other household needs such as food (Ardayfio, 1985).

Any scarcity that involves household needs results in the adaption of coping strategies to minimize the impact on the family members. Several studies conducted in Africa and elsewhere (Thomas et al., 1989; Berio, 1990; Downing, 1988; Kumar, 1988; Frankenberger, 1990) indicate that families, and women in particular, change their resource "management and trade-offs between maintaining current food consumption levels and protecting the future income generating capacity of households" (Corbett, 1988, p. 2110).

In this study coping strategies was defined as the next best option, for increasing

fuelwood availability and food consumption, in the absence of the ideal or preferred commodity. Strategies used to solve the basic problem such as tree planting to alleviate fuelwood scarcity will be considered solutions rather than coping strategies.

The need to understand rural people's perceptions is well documented (Chambers, 1983; Murcott, 1992; Smith et al., 1992; and Pelto & Vargas, 1992) but studies of women's perceptions are quite limited especially those related to food consumption and fuelwood availability. There is information on women's perceptions in relation to health and cultural and social influences on their perceptions (Allison, 1991; Pratt et al., 1992; Dickin et al., 1991. Some studies (Barnes, 1984) and Hageraud (1986), suggest some findings relevant to this issue. For example, Barnes (1984) found that Gusii women perceived fuelwood availability to be a problem and that they expressed the difficulty experienced in obtaining fuelwood. None of the women claimed to "cook fewer times a day or to cook foods that required less fuel" (Barnes, 1984, p. 73). Most women felt that as fuelwood becomes scarcer in the future, they would eliminate cash crops and plant more trees, or buy firewood from those with big lands, or even uproot bananas, both a subsistence and cash crop in this part of Kenya.

The purpose of this study was to describe and quantify women's perceptions of problems and solutions related to fuelwood availability and household food consumption, and women's coping strategies for obtaining fuelwood and food, and their perceptions of time allocation.

## Materials and Methods

### Sample selection

This study was carried out in Kasgunga West sub-location in Homa Bay district, Kenya (formerly part of South Nyanza district). (See Appendix A for guidelines used to conduct qualitative research). Forty-five monogamous households were randomly selected. This was done by using the list of all households in Kasgunga and randomly selecting 5 names from under each headman's jurisdiction or village for equal representation within the sub-location. The sample represented each geographic location thus: the Hill region, consisted of Gera East, Gera West, and Gera Mix villages: the Lake region, consisted of Nyamarandi, Kamaena, and Waluwi villages; and the Town region consisted of Wakunga, Wasulwa, and Kombe.

At the initial meetings, the respondents were also informed of the 3 full day or overnight observational visits and individual interviews to be held in the following 11 months. The respondents were asked to consider the long duration of the study and give their verbal consent if they would be willing to participate.

### Data collection

After the selections, the sub-chief, and the headmen in the study sub-location announced at their weekly barazas (public meetings) that there would be people doing research in their areas. The researcher and research assistant(s) then approached the respondents to schedule the group meetings at the home of one of the study respondents.

The meetings were very informal and there were allowances made for lateness (up to one hour beyond the scheduled meeting time, due to the rural set up and also due to cultural and women's perception of time, and their busy schedules). The meetings usually lasted for approximately 2 hours and were held as long as 3 of the 5 selected respondents of each village within a region were present.

At the meetings, each individual was given a chance to talk and give their perceptions on women's time allocation, seasonal fuelwood availability, and household food consumption, including coping strategies. Data gathering instruments included poster size colored manila paper, pens, and the protocol guide with a series of open-ended questions and probes. The standard protocol was used by the researcher to ensure uniformity with the protocol for each group (Appendix A). Qualitative research was done during the months of May through July 1993.

The pretesting and testing of the standard protocol for qualitative data collection were done at Egerton College; and in the pilot study in Mbita in the months of April and May 1993. The guidelines for qualitative interviews were translated into Dholuo from English and back translated, to ensure that there was no loss of clarity with the translation. Also, it was done to ensure that the responses given corresponded with the questions asked.

This method of qualitative data collection is similar to those used for social differentiation by the Institute of Development Studies/International Institute of Environment and Development (IDS/IIED) (RRA Notes No. 16). To maintain

consistency the researcher led and facilitated all nine meetings.

Protocol

For time allocation, the researcher and respondents sat in circle formation (discussion groups of 3-5 members) either round a table or on the ground. The respondents were then asked to list in chronological order the activities performed on a typical day from the time of rising in the morning to the time they retired to bed in the evening. The researcher recorded the activity on a large poster size manila paper. As the interview progressed, the researcher added to the recorded list whatever activities were unique to each respondent. On completion, each respondent was asked to think about all the activities performed daily and then vote for the 5 that they considered most difficult, starting with the most difficult down to the least difficult.

To assess this, the respondents were each allocated the equivalent of one (1) Kenya shilling in ten cent pieces (coin) for voting. However, respondents were not limited to the ten pieces. If they felt they needed to be paid more than they had for a certain activity, additional coins were provided. Respondents voted by indicating the amount of money they would like to be paid depending on how hard and the amount of time required for the particular task. Everyone voted for the most difficult activity first starting from one side of the circle until all had voted, followed by the second most difficult, until each respondent had voted five times. Each respondent voted or paid themselves for the 5 most difficult tasks by subtracting the money from what they had

and placing the amount on the table or ground beside the manila paper. The researcher then marked the amount of money against the activity on the manila paper, since most of the participants were illiterate in both English and Dholuo (Appendix B).

The next topic of discussion was women's perceptions of problems and solutions of fuelwood availability including coping strategies. Again, each respondent was allowed to verbally list perceived problems as the researcher manually recorded them on the same manila paper for each group. The researcher then listed the solutions to each problems according to respondents' suggestions. Solutions related to fuelwood availability and food consumption were given as a group. For problems and solutions dealing with household food consumption respondents were asked, "If do not have enough food what would you do first?". Then if that was not enough, what they would do next and so on. The same procedure of listing and ranking used in time allocation above was repeated.

Finally, women's perceptions of problems and solutions of household food consumption, including coping strategies, and how all three i.e. time allocation, seasonal fuelwood availability, and household food consumption were interrelated, were prioritized by each 5 membered group.

Data analysis

(a) Time allocation

Thematic scores: the three most difficult tasks performed in a typical day by these respondents, was regarded as a theme and were used as the main type of summary to

compare variations and similarities in responses between groups.

From the group discussion the response or theme was based on the highest average of coins allocated from the women's voting in each of the nine groups. These results were then ranked giving the most difficult activity a value of 3 and the third most difficult task a value of one. The total points were added for each theme and divided by the weighted total (54), and a percentage calculated for time allocation (Table II).

(b) Fuelwood availability

The respondents were asked to discuss what they perceived as problems and solutions related to fuelwood availability. For fuelwood availability the 3-5 respondents in each group had to agree on the order of importance of all ranked responses. From the prioritized, summarized list of problems and solutions generated by respondents - the researcher ranked, weighted and calculated a percentage.

This was done by using the top three problems for each village and ranking and tabulating them (Table III) on a scale of 1 to 3: first ranked was given 3 points; the second, two points; and the third ranked, one point. Then the total points for each problem were divided by the weighted total and a percentage calculated (Table V). The analysis procedure was repeated for the solutions (Table IV and Table V).

To avoid fragmentation and to facilitate discussion, the following criteria were used by the researcher to categorize responses to perceptions of fuelwood availability. All responses which dealt with the physical environment and were encountered or occurred each time fetching fuelwood were put under Direct problems. Those problems

that made fuelwood collection difficult by either reducing available amounts, or taking away the gathered amounts, were considered as Secondary causes. The remaining indirect causes such as lack of food and the resources with which to buy the food, thereby necessitating the sale of fuelwood in order to earn money, were all classified under the Other category.

(c) Food consumption

To get to the respondents' perceptions of food consumption problems, the same procedure used for fuelwood availability (b) was adopted. The prioritized food consumption problems (Table VI), solutions (Table VII), and the percentages (Table VIII) were calculated in a similar manner to that for fuelwood availability. To clarify the discussion the themes were put into groups for comparison (Tables V and VIII). The criteria for categorizing responses were based on the type of activity, e.g. Agricultural, Economic, and Food related. Those responses that did not fall into these categories were regarded as Miscellaneous.

(d) Coping strategies

Coping strategies for both fuelwood availability (Table IX) followed by those for food consumption (Table X) were also discussed. Coping strategies for time allocation were not tabulated because respondents in most groups thought it improbable that one would have food and fuelwood and not have the time to be able to cook. To summarize the results the same procedure of ranking, weighting, and percentage calculation, similar to that for fuelwood availability in (b), was used.

(e) Additional information

In addition, the researcher transcribed included related comments made by respondents and research notes recorded at the bottom of manila papers. Field observations and incidental information were also noted by the researcher and used to clarify results.

Research Site

Kasgunga sub-location in Mbita division lies along the western border of Kenya along the shores of Lake Victoria, a major regional economic resource (Appendix C). The semi-arid sub-location is in a rain shadow, with bimodal rainfall from mid March until June (long rains) and November to December (short rains). It is classified as belonging to agro-ecological Zone IV with infertile and eroded soils (Ministry of Agriculture, 1982).

Most people in rural Kasgunga live in traditional style mud houses with thatch roofs, comprised of one or two small rooms on homesteads, and practice subsistence farming. Sanitation facilities are poor throughout Kasgunga and most of Mbita Division. Mbita town which has a market and health center is the administrative center for both the sub-location and the division. The area was originally inhabited by the Abasuba who have since intermarried with Luos and speak Dholuo.

## Results and Discussion

A. Women's perceptions of time allocation

Table I shows the results of voting and ranking of the three most difficult time allocation activities by village. The totals were weighted as described in Methods and a percentage calculated (Table II). In the whole study area comprising three regions, 35% of the ranked and weighted responses indicated that all fuelwood-related activities related with fuelwood (searching for, collecting, splitting, sale and use of fuelwood) were the most difficult.

In women's perceptions of time allocation, fuelwood availability was "voted" as the most difficult, the most strenuous and the most time consuming task respondents performed daily. However, from the researchers' own observations in the field, most people including the Hill region respondents did not go to the hills frequently for fuelwood for their own use. The big fuelwood gathered by Hill respondents in particular was primarily sold or made into charcoal.

Evans (1986) also found that the poor cannot afford to use good quality firewood and sell instead. A few respondents with large acreages in the Lake region, and those in the Town willing to walk long distances also gathered fuelwood for sale. The fuel for sale was collected in large headloads (up to 6 sale-size loads), three to 4 times a week because women needed alternate days to sell it at Mbita and at the beach villages. Respondents in the Lake region felt that it was more convenient to use crop residues and little fuelwood than spending hours going to fetch fuelwood.

The Town women clearly perceived the relationship between time, food, and fuel. They perceived time fetching fuelwood as interfering with food consumption during weeding. This is because of the triple burden on women of household, family agricultural and income-earning work (Cecelski, 1987). Also there was no way they could go hungry due to lack of fuelwood when food was available because of alternatives "even if one has to use roof thatching, or even tear down the granary" - many of which were empty anyway.

The second time allocation activity child care (23% of the weighted responses) included not just time respondents spent physically providing for and being with the baby, but also time spent in business, either selling fish or fuelwood in order to procure cash and purchase food for their children. Child care itself was not hard because the women left infants and children behind in the care of older children not yet enrolled in school (some as young as 5 to feed and take care of younger siblings) or worked with babies strapped on their backs.

Farming was ranked third by respondents. However, it was an activity that was carried out only 3-4 months in a year whereas, childcare was carried out throughout the year. The reason for it being ranked high or close to child care, is probably due to the intensity with which these activities were carried out. Moreover, the time and energy required to perform farming were in short supply during the rainy season. Farming women plowed and planted on the same day because they were late getting started with farming. But the most difficult part of farming was weeding and the need to complete

weeding before rains are finished (Table II).

When asked how the relationship between time allocation activities affected food consumption and fuelwood availability i.e. if you had fuel and food but no time: respondents were incredulous, some even thought the question inappropriate because they could not imagine having fuel and food but no time for cooking. One woman in this group clearly told me:

> "... it is impossible to have both food and fuelwood available and not have the time to cook! It (the meal) may be late, but cook I shall."

However, one subject who lived farthest from the town, the lake, and fuelwood collection points summed up the situation thus:

> "... we rise early in the morning, milk the cows to go sell the milk (in Mbita) but people cannot afford sugar anymore, so they do not buy our milk for their tea. (So they return home, ferment it and sell it for less money.) Then we strap our ropes around our waists, take our machetes and head for the hills where we search, gather, and carry heavy headloads of fuelwood which make our chests ache! On arrival home, we knock over the fuelwood with so much anger due to the fatigue and hunger... and knowing that the rest of the work is still waiting to be done."

B. Women's perceptions of problems and solutions of fuelwood availability

In Table III, the lack of fuelwood and time taken to fetch it were mentioned by respondents in each region as the major problem. Other problems such as lack of food, foresters and charcoal making were also among the top three problems prioritized by women.

The solution most frequently mentioned to increase fuelwood availability was

planting trees; in the Lake and Town regions which were more depleted of fuelwood, and also in the Hill where people had larger lots and relatively more fuelwood. Respondents also mentioned the need for money, rain and a good harvest (Table IV). A small number of respondents in the Lake and Town regions, felt that stocking fuelwood during the dry season would help. Some, however, felt hopeless because there was nothing they could do about the weather or the government regulations of the forest department.

There were three categories in which the ranked responses were classified after being weighted and a percentage calculated (Table V). Direct problems related to fuelwood availability accounted for over 57% of all fuelwood related problems. Nearly 54% of the ranked and weighted responses indicated that respondents perceived planting trees as the major solution for fuelwood availability, followed by a good harvest (14%) and money (11%).

Respondents perceived lack of food and prolonged hunger as being directly related to fuelwood availability because when there is sufficient food women do not have to sell as much fuelwood (Table V). It has also been shown that where lack of food is severe, fuel shortages play a minor role in determining diets (Cecelski, 1987). Other secondary problems such as charcoal making depleted forests, restriction by forest rangers and land demarcation were also mentioned, but had lower weighted rankings.

The most important perceived solutions for increasing fuelwood availability were planting trees so one could have their own fuel nearby, the need for money to buy food, and a good harvest, so respondents do not have to collect and sell fuelwood in order to

buy food (Table IV). Commercial fuels, charcoal and kerosene, were not purchased. During the wet season the prices of fuelwood and food increased because these two commodities were unavailable and women spent more time collecting fuelwood to obtain additional more money to buy food taking time off from food production.

The respondents gathered small fuelwood around the homesteads, used crop residues when available, and bought fuelwood occasionally from regular sellers to supplement the large fuelwood or for their daily energy needs. It was also noted that women sold the best or big splitable fuelwood while they used off-cuts and other inferior plant material to do their own cooking. Another researcher in Kenya also observed that where "women spend a large portion of time to gather one kilo of wood, less of it will be used due to a greater tendency to conserve and to substitute more readily available fuels" (Hosier, 1984, p. 52). The respondents of Kasgunga, would borrow fuelwood, use sisal stumps, use dung or even tear down a granary before they opted to buy alternative fuel such as charcoal and kerosene. But it was noted that respondents bought fuelwood, which is less expensive, frequently. This could be attributed to the low income levels in Mbita division with an average of KSh. 382.27 (US $17 then and $10 today based on exchange rates in 1985 and 1995 respectively) per month (Chaiken, 1985).Another observation made was that, fuelwood gathering depended on food availability - women did not bother to gather fuelwood if they had no food to cook - whatever little food was going to be available, could be cooked using crop material other than fuelwood. This is similar to Barnes study (1984) where there was more use of

agricultural residues (postharvest), but unlike the Gusii women who did not "cook fewer times a day or cook foods that required less fuel" (p. 73), the Luo-Abasuba respondents of Mbita cooked porridge mainly due to lack of food or to stretch the flour rather than due to a lack of fuel. However, they said that porridge, particularly that made from maize flour, used more fuelwood than that required for the staple because it takes longer to coagulate. This in contrast to the comparative study by the International Labor Organization (ILO) which found that spending less time cooking is an extreme reaction to fuel shortage (Cecelski, 1987); Ardayfio (1985) which says that lack of woodfuels is a contributing factor to poor nutrition; and Evans (1986) who found that women reheated or ate left over foods when they lacked sufficient firewood.

From field observations and discussions with women, it was found that the search for fuelwood and the time spent searching for it was detested. The respondents felt that the headloads were too heavy, and that collecting the wood may have caused injury to eyes and body, resulting in headaches and illness. Cecelski (1987) also found that there are serious dangers to women's health from tree felling and charcoal making. In Kasgunga sublocation, collection points were too far away; too much time was taken to collect fuelwood. Government forest rangers harassed them (due to lack of permits). The distance walked to Mbita with headloads of fuelwood for sale was not worth the money earned especially in the dry season when the fuelwood prices fell. Respondents complained of smoke, which made their pans harder to clean, made their eyes water, and gave them chest ailments. Fuelwood burns fast and needed constant attention from

respondents. This was perceived as taking time off other activities and restricting movement away from the cooking place for too long.

Other solutions suggested by the respondents informally, included planting more trees near and around the homestead to reduce the distance to collection points, the use of charcoal (cleaner, burns slower) although fuelwood was preferred, because the commodity is free. In the absence of fuelwood they used crop residue and dung alone or in combination with fuelwood. Their perceptions of solutions - the need for capital to start businesses so they can buy and not sell the fuelwood, plant more trees nearer homesteads, use donkeys and carts (which belong to the men), and have food, so that women do not sell fuelwood and charcoal too cheaply due to hunger. One respondent in the Hill region summed it thus:

> "... fuelwood gathering may be hard. But fuelwood gathering for charcoal production is even harder. Not to mention the occasional "air holes" in charcoal heaps which burn our charcoal to ashes! Charcoal business is so hard it "drains" the blood."

It was also observed that there were usually fewer women selling fuelwood postharvest season because most people have their own food and it was the Town and Lake region respondents who bought more fuelwood. One Lake region respondent had this to say:

> " ... honestly speaking, fuelwood collection ended with land adjudication and demarcation. We do not do that anymore."

C. Women's perceptions of problems and solutions of food consumption

The ranking of problems (Table VI) and solutions (Table VII) for food

consumption as prioritized by women can be found in Tables VI and VII respectively. The major problems respondents perceived as affecting food consumption were the lack of rain, followed by one poor annual food crop harvest. Other problems such as unfair business deals and delayed payment by fish traders, and distant flour mills and, small pieces of land were also mentioned. Among the solutions were agricultural mechanization, need for rain, and need for capital.

Ranked and weighted responses (Table VIII) were categorized by the researcher under Agricultural, Economic, Food related, and Miscellaneous types of problems and solutions per the criteria in Methods. Fifty-four percent of the perceived problems were Agricultural; 22% Economic; and 15% Food related. This quotation from one of the respondents stresses the relationship between agriculture and food consumption:

> "One cannot do farmwork on an empty stomach, that is why weeding was not completed and so much land lay fallow, but it is easier to do business when hungry than it is to dig or weed."

This explains the preharvest, labor intensive hunger season (Frankenberger, 1990).

Among solutions 46% of the weighted responses could be grouped under Agriculture, 22% under Economic, whereas nearly 17% were Food related. The Miscellaneous category is also important because 11% of the weighted responses showed that respondents felt helpless because there was "nothing" they could do about the rain or against the government in regard to the forest rangers (Table VIII).

The most prevalent food consumption problem as perceived by respondents was

the lack of rain. Followed by poor harvests (which is agricultural), next was an economic problem, the lack of money.

The perceived food solutions were geared towards improved crop husbandry techniques such as mechanization, early planting and plowing larger fields, and proper and complete weeding, and the hope that it would rain enough, and the fact that they could do nothing about their circumstances. Respondents also felt that if they had capital they could invest into income generating projects such as buying their own nets and fishing boats or planting vegetables on a large scale under irrigation for sale. The need for food aid in the region was also frequently mentioned.

The perceptions of household food consumption, both problems and solutions, were just as clear to the women as those related to fuelwood availability. However, maybe the use of some of the following crop husbandry techniques could help the women; early plowing, planting before the rains, and completion of weeding, could augment whatever crop yields were available annually.

Another observation was that those who milled their staple by hand saved both money and time spent going to mechanized mills in the township. Moreover, the sorghum and cassava and other indigenous cereal flours spread further (a small amount of flour is used to make what is considered enough ugali for the whole household) i.e. less flour for the same amount of water for the food cooked. Maize flour, however, got finished sooner because more of it was required to make ugali. Unlike the subjects in Corbett's study (1988) Mbita women indiscriminately cut down trees in their efforts to

provide any food at all, let alone maintain current food consumption levels within the household. According to Cecelski (1984), rural women are suffering the major burden of environmental and economic distress in developing countries: working longer hours to produce enough food and income to support their families, as well as necessary fuel and water collection, with less family labor available.

From field notes respondents' perceptions of solutions to food problems included: hoping for a good harvest, making porridge when the staple was too little or when there were no vegetables for stew; growing vegetables under irrigation and selling them; and the building of more mills so that less time is spent queuing at mills and distances covered to and from the mills are reduced.

D. Coping strategies

Fuelwood availability

Table IX shows that women's hypothetical coping strategies for fuelwood was dominated by the use of little fuelwood (little being the diameter of unsplitable fuelwood 3 inches or less). Alternative strategies were the use of crop residue, and sisal stumps. Other items also used as fuel were granaries, dung, charcoal and the occasional borrowing of fuelwood.

The top three coping strategies for the respondents were the use of little fuelwood (35% of weighted responses), use of crop residue (nearly 19%), and the use of sisal stumps (nearly 17%) (Table XI). Other coping strategies were borrowing fuelwood

(10%), tearing down a granary (7%), and using livestock dung (4%).

Food consumption

To the hypothetical question of what respondents would do during periods of lack of food, women said they would borrow flour and other food items before they considered borrowing money (Table X). The first thing respondents did was to borrow flour for immediate use, as shown by 33.3% of the weighted responses (Table XI). The next option was to do without (19%), and the third most important coping strategy suggested by women was to borrow staple, (13%).

However, a distinction needs to be made between borrowing flour and borrowing staple. The amounts of borrowed flour were small and solved the problem instantly, whereas, borrowing staple put the respondents in debt, because the amounts were greater and required money and time for milling, before it could be used. A few respondents who were close to shops bought flour on credit. There were more people willing to do without food than to borrow staple.

Other minor coping strategies employed by women when food was insufficient or lacking included making uji instead of ugali which is stiffer and more energy dense. Respondents would also cook for children only, borrow money, and buy food on credit (Table XI).

E. The Relationship between fuelwood availability, women's time allocation and

household food consumption

To understand women's perceptions of the relationship between fuelwood availability, food consumption, and time allocation respondents were asked what was common among the three. The solution was perceived by respondents as money.

The respondents blamed poverty and low economic status. With money, they said, these three problems could all be solved by being able to purchase adequate food in large amounts thereby saving them time spent daily going to buy food. Respondents would also be able to buy fuelwood. With adequate food, time spent gathering extra fuelwood for sale would be saved.

In addition the respondents felt that borrowing (money and staple) caused unwanted indebtedness. The staple which was usually borrowed in larger amounts was not an immediate solution because time and money were required for the staple to be milled. This is similar to Corbett's study (1988) who found that women and families changed their resource "management and trade-off" (p. 210). However, these Kasgunga respondents went even further by sacrificing and providing food for part of the family (children only) or making porridge so the flour could spread over many days and be used for the whole family. According to Hosier's study in Kenya (1984) the quantity and type of food cooked was found to influence the amount of energy consumed (p. 54).

## Summary and Conclusion

From this study of women's perceptions of problems and solutions, coping

strategies of fuelwood availability, household food consumption, and time allocation, it is clear that women know what their problems are and know viable solutions to these problems. For time allocation, respondents perceived the major problems as fuelwood activities, childcare, and farming; for fuelwood availability, fuelwood inadequacy, too much time spent, and long distances covered; and for food consumption, the lack of rain, poor harvests, and the lack of money.

The major solutions to fuelwood availability as perceived by women, were: planting of trees for their own use, the need for a good harvest so women do not sell fuelwood in order to buy food, and the lack of money. The following distinctions were noted. The Hill respondents despite having relatively more fuelwood available considered the task hard because they collected fuelwood and made charcoal for a living. The same women walked farthest to selling points carrying heavy loads on their heads. Whereas, only a few of the Lake and Town women collected and sold fuelwood (usually from other people's lands). These respondents had been long resigned to using shrubs and little fuelwood or buying fuelwood instead of searching for and collecting fuelwood. Moreover, the latter own smaller plots of land with less fuelwood available on it. For the same reason, the Lake and Town women harvested less food from the smaller lots than did the Hill respondents from their large lots.

During the rainy season, however, women in the whole study area were observed using weedy shrubs of the Convolvulceae family, which burned faster and more easily than wet wood would, but was required in larger amounts. This is similar to Cecelski's

study (1987) which found that residue were inefficient and that even poisonous weeds may be used as fuel. Another respondent in the Hill region frequently bought trees from her husband for her own fuelwood use and for sale to buy food for the family. Despite this, one respondent had this to say about fuelwood availability: "yes, the fuelwood situation is bad, but it is not yet bad enough because we can still get something to cook with" in response to why women did not plant trees. Cecelski (1987) also observed that poor rural women themselves have not recognized the linkages between their work and the environment. In this case, fast growing shrubs such as Lantana camara would provide women with fuel because the species does not provide any other use but fuelwood.

Major perceptions of food consumption solutions were: to lease and plow more land, the need for rain, and "nothing". Other perceptions of solutions were fragmented due to differences in land sizes, and what were perceived as suitable projects for income generating projects. For example, the Hill region respondents felt that mechanization would increase crop production, whereas respondents in the Lake region felt that irrigation of vegetable crops would yield income with which to purchase food. The Town respondents, however, felt that a source of capital would help in starting business.

What was not clear, however, was why some of the long term solutions, such as planting trees and increasing the acreage under subsistence crops, were not implemented as easily as coping strategies, which are short term. The researcher also noted that the struggle for the poor simply to stay alive can be so desperate in some countries in sub-

Sahara Africa that long term fuel supply is immaterial. But from field observations respondents lacked money with which to plough and in many cases they paid for the ox-plows in kind i.e. the ox-plow owners would take part of their harvest. It was also observed that people lacked the energy to weed large lots which is in agreement with other researchers (Frankenberger, 1990; Kennedy and Cogill, 1985; and Ardayfio, 1986) that people are hungriest when they need energy for farm work most - the hungry season. As such, previously used cultural solutions e.g. group weeding should be encouraged in this sublocation.

The major hypothetical coping strategies employed by women when fuelwood was lacking, were the use of small fuelwood, use of crop residue, and use of sisal stumps. It was also observed that women did not collect fuelwood daily, not only to allow for time to sell it but also as a coping strategy. For food consumption women would borrow flour, go hungry, or they would borrow staple reluctantly. This was a way of conserving energy because the milling was done several miles away and required money. Therefore, milling by hand more frequently, and planting more of the indigenous cereal crops such sorghum should be encouraged.

In this study the use of a participatory method had both advantages in that the researcher was able to get more information on women's perceptions without limiting them to close ended questions, and disadvantages such as women volunteering information about things they would not otherwise say or that they did not do as frequently such as daily fuelwood collection.

The women are not striking a balance in this sub-location as observed during the rest of the research. They end up spending more time looking for food, than on most other activities and only fetch fuelwood for sale or to cook when food is available. Overall, it is not fuelwood availability that is affecting food consumption but food availability that may be deciding the amounts and frequency of fuelwood collection both for use and for sale over the short term period. But the long-term effects of food on fuel and what deforestation is doing to the already devastated ecology will result in more adverse erosion, less food production, and more exposure of top soil due to lack of soil cover. Then, it will be fuelwood affecting food consumption as a result of deforestation and consequent soil erosion. As Cecelski (1987) states, deforestation often results in lower agricultural productivity. and if less time is available for women's production of food crops, family consumption may decrease (Kennedy, 1985).

The importance of agriculture and food consumption, and the relationships between food, time and fuelwood cannot be overlooked. The women perceived money as a solution to all three, but a good harvest would most likely decrease the time spent buying staple and milling it daily, and the time spent fetching fuelwood for sale in order to buy food. These would also free more time to be spent on agricultural production to increase yields and household food consumption.

The purpose of this study was to describe and quantify women's perceptions of problems and solutions of fuelwood availability and household food consumption, women's coping strategies for fuelwood and food, and their perceptions of time

allocation.

The major problems were:

* Activities related to fuelwood collection
* Time spent collecting fuelwood
* Distance to and from collection sites
* Poor rainfall, and poor harvests
* Lack of money

The major solutions were:

* Planting trees
* Good harvests
* Additional money
* Leasing and plowing more land
* Rain
* Do nothing about the problem

TABLE I

Fuelwood ranking in relation to the three most difficult time allocation activities

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=4 | childcare | fuelwood | farmwork |
| Gera West n=5 | livestock | farmwork | fuelwood |
| Gera Mix n=3 | fuelwood | childcare | business |
| Lake region | | | |
| Nyamarandi n=5 | farmwork | livestock | fuelwood |
| Waluwi n=5 | fuelwood | farmwork | childcare |
| Kamaena n=5 | fuelwood | business | childcare |
| Town region | | | |
| Kombe n=5 | fuelwood | lake/water | business/ childcare |
| Wakunga n=5 | childcare | fuelwood | farmwork |
| Wasulwa n=4 | farmwork | childcare | fuelwood |

TABLE II

Weighted percentage ranking of women's perceptions of time allocation activities

| Time allocation activities | Percentage (%) |
|---|---|
| Fuelwood | 35 |
| Childcare | 23 |
| Farming | 22 |
| Livestock | 9 |
| Business | 7 |
| Lake & water related activities | 4 |

TABLE III

Ranking of fuelwood problems as prioritized by women

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=4 | not available | time | dries slowly |
| Gera West n=5 | hills risky | distance | time |
| Gera Mix n=3 | time | fuel sells cheaply | lack of food |
| Lake region | | | |
| Nyamarandi n=5 | not available | distance | permission |
| Waluwi n=5 | hunger | charcoal making | foresters |
| Kamaena n=5 | demarcation | distance | foresters |
| Town region | | | |
| Kombe n=5 | not available | charcoal making | foresters |
| Wakunga n=5 | not available | ask permission to gather | distance |
| Wasulwa n=3 | time/distance | foresters | not available |

Table IV

Ranking of fuelwood solutions as priotized by women

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=4 | plant trees | plant trees | stock in dry |
| Gera West n=5 | money | plant trees | season |
| Gera Mix n=3 | plant trees | plant trees | plant trees<br>good harvest |
| Lake region | | | |
| Nyamarandi n=5 | plant trees | plant trees | stack in dry |
| Waluwi n=5 | good rain | plant trees | season |
| Kamaena n=5 | plant trees | plant trees | nothing<br>let women be |
| Town region | | | |
| Kombe n=5 | good harvest | good harvest | plant trees |
| Wakunga n=5 | plant trees | use little fuelwood | plant trees |
| Wasulwa n=4 | money | nothing | plant trees |

TABLE V

Weighted percentage ranking of fuelwood availability problems and solutions

| Problems | % | Solutions | % |
|---|---|---|---|
| Direct problems | | | |
| Time | 16.7 | Plant trees | 53.7 |
| Distance | 11.1 | Money | 11.1 |
| Hills risky | 5.6 | Use little fuelwood | 3.7 |
| Inadequate fuel | 24.1 | Total | 68.5 |
| Total | 57.5 | | |
| Secondary causes | | | |
| Charcoal making | 10.8 | Let women be | 1.9 |
| Forest rangers | 9.3 | Nothing | 5.6 |
| Demarcation | 5.6 | Stock in dry season | 3.7 |
| Permission - owner's | 5.6 | Total | 11.2 |
| Fuel sells cheaply | 3.7 | | |
| Total | 35.0 | | |
| Other causes | | | |
| Hunger | 5.6 | Need good rains | 5.6 |
| Lack of food | 1.9 | Need good harvest | 14.8 |
| Total | 7.5 | Total | 20.4 |

TABLE VI

Ranking of food consumption problems as prioritized by women

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=4 | one crop/year | no money | long dry season |
| Gera West n=5 | no rain | poor harvest | one crop/year |
| Gera Mix n=3 | no rain | high food prices | no food aid |
| Lake region | | | |
| Nyamarandi n=5 | not enough food | no rain | one crop/year |
| Waluwi n=5 | no rain | unfair fish deals | small land |
| Kamaena n=5 | money | irregular fish payments | poor harvest |
| Town region | | | |
| Kombe n=5 | poor harvest | hand tools | forced to sell milk/fish for staple |
| Wakunga n=5 | poor harvest | foresters | less staple |
| Wasulwa n=4 | sale of fish/ fuel for food | weed for money | mills far out |

TABLE VII

Ranking of food consumption solutions as prioritized by women

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=3 | mechanize/plow early | complete | start business |
| Gera West n=5 | nothing | weeding | plow more |
| Gera Mix n=4 | need rain | plow more<br>food aid | food aid |
| Lake region | | | |
| Nyamarandi n=5 | plant tubers | irrigate veges | food aid |
| Waluwi n=5 | nothing | own nets/boats | lease land/<br>plow more |
| Kamaena n=5 | income giving<br>projects | need capital | food aid |
| Town region | | | |
| Kombe n=5 | need rain | food during<br>farming | food to curb<br>sale milk/fuel |
| Wakunga n=5 | plow more | bribe forester | more mills |
| Wasulwa n=4 | plant veges for cash | good harvest | make uji<br>instead of<br>ugali |

TABLE VIII

Weighted percent ranking of food consumption problems and solutions

| Problems | % | Solutions | % |
|---|---|---|---|
| Agricultural | | | |
| Lack of rain | 22.2 | Lease & plow large plots | 13.0 |
| Poor harvest | 16.7 | Mechanize & plow early | 5.6 |
| Hand tools only | 3.7 | Plant more root crops | 5.6 |
| Small land | 1.9 | Complete weeding | 3.7 |
| One crop/annum | 9.3 | Irrigation for veges | 3.7 |
| Total | 53.8 | Need rain | 11.1 |
| | | Total | 46.4 |
| Economic | | | |
| Poverty | 3.7 | Income generating project | 5.6 |
| Lack of money | 9.3 | Grow vegetables for cash | 5.6 |
| High food prices | 3.7 | Need for capital | 3.7 |
| No government aid | 1.9 | Own nets & boats | 3.7 |
| Mills far and slow | 1.9 | Start business | 1.9 |
| Irregular fish payments | 3.7 | Build another mill | 1.9 |
| Total | 22.3 | Total | 22.4 |
| Food related | | | |
| Not enough food available | 7.5 | Food during farming | 5.6 |
| | | Make uji instead of ugali | 1.9 |
| Sale of fish and fuel for food | 5.6 | Food aid | 1.9 |
| | | Total | 16.8 |
| Forced to sell milk and fish to buy staple | 1.9 | | |
| Total | 15.0 | | |
| Miscellaneous | | | |
| Forest rangers | 3.7 | Bribe foresters | 3.7 |
| Total | 3.7 | Nothing | 11.1 |
| | | Total | 14.8 |

TABLE IX

Women's hypothetical coping strategies for fuelwood availability

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=4 | Borrow fuelwood | little fuelwood | crop residue |
| Gera West n=5 | little fuelwood | crop residue | borrow fuelwood |
| Gera Mix n=3 | little fuelwood | fuelwood | use sisal |
| Lake region | | | |
| Nyamarandi n=5 | little fuelwood | crop residue | dung |
| Waluwi n=5 | little fuelwood | sisal stump | tear down granary |
| Kamaena n=5 | use dry brush | crop residue | tear down granary |
| Town region | | | |
| Kombe n=5 | little fuelwood | crop residue | use charcoal |
| Wakunga n=5 | sisal stumps | tear down granary | old furniture |
| Wasulwa n=4 | sisal stumps | crop residue | dung |

TABLE X

Women's hypothetical coping strategies for food consumption

| Site | Rankings | | |
|---|---|---|---|
| | First | Second | Third |
| Hill region | | | |
| Gera East n=4 | borrow flour | borrow staple | make uji |
| Gera West n=5 | borrow staple | borrow flour | do without |
| Gera Mix n=3 | borrow flour | cook for children only | borrow money |
| Lake region | | | |
| Nyamarandi n=5 | cook for children | borrow flour | do without |
| Waluwi n=5 | only | | |
| Kamaena n=5 | make uji | do without | borrow money |
| | borrow flour | borrow money | buy on credit |
| Town region | | | |
| Kombe n=5 | borrow flour | make uji | do without |
| Wakunga n=5 | buy on credit | do without | borrow staple |
| Wasulwa n=4 | do without | borrow flour | borrow staple |

TABLE XI

Weighted percentage ranking for women's coping strategies for fuelwood availability and food consumption

| Fuelwood availability | % | Food consumption | % |
|---|---|---|---|
| Use little fuelwood | 35.2 | Borrow flour | 33.3 |
| Crop residue | 18.5 | Do without | 18.5 |
| Use sisal stumps | 16.7 | Borrow staple | 13.0 |
| Borrow fuelwood | 9.3 | Make uji | 11.1 |
| Tear down granary | 7.4 | Cook for children only | 9.3 |
| Dung | 3.7 | Borrow money | 7.4 |
| Use charcoal | 1.9 | Buy on Credit | 7.4 |
| Use old furniture | 1.9 | | |

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## Chapter Two.

### Fuelwood Availability Across Seasons in Kasgunga sub-location, Homa Bay District, Kenya


### Abstract

A survey was conducted to assess and quantify fuelwood availability across seasons on a group of 45 women. The respondents were randomly selected and clustered into the Hill, the Lake, and the Town regions of Kasgunga West sub-location in Homa Bay district, Kenya. The Hill respondents had relatively more fuelwood and sold both charcoal and fuelwood for income, and the Town respondents had the least and bought fuelwood from the Hill respondents. The amounts of bought and collected fuelwood, alternative fuel use, and the use of agricultural residues and other non-fuelwood plant material were also quantified in the 10-months of this study. There were reductions in the amount of large fuelwood used and increase in the utilization of small fuelwood and agricultural residue in the region suggesting that fuelwood may have become scarce. Significantly greater amounts of big and small fuelwood, maize cobs, and remains of sorghum heads were utilized during the Postharvest than during the Dry or Rainy seasons. During the Rainy and Dry seasons, approximately 3 and 2 fold more fuelwood were bought compared to Postharvest season. Earnings from the sale of charcoal were 4 and 2 times greater during the Rainy and Dry seasons compared to the Postharvest season. During the Dry season 3.5 times the weekly earnings were derived from the sale of livestock dung than during the Rainy season, and no dung was sold during the

Postharvest season.

Despite fuelwood scarcity, the number of headloads of fuelwood used daily for cooking did not differ significantly across seasons. The number of meals cooked using alternative fuel also did not change with season, possibly because the alternative fuel, kerosene, was mainly for lighting other than cooking. Respondents from the Town region were the most frequent users of large fuelwood, straw, sorghum head remains, and other types of fuelwood, and bought more headloads of fuelwood than people living in the Hill and the Town. Respondents who live around the Hills did not buy fuelwood but earned between 14 and 15 times more from the sale of charcoal, compared with those living around the Lake and in the Town regions.

## Introduction

Population pressure is making it increasingly difficult for households to meet demands for fuelwood, especially where people cannot afford other fuels (Campbell-Asselbergs, 1986). Both urban and rural areas experience fuelwood shortages. According to the FAO (1981), in the developing countries more than 100 million people live in areas with acute fuelwood scarcity and 1.3 billion live in areas with deficits. Several studies in Kenya and elsewhere in the developing world document the importance of wood as a source of fuel and as a diminishing resource, whose demand increasingly outstrips supply, while the potential for meeting demand for fuel from non-biomass sources appears bleak (Barnes et al., 1984: Hosier, 1981; Haugerud, 1984; Mung'ala &

Openshaw, 1984; Bradley, 1984; Brokensha and Riley, 1980; van Gelder, 1984; and O'Keefe, 1983).

Over half of the total energy used in Kenya is consumed by households, primarily for cooking and lighting (Steering Committee, 1984; and quoted by Barnes et al., 1984). In the past, rural households had access to fuelwood. However, wood is acquiring a monetary value in rural areas as its scarcity and marketing potential increase due to a growing urban population (Barnes et al., 1984). Ninety-three percent of rural and 80% of the urban households used woodfuel as a source of energy. Agricultural residues accounted for 5 percent, while kerosene for lighting, accounted for 2% of rural household energy use, and the remainder form capital stock (include poles used for infrastructure and building). Energy demand in Kenya has been projected to grow at an annual rate of 4.7 percent and wood demand will increasingly exceed supply from sustainable stock (Barnes et al., 1984).

According to Brouwer et al. (1989) fuelwood shortage could be defined by both the quantity available in the forest and the amount actually gathered. This is distinct from other studies reviewed (Kumar and Hotchkiss, 1988; Evans, 1986) which based woodfuel availability by placing a "price" value based on the time required to collect a unit (20 kg) of fuelwood.

The concept of fuelwood availability in this study was based on consumption rather than the forest production, such as reforestation. Fuelwood availability was defined as the amount of fuelwood gathered and used by the household. The adequacy

of fuelwood was determined by the women themselves, but was generally considered as enough gathered fuelwood to prepare breakfast, and foods used to make the stew and staple dish for the main meal(s) for the entire household for any given sample day. Fuelwood was expected to be scarce and the available amount to be wet thereby making its use difficult due to excessive smoke produced and respondents' constant attention required to keep it burning in the Rainy season.

The purpose of this study was to quantify the amounts of fuelwood available to respondents in the Hill, Lake, and Town regions across three distinct seasons: the Rainy, the Postharvest, and the Dry. The use of alternative fuels, such as bought organic fuels - kerosene and charcoal, and crop residue use were also quantified.

## Materials and Methods

### Sample Selection

This study was carried out in Kasgunga West sub-location in Homa Bay district, Kenya (formerly part of South Nyanza district) (Appendix C). Forty-five monogamous households were randomly selected. Selection of the households involved using the list of all households in Kasgunga and randomly selecting 5 names from under each headman's jurisdiction or village for equal representation within the sub-location. The sample represented each geographic location thus: the Hill region, consisted of Gera East, Gera West, and Gera Mix villages; the Lake region, consisted of Nyamarandi, Kamaena, and Waluwi villages; and the Town region, consisted of Wakunga, Wasulwa,

and Kombe villages.

At the initial meetings in each region, the respondents were asked for verbal consent after the researcher had explained the details and duration of the study, i.e., each respondent would be visited 3 times starting from the month of August 1993 through May 1994. Thirty-three of the respondents were observed during the day for 12-13 hours, while 12 were observed for twenty-four hours, for each of the 3 visits.

Data Collection

Twelve to 13 hour, day-long, observations and interviews were conducted for each respondent during the Dry, the Rainy, and the Postharvest seasons. Data were collected by the researcher and research assistants from the time the respondents rose in the morning to the time they retired in the evening or until the following morning. Fuelwood collected and used on the sample day was weighed and measured (diameter $>7.5$ cm for splitable fuelwood) by the researcher and research assistants. Sample day was selected by the researcher who collected the data in an attempt to include all the respondents during the peak time of every season. Fuelwood to be used on the sample day was weighed on the eve of the sample day during the Postharvest season. However, this practice was abandoned during the Dry and Rainy seasons because most respondents had no fuelwood set aside for use the following day. Alternative fuel used and/or bought on the sample day also was weighed or measured. In addition, the cost of purchased fuel was recorded in Kenya shillings and the frequencies of collection, daily or weekly, also

were recorded.

Protocol

All the fuelwood collected and used was weighed on a Hanson hanging scale (Forestry Products, Jackson, MS) throughout the day and recorded to the nearest one-tenth of a pound and then converted to metric units. The number of headloads were counted and, the distance to and from collection points was measured to the nearest one-tenth of a mile using an Arinson pedometer (Forestry Products, Jackson, MS) and later converted into kilometers. Time taken by the respondents to collect fuelwood from the time they left the homesteads to the time they returned was recorded to the nearest minute using table clocks. The diameter of splitable large fuelwood was set at $>7.5$ cm, the average size of fuelwood that four women selected to split. The weight of alternative fuel bought was also recorded using the same Hanson hanging scale to the nearest one-tenth of a pound. Crop residue was weighed and kerosene was measured using small containers such as "obabo" a metal holding 100 milliliter, and "fanta" 280- 300 milliliter and "tiritop" at 700 milliliter if it was sold in the villages and in liters if sold in the township. The charcoal was measured in "gorogoro", a 2 kilogram container, in a "debe", a 20 kilogram container, and also by weight using a Hanson hanging scale.

In addition, the researcher recorded field notes and related comments made by respondents. Field observations and incidental information also were noted by the researcher and used to clarify results.

An individual survey format with close ended questions was used to assess fuelwood availability. The survey instrument (Appendix D) was developed by the researcher, and was pilot tested and revised for precision and then translated into the local dialect and back translated into English to make sure that the translation was correct and that the questions were clear.

Three hanging scales were used. Two were in constant use and one was used to calibrate the other two daily. The clocks were adjusted to the radio clock and the pedometer had an adjustable button. For accuracy the pedometers were adjusted to an average stride length of 45 cm the average of four women carrying and walking with headloads of fuelwood. For reliability the researcher collected and entered all the data.

Data Analysis

Data were analyzed by two-way analysis of variance (ANOVA) and frequency analysis (FREQ) according to Epi Info Version 5 (Dean et al., 1990). Means were separated by Tukey's Highest Significant Difference (HSD) test ($P = 0.05$) using to SAS (1988). In this study, means along rows followed by different letters differ significantly by Tukey's HSD test. Where, a is significantly different from b, but ab may fall into either category a or b. Therefore, ab is not significantly different from either a or b.

Demographics

The sample consisted of 45 women between the ages of 24-68 years. All were housewives except for one school teacher and one part time maid. Of the 45 respondents, 20 had never been to school, 12 had 1-4 years of schooling, 10 had 5-8 years of schooling, two had 1-2 years of high school education, and one had completed high school and was a trained elementary school teacher.

Thirty-eight lived in grass thatched huts with mud walls, six lived in houses with mud walls and corrugated iron sheets, and only one had a permanent stone building with a water reservoir. There were nine widows and four respondents lived alone with their children. The average number of children per household was three children with a range of 0-8. Average size of households was five people; but varied from 1-20. Most households, 69%, had two adults with a variation of 1-11 (where sons and their wives ate at the mothers house) (Appendix Table IV).

**Results**

Seasonal Differences

Significantly greater amounts of large fuelwood (>7.5 cm diameter), small fuelwood (<7.5 cm diameter), maize cobs, sorghum heads, and other non-wood plant material were utilized during the Postharvest season than during either the Dry or Rainy seasons (Table I). The greatest amount of straw was utilized during Postharvest followed by the Dry season and no straw was used during the Rainy season (Table I). The

amounts of dung, sisal, and borrowed fuelwood, or other types of fuel, did not differ significantly across seasons. Respondents used significantly more purchased fuelwood in the Rainy than in the Postharvest seasons. The use of livestock dung as fuel did not differ by season, whereas sorghum heads were mostly used as fuel in the Postharvest season (Table I). In contrast, fuelwood and livestock dung were plentiful during the Dry and the Postharvest seasons. However, there was a marked increase in the use of agricultural residues in the latter season and livestock dung in the former.

Table II depicts the cost and earnings of different types of fuel by season. Weekly cost of fuelwood and weekly earnings from the sale of fuelwood did not differ significantly by season (Table II). However, the weekly earnings from the sale of charcoal during the Rainy and Dry seasons were approximately 4 and 2 times higher than during the Postharvest season, respectively, but these differences were not of any statistical significance. During the Rainy and the Dry season, however, respondents earned significantly more money from weekly sales of livestock dung than during the Postharvest season (Table II).

The results of fuelwood and alternative fuel use by season are shown in Table III. The number of headloads bought on the sample day and per week, the number of headloads used on the sample day, and the number of meals cooked with alternative fuel did not differ significantly by season (Table III).

Table IV shows the means for fuelwood collected, percent respondents who collected fuelwood, and use of alternative fuel by season. Seventy-one percent of the

women collected fuelwood 4 times per week in the Dry season, followed by 81% who collected 3 times in the Postharvest while during the Rainy season 80% of the respondents collected fuelwood only twice a week. Ninety-three percent of the households collected 6 headloads of fuelwood per week in the Postharvest season compared with 5 headloads a week by 91% in the Rainy and 4 headloads per week by a similar proportion in the Dry season (Table IV).

Although alternative fuel use was limited across seasons, a greater proportion of the people used more charcoal and kerosene except in the Rainy season. Approximately twice the number of respondents used charcoal in the Dry season while charcoal use was the same in the other two seasons. The highest number of the total respondents who collected large fuelwood in one season was only 21% during the Rainy season, followed by 13% in both the Postharvest and Dry season. Small fuelwood use was prevalent in the Dry season (91%), followed by the Rainy (87%) and 82% during the Postharvest (Table IV). The percentages were derived from the total number of respondents in the sample who performed the given activity or used alternative fuel in any of the three seasons.

Regional Differences

Fuelwood availability differed significantly across the region (Table V). Although respondents in the Town bought more than twice the amount of fuelwood than did respondents in the other two regions it was not statistically significant. The Town

people also used significantly more large fuelwood, straw, sorghum heads, and other types of non-wood plant fuel such as brushes and convolvulus (a hollow semi-creeping shrub), than those living in the Hill and Lake regions. In contrast, Hill respondents utilized more small fuelwood than people living around the Lake and Town regions. Respondents in the Hill and around the Lake used significantly greater amounts of borrowed fuelwood than people in the Town. The amount of dung, maize cobs, or sisal used and the amount of fuelwood purchased did not differ significantly across regions.

The cost and earnings of fuel by region are shown in Table VI. The Town respondents spent approximately seven times more money purchasing fuelwood per week than those living around the Lake. Fuelwood was not purchased by Hill people. Weekly costs were highest for the Town respondents and lowest for the Hill and the Lake respondents. Weekly earnings from fuelwood were not significantly different in the three regions. However, charcoal earnings for the Hill region were more than 14 and 15 times those of the Town and Lake respondents, respectively. The Hill women also earned 12 times more than the Lake respondents from the sale of livestock dung and Town respondents, did not sell livestock dung. There was a wide range in the amount of money earned by respondents: as few as 2 headloads per week ( 20-30 Ksh depending on the season to several donkey cartloads (500- 2,000 Ksh per week).

In Table VII, neither the number of headloads of fuelwood bought or used on the sample day, nor the number of meals cooked using alternative fuel differed significantly by region. Respondents who lived in Town, however, purchased significantly more

headloads of fuelwood per week than people in the Hill and Lake regions.

Table VIII summarizes fuelwood activity in Kasgunga with the means for fuelwood collected, percent respondents collecting fuelwood, and the use of alternative fuel by region. There appeared to be more fuelwood activity in the Hill region than there was in either the Lake or the Town regions. Eighty-seven percent of the Hill respondents collected fuelwood three times weekly, which was more than the Lake (2.5 times) and the Town (2 times) women. Ninety-six percent of the Hill respondents collected an average of 6 headloads per week which is more than the 5 headloads collected by 91% in the Lake and 4 headloads per week by 89% of the respondents in the Town.

The same Hill respondents had the highest number (96%) collecting small fuelwood, followed by 91% in the Lake and much lower number (73%) in the Town. An equal number (18%) of respondents in the Hill and Lake collected large fuelwood whereas, only 12% of the Town women collected large fuelwood. Alternative fuel use was minimal, but was highest in the Lake region. Eleven percent used kerosene and 13% used charcoal compared with only 4% and 11% kerosene and charcoal use in the Town, respectively.

By region, the Hill respondents had more fuelwood available for sale and home use, followed by the Lake region, while the Town region had the least amount and ended up buying most of their fuelwood from the Hill people. Most respondents from the three areas in Kasgunga collected fuelwood from the Hill region.

**Discussion**

The women in Kasgunga used small fuelwood ranging from an average of 5.9 kg per day during the Postharvest season to as little as 3.1 kg in the Rainy season (Table I). In particular the Hill respondents used relatively more fuelwood (5.4 kg) but still far below the national average (12.0 kg) (Hosier, 1981), which may be due to supplementation with other plant materials such as dry sisal leaves, remains of sorghum heads and livestock dung.

The greatest use of sisal in the Rainy season (Table I) may be because the plant was dry and burned more easily than fuelwood during this time of the year. Although fuelwood was bought every season, respondents bought more fuelwood in the Rainy season due to inadequate supplies of dry fuelwood to collect. The high fuelwood and agricultural crop residue use in the Postharvest season was perhaps due to more food available to be cooked. The increased livestock dung used as fuel in the Dry season may have been due to the dry amounts available for collection. Apart from being used as fuel, livestock dung was also observed being used as wind shield for the open fires. With less food to cook, respondents may not have collected as much fuelwood even though it was most plentiful in the Dry season. Borrowing fuelwood was not a common practice in the area.

Hageraud (1984) found that the use of unpurchased woodfuel in Embu (Kenya) was determined by the size, number, location, and quality of land holdings. This is similar to the results obtained from the respondents in all three regions, in Kasgunga

West sublocation, and may help explain why the Hill respondents with larger more wooded lots collected and sold the best fuelwood to the respondents in the Lake and Town regions. Barnes (1984) reported that scarcity of woodfuel resulted in women using limbs and tops of trees. The increased use of small fuelwood and brushes in the region showed that fuelwood may have been already scarce. When available however, the Kasgunga respondents used the whole tree: the large fuelwood (trunks and big branches) for making charcoal and as a source of income, and the offcuts (parts of the tree too small for charcoal making) for sale and for home use.

The fact that more charcoal was sold in the Rainy season (Table II) might have been due to the decreased fuelwood supply and relative ease with which charcoal was made out of the same dry fuelwood in earthen urns, compared with carrying headloads of semi-dry fuelwood for sale. Sale of fuelwood was common in the region, however, the wide variations among respondents in the amounts of fuelwood sold between seasons, resulted in lack of statistically significant differences.

This study showed that plant material used to supplement fuelwood was collected daily. However, the number of times fuelwood was collected was always lower than seven days per week. The apparent small number of times fuelwood was collected, especially for the Hill respondents may be due to the following reasons: first, the number of times given for fuelwood collection did not include the woodfuel used for making charcoal because charcoal was made on site. Secondly, use of offcuts as fuelwood was not considered as fetching or collecting fuelwood by most respondents.

Thirdly, it takes a lot more wood to make charcoal and the respondents earned more money from the sale of charcoal (Table II) than they did from the sale of fuelwood which meant that a lot more fuelwood was not accounted for. Both fuelwood and charcoal were sold, but respondents sold more of the former because charcoal fetched more money and was lighter and therefore, easier to carry over long distances.

It was also observed that one headload of fuelwood collected was divided into several sale units (up to 5 sale-size headloads) and this therefore, explains why fewer headloads were reported collected than sold. Respondents were able to carry up to 3 headloads of fuelwood and to walk to selling sites. However, income from fuelwood was only half what they earned from an equivalent weight of charcoal. By the same token, dry livestock dung was easier to carry over long distances and more available in the Dry season, hence its increased sale (Table II). However, the lack of sale of livestock dung in the Postharvest season may be explained by greater availability and increased use of agricultural residue.

Fuelwood and alternative fuel (kerosene and charcoal) use varied among the seasons but overall the amounts were rather small (Table III). This may have been due to the reduced number of meals cooked during each season. The number of meals cooked using alternative fuel was a similar trend (Table III), and was perhaps due to lack of adequate food to cook as a result of poor harvests, and/or lack of money with which to purchase food. Only 2-9% of the respondents bought and used kerosene while 9-16% used purchased charcoal throughout the three seasons indicating that the two types of fuel

were not important energy sources (Table IV). This may be due to the use of kerosene preferably for lighting, and charcoal mainly for sale. The high use of small fuelwood in the Dry season is due to greater availability of this type of fuelwood when it is dry. The greatest proportion (21%) of large fuelwood was collected in the Rainy season, mainly for contingency purposes (lasts longer).

However, on a regional basis (Table V) large fuelwood use was negligible in comparison to small fuelwood use which may be due to scarcity of the former. The Town respondents bought most of their fuelwood and used most of the agricultural residue to supplement fuelwood, due perhaps to inadequate supplies and lack of their own stocks. This is further supported by the fact that the respondents from the Hills with relatively greater supplies of fuelwood and charcoal used the greatest amount of small fuelwood and sold large fuelwood and charcoal. The frequent use of borrowed fuelwood by Lake respondents was not clear. However, the Lake region may have used more livestock dung because respondents were able to gather more when cattle were led to drink water to and from lake Victoria.

Hosier (1981) explains the limited use of alternative fuel by the greater tendency of women to use less "to conserve and substitute more readily available fuels" (p. 52). Other factors, such as the amount and type of food cooked, and wood species available and used, may also have contributed to the low levels of fuelwood used by respondents in this sublocation.

Seasonal differences were also seen in the utilization of agricultural residue and

most of the residue was used during the Postharvest and the first part of the Dry season before it was exhausted. Similar patterns of agricultural residue use ware also reported by Mung'ala and Openshaw (1984). By the Rainy season, most of the agricultural residue had been exhausted and respondents used the sisal plant, brushes including convolvulus, and livestock dung; whose use was not significantly different by season (Table I) or region (Table V), perhaps due to their continued use throughout the year as a result of scarcity of large fuelwood.

Weekly earnings from charcoal, and dung were significantly higher in the Hill region. Scarcity of fuelwood in all three regions in Kasgunga West sublocation did not appear to increase dependence on purchased alternative fuels such as kerosene and charcoal (Tables VI).

The respondents from the Town bought significantly more headloads of fuelwood both per week and on the sample day (Table VI), mainly from the Hills where there was relatively more wood available. The percent of respondents collecting large fuelwood was highest in the Rainy season when fuelwood is usually less available. This might have been because large fuelwood lasted longer and the women wanted to have good quality fuelwood available as stock for sale and for home use.

The Hill respondents did not buy fuelwood either on a weekly or daily basis. The number of headloads of fuelwood used by all three regions was almost the same, perhaps because people purchased and ate nearly equivalent amounts of food in all three regions. The Hill people who had relatively more fuelwood available, had the greatest amount of

headloads and collected fuelwood more frequently than the other two regions, and used some money earned from the fuelwood sale to purchase alternative fuel. The Town respondents used the least amount of alternative fuel maybe because they bought more fuelwood (cheaper source of energy) and spent less on the more expensive fuels (kerosene and charcoal). The increased use of kerosene by Lake respondents may have been because it was more available at the fishing centers where it was also used for fishing lamps.

Several observations indicate there was a scarcity of fuelwood in the region. There was increased use of non-fuelwood plant material including agricultural residues (maize cobs, sorghum heads, straw), sisal plant, livestock dung, and brushes and twigs including convolvulus. This is similar to Kumar's and Hotchkiss' (1988) study which showed an increased use of dung cakes and straw when fuel was scarce. The women in Evan's study (1986) increased supplies of alternative fuel (domestic oil) with decreased fuelwood availability. Barnes (1984) suggested that wood has acquired monetary value in rural areas due to increased scarcity and marketing potential, resulting from a growing urban population. This trend was noted on the part of this study dealing with the earnings from fuelwood per week by season (Table II) and by region (Table VI). Of interest was the fact that the Lake, and particularly the Town respondents also had income from the sale of fuelwood and charcoal. This may be explained from field observations. The researcher noted that Town respondents cut down big trees from their own homesteads or within their land to make charcoal in particular, and to use or sell

the offcuts from the same trees. Alternatively, they bought standing trees from other people in the region for the same purpose and occasionally the Town respondents went to the Hills to collect fuelwood for sale and for their own use.

Barnes (1984) hypothesized that the substitution of agricultural residue, rather than the purchase of fuelwood indicated financial constraints. This is similar to Kasgunga respondents, but to a much greater extent, because it was observed that they used brushes, and almost exhausted every available plant material for cooking before they purchased fuelwood and alternative fuelwood. In addition, these respondents often supplemented the purchased fuelwood with other crop material and dung. The type and size of wood used which determines the rate or efficiency of burning or the calories yielded by the wood, was dependent on the amount of food available to be cooked, and most of all, the type and location of kitchen and stove/fire. Most respondents cooked in the open air on 3-stone open fires. It was also observed and noted from conversations with respondents that the preferred and popular, hard, slow-burning species of wood, such as the Acacia, were almost all exhausted in this sublocation.

**Summary and Conclusions**

The geographic location of this study, Kasgunga West sub-location, Mbita Division of Homa Bay District, is characterized by low, unreliable, bi-modal, torrential rainfall. Consequently, subsistence crop yields are low and natural tree and other vegetation is cover sparse, leading to low agricultural and forestry productivity.

Hence, the low income levels. Population density is high, 400 people per square mile (Central Bureau of Statistics - CBS, Kenya Population Census, 1979) and people are almost totally dependent on trees as a source of fuel for cooking. Unfortunately, despite the reduced levels of biomass, fuelwood still forms a major source of income particularly in the sale of fuelwood and charcoal.

Results from this study suggest that women will most likely continue to use fuelwood alone or in conjunction with other types of "free" fuel with the buying and selling of fuelwood and charcoal, thereby, further depleting the trees and what little is left of the forest.

The major findings of this study are:

* There was greater use of small wood and agricultural residue and less use of large fuelwood, perhaps suggesting fuelwood scarcity.

* Fuelwood was supplemented with agricultural residue mostly in the Postharvest season.

* More fuelwood was sold and purchased in the Dry and Rainy seasons, also making earnings from charcoal and fuelwood highest in these same seasons.

* Livestock dung was used to supplement fuelwood and sold mainly in the Dry season.

* Despite the high earnings from charcoal sale, alternative fuel use (both charcoal and kerosene) by respondents in Kasgunga was negligible.

* The Town region, bought from the Hill respondents, and utilized greater

amounts of large fuelwood and agricultural residue than the other two regions.

* Charcoal earnings of Hill respondents was 14 and 15 times more than the Lake and Town respondents.

Table I

Fuel use by season

| Variable | Mean sample day (kg) | | | | | |
|---|---|---|---|---|---|---|
| | Rainy N=42 | Post harvest N=45 | Dry N=45 | Mean total | F-Ratio | P-value |
| Large fuelwood[x] | 0.1b[z] | 1.3a | 0.3b | 0.6 | 8.07 | 0.0005 |
| Small f/wood[y] | 3.1b | 5.9a | 4.1b | 4.4 | 8.77 | 0.0003 |
| Borrowed f/wd | 0.2a | 0.2a | 0.1a | 0.2 | 0.26 | 0.7692 |
| Bought f/wood | 2.6a | 0.9b | 1.4ab | 1.9 | 1.54 | 0.0217 |
| Straw | 0.0b | 1.4a | 0.3ab | 0.6 | 3.39 | 0.0367 |
| Maize cobs | 0.0b | 0.3a | 0.0b | 0.1 | 3.99 | 0.0209 |
| Sisal | 1.1a | 0.4a | 0.3a | 0.3 | 2.93 | 0.0571 |
| Livestock dung | 0.3a | 0.3a | 0.6a | 0.4 | 0.94 | 0.3952 |
| Sorghum heads | 0.0b | 0.5a | 0.0b | 0.2 | 26.13 | 0.0001 |
| Other e.g. brushes | 2.5a | 3.2a | 2.5a | 2.7 | 0.37 | 0.6912 |

[x]Large fuelwood = splitable fuelwood with diameter >7.5 cm.
[y]Means along rows followed by different letters differ significantly by Tukey's HSD test, P = 0.05.
Small fuelwood = unsplitable fuelwood with diameter <7.5 cm.

Table II

Cost and earnings of fuel by season

| Variable | Mean (K.sh) | | | | |
|---|---|---|---|---|---|
| | Rainy N=42 | Post-harvest N=45 | Dry N=45 | F-Ratio | P-value |
| Fuelwood cost | | | | | |
| Weekly | 4.9a[z] | 8.0a | 6.1a | 0.41 | 0.6658 |
| Weekly earnings | | | | | |
| Fuelwood | 49.3a | 35.2a | 44.6a | 0.38 | 0.6836 |
| Charcoal | 401.8a | 113.8a | 254.7a | 2.73 | 0.2945 |
| Livestock dung | 3.1a | 0.0b | 10.7a | 1.23 | 0.0267 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, P = 0.05.

Table III

Fuelwood and alternative fuel use by season

| Variable | Mean (No.) Rainy N=42 | Post harvest N=45 | Dry N=45 | F-Ratio | P-value |
|---|---|---|---|---|---|
| Headloads used today | 0.7a[z] | 0.9a | 0.7a | 1.18 | 0.3104 |
| Headloads bought today | 0.1a | 0.1a | 0.1a | 1.54 | 0.2179 |
| Headloads bought/wk | 0.3a | 0.6a | 0.6a | 0.31 | 0.7305 |
| Meals cooked with alternative fuel[d] | 1.0a | 1.2a | 1.1a | 2.61 | 0.0778 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, P = 0.05.

[d]Alternative fuel equals kerosene and charcoal.

Table IV

Means for fuelwood collected, percent respondents collecting fuelwood, and use of alternative fuel[d] by season

| Variable | Rainy N=42 | Post harvest N=45 | Dry N=45 |
|---|---|---|---|
| Freq of collection/wk | 2 | 3 | 4 |
| % collecting | 80 | 81 | 71 |
| H/loads collected/wk | 5 | 6 | 4 |
| % collecting/wk | 91 | 93 | 91 |
| % kerosene use | 9 | 4 | 2 |
| % charcoal use | 9 | 9 | 16 |
| % collecting large fuelwood | 21 | 13 | 13 |
| % collecting small fuelwood | 87 | 82 | 91 |

[d]Alternative fuel = kerosene and charcoal.

Table V

Fuel use by region

| Variable | Mean/sample day (kg) | | | | | |
|---|---|---|---|---|---|---|
| | Hill n=15 | Lake n=15 | Town n=15 | Mean total | F-ratio | P-value |
| Large fuelwood[x] | 0.3b[z] | 0.3b | 1.1a | 0.2 | 4.25 | 0.0164 |
| Small f/wood[y] | 5.4a | 4.6b | 3.1b | 4.4 | 6.19 | 0.0027 |
| Borrowed f/wd | 0.1b | 0.4a | 0.1b | 0.2 | 4.52 | 0.0128 |
| Bought f/wood | 0.0a | 0.3a | 0.7a | 0.3 | 2.25 | 0.1092 |
| Straw | 0.0b | 0.1b | 1.5a | 0.5 | 4.08 | 0.0192 |
| Maize cobs | 0.0a | 0.1a | 0.1a | 0.1 | 0.18 | 0.8336 |
| Sisal | 0.5a | 0.6a | 0.8a | 0.6 | 0.39 | 0.6755 |
| Dung | 0.6a | 1.1a | 0.4a | 0.7 | 1.10 | 0.3357 |
| Sorghum heads | 1.4b | 2.0b | 4.8a | 2.7 | 7.24 | 0.0011 |
| Other - brushes | 0.1b | 0.0b | 0.3a | 0.1 | 9.91 | 0.0001 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, P = 0.05.

[x]Large fuelwood = splitable fuelwood with a diameter >7.5 cm

[y]small fuelwood = fuelwood with diameter <7.5 cm

Table VI

Cost and earnings by region

| Variable | Mean (K.sh) Hills n=15 | Lake n=15 | Town n=15 | F-Ratio | Pr>F |
|---|---|---|---|---|---|
| Fuelwood cost | | | | | |
| Weekly | 0.0b[z] | 2.4b | 16.6a | 13.27 | 0.0001 |
| Weekly earnings | | | | | |
| Fuelwood | 57.8a | 39.2a | 32.2a | 1.30 | 0.2774 |
| Charcoal | 677.1a | 44.2b | 48.9b | 6.10 | 0.0006 |
| Livestock dung | 12.7a | 1.1b | 0.0b | 7.89 | 0.0030 |

[z]Means along rows followed b different letters differ significantly by Tukey's HSD test, P = 0.05.

Table VII

Fuelwood and alternative fuel use by region

| Variable | Means (No.) Hill n=15 | Lake n=15 | Town n=15 | F-Ratio | Pr>F |
|---|---|---|---|---|---|
| Headloads used today | 0.8a[z] | 0.7a | 0.8a | 0.26 | 0.7687 |
| Headloads bought today | 0.0b | 0.2b | 1.2a | 2.25 | 0.1092 |
| Headloads bought/wk | 0.0b | 0.2b | 1.2a | 8.10 | 0.0005 |
| Meals cooked with alternative fuel[d] | 1.0a | 1.1a | 1.1a | 0.97 | 0.3811 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, P = 0.05.

[d]Alternative fuel = kerosene and charcoal.

Table VIII
Means for fuelwood collected, percent respondents collecting and use of altenative fuel[d] by region

| Variable | Hill n=15 | Lake n=15 | Town n=15 |
|---|---|---|---|
| Freq of collection | 3 | 2.5 | 2 |
| % collecting | 87 | 78 | 76 |
| H/loads collected/wk | 6 | 5 | 4 |
| % collecting/wk | 96 | 91 | 89 |
| % kerosene use | 4 | 11 | 0 |
| % charcoal use | 11 | 13 | 9 |
| % collecting big fuelwood | 18 | 18 | 12 |
| % collecting little fuelwood | 96 | 91 | 73 |

[d]Alternative fuel = kerosene and charcoal.

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**Chapter Three.**

## Household Food Consumption by Region and Across Seasons in Kasgunga West Sub-location, Homa Bay District - Kenya


### Abstract

This longitudinal 10-month study was undertaken with a group of 45 Kenyan women in Kenya to assess household food consumption across seasons: the Rainy, mid-March to end of May; Postharvest, mid-July to end of October; and Dry, December to end of February. The respondents were randomly selected and clustered into the Hill, the Lake, and the Town regions of Kasgunga West sub-location in Homa Bay district - Kenya. In good harvest years the Hill usually has relatively better crop yields, due to larger farm sizes, more fertile soils, more rain, and are more likely to use animal draught power, compared with the Lake and Town regions. The Town and Lake regions which are closely situated to the market, however, have much smaller tracts ofland, plow and weed manually, and generally receive less rain. The amounts of cooked food eaten in the three sample days during the Dry, the Rainy, and the Postharvest seasons were weighed and measured. The results of this study showed that approximately 91% of the staple consumed in the region was bought from the market and the rest was harvested from the farms (7%) or borrowed from friends and relatives (2%). However, the proportion of staple consumed that originated from the farms rose to 44% during Postharvest season. Greater proportion (97-98%) of the staple was purchased from the markets during the Rainy and Dry

seasons compared the Postharvest (78%) season. Respondents ate an average of 1 meal a day during the busiest Rainy season, relative to the Postharvest and Dry seasons with almost two meals per day. As the preferred staple diminished and the prices of sorghum, finger millet, and cassava rose, it was observed that respondents used maize flour (the main but not the preferred staple) for both ugali and uji. Porridge (uji) was often substituted for, and consumed as, a meal when food supplies were low. The amount, cost, and type of food consumed did not differ much in the region. However, people who lived around the Hill region spent a greater amount of money (Ksh) to purchase staple, and substituted the flour normally used for making ugali (major staple) to make uji (porridge) more frequently than their counterparts in the Town suggesting respondents may have had less food to eat.

**Introduction**

Research conducted in developing countries has shown the seasonality of food consumption with emphasis on the hungry season (most people experience hunger due to low food supplies) in particular. Studies include Kennedy and Cogill (1985), Frankenberger (1990), Messer (1990), and Richards (1939), Foeken & Hoorweg (1988), Meilink (1987), Oosten (1989), Kliest (1985), Hoorweg et al. (1988), Hoorweg et al. (1991), Neimeijer (1991), Foeken & Tellegren (1992).

Frankenberger (1990) states that most areas of the world have a seasonal dimension to agricultural production, food availability and malnutrition, and farm

families must cope with a cyclical period of deprivation referred to as the "hungry season". As early as 1939, Richards over several seasons observed and suggested that insufficient nutrient intake by adult women during the lean planting season affected their ability to perform both productive tasks and household maintenance.

In this study, the concept of food consumption relied primarily on the measurement of the staple food and all cooked food consumed. People normally eat together from a common container which holds the staple. The stew may be shared from one bowl, but is often provided or served individually. Men eat alone, or men with older boys, and women with children. Occasionally, the whole family (extended and nuclear) including "passers-by" may all eat together, sharing the same staple and even the stew. Thus, it is not easy to determine how much an individual consumes. In Evans's study (1986) food implied both the carbohydrate and proteins, i.e., the tortillas and beans eaten for the main meal.

According to the FAO, variables which might affect food consumption are the time women spend on water and fuel collection or agricultural/food processing work; availability, cost or distance of fuel supplies; and access to food processing technologies such as grain mills (FAO, 1985). Kumar and Hotchkiss (1986) examined food consumption as the level of calorie intakes as a function of incomes, agricultural production, time allocation patterns and quantity of fuelwood used. Household food consumption was converted to consumption units of the household. Consumption unit was an expression of the age and sex composition of the household

and were calculated using factors (Appendix, Table IV) (FAO/WHO) and used in the data analysis. The purpose of this study was to investigate household food consumption by region and across seasons.

## Materials and Methods

### Sample Selection

The study was carried out in Kasgunga West sub-location in Homa Bay district, Kenya (formerly part of South Nyanza district) (Appendix B). Forty-five monogamous households were randomly selected. Selection of the households involved using the list of all households in Kasgunga and randomly selecting five (5) names from under each headman's jurisdiction or village for equal representation within the sub-location. The sample represented each geographic location thus: the Hill region, consisted of Gera East, Gera West, and Gera Mix villages: the Lake region, consisted of Nyamarandi, Kamaena, and Waluwi villages; and the Town region consisted of Wakunga, Wasulwa, and Kombe villages.

At the initial meetings, the respondents were asked for verbal consent after the researcher had explained the details and duration of the study, i.e., each respondent would be visited 3 times starting from the month of August 1993 through May 1994. Thirty-three of the respondents were observed for a full day 12-13 hours while 12 were observed for twenty-four hours.

Data Collection

Day-long observations and interviews were conducted for each respondent during the Dry, the Rainy, and the Postharvest seasons. Data were collected by the researcher and research assistants from the time the respondents rose in the morning to the time they retired to bed or until the following morning, i.e., for 24 hours.

Household food consumption data were collected by measuring the dry and wet weights of the stewing foods and the dry weight of staple cooked on the sample day using a Hanson hanging scale. The harvested crop and the amount of weekly and annual staple considered adequate were also assessed and estimated by respondents. All to be cooked was weighed before it was cooked. In addition, the cost of the staple bought on the sample day including the milling costs were determined.

Protocol

All the food cooked on each sample day (borrowed, bought, or own harvest) was weighed throughout the day before cooking on a Hanson hanging scale (Forestry Products, Jackson, MS) and recorded to the nearest one-tenth of a pound. The amount of grain used as the food staple for both breakfast and main meals, including the foods used to prepare the stew, and cooked for the day was weighed because it was hypothesized that these would be affected by woodfuel availability.

In addition, the researcher included related comments made by respondents and recorded research notes. Field observations and incidental information were also

noted by the researcher and used to clarify results.

An individual survey format with close ended questions was used in this study to assess household food consumption across seasons in Kasgunga West sublocation, Mbita Division. The survey instrument (Appendix D) was developed by the researcher, and was pilot tested and revised for precision and then translated into the local dialect - Dholuo, and back translated into English to make sure that the translation was correct and that the questions were clear. Three hanging scales were used. Two were in constant use and one was used to calibrate the other two daily. Direct observation of the respondents is also a valid and recommended method for time use studies (Messer, 1990). It is the method most commonly used by anthropologists to provide a description of the activity patterns, food habits, and social organization of study populations (Messer, 1990) as opposed to recalls or spot checks.

Data Analysis

Data were entered into Epi Info Version 5; A Word Processing, Data Base, and Statistics System for Microcomputers (Dean et al., 1990) and analyzed by two-way analysis of variance (ANOVA). Treatment means were separated by Tukey's HSD test ($P \leq 0.05$) and analyzed according to SAS (SAS, 1988). In this study, means along rows followed by different letters differ significantly by Tukey's HSD test. Where, a is significantly different from b, but ab may fall into either category a

or b. Therefore, ab is not significantly different from either a or b.

## Results

Seasonal differences

The bulk of the staple food consumed (97.7%) during the Dry season, in Kasgunga West sublocation, was purchased from the market (Table I) in comparison with home stock (granary (6.7%) or borrowing (2.2%)). During the Dry and Rainy seasons a greater percentage of food (97% to 98%) is purchased from the market than during Postharvest (77.8%). During Postharvest season 44.4% of the staple was obtained from the granary compared to 6.7 and 2.4% during the Dry and Rainy seasons, respectively. About 2.2% of staple used was borrowed from neighbors during the Postharvest and Dry season but not during the Rainy season (Table I). (The reason the percentages did not add up to 100% was because respondents were allowed to indicate all the sources of staple each season. For example, if one borrowed, bought, or used their own staple in the past week they could indicate all three and still list other sources of staple).

Food sufficiency varied greatly among the three seasons (Table II). Number of meals cooked per day was significantly greater during Dry and Postharvest seasons in comparison with the Rainy season. During the Dry and Rainy seasons, flour which is normally used to prepare ugali was diverted more frequently to prepare uji than during the Postharvest seasons (Table II). However, households were deficient of

food every season (Table II).

The amounts and cost of various food items differed significantly by season (Table III). Significantly greater amounts of flour were used to prepare *ugali* during Postharvest and Dry seasons than during the Rainy season. Significantly less flour was required to cook *uji* in the Rainy than in the Dry season. However the amount of flour needed for *uji* in the Postharvest season, although higher on average than that used during the Rainy season, was not significantly different from that used either in the Rainy or during the Dry seasons. Weight of stew used per day did not differ significantly by season. The amount of money spent on staple per day was significantly higher in the Rainy season than in the Dry season with the Postharvest and Dry season not being significantly different. As seen in (Table III) the amount spent on staple per week was significantly higher in the Rainy and Dry seasons than the Postharvest season. The amount of money used by respondents in both the Dry and Postharvest seasons to purchase omena (sardine-like fish) was more than twice that used during the Rainy season. However, the amount of money used for milling flour, purchasing other types of fish (Nile perch, tilapia) or buying vegetables did not significantly differ across seasons (Table III). From field observations vegetables were rarely consumed due to high prices, but during the Rainy season most households used foraged wild greens. In the Postharvest and Dry seasons the vegetables were bought at the local market.

During the Postharvest and Dry seasons, twice as many people sampled said

they had sufficient staple per week compared to the 28% in Rainy season (Table IV). The percentage of people who thought they had enough food to last for one season increased over two-fold higher during the Dry and Postharvest seasons compared to the Rainy season. The amount of staple (the number of *gorogoros*) milled and bought per week and the corresponding percentage of respondents did not differ substantially across seasons (Table IV).

Regional Differences

Household food sufficiency (measured as food deficits) did not differ significantly by region (Table V). However, people who lived in the Hill and Lake regions substituted the flour normally used to prepare *ugali* for making *uji* more frequently than people living in the Town. The number of meals cooked per day, number of times uji was cooked for a meal per week, and the additional amount of *gorogoros* of staple required by each family did not differ significantly by region (Table V).

Weight and cost of most food items did not differ much by region (Table VI). However, people who live in the Hill region spent greater amount of money (Ksh) to purchase staple per week than people living around the Lake and in Town (Table VI) although there were no significant differences in the amount spent per day by region. The weight of staple used to prepare ugali and uji and stew, the amount of money spent to mill flour and to purchase large fish (Nile perch, and tilapia), omena

vegetables, and meat did not significantly differ by region (Table VI).

People who lived in the Hills milled greater numbers of gorogoro per week than those living in and around the Lake or those living in the Town area (Table VII) although these differences were not tested for statistical significance. Percentage of people who responded that they milled ugali per week was, however similar for the Hill, Lake and Town regions. A greater percentage of people who lived in Town, milled staple for uji per week and said they had sufficient food for the season than people living in the Hills or in the Lake region (Table VII). People who lived in the Hills bought more ugali per week and had greater percentage of respondents than those living around the Lake and Town regions buying per week. Greater percentage of people living in the Hill and Town regions bought staple for preparing uji per week than people around the Lake (Table VII). However, analyses were not conducted to test for statistically significant differences.

## Discussion

### Source of staple

Between 78 and 100% of the food in this region was bought from the market throughout the 3 seasons showing the low agricultural productivity as a result of unreliable rainfall (Appendix Table III). However, after harvest, mainly in the Postharvest season approximately 44% of the food came from the granary, but this did not last long. The percent dropped drastically in the Dry and Rainy seasons when

only 6.7% and 3% of the respondents, respectively, used their own grain and bought the bulk of their staple (Table 1) as shown by the 7% of respondents who still had food in the granary in the Rainy season which confirms the dependency of these respondents on the market.

This is in agreement with observations made by Schmidt (1979) and Maritim (1982) who noted that on average smallholders seemed to sell maize despite the fact that the remaining amounts were insufficient to meet their own requirements and that they must buy back considerable quantities of those crops later. This pattern is particularly true for the poorer smallholders. Kleist (1987) also showed that seasonality in production had important implications for the availability of food in Kenya.

Food Sufficiency

Food sufficiency in Kasgunga West sublocation appeared to be more highly associated with season than with region. Schmidt (1979), Maritim (1982), Frankenberger (1990), and Kennedy & Cogill (1985), also showed seasonality effects in other parts of Kenya. In this study, the number of meals cooked per day may perhaps be due to food shortages, as most respondents cooked less than two meals per day throughout the three seasons in all three regions. But during the Dry and Postharvest seasons the number of meals cooked were almost similar which may have been due to the following reasons: slightly more food available in the Postharvest

season, and more time available to the respondents to search for and cook food for their households in the Dry season. However, the use of ugali flour for uji during the Dry and Rainy seasons was more than double that of the Postharvest season when the preferred uji staples of finger millet and cassava were available and sold less dearly at the local market. The use of uji instead of ugali, may also be due to reduced amounts of food because less flour is needed to prepare uji. It should be noted that it is the maize staple that was used in most of the Dry and all of the Rainy season by most respondents for both *ugali* and *uji*. Hence, the use of the little flour available for making uji instead of ugali, in the Dry and Rainy seasons. This question was a polite way to get to the sensitive issue of the number of times people went without food. Unfortunately in its answer, respondents did not include the number of times they actually went hungry only the number of times they made uji for a meal in the past week.

Greater substitution of ugali flour for uji evidenced by people living in the Hill and Lake regions may have been due to the greater distance from the market and the more time spent weeding their larger farms - where they also took uji with them to eat on the farms. The fact that respondents said they needed additional food each season showed the extent of the food deficit in this region irrespective of season or region.

Milling and Buying Staple

During the Dry and Rainy seasons when food was relatively insufficient the

amounts of staple bought and milled did not differ significantly. But in the Postharvest season when respondents still had their own stock, the respondents milled more than they bought indicating that the difference was likely to be from their own staple in the granaries.

When respondents were asked whether they had sufficient staple by season the difference between the Dry and Postharvest seasons were negligible, but during the Rainy season, less than 25% were self sufficient. However, it must be noted that no more than 60% of the respondents said they were sufficient by season and region. By region, the Hill bought and milled more staple than both the Lake and Town regions, although more Town people (57%) said they were sufficient while the Lake reported the least sufficient number of people as (39%). However, it was not clear why the Town respondents milled more staple than they bought. It may have been borrowed or supplemented with their own grain, yet they had the least harvest in all three regions studied.

However, the source of buying should be clarified. In the Dry season, the staple was bought at the market where it was still in the grain form, and respondents had to mill it themselves. But in shops or from vendors, the staple was in flour form already milled, and packaged in sacks/gunny bags or in small 2 kilogrammes (kg) packets. The packets were Grade I sifted maize meal and the least preferred by respondents. The flour from sacks was Grade II and similar to what they would have had, had they milled their own grain, but it was measured in gorogoros which always

ended up giving them short measure and sold more dearly to respondents.

There were significant differences in the amount of money spent on staple. The seasonality of food prices may have contributed to the variation. Respondents were observed buying and consuming less food in the same Rainy season in which higher expenditure of money was recorded. Respondents were more dependent on milled flour for lack of their own grain/staple to mill in the Rainy season. Milling costs were set by the millers and varied by only fifty cents in the duration of this study, hence, perhaps the lack of significance in milling costs by season.

On the other hand there were no significant differences in the amounts of bought and consumed stew on the sample day. The stew normally consisted of fish, vegetables, meat, and omena (Table III). When the predominantly eaten stew components were analyzed separately, only *omena* differed across seasons. The amount of money spent on omena was significantly lower in the Rainy season (when fish is more plentiful and prices lower) than the more than double the money paid by respondents in the Dry and season but not significantly different than the Postharvest season. The fact that vegetables were not significantly different throughout the seasons may be due to the fact that vegetables were not bought during the rainy season as such, but respondents were asked to estimate the value of the vegetables cooked. Most of the vegetables were foraged and had no market value because they were available to everybody during this season. Meat (refers to beef) was very expensive and did not form part of the diet too often. There were no significant

differences in the amount of money spent on buying fish, vegetables, or meat. However, there was very little to no foods consumed in the form of staple during the Rainy and agriculturally busiest season which may have been due to the observed decrease in the food and money available to respondents in the whole sublocation. It should be noted that the lack of staple in Kasgunga West sublocation constituted famine/hunger according to respondents.

These results are similar to Meilink's (1987) who addressed food consumption patterns in rural and urban Kenya, and price changes in the rural markets, and noted "that variations in food availability during the year in rural areas are great and occasionally give rise to sudden price increase in local markets" (p. 7). According to the Integrated Rural Survey of 1974/75, on average 15-40% of total (maize) consumption was estimated to have been based on purchases, making farmers dependent on food markets as both sellers and buyers at different times of the year (Smith, 1978; Schmidt, 1979; Maritim, 1982; Cowen, 1983; and Olsen, 1984).

The market from which food was bought was shared by respondents in all three regions of the Hill, Lake, and Town. Kasgunga women were like a large part of Kenya's rural population which were dependent on unofficial rural markets when they sell or buy maize. Rural markets "exhibit erratic price fluctuations" (Ateng, 1984). The Household Welfare Monitoring and Evaluation Survey of South Nyanza District (July, 1991) indicates that Mbita Division spends 63% of its expenditure on food which is above the 61% for the District mean and 30% of its household food

expenditure on cereal and 9% on vegetables respectively.

Despite this, the amount of food consumed in all three regions was way below the national average. Greer and Thorbecke (1984) classify Nyanza Province, in which Kasgunga lies, as having 41.5% of its smallholder households as being food poor based on the RDA of 2250 calories consumed. The average daily food availability amounts to 2385 calories (CBS, 1983) a little higher than the FAO/WHO recommended average of 2362 calories (Republic of Kenya, 1984: p. 34).

Of importance is the observation by Kliest (1985) that seasonality in production has important implications for the availability of food. Schmidt (1979) and Maritim (1982) note that on average smallholders seem to sell maize despite the fact that the remaining amounts are insufficient to meet their own requirements and that they must buy back considerable quantities of those crops later. This pattern is particularly true for the poorer smallholders in both good and lean years.

**Summary and Conclusions**

From this 10-month study of household food consumption by region across the Dry, the Rainy, and the Postharvest seasons, the respondents and their households were found to be consuming less food than their counterparts in the District, the Province, the Nation, and even fewer calories than recommended by the FAO/WHO. This was all shown, by the number of meals eaten, the frequency of substitution of uji for ugali, the number of gorogoros of staple milled for both uji and ugali, and in the

weights of both staple and stew cooked on sample day. The respondents were almost totally dependent on the market for their staple most of the year, and even in the Postharvest season when they had some of their own grain. There was occasional borrowing of staple. Very little consumption of vegetables and meat were recorded, the latter due to the high costs.

The low food consumption may be blamed on the poor agricultural subsistence crop yields due to unreliable, unpredictable rainfall among other things, but the problem is multi-dimensional and likely deeper than may be apparent from these results.

The major findings of this study were:

* On average, no region had 2 meals per day in any one season
* Only 60% of the respondents were sufficient of staple even in the Postharvest season
* Respondents were short between 1 and 3 gorogoros of staple per week as shown by seasonal deficit (1.2-2.8)
* Substitution of ugali with uji was more common in the Rainy season when respondents were busiest and only 25% said they were sufficient
* There was very little consumption of vegetables and meat in this region
* Respondents used a lot of money to buy staple daily and weekly

Table I

Source of staple by season

| Variable | Rainy | Postharvest | Dry |
|---|---|---|---|
| Market | 100.0% | 77.8% | 97.7% |
| Granary | 2.4% | 44.4% | 6.7% |
| Borrow | 0.0% | 2.2% | 2.2% |

Table II

Food sufficiency by season

| Variable | Rainy | Post-harvest | Dry | Mean total | F-Ratio | P-value |
|---|---|---|---|---|---|---|
| Meals cooked | 1.3b[z] | 1.8a | 1.7a | 1.6 | 10.96 | 0.0001 |
| Uji for meal (No./wk) | 3.4a | 0.8b | 1.8b | 2.0 | 25.51 | 0.0001 |
| Ugali flour for uji (No./wk) | 5.1a | 2.3b | 4.8a | 4.1 | 13.32 | 0.0011 |
| Deficit | 2.8a | 2.0a | 1.8a | 2.2 | 1.07 | 0.3450 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, $P \leq 0.05$.
Deficit = extra number of gorogoros, as estimated by respondents, needed by households in order to be sufficient.

Table III

Mean weight and cost of sample day household food consumption by season

| Variable | Rainy | Post-harvest | Dry | Mean total | F-Ratio | P-value |
|---|---|---|---|---|---|---|
| Weight (lb.) | | | | | | |
| Ugali flour | 3.3b[z] | 5.9a | 5.0a | 4.8 | 9.29 | .0002 |
| Stew | 1.8a | 2.1a | 1.9a | 1.9 | 0.44 | .6450 |
| Uji | 0.6b | 0.7ab | 1.1a | 0.8 | 3.86 | .0236 |
| Cost (K.sh) | | | | | | |
| Staple today | 85.2a | 33.5b | 41.9ab | 54.2 | 3.45 | .0349 |
| Staple/week | 344.5a | 219.2b | 344.7a | 302.8 | 6.53 | .0020 |
| Milling | 4.2a | 3.8a | 2.7a | 3.6 | 0.46 | .6319 |
| Fish | 4.3a | 8.4a | 8.8a | 7.2 | 2.21 | .1139 |
| Omena | 3.1b | 7.0ab | 7.9a | 6.0 | 3.92 | .0223 |
| Vegetables | 2.5a | 2.9a | 1.9a | 2.4 | 0.26 | .7747 |
| Meat | 0.9a | 2.9a | 2.9a | 2.2 | 0.72 | .4866 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, $p \leq 0.05$.

Table IV

Mean gorogoros milled and bought and percent respondents buying and milling by season

| Variable | Rainy | Postharvest | Dry |
|---|---|---|---|
| Ugali gorogoros milled per week | 7.0 | 7.5 | 7.8 |
| % milling/week | 93 | 100 | 100 |
| Ugali gorogoros bought per week | 7.0 | 5.5 | 7.8 |
| % buying/week | 93 | 80 | 90 |
| Uji gorogoros milled per week | 20 | 53 | 27 |
| Uji gorogoros bought per week | 20 | 51 | 27 |
| Sufficiency[x] | 24 | 58 | 60 |

[x]Percentage of respondents who indicated that they had enough food each season.

Table V

Food sufficiency by region

| Variable | Hill | Lake | Town | Mean total | F-Ratio | P-value |
|---|---|---|---|---|---|---|
| Meals cooked | 1.7a[z] | 1.7a | 1.5a | 1.6 | 1.75 | 0.1780 |
| Uji for meal | 1.8a | 2.1a | 2.2a | 2.0 | 0.71 | 0.4927 |
| Ugali flour for uji | 5.1a | 4.1a | 3.1b | 4.1 | 5.34 | 0.0066 |
| Deficit | 1.7a | 2.7a | 2.2a | 1.5 | 1.09 | 0.3384 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, $p \leq 0.05$.

Table VI

Mean weight and cost of sample day household food consumption by region

| Variable | Hill | Lake | Town | Mean total | F-Ratio | P-value |
|---|---|---|---|---|---|---|
| Weight (lb) | | | | | | |
| Ugali | 5.4a[z] | 4.2a | 4.6a | 4.7 | 1.86 | 0.1602 |
| Uji | 1.0a | 0.7a | 0.7a | 0.8 | 2.62 | 0.0771 |
| Stew | 1.6a | 2.2a | 2.1a | 2.0 | 1.49 | 0.2296 |
| Cost (K.Sh) | | | | | | |
| Staple today | 61.9a | 43.9a | 54.7a | 53.5 | 0.37 | 0.6935 |
| Staple/week | 392.5a | 262.9b | 252.9b | 302.8 | 7.55 | 0.0008 |
| Milling | 4.7a | 2.5a | 3.5a | 3.6 | 0.84 | 0.4325 |
| Fish | 6.0a | 8.2a | 7.4a | 7.2 | 0.43 | 0.6517 |
| Omena | 6.5a | 6.5a | 5.0a | 6.0 | 0.47 | 0.6284 |
| Vegetables | 1.7a | 1.6a | 4.0a | 2.4 | 1.98 | 0.1419 |
| Meat | 2.7a | 2.3a | 1.6a | 2.2 | 0.17 | 0.8437 |

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test, $p \leq 0.05$.

Table VII

Mean gorogoros milled and bought and percent respondents buying and milling by region

| Variable | Hill | Lake | Town |
|---|---|---|---|
| Ugali gorogoros milled per week | 9.5 | 6.5 | 6.5 |
| % milling/week | 98 | 98 | 98 |
| Ugali gorogoros bought per week | 9.5 | 5.5 | 6.5 |
| % buying/week | 96 | 91 | 87 |
| Uji gorogoros milled per week | 36 | 24 | 40 |
| Uji gorogoros bought per week | 36 | 24 | 38 |
| Sufficiency | 48 | 39 | 57 |

[x]Percentage of respondents who indicated that they had enough food each season.

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## Chapter Four.

### Women's Time Allocation in Relation to Fuelwood Availability and Household Food Consumption by Region and Across Seasons


### Abstract

This survey was undertaken to investigate women's time allocation in relation to fuelwood availability and household food consumption with 45 women in Mbita Division, Kenya. Results obtained in this study showed that respondents allocated the greatest proportion (26%) of time to community work and entertainment per day followed by housework (17%), then business (13%), and food consumption 13%. Other activities were water collection, farming, fuelwood collection, child care, and leisure, each allocated 5, 4, 4, 3, and 1% of the total daily time, respectively. Analysis of time spent on each activity based on region showed that people living around the Lake and in Town spent 45 and 34% of time collecting water compared with 21% of the time for those who live in the Hill region. On the other hand, respondents in the Hill region spent most of their total waking time on fuelwood related activities compared with about halt of the time for people living around the Lake and in the Town regions. People living in the Hill and around the Lake spent most time for child care, followed by the Hill respondents, and the Town people spent the least time for the same activity.

The proportion of time allocated for other activities was not influenced by season. When the time spent on each activity was partitioned according to season, results indicated that respondents spent most time on housework during the Postharvest and least

time in the Rainy seasons. Most farming activities were performed during the Rainy season and the least in the Postharvest season. Significantly more water was collected in the Postharvest and least in the Rainy season. Greater amount of time was spent for food consumption during the Postharvest, followed by the Dry season, and least time during the Rainy season.

**Introduction**

A study by Krystall and Gommes, (1979) on women's weekly time allocations in Kenya found that women in high potential agricultural areas spent 5.25 hr/wk on collecting firewood as opposed to the 6 hr spent by women residing in low potential areas. Women spent 13.5 hr/wk on farming and 12 hr caring for animals in low potential areas and 12.25 hr/wk and 19 hr/wk in high potential areas, respectively. Traditionally children, particularly daughters, assist their mothers in gathering firewood. A 1981 survey of 40 households in two clusters in the Kisii region of western Kenya showed that in 70% of the cases women were the exclusive collectors of wood for domestic use, and in 17% of households women and children shared the task, and 12% had children solely collecting firewood (Barnes, 1984). The time required was 40 minutes per day per household member daily for firewood collection (Hosier, 1984). It also was estimated that rural Kenyan women spend one-third of their working time in the fields caring for both cash and subsistence crops (ILO, 1986). Other activities performed by women in Kenya include milking, marketing, child care, and cooking.

Haugerud (1984) found that the growing scarcity of wood increases the time required for fuelwood collection and takes family labor away from other essential activities thereby seriously diminishing welfare and production. Household fuel collection was done by females and commercially by men. In particular, it was found that fetching water was a task for which less time may become available when fuelwood collection times increased.

Mun'gala and Openshaw (1984) found that the rural householder walked an average of 1.6 km to collect fuelwood, whereas the rural non-householder (those consumers using fuelwood for commercial or service industry) brings it from 6 km away. The alternative fuel (charcoal) was found to come from 90 km away. For a family of 6.5 people, 468 hr/yr or greater than 1 d/wk, was spent collecting fuelwood, a task normally performed by women.

Distance, time spent per day's supply, and time spent/kg, were higher in the savannah zone than for either the high potential or arid zones. The great amount of time spent collecting one day's supply of wood in the arid zone was due not to the scarcity of wood in the arid zone but to the enormous quantity of wood used, as the time spent per kg of wood was actually less than in the high potential zone. Larger households were found to spend less time per capita collecting wood and to be more efficient in use of fuelwood. Each additional minute required to gather a kg of wood reduced annual consumption by 171 kg and an additional member required 226 kg/yr (Mun'gala and Openshaw, 1984).

In the current study the concept of women's time allocation was the actual time reported or observed being spent on a particular activity rather than estimates of typical time spent. The concept of food consumption was the weighing of the staple food and all cooked food consumed. On the other hand, the concept of fuelwood availability was the amount of weighed fuelwood, alternative organic fuels, and other non-crop residues used on the sample day and during the past week.

The purpose of the study was to investigate how women's time allocation is related to season and region in the context of fuelwood availability and household food consumption.

## Materials and Methods

### Sample Selection

This study was carried out in Kasgunga West sub-location in Homa Bay district, Kenya (formerly part of South Nyanza district) (Appendix B). Forty-five monogamous households were randomly selected. Selection of the households involved using the list of all households in Kasgunga and randomly selecting 5 names from under each headman's jurisdiction or village for equal representation within the sub-location. The sample represented each geographic location thus: the Hill region, consisted of Gera East, Gera West, and Gera Mix villages: the Lake region, consisted of Nyamarandi, Kamaena, and Waluwi villages; and the Town region consisted of Wakunga, Wasulwa, and Kombe villages.

At the initial meetings, the respondents were asked for verbal consent after the researcher had explained the details and duration of the study, i.e., each respondent would be visited 3 times starting from the month of August 1993 through May 1994. Thirty-three of the respondents were observed for a full day (12-13 hr) while 12 were observed for 24 hr.

Data Collection

After selections, day-long observations and interviews were conducted for each respondent during the Dry, the Rainy, and the Postharvest seasons. Time allocation data were collected by the researcher from the time the respondents rose in the morning to the time they retired to bed in the evening or until the following morning. Time allocation data were collected by the researcher using direct observation method and every activity performed by the respondents recorded to the nearest minute. Time allocation activities were categorized as follows:

Fuelwood Time used in collecting (includes distance to and from the site), time taken used for splitting, buying, and also borrowing.

Food Time used in the buying, drying, shelling, winnowing, food preparation from start to completion of meal, and time spent borrowing.

Water All activities carried out by the lakeside; washing dishes, clothes, bathing children/self, fetching water, buying fish both commercial and for food consumption (mostly done in one, consecutive trips such as "airing" *omena*, collection and bagging,

weighing and storage of *omena* are under lake especially the early morning commercial purchasing of *omena*. Also includes time taken to cover the distance to and from the Lake or well.

*(Omena* was not put under Business or Food consumption unless the respondents specified that they were going to buy *omena* for sale or for home consumption only. This is because respondents were not followed to the lake or to the wells).

Farming/Livestock Includes taking care of domesticated animals (feed, treat, and water), letting them out to graze, milking of goats and cows, taking them for a drink at the Lake or well.

Child care Feeding, breast feeding, dressing, bathing, putting them to bed and to the doctor, holding them , giving them haircuts etc.

Leisure Time for the women who sat or layed down to rest.

Business Income generating activities including time taken to cover distance to and from site of transaction, such as fuelwood selling, fish smoking and selling, fish buying at the lake, making and selling illegal brew at home, selling of matches, kerosene, soap, salt, cigarettes sugar, etc., community village health assistants who sell medication at subsidized prices, and selling of staple from the homesteads.

Overlap

All activities done in conjunction with others such as child care with cooking or eating, going to the Lake or market while the food is cooking, etc. Such activities were recorded twice, in the category to which they belong and under overlap where it is

specified that it also belongs to another category.

Housekeeping Sweeping, smearing walls, dusting, mopping, washing face, bathing, washing dishes or clothes at home, clearing the table after meals, spreading clothes out to dry, etc.

Community and Entertainment Time spent on visitors. Both those who interrupt whatever activity the respondent was previously engaged in, or who cause overlapping of her current activity with the visitor's presence. Community work included voluntary/mandatory work at schools, churches, attending the chief's *barazas* and seminars, attending funerals, and selling of subsidized medication to the community.

Protocol

Women's time allocation activities were recorded to the nearest minute from the time the respondent started performing the activity until the activity was completed. All overlapping activities were also recorded from the time started to the time completed. The on-going activity was regarded as the major activity, while any activity or activities started before the completion of the on-going activity was considered overlapping. All time was recorded to the nearest minute using a table clock.

For increased accuracy and consistency, the researcher collected and recorded all the time allocation data. The direct observation method used to collect time allocation data is the method most commonly used by anthropologists to provide a description of the activity patterns, food habits, and social organization of a study population (Messer,

1990).

Data Analysis

Data were entered into Epi Info Version 5; A Word Processing, Data Base, and Statistics System for Microcomputers (Dean et al., 1990) and analyzed by two-way analysis of variance (ANOVA). Treatment means were separated by Tukey's HSD test ($P \leq 0.05$) according to SAS (SAS, 1988). In this study, means along rows followed by different letters differ significantly by Tukey's HSD test. Where, a mean value preceding letter (a) is significantly different from that preceding letter (b), but mean values preceding letters (ab) may fall into either category (a) or (b). Therefore, (ab) values are not significantly different from either (a) or (b), even though they may be lower or higher than either one.

Percentages of time allocation were calculated by taking mean time that respondents spent on a particular activity by season and region and divided by the mean total time spent on all ten categories of activities multiplied by a hundred. Only the time during which the women were observed was considered, thus sleeping time was not included.

Demographics

The sample consisted of forty-five (45) women aged between 24-68 years. They were housewives except one school teacher and one part time maid. Of the forty five

respondents, twenty (20) had never been to school, 12 had 1-4 years of schooling, ten (10) had 5-8 years of schooling, two had 1-2 years of high school education, and one had completed high school and is a trained elementary school teacher.

Thirty-eight (38) lived in grass thatched huts with mud walls, six lived in huts with mud walls with corrugated iron sheets, and only one had a permanent stone building with a water reservoir. There were nine widows among the respondents, four living alone with their children, and the family sizes ranged from none to eight children per household (Appendix Table I).

## Results

### Overall Differences

Fig. 1 represents the proportion or percent time allocated by respondents for each activity per day. More than 25% of the total time was spent doing community work and entertainment. The next important time consuming activities within the region were housework, overlapping, business, and food consumption, which were allocated 17.1%, 14.3%, 13.2%, and 13.0% of the total time per day, respectively. Water collection, farming, fuelwood collection, child care, and sleeping and leisure, were allocated the least proportion of total time per day, each allocated 5%, 4%, 4%, 3%, and 1%, respectively. (Fig. 1).

### Seasonal Differences

The time spent on several different categories of activities differed significantly across seasons (Table I). Significantly more time was spent on fuelwood related activities during the Postharvest (1.3 hr/d) and Dry seasons (1.1 hr/d) than in the Rainy season (0.8 hr/d). Time allocation for Food consumption activities was significantly lower in the Rainy season (2.7 hr/d) than it was in the Postharvest (4.3 hr/d), but these two seasons were not significantly different than the Dry season (3.4 hr/day). Significantly more time was spent on Housework during the Dry (3.6 hr/d) and Postharvest (4.9 hr/d) seasons than in the Rainy season (2.3 hr/d). Time spent on Farming/Livestock activities during the Rainy (1.9 hr/d) and Dry (1.2 hr/d) was significantly higher than during the Postharvest seasons (0.3 hr/d). There was significantly more time used for water during the Postharvest (1.9 hr/d) than either during the Rainy (0.7 hr) and Dry seasons (0.9 hr) (Table 1). However, the amount of time allocated for Business, Child Care, Rest and Leisure, Community work and Entertainment, and Overlapping activities (Table I) did not differ significantly by season.

Regional differences

Major activities performed within the households and the approximate amount of time allocated for each in hours, are represented in Table II. People living around the Lake spent significantly greater amount of time on water related activities (1.6 hr/d) than people who lived in the Hill region (0.7 hr/d). The time the Town people spent on water related activities was not significantly different than either the Hill or Lake respondents

(Table II). Significantly more time was spent for child care by people who lived in the Hill region (1.1 hr/d) than for people living in Town (0.4 hr/d). For the Lake respondents, time spent on Child care did not significantly differ from that of the Hill and Town women. However, significant amounts of time spent on Housework, Farming and Livestock, Food Consumption, Business, Rest and Leisure, Community and Entertainment, nor on time spent doing more than one activity at a time (Overlapping) did not differ significantly by region (Table II).

**Discussion**

Overall

Based on the categories discussed in the earlier sections the time allocated for sample women during (1993/94) showed that the single activity that consumed the greatest time on average was (Community) Entertaining visitors (26%). The bulk of time spent on this activity involved entertaining visitors on informal visits (friends, neighbors, and passers-by). However, an additional analysis was done by simply adding the percentages in the categories to form larger related kinds of categories of activities. They were: Informal visits (community and entertainment), Food Related (business, water collection, farming, and fuelwood collection, food consumption), Household related (housework, Child care), Leisure (leisure), and Overlap. Then the most time consuming activities were food related (42%), and Informal Visits (26%), followed by Household Related (20%), and least time was spent on Rest (14%). The remaining 14%

of the time was shared among activities which Overlapped (Overlap).

Seasonal differences

Respondents spent significantly more time on housework during both the Postharvest and Dry seasons than they did during the Rainy season. This may have been because of increased time available to the women because they did not have to go look for food as it was available in the homes then. Farming/livestock activities were a major preoccupation in the Rainy season, because in addition to the digging and weeding, women had to tether livestock in grazing land away from the agricultural fields which were under crops. The respondents had also to go bring the livestock back into homesteads after watering them at wells for the Hill region, or in the lake, for the Lake region and most of the Town region. But the increased time in Farming/livestock activity was also contributed to by the amount of weeding done in the Rainy season. The 1.2 hr/d (6.0 hr/wk) spent on farming in this study is much lower than the 13.5 hr/wk reported by Krystall and Gommes (1979).

However, most of the farming/livestock activities carried out during the Postharvest season were directly related to livestock, mainly watering livestock, milking and tethering in sheds or huts for the night, with no agricultural activity involved. The mean time spent on farming activities however, is much less compared with the one-third of women's working time reported by ILO (1986). It should also be noted that very few families owned livestock, and the few did any, had fewer than ten animals with very low

milk production levels (<1 liter per cow) and even less for goats. Hence, the significantly lower time spent on the land, unlike the 12 hr spent by Kenyan women on caring for animals according to Krystall & Gommes (1979).

Water collection varied by season. From observations in the field, many respondents especially those with corrugated iron sheets or tin roofs trapped roof water for domestic use in the Rainy season while others especially far from the lake fetched any standing water from the roadside culverts and elsewhere. The increased water collection time during the Postharvest season may have been contributed to by the increased housework activities such as house smearing (which requires lots of water for mixing the livestock dung and fine soil).

The statistically significant differences in the fuelwood activities may be due to the variations in the amounts of time different respondents spent on it. One respondent who sold fuelwood to the local high school walked up to 12 km to and from her fuel collection site and returned to collect her fuelwood using a donkey cart from the site. However, it was observed that less food was available in the Rainy season, therefore, a reduced need for fuelwood, but it may be because the fuelwood was wet and the respondents resorted to the use of non-fuelwood plant material such as climbing plants and sisal plant for cooking. The higher mean in the Postharvest season with 1.3 hr/day spent collecting fuelwood, may be as a result of more food available to be cooked.

Krystall and Gommes (1979) found that women in low potential areas who would have a food supply similar to the study area spent 6 hr/week collecting fuelwood which

is approximately the same as the respondents in this study. Mung'ala and Openshaw (1984) found that greater than one day/week was spent collecting woodfuel for a family of 6.5 people. The fact that Kasgunga respondents spent less time by season may perhaps be due to the fact that fuelwood was not the sole material used for cooking, other non-fuelwood material was used.

Time spent on food related activities was significantly lower in the Rainy than in the Postharvest season and much lower although not significantly different, than in the Dry season. Respondents spent 3.5 hr/day on food related activities. This can be explained by the increased food available to be threshed, shelled, winnowed, milled, and cooked in the Postharvest season and the apparent decrease of available food in the Dry and Rainy seasons.

Although quantitative analyses did not show any significant differences on time spent on Business across seasons, maybe because respondents did not have to look for food during Postharvest because most women had sufficient food stock. From observation, there may have been seemingly contradictory reasons why respondents spent more time on business across seasons: during the Postharvest season there was more food and time available, so respondents would leave home knowing somebody else would cook the meal while they attended to their business; secondly, in the Rainy season, Business (mainly fish and fuelwood related) was the major source of income which went towards buying household food; and lastly, there were no more than 60% of respondents who had sufficient food in any one season (Ch.3). Although the mean time for Business

related activities was lower, there were no significant differences, although it was observed that fuelwood sold for less and fish was less plentiful in the Dry season possibly contributing to reduced Business. However, there were respondents who were more aggressive and hardworking at Business such as those who sold fuelwood to institutions who spent considerably more time in Business across seasons.

Child care ranged from a little more than half an hour in the Dry to about 1 hr in the Postharvest season. Increased time available in the Postharvest season may be due to more food available to respondents to feed their children with and also the time saved from not having to look for food.

Although there were not statistically significant difference in time for Leisure/rest, it seemed in field observations that respondents rested more in the Rainy season, after weeding all morning, than they did during the Dry and Postharvest seasons. This was mainly from around noon to mid-afternoon. Quite a few of them resumed weeding as the sun went down in the evening. From observation, it seemed that the rest may also have been precipitated by the lack of food to be cooked.

Although not statistically significant there was a reduction on average, of over one and one-half hours in the time respondents spent attending to Informal visitors in the Rainy compared with that spent in the Dry and Postharvest seasons. This observation may have been due to increased farming activities.

Overlapping activities which were mainly cooking, while attending child care, or going on Business while the food is cooking was more prevalent in the Postharvest and

Dry seasons. With less food to cook in the Rainy season the mean Overlap time decreased but not to statistically significant levels.

Regional Differences

There were not statistically significant differences on average, spent more time on Housework. The Hill respondents had more livestock and larger pieces of land than the rest of the respondents. Hence, a higher but not significant mean difference on the Farming and livestock activity.

Regional water collection was significantly higher for the Lake respondents perhaps due to combining several activities to be performed at the lake. Women went to the lake with all dirty laundry, and dirty dishes, bathe (children and respondents); and returned to the homesteads with clean semi-dry clothes and dishes, approximately 20-30 liters of water, and having bought fish for both lunch and Business. Hill respondents did not combine as many activities with Water collection because they collected water from wells where fish was not available. Secondly, they normally sent children to bathe and do the dishes if they did not do the former in the homesteads. The Town people also followed a format similar to the Hill respondents but they did not engage in as much Business at the Lake.

The Hill and Lake respondents spent significantly more time collecting fuelwood because and most of it was sold to the Town and Lake respondents, who also engaged in fuelwood activities on other people's lots where it was more available. For the Hill

people fuelwood formed the basis of their Business.

With Food related activities, time spent was not significantly different possibly because the whole region was deficient in food, but the Town respondents had a higher mean while the Hill had the least. Although, there were no significant differences in the time the women spent on business by region, the Lake and Town respondents were mainly fish mongers while the Hill women sold mainly charcoal and fuelwood.

It was not however, clear why the Town people spent significantly less time on child care than the Hill people. The Lake people were in between but not significantly different than the others. Respondents spent a small but equal amount of time on leisure throughout the 3 regions. The Town and Lake respondents spent more time on Community and Overlapping activities than did the Hill people. The difference not, however, significant.

When time allocation for each individual type of activity in each of the three regions was considered, the study showed a more realistic picture. Fuelwood collection was the major activity of the respondents living around the Hills taking 50% of the total daily time allocation spent on water collection time. This was because most of the supplied fuelwood sold in the market. The study also showed that fuelwood collection had expanded to other regions as 27 and 23% of the total time spent by respondents from the Lake and Town respectively. Most people from the Lake and some from the Town also sold water to masons in the township, therefore, accounting for the high proportion (45 and 34% of the total time spent on water collection by each group, respectively.

Percent people living in the Hill region, had to walk longer distances if they needed to fetch lake water or to water their animals 21% of the time spent; but they usually just fetched well, and underground river water for all their domestic needs. However, based on lengthy field observations it was apparent to the researcher that the priority need was for food. When the individual categories were combined according to needs then, food consumption was the most important.

**Summary and Conclusions**

This study examined women's time allocation in relation to fuelwood availability and household food consumption. The following activities may have had an interactive effect with food consumption and fuelwood availability as there were significantly lower or higher differences by season: Housework, Farming/Livestock activities, and Water collection. Only Child Care and Water Collection were significantly different by region. All the other activities were not statistically significantly different by season or by region.

From observation, Food Consumption and Fuelwood availability were ready in short supply in this region, which may have contributed to the lack of a relationship between women's time allocation with fuelwood availability and household food consumption.

The major findings in this study were:

* The major activities on which women spent most of their time were:

1) Community and Entertainment category, 2) Housework, 3) Business, and 4) Food consumption (in descending order) across season and by region.

* When activities were categorized into related groups then the single most important activity was, 1) Food consumption, followed by 2) Entertainment, 3) Overlap, 4) Housework, 5) Child care, and 6) Leisure.

TABLE I.

Women's daily time allocation for major activities by season

| Activity | Time (hr) | | | | F-Ratio | P-value |
|---|---|---|---|---|---|---|
| | Rainy | Post harvest | Dry | Mean Total | | |
| Housework | 2.3b[z] | 4.9a | 3.6a | 3.6 | 8.7 | 0.0003 |
| Farming/ livestock | 1.9a | 0.3b | 1.2a | 1.2 | 8.8 | 0.0003 |
| Water collection | 0.7b | 1.9a | 0.9b | 1.2 | 13.2 | 0.0001 |
| Fuelwood | 0.8b | 1.3a | 1.1a | 1.0 | 1.4 | 0.2579 |
| Food | 2.7b | 4.3a | 3.4ab | 3.5 | 5.0 | 0.0080 |
| Business | 3.9a | 3.9a | 2.7a | 3.5 | 0.9 | 0.4061 |
| Child care | 0.7a | 1.1a | 0.5a | 0.8 | 1.8 | 0.1756 |
| Leisure | 0.3a | 0.3a | 0.3a | 0.3 | 0.2 | 0.8193 |
| Entertainment[y] | 5.7a | 7.1a | 7.6a | 6.8 | 1.4 | 0.2451 |
| Overlap | 2.6a | 4.5a | 4.2a | 3.8 | 2.1 | 0.1334 |

[y]Entertainment = community activities and visitors.

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test (P = 0.05).

TABLE II.

Women's mean daily time allocation for major activities by region

| Activity | Time (hr) | | | | F-Ratio | P-value |
|---|---|---|---|---|---|---|
| | Hill | Lake | Town | Mean total | | |
| Housework | 5.6a[z] | 4.4a | 3.6a | 4.5 | 1.9 | 0.1531 |
| Farming/ livestock | 1.5a | 0.7a | 1.2a | 1.2 | 3.5 | 0.1348 |
| Water collection | 0.7b | 1.6a | 1.2ab | 1.2 | 5.9 | 0.0036 |
| Fuelwood | 1.6a | 0.9b | 0.7b | 1.0 | 4.6 | 0.0116 |
| Food | 3.2a | 3.4a | 3.8a | 3.5 | 0.7 | 0.4809 |
| Business | 3.6a | 3.1a | 3.9a | 3.5 | 0.3 | 0.7185 |
| Childcare | 1.1a | 0.9ab | 0.4b | 0.8 | 3.5 | 0.0338 |
| Leisure | 0.3a | 0.3a | 0.3a | 0.3 | 0.1 | 0.0992 |
| Entertain-ment[y] | 5.7a | 7.7a | 7.0a | 6.8 | 1.6 | 0.2095 |
| Overlap | 2.5a | 4.3a | 4.6a | 3.8 | 2.5 | 0.0860 |

[y]Entertainment = community activitites and visitors.

[z]Means along rows followed by different letters differ significantly by Tukey's HSD test (P = 0.05).

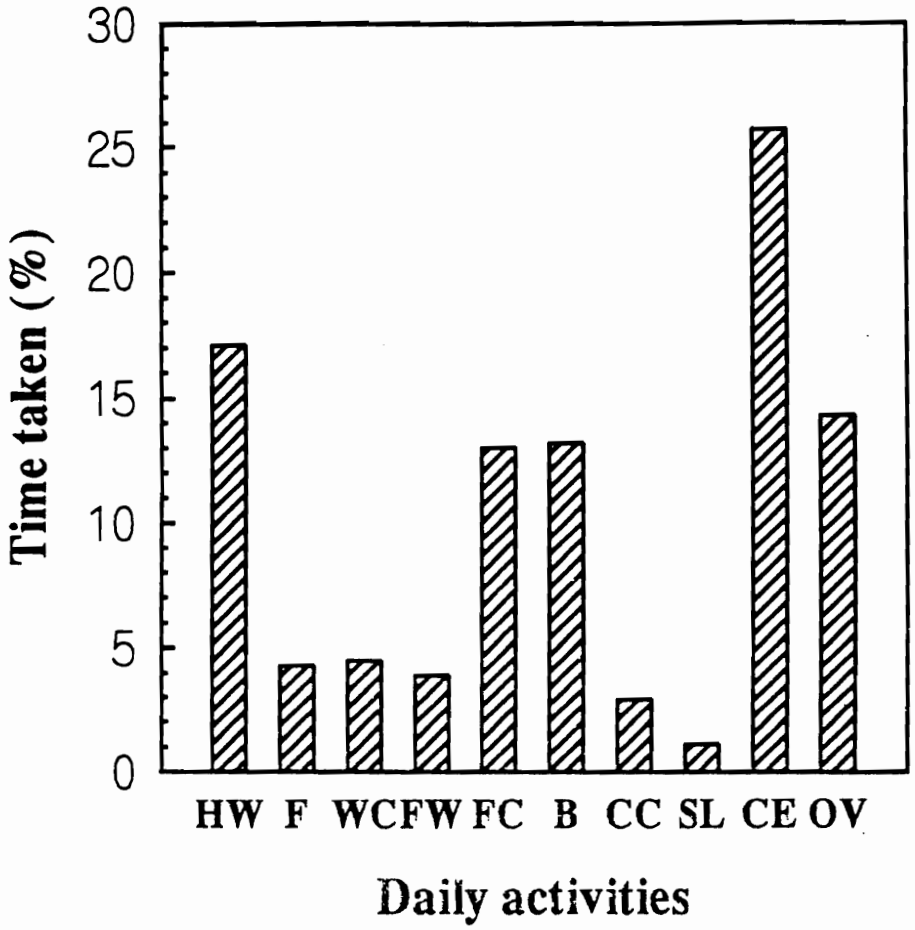


Fig. 1. Proportion of time (%) for daily activities

Legend:
HW = Housework
F = Farming/livestock
WC = Water collection
FW = Fuelwood
FC = Food consumption
B = Business
CC = Child care
SL = Sleep (nap)/leisure
CE = Community/Entertainment
OV = overlap

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## Chapter Five.

### The Relationship Between Fuelwood Availability, Household Food Consumption and Women's Time Allocation Across Seasons


### Abstract

A survey was undertaken to investigate the relationship between fuelwood availability, women's time allocation, and household food consumption. The sample consisted of 45 women in Mbita Division, Kenya. The respondents were clustered into three regions consisting of the Hill, the Lake and the Town. Total time spent by respondents collecting fuelwood was correlated with the amount of fuelwood collected ($r=0.69$), with earnings from the sale of charcoal ($r=0.61$), and with the number of meals cooked per day ($r=0.26$). Time spent by respondents on food consumption, however, was more highly correlated with weight of little fuelwood collected ($r=0.62$), than with the weight of ugali (main staple) ($r=0.43$), and with the number of meals cooked per day ($r=0.38$). This may have been due to the fact that the respondents frequently ate less than two meals per day. Time spent on farming activities was mostly correlated with the number of times uji (porridge) was substituted for ugali (main staple) ($r=0.33$), while time spent on housework was correlated with the weight of little fuelwood used ($r=0.31$), and with the number of meals cooked ($r=0.30$) per day. Most of the relationships were positive. For example, the study showed that, as the time spent on housework increased ($r=0.27$), so did the time spent on leisure ($r=0.33$). The activities which competed for time in the region were farming/livestock and water

collection (r=-0.21), and housework with the number of times uji was cooked as a main meal (uji) (r=-0.28).

## Introduction

Few studies have been undertaken showing the relationship of fuelwood availability, women's time/work/labor, and nutrition, in developing countries. Studies done in other parts of the world such as Nepal, Ghana, India, Peru, and Mexico, show important linkages found between household nutrition and fuelwood shortages with increased time spent on fuelwood collecting leading to: a reduction in the time spent cooking, and often the quality and quantity of food eaten; a reduction in the number of meals cooked; and increased consumption of snack foods and cold left-over foods (Kumar and Hotchkiss, 1985; Cecelski, 1984, 1987; Evans, 1986; Dasgupta and Maiti, 1986; Brouwer, 1989; Ardayfio, 1986). For example, Evans (1986) pointed out linkages between fuel consumption and nutrition in relation to women's employment. Women tended to adapt time-saving cooking methods and to increase supplies of alternative fuel (domestic oil). With an increase in economic status, in this Mexico study, there were variations in patterns of fuel used such as the use of gas stoves. In addition the poor cooked less beans and decreased consumption of other foods as well. In Nepal, Kumar and Hotchkiss (1985) found that fuelwood scarcity led to replacement with dung cakes and straw and that deforestation led to a 45% increase in time allocated for fuelwood collection. Hence, maize was substituted instead of the preferred rice as a result of

fuelwood scarcity. Samanta (1982) found that women's attempts to reallocate labor in the face of competing demands on their time had serious nutritional implications, such as malnutrition, and hampered efforts to tackle problems related to their roles as farmers and caretakers of their children. However, where food shortages were too great, fuelwood availability had little effect on food consumption (Cecelski, 1987).

Of these studies, Ojiambo (1967) who conducted an 18-month long survey in the form of interviews and friendly discussions, showed that when there was increased demands on the labor time of Abasamia women of Kenya, they were unable to devote sufficient time to nutritionally relevant activities such as food preparation. This is because women left home "early in the mornings to tend to their fields till midday, then left to collect firewood and water, grind grain into flour, and pick greens from the fields for the meal" (Ojiambo, 1967, pp. 218). Not only did these numerous responsibilities result in low efficiency, small harvests, and lack of energy to look after the toddlers; but it also resulted in the preparation of only one big meal a day for both the adults and children.

Barnes (1984) in her work in the Kisii district of Kenya, found that within each homestead, each adult woman was responsible for collection of fuelwood and preparation of meals (which took the greater part of the day), because of the emphasis placed on the provision of food and drink to visitors and at social occasions, based on the Gusii ideal of sharing food. Women who experienced fuelwood shortages met their needs by requesting friends and relatives help, especially if no alternative free source of fuel, such

as maize cobs was available. This usually involved "the donation of time, labor and produce" (Barnes, 1984). In Hosier's (1984) regional study undertaken in Kenya, the quantity and type of food cooked was found to influence the amount of energy consumed.

## Materials and Methods

### Sample Selection

This study was carried out in Kasgunga West sub-location of Mbita Division, in Homa Bay district, Kenya (formerly part of South Nyanza district) (Appendix B). Forty-five monogamous households were randomly selected. Selection of the households involved using the list of all households in Kasgunga and randomly selecting 5 names from under each headman's jurisdiction or village for equal representation within the sub-location. The sample represented each geographic location: the Hill region, consisted of Gera East, Gera West, and Gera Mix villages: the Lake region, consisted of Nyamarandi, Kamaena, and Waluwi villages; and the Town region consisted of Wakunga, Wasulwa, and Kombe villages.

At the initial meetings, the respondents were asked for their verbal consent after the researcher had explained to them the details and duration of the study, i.e., each respondent would be visited 3 times starting from the month of August 1993 through May 1994. Thirty-three of the respondents were observed for a full day (12-13 hr) while 12 were observed for 24 hours.

Data Collection

After selections, day-long observations and interviews were conducted for each respondent during the Dry, the Rainy, and the Postharvest seasons. Data were collected by the researcher and research assistants from the time the respondents rose in the morning to the time they retired to bed in the evening or until the following morning. Weight of fuelwood collected and used, and that of all food cooked for all members of the household on the sample day was weighed and measured by the researcher and research assistants.

Alternative fuel used and/or bought on the sample day also was weighed or measured. In addition, the cost of bought fuel was recorded in Kenya shillings and the frequencies of collection, daily or by the week, were recorded.

Time allocation data was collected by the researcher using respondent direct observation and every activity, including overlapping activities accounted for to the nearest minute and was later converted into hours.

Protocol

All the fuelwood collected and used, and the weight of all food cooked on each sample day was continuously weighed on a Hanson hanging scale (Forestry Products, Jackson, MS) and recorded to the nearest one-tenth of a pound and also in the number of headloads, the distance to and from collection points was measured and recorded to the nearest one-tenth of a mile using a pedometer (Forestry Products, Jackson, MS), and

time taken by the respondents to collect fuelwood from the time they left the homesteads to the time they returned was recorded to the nearest minute using table clocks. The diameter of fuelwood that split was set at >3 inches.

The weight of alternative fuel bought was also recorded using the hanging scale to the nearest one-tenth of a pound. Crop residue was weighed and kerosene was measured in small containers such as "obabo" a metal can holding 100 ml, and "fanta" 280- 300 ml and "tiritop" at 700 ml if it was sold in the villages and in liters if sold in the township. The charcoal was measured in "gorogoro" a 2 kg container, in a "debe" - a 15-20 kg container, or in a gunny bag and also by weight using a hanging scale.

An individual survey format with close ended questions was used to assess fuelwood availability. The survey instrument (Appendix D) was developed by the researcher, and was pilot tested and revised for precision and then translated into the local dialect and back translated into English to make sure that the translation was correct and that the questions were clear.

Three Hanson hanging scales were used. Two were in constant use and one was used to calibrate the other two daily. The clocks adjusted to the radio clock and the pedometer had an adjustable button. For accuracy the pedometers were adjusted to an average stride length of 2 feet, the average of four women carrying and walking with headloads of fuelwood.

Direct observation method used to collect time allocation data is the method most commonly used by anthropologists to provide a description of the activity patterns, food

habits, and social organization of a study population (Messer, 1990).

Data analysis

Data were entered into Epi Info Version 5; A Word Processing, Data Base, and Statistics System for Microcomputers (Dean et al., 1990) USD, Incorporated, Stone Mountain, GA) and them converted to SAS (SAS, 1988). The relationship between any two variables was determined by Pearson Correlation Coefficients (PROC CORR) according to SAS (SAS, 1988).

Demographics

The sample consisted of 45 women aged between 24-68 years of age. They were housewives except one school teacher and one part time maid. Of the forty five respondents, 20 had never been to school, 12 had 1-4 years of schooling, 10 had 5-8 years of schooling, two had 1-2 years of high school education, and one had completed high school and is a trained elementary school teacher.

Thirty-eight lived in grass thatched huts with mud walls, six lived in mud walls with corrugated iron sheets, and only one had a permanent stone building with a water reservoir. There were nine widows among the respondents, four living alone with their children, and the family sizes ranged from none to eight children per household (Appendix Table IV).

## Results

The relationship (Pearson Correlation Coefficient) between the time spent by respondents collecting fuelwood and amount of fuelwood collected and used, earnings from sale of charcoal, and number of meals cooked is given in Table I. Time spent by respondents on fuelwood collection was significantly and positively correlated to weights of little ($r=0.64$) and big ($r=0.49$) fuelwood collected. Neither weight of little fuelwood used ($r=0.25$) or number of meals cooked ($r=0.26$) was very strongly correlated with time spent by respondents collecting fuelwood (Table I). Earnings from sale of charcoal ($r=0.61$) was positively correlated to time spent on fuelwood collection, and so were time spent on ($r=0.41$) and distance ($r=0.37$) to and from fuelwood collection, respectively (Table I).

Table II shows the relationship between the time spent by respondents on food procurement and preparation, and measures of food, fuelwood and time allocation. Pearson correlation coefficients between time spent by respondents on food consumption and the weight of ugali (main meal), number of meals cooked, and weight of flour milled for ugali were 0.43, 0.38, and 0.24, respectively. The relationship between time spent by respondents on fuelwood collection and total fuelwood used ($r=0.40$), weight of fuelwood used ($r=0.31$), weight of fuelwood collected ($r=0.64$), and total number of headloads of fuelwood used ($r=0.38$) was significant (Table II). Time spent by respondents on leisure and housework were positively related to time spent on food preparation, $r=0.27$ and $r=0.33$, respectively (Table II).

The relationship between time spent by respondents on housing activities and fuelwood collection and utilization, and food consumption is shown in Table III. Pearson correlation coefficient (r) between time spent on housing activities and between weights of big and little fuelwood used were r=0.32 and r=0.31. Weight of big fuelwood collected per day was also positively correlated with time spent on housing (r=0.27) (Table III).

Time spent by respondents on farming activities was only significantly related to number of times uji (porridge) was cooked as the main meal (r=0.20), the number of times the flour for ugali (main dish) was substituted for making uji (r=0.33), and the total time spent collecting water (r=-0.21) (Table VI).

**Discussion**

Results obtained in this study showed that as the time spent on fuelwood collection increased, the time spent on collection of little and big fuelwood singly or together increased significantly. When both little and big fuelwood were put together, the Pearson correlation coefficient increased from r=0.64 for time spent on little fuelwood alone to r=0.69, indicating that the greatest time spent on fuelwood collection was used for collection of little fuelwood. The study also showed that the earnings from sale of charcoal increased significantly as the time spent in fuelwood collection increased (r=0.61). This was possibly due to the fact that greater proportion of woodfuel was used for making charcoal and therefore, more time spent for cutting woodfuel led to

increased charcoal made and ultimately sold. The increased use of woodfuel for charcoal making may also help explain why the relationship between weight of little fuelwood collected (r=0.64) and the time spent on fuelwood collection was greater than the amount of little fuelwood (r=0.25). Number of meals cooked per day was also positively correlated with the time spent on fuelwood collection (r=0.23). The relationship, however was not very highly correlated, possibly because most of the charcoal was sold instead of being used directly for cooking. The mean time (1.7 hr) and distance (3.4 km) to and from fuelwood collection site need clarification. Both include time and distance spent collecting fuelwood and other plant material related cooking fuel which was gathered within and without the homesteads. There also are respondents who did not ever go to collect little and big fuelwood and were exclusively dependent on buying fuelwood and gathering fuel nearby.

In this study, when the amounts of fuelwood collected and used increased, the time spent on food preparation also increased. This is contrary to Evans' Mexico study (1986) which found that lack of fuelwood led to decreased food consumption. However, the weight of little fuelwood collected was more strongly correlated with time spent on food consumption (r=0.62) than the amount (in kg) of little fuelwood (r=0.31) or number of headloads of fuelwood (r=0.38) used for food preparation. Time spent on food consumption was related to amounts of various food items surveyed in this study, such as weight of ugali cooked (r=0.24). In Hosier's (1984) regional study undertaken in Kenya, the quantity and type of food cooked was found to influence the amount of

energy consumed. The small number of meals prepared by the respondents (Ch. 3) may have contributed to the lack of strong relationship between time spent on food preparation and amounts of food used. This is in agreement with Cecelski (1987) who stated that with great food shortages fuelwood availability had little effect on food consumption.

The relationship between time spent by respondents on housework and amounts of fuelwood collected or utilized and with amounts of staple and other foods was significant but not as strongly correlated. The study, however, showed that as the time spent on housework increased the number of times uji (porridge) was cooked decreased ($r=-0.28$). Samanta (1982) found that women's attempts to reallocate labor in the face of competing demands on their time had serious nutritional implications, such as malnutrition, and hampered efforts to tackle problems related to roles as farmers and caretakers of children. Ojiambo (1967) also found similar results. Uji was mostly prepared at home, therefore increase time spent on its preparation may have meant less time available for housework. The relationship between time spent on housework and number of meals cooked ($r=0.30$) and weight of flour used for making ugali ($r=0.27$) was positive despite these being competing activities. This reduction in competition was possibly due to the lower number of meals cooked that meant more time still was available for housework.

Since the same respondents collected and used fuelwood in addition to doing housework, the relationship between time spent on housework and amounts of fuelwood used and collected should have been negative. The results obtained in this study were,

however, positive. This may be due to the little time spent on housework. The decrease in number of meals cooked (Ch.3) meant less fuelwood utilization and this in turn relaxed competition between housework activities and the amount, of fuelwood collected or used. Still the time spent on food consumption increased as time spent on housework increased, possibly because these two activities were usually dove-tailed. The study showed that as time spent on farming activities increased the number of times ugali was substituted for uji and the number of times uji was cooked as a meal increased. This is because of the seasonal effects particularly that of the Rainy season, when most farming was done and also less food was available to respondents and their households. Uji (porridge) was prepared and taken, to the farms for those working there, so its consumption was expected to increase as time spent on farming activities increased as shown in this study but also because of a reduction in the amounts of staple. Time spent on water collection however, was negatively correlated with time spent on farming activities ($r=-0.21$), indicating that the time activities competed for time. But it was observed that women trapped water and collected standing water in the Rainy season (Table IV).

**Summary and Conclusions**

From this study there were both positive and negative correlations found between fuelwood availability, household food consumption and women's time allocation across seasons. Results showed a high correlation between the time spent by respondents

collecting fuelwood and: the amount of fuelwood collected and used, earning from the sale of charcoal, and the number of meals cooked per day. The time spent of food consumption was more highly correlated with weight of little fuelwood collected than with the weight of ugali and the number of meals cooked per day. Time spent on farming and livestock activities was correlated with the number of times uji was used as a main meal and the time spent on housework correlated with the weight of little fuelwood used and the number of meals cooked per day. There were however, activities which were shown to compete for time with each other, such as farming and livestock activities with water collection and housework and the cooking of uji.

The major findings were:

* Food consumption was correlated with the weight of little fuelwood collected and used, and with the weight of ugali cooked

* There was a relationship between fuelwood collection, earnings from the sale of charcoal and the number of meals cooked per day.

* Farming activities were correlated with the number of times uji was taken as a main meal

* Farming and livestock activities were negatively correlated with both housework and the use of uji for main meal

Table I.

Pearson correlation coefficients (r) for relationship between time spent on fuelwood collected and: the amounts of fuelwood collected and used, earnings from the sale of charcoal, the number of meals cooked per day, time taken and distance to and from collection site

| Variable | Mean | Correlation | P-value |
|---|---|---|---|
| Weight of little fuelwood collected today (kg) | 13.4 | 0.64 | 0.0001 |
| Weight of little fuelwood used today (kg) | 4.4 | 0.25 | 0.0035 |
| Weight of big fuelwood collected today (kg) | 2.8 | 0.49 | 0.0001 |
| Combined weight of big and little fuelwood collected today (kg) | 16.2 | 0.69 | 0.0001 |
| Earnings from charcoal (Ksh) | 256.74 | 0.61 | 0.0001 |
| Number of meals cooked per day | 1.6 | 0.26 | 0.0026 |
| Time to and from collection site (hr) | | | |
| Distance to and from collection site (km) | 1.7 | 0.41 | 0.0001 |
| | 3.4 | 0.37 | 0.0001 |

Table II

Pearson correlation coefficients (r) for relationship between time spent on household food consumption and: the number of meals, fuelwood items, and time spent on leisure

| Variable | Mean | Correlation | P-value |
|---|---|---|---|
| Weight of ugali prepared per day (kg) | 2.2 | 0.43 | 0.0001 |
| Combined weight of big and little fuelwood used today (kg) | 5.0 | 0.40 | 0.0001 |
| Number of meals cooked today | 1.61 | 0.38 | 0.0001 |
| Number of headloads of fuelwood used today (kg) | 0.8 | 0.38 | 0.0001 |
| Weight of little fuelwood used per day (kg) | 4.4 | 0.31 | 0.0002 |
| Weight of little fuelwood collected today (kg) | 13.4 | 0.63 | 0.0001 |
| Number of gorogoros milled for ugali this week | 8.50 | 0.24 | 0.0053 |
| Time spent on housework activities (hr) | 4.50 | 0.27 | 0.0014 |
| Time spent on leisure (hr) | 0.3 | 0.33 | 0.0001 |

Table III.

Pearson correlation coefficients (r) for the relationship between time spent on housework and the amounts of fuelwood, the number of meals and the time spent on food consumption

| Variable | Mean | Correlation | P-value |
|---|---|---|---|
| Combined weight of little and big fuelwood used today (kg) | 5.0 | 0.32 | 0.0002 |
| Weight of little used today (kg) | 4.4 | 0.31 | 0.0002 |
| Number of meals cooked today | 1.6 | 0.30 | 0.0004 |
| Number of times uji was made instead of ugali | 2.0 | 0.28 | 0.0011 |
| Weight of big fuelwood collected today (kg) | 2.8 | 0.27 | 0.0012 |
| Number of times uji was made using ugali flour | 4.8 | 0.27 | 0.0015 |
| Time for food consumption (hr) | 3.5 | 0.27 | 0.0014 |

Table IV

Pearson correlation coefficients (r) for the relationship between farming/livestock activities and use of main staple (ugali) and time spent for collecting water

| Variable | Mean | Correlation | P-value |
|---|---|---|---|
| Number of times ugali flour was used to make uji | 4.1 | 0.33 | 0.0001 |
| Number of times uji was made instead of ugali | 2.0 | 0.20 | 0.0172 |
| Time for water collection (hr) | 1.3 | -0.21 | 0.0162 |

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## Overall Summary

The qualitative results of this study show that women know what their problems are and viable solutions to these problems. Respondents perceived the major problems as fuelwood activities, child care, and farming for time allocation; fuelwood inadequacy, too much time spent and long distances covered in regard to fuelwood availability; and the lack of rain, poor harvests, and lack of money for food consumption. The major solutions for fuelwood availability as perceived by women were tree planting on own homesteads or land, whereas, that for food consumption was the leasing and plowing of more land. The major hypothetical coping strategies employed by women when fuelwood was lacking was the use of small fuelwood and the use of crop residue and sisal stumps. For food consumption women borrowed flour and staple, or even go hungry before they borrowed money for the purchase of food.

The quantitative results support most of the problems as perceived by respondents but only some of the perceived qualitative solutions. In fuelwood availability, women were found to use more of the non-wood fuel than fuelwood, and the crop residue was nearly always used in conjunction with little fuelwood. Most of the good quality fuelwood was however, sold as such or in the form of charcoal for much needed cash and alternative fuel use was minimal.

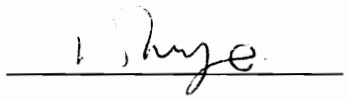
For food consumption, respondents ate less than the national and the WHO/FAO of the daily recommended daily allowances in calories, which may be explained by the women opting to go hungry and by the number of meals missed.

Time allocation was the contradictory one. While respondents claimed that fuelwood activities were the most difficult qualitatively, this task was one of the least important quantitatively. These results perhaps imply that extra caution should be exerted when dealing with either quantitative or qualitative data alone. However, there are interactions and correlations with each variable.

## VITA

Ruphina was born to Martha Atieno Oluoch and Christian Nyawade Awich on July 10, 1955 in Ran'gala, South Ugenya. She attended Madaraka primary school, Thika. High school education was at Loreto Limuru (O-levels) and A-levels at Loreto Msongari, Nairobi - Kenya. On completion she taught Biology in Mombasa, before joining Egerton College, Njoro for a 3-year diploma course.

She worked for several years with the Ministry of Agriculture both with the Research and Extension Divisions in Nakuru District, Rift Valley Province before going for further studies in the USA. She is married to Okeyo Ajuoga and they have four children, Ogaya, Nyawade, Bunge, and Obiero.



Ruphina Nyawade Okeyo

# APPENDICES

Appendix A

Guidelines for qualitative research including coping strategies

PART I

I. Introduction researcher, research team, and supervisor - Dr. Prehm. Respondents introduce themselves.

II. Respondents given brief purpose of research.

III. Women's perceptions and prioritization of daily time allocation activities

1. Respondents were each asked to list (narrate) all activities performed from the time they woke up to the time they retired to bed, while the researcher recorded each respondent's answers on a manila paper, (each of the nine groups had its own paper)

2. Each respondent was then asked to vote for the three most difficult activities performed daily by "paying" themselves using ten-cent-piece coins. Q. If you were to be paid for your daily activities which three would you ask the most money for starting with the most difficult to the least difficult?

3. Each "voted" for the most difficult, then respondents were given a chance to "vote" for the second, and third

IV. Women's perceptions and prioritization of problems and solutions of fuelwood availability

1. Respondents were asked as a group to list (narrate) all problems related to fuelwood starting with the greatest to the smallest problem

2. Then respondents were asked to give solutions for each prioritized problem

V. Women's perceptions and prioritization of problems and solutions of household food consumption

1. Respondents were asked as a group to list (narrate) all problems related to household food consumption starting with the greatest to the smallest problem

2. Then respondents were asked to give solutions for each prioritized problem

PART II

Women's coping strategies

| Fuelwood availability | Food consumption |
|---|---|
| What is the first thing you would do if you had no fuel to cook for your family?<br>1.<br>2. next?<br>3. then? | What is the first thing you would do if you had no food to cook for your family?<br>1.<br>2. next?<br>3. then? |
| What is the first thing you would do if you had little fuelwood to cook for your family?<br>1.<br>2. next?<br>3. then? | What is the first thing you would do if you had little food to cook for your family?<br>1.<br>2. next?<br>3. then? |
| What is the best solution to the fuelwood problems in this location?<br>1.<br>2.<br>3. | What is the best solution to the food problems in this location?<br>1.<br>2.<br>3. |
| What would you do if you all had no time to cook but the fuelwood was plentiful? | What would you do if you all had no time to cook but the fuelwood was plentiful? |

Observations

Appendix B

Manila paper format for taking down qualitative data answers
Respondent's ranking of time allocation activities, fuelwood availability, and household food consumption

| Time allocation/ daily activities | Fuelwood problems | Fuelwood solutions | Food problems | Food solutions |
|---|---|---|---|---|

Related observations and Comments made by respondents

# Appendix C

## Site Maps

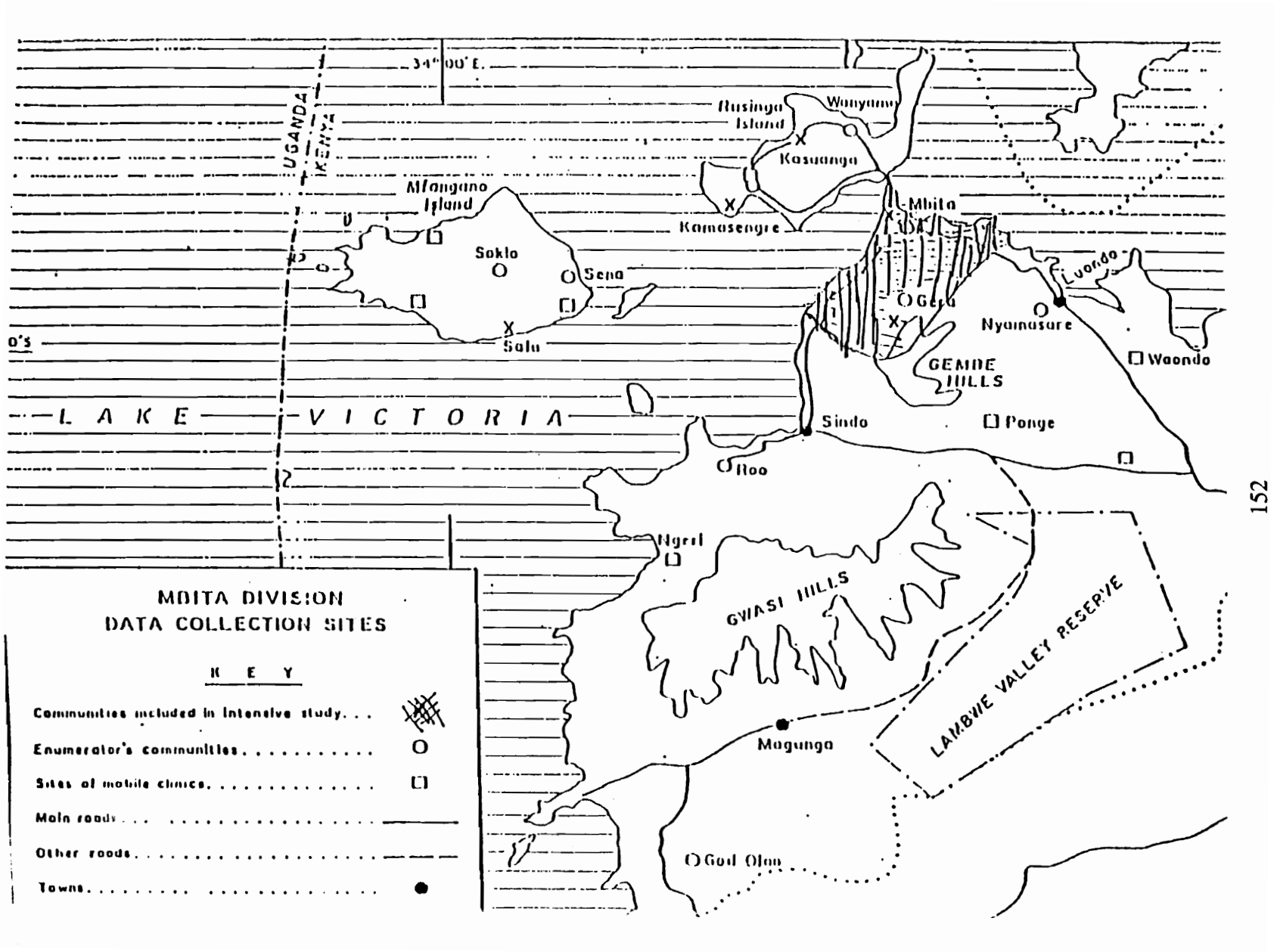
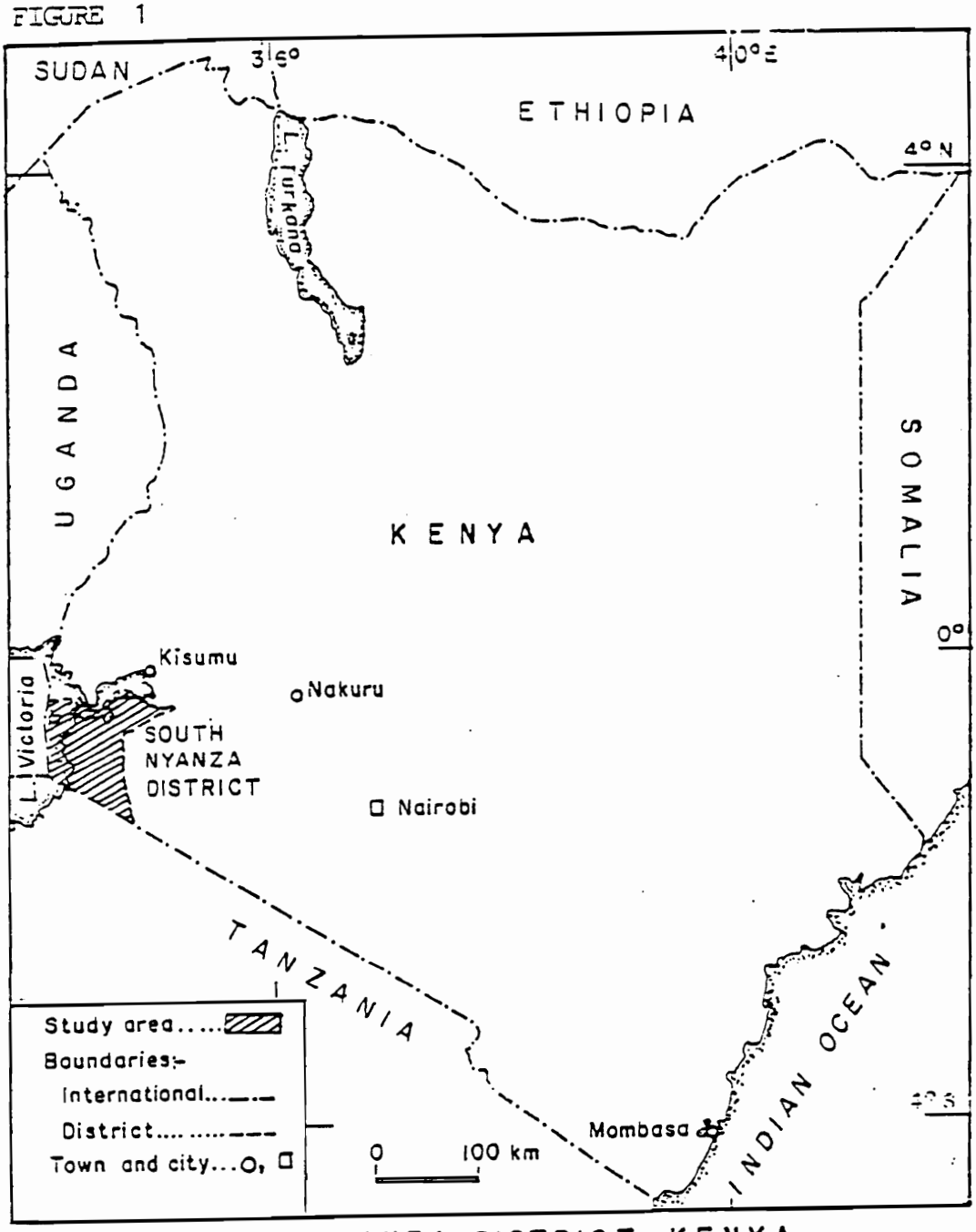

34° 00' E.
UGANDA
KENYA
Rusinga Island
Wanyama
Kasuanga
Mfangano Island
Kamasengre
Mbita
Soklo
Sena
Luanda
Gera
Nyamasare
Waondo
Sala
GEMBE HILLS
LAKE VICTORIA
Sindo
Ponge
Roo
Ngeri
GWASI HILLS
LAMBWE VALLEY RESERVE
Magunga
Got Olon
MBITA DIVISION
DATA COLLECTION SITES
K E Y
Communities included in intensive study...
Enumerator's communities.....
Sites of mobile clinics.....
Main roads.....
Other roads.....
Towns.....

FIGURE 1




SOUTH NYANZA DISTRICT, KENYA

Appendix D

Questionnaire for the Quantitative Assessment of
Fuelwood Availability, Household food Consumption, and
Women's Time Allocation

Date --/--/--
Enumerator's name .....
Household code No: - - - - -

I. Demographics

1. Village name .....
2. Name of head of household.....
3. Respondent's name.....
4. Number of all household members living with you _ _
   Number of adults _ _
   Total number of children _ _
   Children <1 year old _ _
   Children ages 1-6 _ _
   Children ages 7-13 _ _
   Children ages 14-19 _ _
   Children ages >20 _ _

II. Fuelwood availability

N.B. 1) Fuelwood to be used on sample day to be weighed on the previous evening. 2) Week = the 7 days prior to sample day. 3) Today = sample day.

1. The number of days the respondent collected fuelwood this past week ____

2. The number of days children collected fuelwood this past week ____

3. The number of headloads of fuelwood collected this past week for;
   cooking _____
   making charcoal for home use ____
   making charcoal for sale ____
   fuelwood for sale ____
   ceremonial ____
   Other ____, specify .....

4. Number of headloads of fuelwood bought this past week ____ (No.)

5. Cost of bought fuelwood this past week ____ (Sh.)

6. Number of headloads of fuelwood bought today ____ (No.)

7. Cost of bought fuelwood today ____ (Sh.)

8. Number of headloads of fuelwood used today ____ (No.)

9. Amount of alternative fuel used today: (circle one)
   kerosene ____ obabo/fanta/tiritop
   charcoal ____ gorogoro/debe/gunia
   Other ____, Specify .....

10. Cost of alternative fuel bought today:
   kerosene ____ (Sh.)
   charcoal ____ (Sh.)
   Other ____, specify .....

11. Do you have a fuelwood problem? (Circle one)
   Yes ____ No ____
   Why? .....

Observed and/or measured:

12. Amounts of agricultural residue used today:
   1. plant stalks/straw ____ (lb.)
   2. sorghum/millet heads ____ (lb.)
   3. groundnut husks ____ (lb.)
   4. Sisal hemp ____ (lb.)
   5. little fuelwood (<3 inches diameter) ____ (lb.)
   6. big fuelwood (>3 inches in diameter) ____ (lb.)
   7. Dung ____ (lb.)
   8. Other ____, specify ..... (lb.)

13. Do you use agricultural crop residue in the postharvest season?
   Yes ____ No ____

14. Number of meals cooked using plant material fuel other than fuelwood
   None ____

One ____
Two ____
Other ____, specify .....

15. Was breakfast cooked this morning?
Yes ____ No ____

16. Distance to and from fuelwood collection site (read from pedometer) _____ (miles)

17. Time taken to and from fuelwood collection site ____ (min.)

18. Weight of bought fuelwood today ____ (lb.)

19. Weight of collected fuelwood today:
1. big fuelwood ____ (lb.)
2. little fuelwood ____ (lb.)
for: 3. cooking ____ (lb.)
4. home use charcoal ____ (lb.)
5. charcoal for sale ____ (lb.)
6. smoking fish ____ (lb.)
7. ceremonial ____ (lb.)
8. Other ____, specify .....

20. Weight of borrowed fuelwood today ____ (lb.)

21. Number of headloads of fuelwood sold today ____ (No.)

22. Earnings from the sale of fuel this past week:
1. fuelwood ____ (Sh.)
2. charcoal ____ (Sh.)
3. dung ____ (Sh.)

III. Household food consumption

1. Number of gorogoros of staple milled for ugali this past week ____ (No.)

2. Number of gorogoros of staple milled for uji this past week ____ (No.)

3. Number of gorogoros of ugali staple bought this past week ____ (No.)

4. Number of gorogoros of uji staple bought this past week ____ (No.)

5. Is this number of gorogoro of staple sufficient for you and your household?

   Yes ____ No ____

6. Additional number of gorogoros considered sufficient for the week?

   ____

7. Amount of money used for buying staple this past week ____ (Sh.)

8. Type of staple milled for ugali this past week (circle one)
   1. maize
   2. sorghum
   3. millet
   4. maize/cassava
   5. millet/cassava
   6. maize/cassava/sorghum
   7. none
   8. Other, specify .....

9. Type of staple milled for uji this past week (circle one)
   1. maize
   2. sorghum
   3. millet
   4. maize/cassava
   5. millet/cassava
   6. maize/cassava/sorghum
   7. none
   8. Other, specify .....

10. Number of times ugali flour was used to make uji ____ (No.)

11. Number of times uji was cooked as a main meal this past week ____ (No.)

12. Type of staple milled for ugali today (circle one)
   1. maize
   2. sorghum
   3. millet

4. maize/cassava
5. millet/cassava
6. maize/cassava/sorghum
7. none
8. Other, specify .....

13. Type of staple milled for uji today (circle one)
    1. maize
    2. sorghum
    3. millet
    4. maize/cassava
    5. millet/cassava
    6. maize/cassava/sorghum
    7. none
    8. Other, specify .....

14. Total cost of staple today ____ (Sh.)

15. Cost of milling staple today ____ (Sh.)

16. Weight of borrowed staple ____ (lb.)

17. Amount of money used to buy stewing foods today
    1. fish ____ (Sh.) type .....
    2. omena ____ (Sh.) type .....
    3. vegetables ____ (Sh.) type .....
    4. meat (beef) ____ (Sh.)
    5. Other _____ (Sh.), specify .....

18. Source of staple this season (circle all sources)
    1. granary/own
    2. market
    3. borrowed
    4. Other, specify .....

19. Date of planting
    1. January
    2. February
    3. 1-15 March
    4. 16-31 March
    5. April
    6. May
    7. June

20. Amount harvested this year
    1. Nothing
    2. 1-10 gorogoro
    3. 11-20 gorogoro
    4. >20 gorogoro
    5. 1-5 sacks (90 kg - gunny bags)
    6. 1-2 granaries
    7. Other, specify .....

21. How long will this harvest last?
    1. 1-10 days
    2. 2-4 weeks
    3. 1-2 months
    4. 3-4 months
    5. Other, specify .....

22. Will this harvest feed you till the next harvest?
    Yes ____ No ____

23. Estimate the amount of staple that is sufficient for your household for a year ____ granaries/gorogoros/sacks (specify units)

24. What seasons do you buy staple? (circle one)
    1. Postharvest
    2. Dry
    3. Rainy

Observed and/or measured

25. Number of meals cooked today ____ (No.)

26. Weight of flour used for making ugali today
    lunch ____ (lb.)
    dinner ____ (lb.)
    Total ____ (lb.)

27. Weight of stewing foods today
    lunch ____ (lb.)
    dinner ____ (lb.)
    total ____ (lb.)

28. Weight of flour used for making uji today
    lunch ____ (lb.) dinner ____ (lb.) total ____ (lb.)

TABLE I

Fuelwood and charcoal use by different sectors

Source: MOERD, 1986

| | National consumption (%) | |
|---|---|---|
| Sector | Fuelwood | Charcoal |
| Rural households | 74 | 36 |
| Urban households | 1 | 45 |
| Informal industry | 15 | 17 |
| Large industry | 8 | 0 |
| Institutions | 1 | 1 |

MOERD = Ministry of Energy and Regional Development, Kenya

TABLE II

Demographics

| Age (yr) | Years in school | Type of housing |
|---|---|---|
| 24-68 | 20 with 0 years | 38, grass/thatch |
| | 12 with 1-4 years | 6, mud/iron roof |
| | 10 with 5-8 years | 1, stone house |
| | 2 with 1-2 high school years | |
| | 1 school teacher | |

TABLE III

Mean rainfall figures (mm) in Mbita

| Month | 1993 Rainfall (mm) | 1994 Rainfall (mm) |
|---|---|---|
| January | 336.44 | 20.50 |
| February | 92.98 | 21.13 |
| March | 72.10 | 392.74 |
| April | 207.30 | 208.37 |
| May | 509.53 | 151.45 |
| June | 177.23 | 44.94 |
| July | 0.00 | 40.50 |
| August | 25.40 | 14.75 |
| September | 39.65 | 0.00 |
| October | 30.85 | |
| November | 94.64 | |
| December | 122.10 | |

Source: ICIPE Weather station - Mbita field station

TABLE IV

Consumption units conversion factors

Source: FAO/WHO (1985)

| Age (years) | Females | Males |
|---|---|---|
| <1 | 0.3 | 0.3 |
| 1-6 | 0.5 | 0.5 |
| 7-13 | 0.7 | 0.7 |
| 14-19 | 0.9 | 0.9 |
| 20-59 | 0.9 | 1.0 |
| >59 | 0.7 | 0.9 |

## Glossary

| | |
|---|---|
| **Staple** | Cereal grain, such as sorghum, millet, maize, usually blended with cassava (manioc) tuber and ground into flour. |
| **Uji** | Gruel, porridge, mush |
| **Ugali** | Stiff porridge made out of flour |
| **Gorogoro** | A 2 kg measuring unit |
| **Baraza** | Chief's meeting |
| **Meal** | Eaten between noon and late afternoon, or in the evening. Therefore, breakfast not considered a main meal |