HOUSEHOLD FOOD INSECURITY IN KENYA'S SEMI ARID LANDS: UNDERPINNING, INCIDENCES AND COPING STRATEGIES

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December 2003

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‘‘Unless Africans are careful, many people are going to starve to death before our eyes. We in Europe shall see them die shamelessly on our television sets.... We shall soon be surrounded by a sea of starving and begging faces, involving millions of people desperately scrambling to be fed on aid...." **Snow, C.P. (in K'Okul, 1995)**

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ACKNOWLEDGEMENT

This study received support from International Food Policy Research Institute (IFPRI) at two levels, financial and intellectual. Financially, 2020 Vision Network for East Africa, which is coordinated by IFPRI, funded the research. We wish to thank the head of the IFPRI 2020 Vision initiative, Ms. Rajul Pandya-Lorch. We are also grateful to the invaluable support accorded to us by the IFPRI Network Country Coordinator (Kenya) for the IFPRI 2020 Vision Initiative for Food, Agriculture, and the Environment, Dr. Hezron Nyangito.

At intellectual level, we wish to thank IFPRI for providing the opportunity to present the research proposal and preliminary results of this study. The comments and suggestions received greatly improved the quality of the study. We recognize Dr. Suresh Babu, Dr. Steve Were Omamo (both of IFPRI), Mr. S. Oyombe (CBS) and Kisilu Kitainge of RMIT University, Melbourne, Australia for the technical support rendered at different stages as we went through the study. Ms. Valerie Rhoe of IFPRI was always available for us with all the reading materials needed. We also sincerely appreciate the useful comments by our anonymous reviewer.

We also appreciate the time afforded to us by our respondents in the three districts (Makueni, Kitui and Mbeere) covered by the study.

Though so many people contributed to this study, we remain fully and exclusively responsible for the ideas and views expressed.

ACRONYMS

AHFSI	The Aggregate Household Food Security Index
ANOVA	Analysis of Variance
ASAL(s)	Arid and Semi Arid Land(s)
CBO(s)	Community Based Organization(s)
CBS	Central Bureau of Statistics
FAO	Food and Agriculture Organization
FEWS	Famine Early Warning Systems
GDP	Gross Domestic Product
IFAD	International Fund for Agriculture & Development
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
KEFRI	Kenya Forestry Research Institute
KIPPRA	Kenya Institute of Public Policy Research and Analysis
NCPB	National Cereal and Produce Board
NGO(s)	Non-Governmental Organization(s)
Exchange Rate	KShs. 78 = 1 US$

SUMMARY

Most developing countries, if not all, are grappling with the challenge of poverty as spelt out in their economic policy currently. Particularly in Sub-Saharan Africa, poverty will not be deemed eradicated or even alleviated if the intricate issue of food insecurity is not resolved first. Food insecurity refers to the incidence whereby people not only live with hunger but also under starvation. Any nation that claims to be active in the fight against food insecurity cannot claim to have won the battle unless food is widely available to majority, if not all, and citizens can afford and access it whenever in need.

In spite of relatively good harvest and good harvest -potential, rural households in semi-arid lands are often unable to meet their food requirements for the whole year. The situation of food insecurity in semi-arid lands is mostly transitory in nature. It is therefore not unusual to find households going without food, not too long after a good harvest.

The main objective of this study was to identify and analyze the incidence, causes and effects of seasonal variations in food supply leading to relative and absolute food shortage in arid and semi arid areas in Kenya.

This study adopted an exploratory design. A stratified sample of 300 households based on agro-ecological zones, was drawn from Kitui, Makueni, and Mbeere districts. The study area represents more than 40 percent of Kenya's semi-arid lands. The area also presents interesting mix of both ecological and cultural diversity. Such diversity provides insights into food security experiences and coping mechanisms.

From the study, crop diseases and destructive pests emerge as some of the causes of transitory food insecurity. The failure of the government to implement sound policies on marketing of farm output, credit access, and technical services was also found to contribute significantly to food insecurity in semi-arid lands. Other factors contributing to food insecurity include poor farm implements, inefficient and exploitative marketing channels, poor soils, limited alternative sources of livelihood, and weather related problems.

The findings also indicate that the forces creating transitory food insecurity in semi-arid lands take economic as well as social dimensions. The incidence of transitory food insecurity is not the

outcome of the failure of the farmer alone. Food insecurity reflects outcomes of resource allocation, within a national policy environment, that are made by community members jointly and severally.

Based on the findings it is evident that most of the causes of food insecurity are reversible. It is therefore recommended that the government in collaboration with other stakeholders should consider the following strategic options when designing a food security policy for semi-arid lands communities in Kenya:

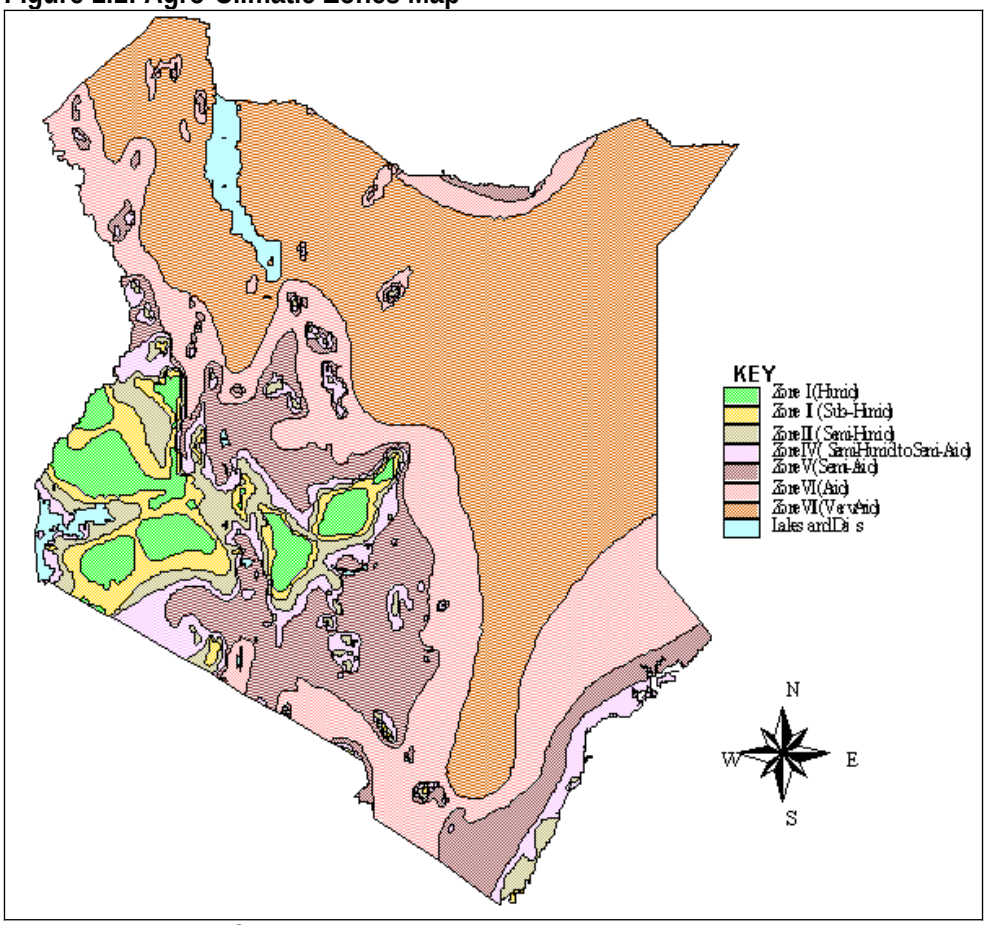
- Revive technical support services to rural farmers in order to improve crop husbandry and livestock management.
- Encourage crop diversification.
- Establish community cereal banks to improve storage of cereals and stabilize market forces.
- Subsidize the cost of social services especially education and health in semi-arid lands communities to ease pressure on limited household resources.
- Research on the control of destructive large grain stock borer that is prevalent in semi-arid lands.
- Strengthen chemicals standards institutions to guard against sale of ineffective insecticides.
- Formalize and regulate sustainable charcoal burning as an option to economically empower rural households.

1.0 INTRODUCTION

1.1 Background

Food insecurity among Kenyan communities has been an issue of concern to scholars, farmers, and policy makers. It has been attributed to declining productivity levels, owing to insufficient rainfalls, inefficient farming systems and soil degradation. Over the years the Kenya government has adopted several policies to check the situation ranging from introduction of agricultural extension services to establishing stabilizing cereal boards. Unfortunately, the country has proved incapable of matching food production to the growing population. Subsequently food shortages have not only caused a general deterioration of institutional stability, but have also resulted in increased food imports and food aid. It is in the arid and semi-arid lands, which form 80 percent of Kenyan land, where the problem of food insecurity is more acute (figure 1.1).

Figure 1.1: Agro-Climatic Zones Map



Source: Survey of Kenya

The arid areas receive less than 250 mm of rainfall while semi-arid areas receive between 250 and 800 mm annually. In Agronomical terms, ASALs are prone to cyclic episodes of drought, flood, famine, diseases and inadequate production activities. Soils in ASALs are shallow often 50-100 cm thick. Rates of soil formation are low. The soils also have low organic matter (2 percent) and have low amounts of Nitrogen, Phosphorus and Sulphur. Although population density in ASALs is low (varying between 2 and 30 persons per Km^2), population growth rates remain high, with an average rate of about 3.5 percent per

annum. The rapid growth in ASALs population is derived both from natural growth as well as emigration from the densely populated, but high potential agro-ecological zones.

Majority of ASALs inhabitants are small-scale subsistence farmers engaged in crop production and livestock keeping. The major food crops are maize, beans, cowpeas, pigeon peas, millet, and sorghum.

Cases of malnutrition and nutrition deficiency related diseases are common in the ASALs. According to medical reports, mortality rates in ASALs among the zero-to-five age group are high and above national averages, sometimes exceeding 123 per 1000.

The living standards for majority of ASAL people are generally low. The situation has in many cases been attributed to the fact that recurrent droughts limit agricultural potential not only in the production of food crops but also cash crops. These regions also lack alternative income generating activities and intra-district employment opportunities. The ASALs suffer from near exclusion from mainstream modern economic activity. They are considered marginal to the priority development interests of most governments in the resource strapped developing world.

This study was undertaken to gain insights into household transitory food insecurity in semi arid lands in Kenya. The study is motivated by the fact that despite many studies and efforts by the government and other concerned parties to address food security issues in semi arid lands, getting a lasting solution has been elusive. Several factors have been cited as possible reasons for vulnerability to food insecurity. These include unreliable rainfall patterns, declining soil fertility, pests and diseases, lack of access to land by some potential producers, low commodity prices, reliance on traditional methods of production such as use of unimproved seeds and use of the hand hoe, and poor extension services. While many of these factors may affect the level of production in semi arid lands, no study has been done to determine which ones are critical than others. Yet, policy formulation and intervention must be guided by empirical findings. There are fears that if a lasting solution to transitory food insecurity is not found on time, repeated seasonal food insecurity would deplete the economic base of semi arid communities, exposing them to chronic food insecurity.

Results of the study are expected to provide information that will guide economic planners and policy makers in their effort to develop interventions programs and formulate policies that will ultimately lead to semi arid households food security.

This paper is organized as follows: Section one contains a background of the study, which describes the challenges faced by semi arid lands households. Section two presents the objectives of the study. Study methodology is presented in section three which highlights design, sampling and methods of data collection. Section four covers results and discussions while section five zeroes in on conclusion and policy recommendations.

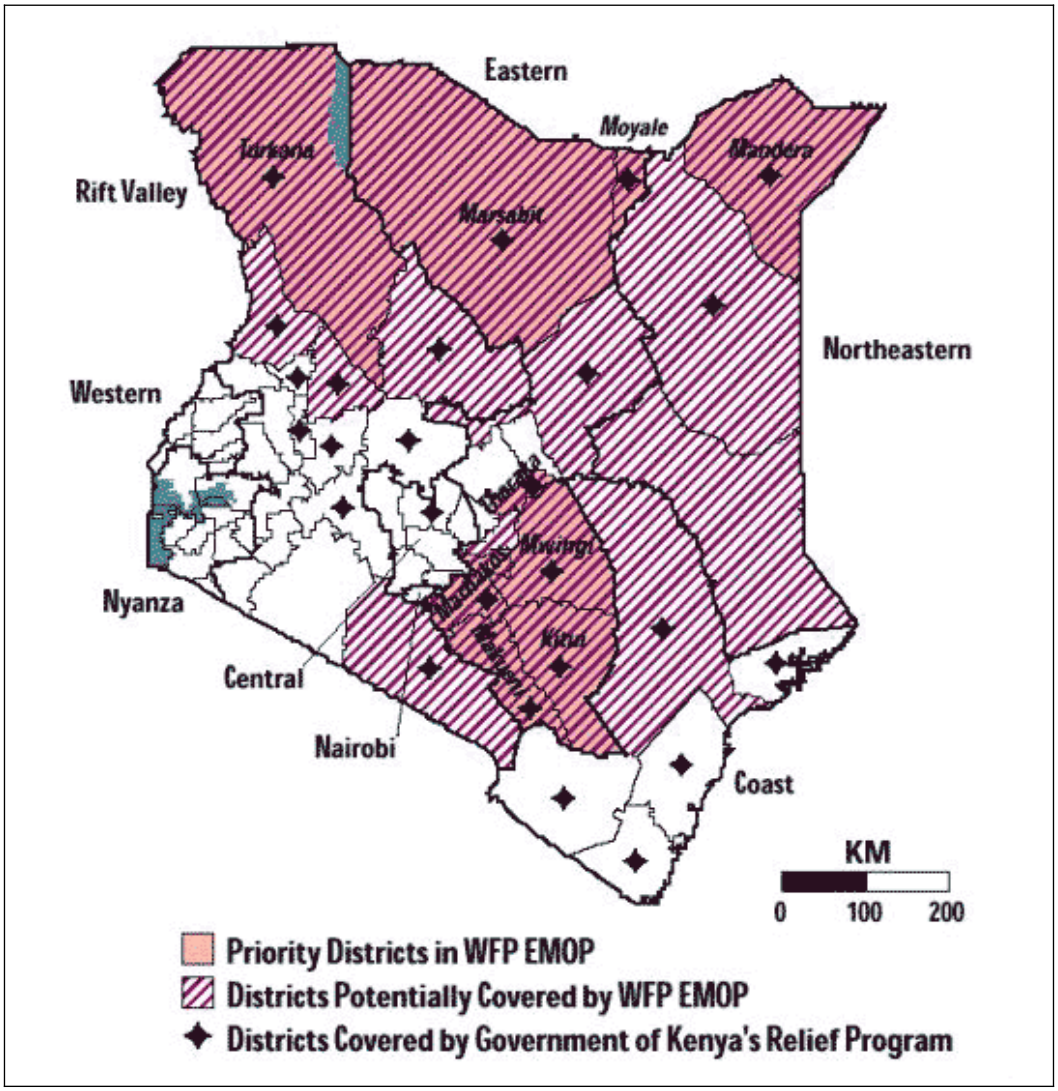
1.2 Food Security in Kenya

The concept of food security is as wide as its causes. The interpretation of the term has evolved over the years from simply preoccupation with international supplies of food to national self-sufficiency to include household ability to feed itself. A generally accepted definition of food security is a situation in which households at all times have access to

adequate quantities of safe and nutritious food to lead a healthy and active life (Lynton-Evans, 1997; FAO, 1997; Ayalew, M., 1996; Kigutha 1995; Ayelew 1988), and when households are not at undue risk of losing such access (Von Braun et al, 1998, Bahiigwa 1999). This definition is generally acceptable, because it has the three critical aspects (availability, access and risk). Access refers to the ability to obtain the necessary food, either through own production or purchasing from the market. Risk arises from fluctuations in production or income. In semi arid lands context, given that the majority of households depend on own production, the risk is associated more with fluctuations in production than from income because very little of what they consume is purchased.

Despite the availability of potential to increase food production, Kenya has been experiencing low outputs and shortages which have become endemic and severe enough to put the country in the list of food crisis countries (see figure 1.2). This is contrary to the trend nurtured during the 1960's and 70's with rapid adoption of innovations availed by the `Green Revolution'.

Figure 1.2: Food Insecure Districts in Kenya



Source: FEWS/Kenya, FEWS, March 2000

It is also worthy noting that food insecurity is a problem across the African continent. The Food and Agriculture Organization (FAO 1995) reports that, two-thirds of all countries experiencing food insecurity are in Africa. Of the 44 countries with poor or critical food security, 30 are in Africa. Present trends reveal that the number of chronically undernourished in Sub-Saharan Africa may rise from 180 to 300 million by the year 2010.

FAO has also incorporated the three elements of its broadened concept of food security - availability, stability of supply and access - into an index of household food security. The Aggregate Household Food Security Index (AHFSI) calculates the *food gap* between the undernourished and average national requirements, the instability of the annual food supply and the proportion of undernourished in the total population.

Based on this index, Kenya ranked 51 out of 61 countries with an AHFS Index of 71.7. Poverty and vulnerability assessments indicate that 56 percent of the population lives in absolute poverty. Vulnerability to food insecurity is highest among the pastoralists and the small-scale agriculturalists in the arid and semi-arid lands (ASALs) of the country. Additionally about 25 percent of the urban population falls below the poverty line.

Food insecure households are usually categorised into two groups, those who are chronically food insecure and those who are transitory food insecure. The chronically food insecure include those sectors of the population which lack adequate income and other resources at the household level to produce or otherwise gain access to the basic food needs of the household. Transitory food insecurity is a temporary decline in household's access to enough food. The transitory food insecure households are those that, under normal circumstances, are able to produce or gain access to their basic food needs but are vulnerable to supply problems when external shocks affect their food production systems or distribution chains for a limited period of time. In the case of semi-arid lands, local prices rise during the dry season and food is continuously available at high prices. But the majority of the households cannot afford it, simply because they lack purchasing power.

It is also important to note that both chronic and transitory problems of food insecurity are severe in Kenya. Close to about 43 percent of Kenyans are undernourished (1996/98), slightly down from 47 percent in 1990/92 (FAO, 2000). Chronic food insecurity exists due to the high ratio of urban unemployment and limitations of rural land holdings. In most of these cases, more than one third of the households' farm in less than 0.5 hectares which under rain-fed agriculture is inadequate to generate full subsistence. On the other side, there is transitory food insecurity arising from drought, displacement of people, and refugee inflows.

The rural poor especially those with smaller land holdings, and a weaker resource base are more often vulnerable to food stress than wealthier households and suffer earlier than the rest when food shortages strike. This category has traditionally relied upon agricultural based savings in terms of food stocks. When these households deplete their stocks long before the next harvest, the availability of wage employment becomes vital for their survival. However, wage employment especially in the rural areas is usually scarce and seasonal.

1.4 Conceptual Framework

Generally less than a third of Kenyan land is available for crop production and livestock farming while the rest consists largely of Arid and Semi-Arid Lands (ASALs). Communities living in arid lands are generally pastoral, prone to drought and are vulnerable to chronic food insecurity. In semi arid lands, live settled agro-pastoral communities that are prone to transitory food insecurity owing to fluctuations in crop production.

This study mainly focuses on the semi arid lands of Kenya. Decreasing land sizes due to increasing population pressure in semi arid lands has reduced the importance of livestock as an insurance inventory safeguarding households from fluctuations in production. It has for long been hypothesized that households in African semi-arid tropics keep livestock as a buffer stock to insulate their consumption from fluctuations in production (Binswanger and McIntire (1987), Bromley and Chavas (1989). A study by Fafchamps et al (1996) establishes that that there seems to be little relation between cattle transactions and rainfall shocks, but a weak negative correlation exists between small stock net purchases and rainfall[1]. Therefore, food security in semi arid lands is related to own crop production and ability to buy incase of food supplies shortfalls.

To conceptualize transitory food insecurity semi arid lands, it is imperative to comprehend the underlying causes of food insecurity in general (figure 1.3). While food crisis in Kenya is always attributed to climatic and environmental conditions, there are other equally important factors. These factors include declining soil fertility, pests and diseases, lack of access to land by some potential producers, low commodity prices, reliance on obsolete farming methods of production such as use of unimproved seeds and use of the hand hoe, and poor extension services (Bahiigwa 1999).

Grain losses, both before and after harvest, greatly influence households' food security status. For example, the damage caused by weevils upon grains both on farm and post harvest storage has significantly contributed to food insecurity since 1996.

There is widespread evidence revealing a strong link between food insecurity and poverty. This relationship is founded on the natural and technological resource base on which most agriculture is done in sub-Saharan Africa. It is estimated that soil degradation has affected 65 percent of the agricultural lands in Africa, while 39 percent of the land suffer from acute deforestation. Whereas these natural constraints have been systematically addressed in developed economies, little has been achieved in poor countries due to under-investment in agricultural research (Haddad, 1997).

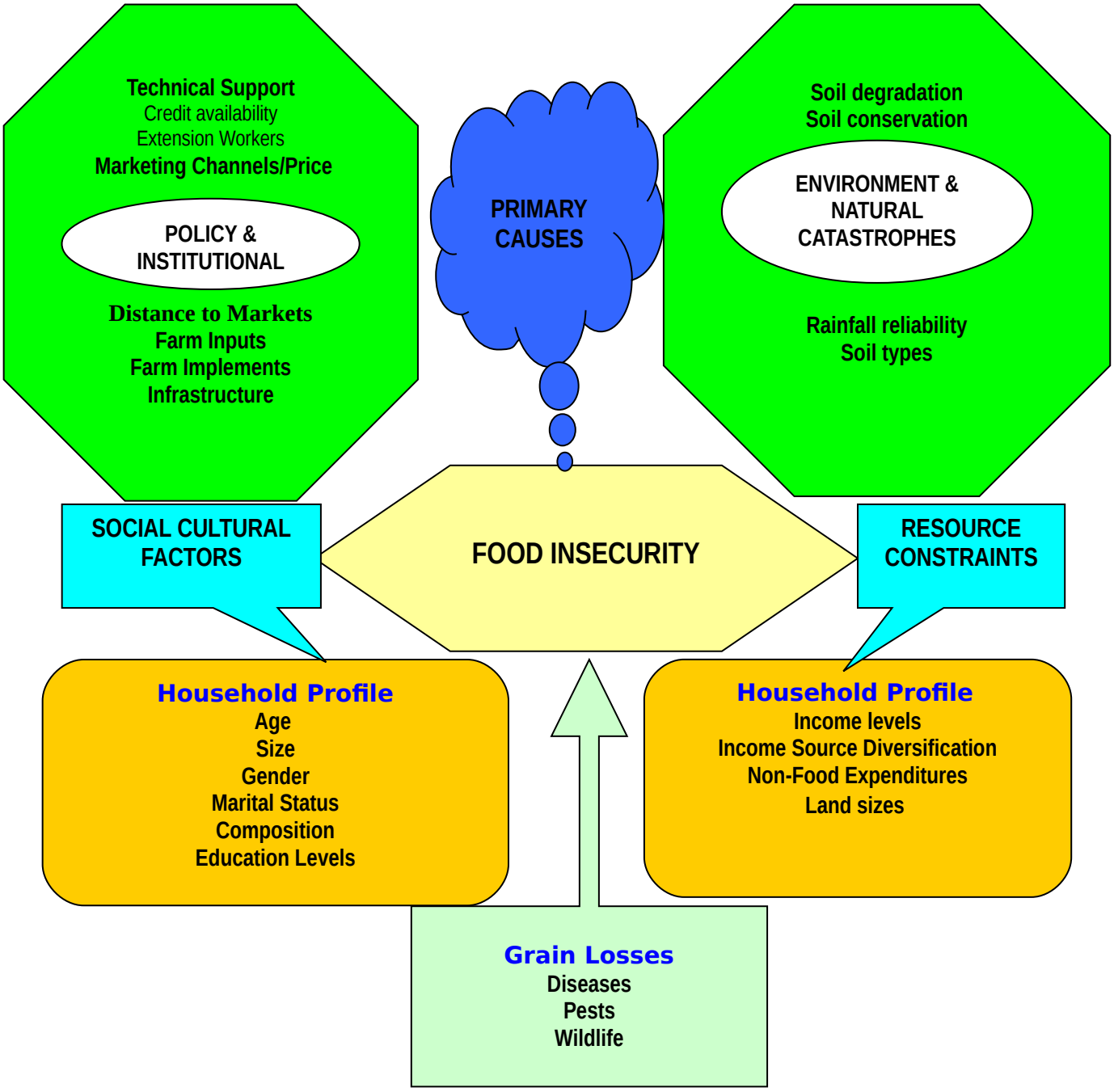
Land remains the basis for the production of food and raw materials. However, increasing scarcity of arable land coupled with rapid population growth and strong land inheritance traditions (leading to rapid fragmentation of land) has reduced landholdings to uneconomical sizes, thus exposing rural households to food insecurity. It is important to note that the same piece of land can produce varying income depending on the crop enterprise mix, intensity of land use and technology employed. Lack of secure land

[1] There doesn't seem to exist formal tests, which show that livestock inventories are used to smooth income fluctuations in Africa.

tenure acts as a disincentive to adopting environmentally sound agricultural practices. Access to land ownership is critical in motivating investment in soil conservation.

Non-food expenditure levels are also thought to influence the household food security. Given the limited alternative sources of income, households have no choice but to sell their hard earned cereals and livestock (including draught animals) to pay school fees and meet medical expenses.

Figure 1.3: Conceptual Framework[2]



[2] Adapted from Von Braun et al (1998) with modification from the authors based on literature review

2.0 STUDY OBJECTIVES AND RATIONALE

2.1 Study Objectives

This research sought to identify and analyze the incidence, causes, and effects of seasonal variations in food supply leading to relative and absolute food shortage in semi arid lands of Kenya. With this scope, the specific objectives of the study are as follows:

- Identify factors causing household transitory food insecurity semi arid lands in Kenya;
- Explain the observed households' non-optimization behaviour in production and disposal of produce;
- Identify existing food insecurity coping mechanisms among the semi arid households; and
- Suggest policy strategies, based on research findings that would lead to sustainable solution to transitory food security in semi arid areas.

2.2 Rationale of the Study

Literature attributes food insecurity to the declining production levels associated with the inherent difficulties of farming on fragile soils, the growing demand for more food, lack of more arable land, and a labyrinth of political, technical and structural constraints (Omosa, 1996). To counter this, Kenya’s government policies have endeavored to adopt strategies that can enhance production, namely: use of hybrid seeds, widespread application of fertilizers and insecticides, irrigation farming and intensified on-station research and subsequent dissemination of results to farmers. In spite of these efforts, achieving food security for communities living in Semi-Arid lands has remained an elusive goal.

It appears that other than climatic conditions, there are other factors that determine the degree to which households are exposed to seasonal fluctuations in food availability. This study attempts to appreciate food insecurity situation in semi arid land and to isolate the factors that are more critical in explaining food insecurity in these area. Results from the study are expected to provide useful information to aid policy formulation and intervention geared towards addressing transitory food insecurity in semi arid lands.

The study is also necessary because if a lasting solution to the problem of transitory food insecurity is not found on time, repeated seasonal food insecurity will deplete the assets of the semi arid communities, making them vulnerable to higher levels of food insecurity. Although transitory food insecurity is temporary, a critical intervention is needed to ensure that it does not evolve to chronic food insecurity.

3.0 DATA COLLECTION AND ANALYTICAL METHODOLOGY

3.1 Data Collection

This is a quantitative social survey and adopts cross-sectional[3] design. The construction of the survey instruments was done in two stages. The first was a literature search on manifestations of food insecurity and coping mechanisms. The second stage involved reconnaissance visits and formal survey with use of questionnaires by a team of three enumerators and the researchers.

The study sample was drawn from three semi arid districts of Kenya namely, Kitui, Makueni, and Mbeere. These districts represent more than 40 percent of Kenya's semi arid lands and present some interesting mix of both ecological and cultural diversity. Quasi-random sampling methods were applied in the formal survey to ensure external validity of the results. First, a multi-stage sampling method was used to identify the districts and divisions to be include in the sample. This was because construction of a full sampling frame of households living in semi arid lands in Kenya was not feasible in terms of prohibitive cost and time constraint.

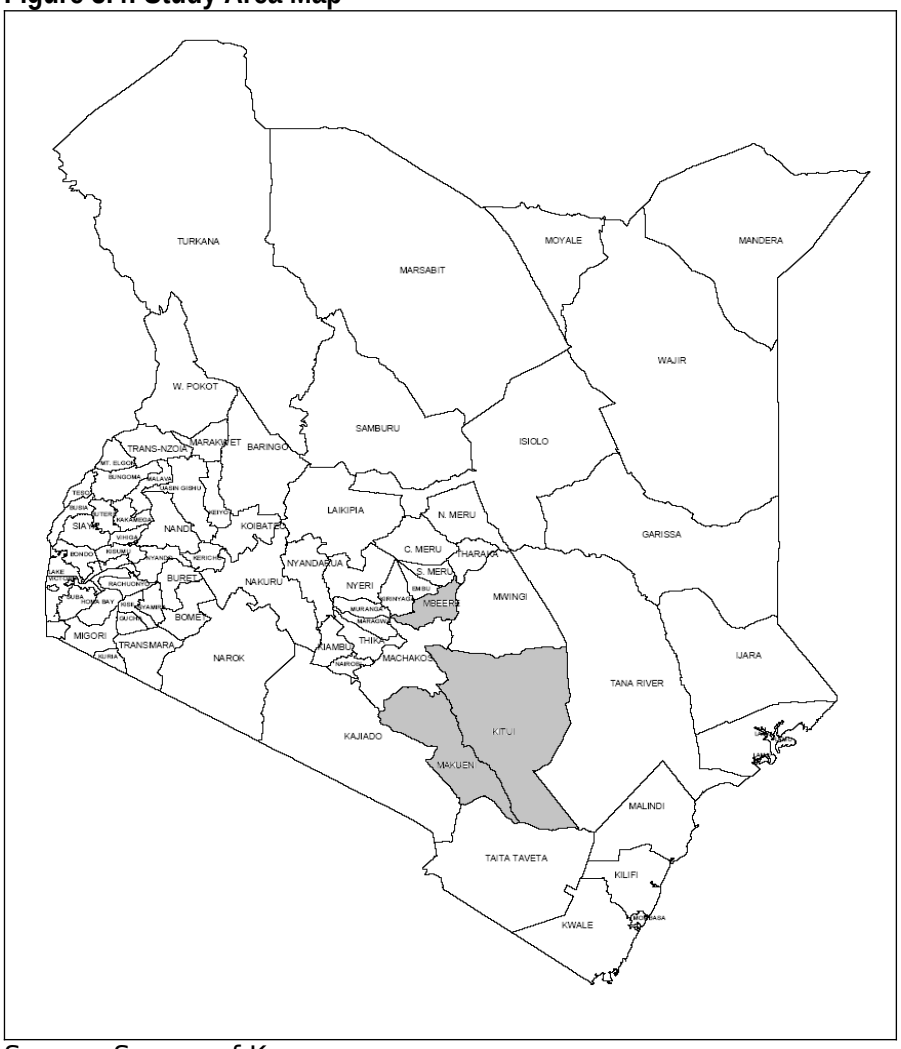
A total of 300 structured questionnaires were administered to sampled households in the three districts. In each district, divisions with semi arid characteristics were identified for inclusion in this study. Based on population density of each administrative division, stratified random sampling was used to identify households in each of these districts for interview. The probability of a household to be interviewed was proportional to the division's population size. Table 3.1 presents the sample distribution across the various administrative divisions in the three districts while figure 3.1 shows the study districts.

Table 3.1: Study Sample Distribution

DISTRICT	Division	Number of Respondents	Percent of sample
KITUI	Yatta	21	7.1
	Ikutha	18	6.1
	Mutha	21	7.1
	Mutomo	16	5.4
	Mwitika	22	7.4
	Total	98	33.3
MBEERE	Siakago	42	14.2
	Gachoka	42	14.2
	Evurori	12	4.1
	Total	96	32.6
MAKUENI	Emali	4	1.3
	Kathonzweni	26	8.8
	Wote	16	5.4
	Mavindini	24	8.1
	Kisau	14	4.7
	Kibwezi	16	5.4
	Total	100	34.0
	Non-Responses	6	2.04
TOTAL		294	100.0

[3] A cross-sectional design entails the collection of data on more than one case and at least at a single point in time in order to collect a body of qualitative or quantifiable data in connection with two or more variables, which are then examined to detect patterns of association (Bryman A. 2001).

Figure 3.4: Study Area Map



Source: Survey of Kenya

3.2 Analytical Methodology

The definition of food security used in this study is based on quantity and availability as well quality (nutritional value). Household data collection was based on the concept of 'enough' as perceived by the households. Therefore, household's food security status was based on the household's ability to provide its members with three meals in a day through out the year as reported by the household heads and the average quality of food consumed during these meals.

Both univariate and bivariate statistical techniques are used in data analysis. In univariate analysis, frequency tables and graphs are used while in bivariate analysis cross tabulations, correlation and analysis of variance (ANOVA) are used. The bivariate techniques allow the researchers to tease out the intricate relative influence of key variables as far as households' food security status in semi arid areas is concerned.

4.0 RESULTS AND DISCUSSION

4.1 Food Security Index

Several indices for measuring food insecurity have been developed (FAO 1995). Some of these indices focus mainly on availability and affordability concepts of food security. However, food security in semi arid lands is more of an availability issue rather than affordability. This is because of the limited alternative sources of income among semi arid households, which makes affordability of foodstuffs difficult. In this study attempts were made to come up with a food security measure specifically tailored for semi arid households.

In the first attempt, households' assured of three meals in a day were designated, as food secure while those not assured being the food insecure. In the second attempt, households with sufficient stocks of foodstuffs to last for one year were classified food secure on availability basis. Households without sufficient stocks but able to replenish were labeled food secure on affordability basis. Households that had no sufficient stocks and could not afford to replenish were classified as food insecure.

According to the availability measure, 38 percent of the respondents were found to be food secure in the entire sample. Kitui District registered the highest figure of food insecure households (65 percent), followed by Makueni (57 percent) and Mbeere (55 percent) in that order.

On basis of adequacy of food stocks, 54 households, or and 8 percent of the sample was found to be food secure on availability and affordability basis. Thirty six (36) percent was food insecure. Mbeere District had the highest percentage (52) of food insecure households, followed by Makueni (30 percent) and Kitui (26 percent). Having adequate stocks or the ability to replenish did not directly imply that households were guaranteed of wholesome three meals in a day through out the year. Thus, construction of a composite food security index was imperative.

The composite index required households to identify the type of foods consumed at the usual meals – breakfast, lunch, and dinner. Various weights were assigned to a meal having been checked (0.5) and its corresponding nutritional value to generate a food security index (table 4.1). Starch, protein, and vitamin content presence determined the nutritional value of a particular meal.

Table 4.2: Constructing the Composite Food Security Index

Breakfast	Lunch	Dinner	Index
Quantity- Take breakfast= 0.5 Quality- Porridge=0.25 Tea/coffee alone= 0.20 Tea/coffee/Muvyuvyo[4]=0.30 Tea/Coffee/bread/cassava/sweet potatoes=0.50	Quantity- Take Lunch= 0.5 Quality: Protein=0.2 Carbohydrates=0.2 Vitamins=0.1	Quantity- Take Dinner= 0.5 Quality: Protein=0.2 Carbohydrates=0.2 Vitamins=0.1	1: If the total Score is 2.41 and above = **Food Secure** 2: If the total Score is below 2.41=**Food Insecure**

[4] Leftovers of previous day's dinner

It should be noted that this is another way of looking at household food insecurity and it relied heavily on household heads ability to recall the average quantity and quality of food consumed through out the year.

At this point, it is important to establish whether the composite food security index is different from the other two measures (i.e. availability and adequacy). To examine this cross tabulation and chi-square test are used under the null hypotheses that the index is similar in quality of results to the other two measures. The results are presented in table 4.2 below.

Out of the 97 households found to be food secure on availability basis, only 36 percent was found to be food secure based on the index. For the rest 64 percent quality of food consumed was poor. Twenty seven (27) percent of 145 household designated as food insecure on availability basis were found to be food secure based on the composite index. Even though these households were not assured of three meals through out the year, the nutritious quality of the meals taken was expected to be high. Seventy three (73) percent of households found to be food insecure on availability basis were actually so based on the index.

Similarly, out of 143 households found to be food secure on food adequacy and affordability basis, only 27 percent were found to be so when the quality of the food was factored in. Seventy three (73) percent was found to be food insecure on basis on the composite index. Out of the 99 households established to be food insecure food adequacy and affordability basis, 65 percent were actually so when quality of food consumed was considered.

Table 4.3: Relating the Food Insecurity Measures

		Availability		Adequacy	
		Food Secure	Food Insecure	Food Secure	Food Insecure
Composite	Food Secure	36.1%	26.9%	27.3%	35.4%
Index	Food Insecure	63.9%	73.1%	72.7%	64.6%
		Pearson Chi-Square	**DF**	**Pearson Chi-Square**	**DF**
		2.310	1	1.800	1

The calculated Chi square value for the relationship between the index and availability measure is 2.31 while for the relationship between the index and adequacy measure is 1.80. The critical chi-square value at one degree of freedom and 5 percent level of significance is 3.84. The calculated value of chi-square in the two cases is much lower than the critical value. Hence, the null hypothesis does hold. The composite measure is not significantly different from the other two measures and the variations observed arose simply by chance. However, in this study we opt to use the composite index because of its ability to capture quantity as well as the nutrition value of meals taken. In cases where ANOVA is to be carried out, the total scores (discrete) instead of the index (ordinal), is used.

Based on the food security index, it is imperative also to establish whether food security status vary across the three districts involved in the study. To determine this, cross tabulation and chi square test is carried out. The null hypothesis is that the food security status is independent of the territorial borders and location. The results are presented in table 4.3 below.

From the valid sample of 272 successful responses, 71 percent of respondents are found to be food insecure. Makueni district leads with 76 percent, followed by Kitui (71 percent) and Mbeere (65 percent). Even though Mbeere ranked last on the basis of adequacy, adding quality component to our definition improves food security situation in the district. Makueni leads on food adequacy basis but adding food quality aspect, the district comes the last.

Table 4.4: Food Insecurity Across the Sample Districts

			District			Total
			Kitui	Mbeere	Makueni	
Food security category	Food insecure	% within District	70.7%	65.2%	75.8%	70.6%
	Food secure	% within District	29.3%	34.8%	24.2%	29.4%
Total		Count	92	89	91	272
		% within District	100.0%	100.0%	100.0%	100.0%
Pearson Chi-Square		DF		Asymp. Sig. (2-sided)		
2.461		2		0.292		

4.2 Factors Determining Food Security in Semi - Arid Lands

4.2.1 Households' Social Profile

Sex and Marital Status

Males headed most of the households in the three districts under study. In total, 66 percent of household heads were male while female heads constituted only 34 percent. There are several factors that can explain this scenario. Most of these factors are pegged on single motherhood as a result of separation (1.7 percent), divorce (0.7 percent), widowhood (12.6 percent), or women who never married (1.4 percent). Interesting to note, is the fact that women whose husbands worked elsewhere (13.4 percent) or whose husbands were polygamists (2.4 percent) and leaving outside the household, considered themselves as the household heads. This can be attributed to the fact that the husbands were absent for long necessitating the women to make important household decisions. Only 0.3 per cent of the female headed households were as a result of the *Maweto*[5] marriages.

To establish whether food security status varies with the sex or the marital status of the household head, cross tabulation and chi-square test is used. The null hypothesis is that food security status does not vary significantly either by sex or marital status.

Among the 179 male-headed households 71.5 percent was food insecure while only 28.5 percent were food secure. In the case of female-headed households 69 percent were food insecure while 31 percent were food secure. The Chi-square test of independence was used to test whether food security status was influenced by sex of household head. The calculated value of Chi Square is 0.166 while the critical value is 3.84 at a significance level of 0.05. This means that food security status of household is not significantly influenced by the sex of the household head.

[5] Where a woman marries another to raise children on her behalf

The marital status of a household was identified by three categories including; single, married- polygamous and married non-polygamous. There were 273 valid cases. Of these 75 percent were married non-polygamous, 16 percent married polygamous and 1.4 percent were single. Among the married non-polygamous 71 percent were food insecure while only 29 percent were food secure. In the case of married polygamous and single families, 64 and 75 percent were food insecure while 36 and 25 percent were food secure respectively. The calculated value of chi square is 2.17 which is less than the critical value 7.81 at 3 degrees of freedom assuming 0.05 significance level. This means that marital status does not significantly influence household's food security either.

Age of Household Head

Majority of the household heads (66.7 percent) were aged between 26-55 years. Some 26.2 percent were aged below 25 years. The distribution of respondents across the districts does not show remarkable differences. Some respondents raised concern that the young household heads, who, presumably are the most physically active have limited access to land. They only have user rights and thus cannot develop such land to the maximum because they do not own it. Their engagement in agricultural production is thus limited and this may pave way to food insecurity in such households until ownership rights are conferred to them through inheritance. In addition, this is an age where one has not acquired stable sources of income and majority move into urban areas to look for employment and thereby limiting their contribution in agriculture. However, most of the aged are not physically capable of coping with farm work and are not willing to relinquish such land and resources to the young for productive use. Thus the land they own is not optimally utilized and hence less productive.

To determine whether food security varies with the age of household head, one-way analysis of variance (ANOVA) is used. The null hypothesis to be tested is that age does not significantly influence the food security status of a household. The results are presented in table 4.4.

Table 4.5: Food Insecurity and Household Head's Age

	Sum of Squares	DF	Mean Square	F	Sig.	F Critical
Between Groups	6871.575	15	458.105	1.771	.039	1.75
Within Groups	63641.544	246	258.705			
Total	70513.118	261				
		Pearson Correlation= 0.068				

The calculated value of F statistic is 1.771, which is more than the critical value of 1.75 at 5 percent level. This analysis does not support the null hypothesis, therefore, we may conclude that the difference in food security due to household head age is significant and is not just a matter of chance. The Pearson correlation indicates that the relationship between food security level and age is positive, though weak (0.068). This means that the more aged the household head is, the more food secure the household he represents will likely be. This correlation may be attributed to the ability of the aged (owing to their wealth of experience) to establish hedging mechanisms against possible food insecurity. The weakness in the strength of the coefficient could also be associated with the poor ability of such aged household heads to appreciate the importance of quality food.

Level of Education

Majority of the household heads (51 percent) had only attained primary level of education while only 16 percent had secondary level of education. A significant minority (28 percent) had either informal education or no education at all. Only 5.7 percent of the household heads had tertiary level of education.

To establish whether food security status among the respondents varies with the household head's highest level of education acquired, a cross tabulation and chi-square test is used. The null hypothesis is that food security status does not vary with the highest education level a household head has acquired. The results are presented in table 4.5 below.

Table 4.6: Food Insecurity and Household Head's Education Level

			Level of education of household head (%)				
			Informal	Primary	Secondary	Tertiary	Total
Food security category	Food insecure	% Within level of education of household head	69.9	71.9	66.7	66.7	70.2
	Food secure	% Within level of education of household head	30.1	28.1	33.3	33.3	29.8
	Total	% Within level of education of household head	100.0	100.0	100.0	100.0	100.0
Pearson Chi-Square					**DF**		
0.520					3		

Thirty three (33) percent of those household heads that had acquired either secondary education or tertiary education, were found to be food secure. Sixty seven (67) percent were food insecure respectively. This phenomenon could be attributed to other factors other than the level of education acquired. Only 30 percent and 28 percent of households headed by members who had acquired informal or primary education respectively were food secure. The calculated Chi square value is 0.520, which is lower than the critical value 7.815 at one degree of freedom at 5 percent level of significance. Thus, the null hypothesis holds. Food security does not vary with the education level of the head of household.

This weak relationship can be explained by the fact that more than three quarters of the household heads had little or no formal education. Household heads that had attained either informal or primary level of education formed 79.5 percent of the total sample. Such people have slim chances of obtaining any formal employment due to lack of skills. As such, they have limited alternative sources of income other than agriculture, and besides, they lack technical knowledge to optimize agricultural production. In effect, it can be asserted that their involvement in agriculture is not optimally productive; though in terms of opportunity cost of labour, it is their best option. Further, agriculture is a seasonal activity in most of these areas and thus when the rains fail; it opens a leeway for severe food shortages in such households.

Only a small percentage of households (20.5) are headed by people with chances of securing other forms of employment in addition to agriculture. It is only in such households where there are higher chances of being food secure on affordability basis.

Household Size

The average family size was 6 members. However most of the households (52.7 percent) had large families constituting 7 to 10 members. Some 29.5 percent had between 4-6 members while 15.7 percent had more than 10 members. Only 2.1 percent of the households had up to 3 members. More than 68 percent of the households had more than 7 members.

To determine whether food security level varies with household size in the study area, one-way analysis of variance (ANOVA) is used. The null hypothesis to be tested is that size of household does not significantly determine its food security status. The calculated value of F is found to be 1.564, which is less than the critical value of 1.75 at 5 percent level. These results do support the null hypothesis; therefore, we may conclude that the difference in food security due to household size is insignificant. Any relationship observed between household size and food security could be more of chance.

This observation is reinforced by a very weak and insignificant correlation coefficient between the two variables and thus cannot be generalized to the entire sample. Thus, in Kenyan ASALs the incidence of food insecurity is caused by other factors incidental to individual households or the greater society rather than family size.

Given that family size is not related to food security status of the household, there are two effects (related to family size), which may explain this phenomenon. A small household's annual food requirement is not enormous compared to large families. Large families are endowed with great labor force. Besides, chances of having extra income from family members working outside the household are also high. These two opposing forces may obscure the relationship between food security status and family size in arid lands.

Household Composition

Most of the households in the survey (39.8 percent) had more males than females while approximately a similar percentage (37.4 percent) had more females than males. In the rest of the households (21.8 percent) males were equal to females. In Mbeere district, the percentage of the households with more females than males is quite high compared to the Kitui and Makueni Districts.

To test the relationship between food security status and the households' composition, cross tabulation and chi-square to test is used. The null hypothesis is that a household's food security status does not vary with its composition.

In the female-equal-to-male category, 73 percent of the households were food insecure while only 27 percent were food secure. In the female-more-than-male category, 69 percent were found to be food insecure while 31 percent were food secure. In the female-less-than-male category, 71 and 29 percent were found to be food insecure and secure respectively.

From these results it seems that households that have more female members than males are relatively better off in food security terms. This finding, though weak, supports the African held belief that, farm work is predominantly a female domain and thus families with high proportion of females are supposedly food secure. Nevertheless a chi-square test provided a value of 0.232, which is far less than the critical value of 5.991 at 5 percent significance level. Thus, the null hypothesis holds. Households' food security

situation is not significantly influenced by its composition in this sample. The observed relationship within the category of households with more females was more of chance than otherwise, or attributable to other factors.

4.2.2 Households' Economic Profile

Household Main Economic Activity

Almost two thirds of the respondents (57.1 percent) depend on agriculture (livestock and crop farming) as the most important source of income with crop farming accounting for 33.7 percent of the total sample. A mere 2.4 percent rely on salaries while 9.9 percent are small retail traders. Some 8.8 percent of the respondents rely on remittances from their children and/or relatives working elsewhere while one percent have other sources of income such as charcoal burning, tree farming, brewing illicit liquor among others.

Evidently, majority of the respondents rely on agricultural output to earn incomes. Given the unreliable rainfall and small farm sizes (majority 66 percent have farms ranging from 1-4 acres in size) coupled with poor agricultural practices, food productivity is low. In essence, such produce is not enough to fully cater for both monetary and food needs of a typical family. Only 2.4 percent of the population have a reliable source of income (wages) and thereby dedicate all the agricultural produce to domestic use. Livestock selling was their second most important source of income.

To verify the contributory strength of various forms of economic activity to food security, households were classified on the basis of their main economic activity. The study identified six major classes of households based on economic activities families engaged in. The results show that in all cases households that engaged in other activities besides farming are more likely to be food secure (table 4.6).

Table 4.7: Food Insecurity and Household Economic Characteristics

			Household Characteristic (%)						Total
			Food crop farming	Food and livestock farming	Peasant earning wages	Peasant earning salary	Peasant owning small business	Squatter	
Food Security Category (%)	Food Insecure	% Within Household characteristic	71.2	72.1	54.5	41.7	55.0	75.0	70.7
	Food Secure	% Within Household characteristic	28.8	27.9	45.5	58.3	45.0	25.0	29.3
Total		% Within Household characteristic	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pearson Chi-Square				**DF**			**Asymp. Sig. (2-sided)**		
27.388				6			0.000		

Fifty eight (58) percent of peasant households with a salary were food secure compared to 27.9 percent of households, which engaged in both food and livestock farming. A significant 45 percent of peasant households that either engaged in casual labor or operated a small business were also relatively food secure compared to only 28.8 percent of food crop farming households.

The chi-square test is used to examine whether household livelihood characteristics influence food security. The calculated chi square value is 27.38, which is more than double the critical value (12.59) at 5 percent level. This means that the two variables are not independent of each other. Household characteristics significantly influence a family's food security status. It is clear that engaging in non-farm activities, besides farming can significantly improve the food security status of a family.

Household Estimated Income

Does the level of household income determine households' food security status? To answer this question, one-way ANOVA test is carried out. The null hypothesis to be tested is that there is no significant difference in food security across various levels of income. The calculated value of F was found to be 1.144, which is less than the table value of 1.75 at 5 percent significance level. This analysis supports the null hypothesis; therefore, we may conclude that the difference in food security due to household estimated level of income is insignificant and thus any relationship observed is just a matter of chance. Further, the two variables bear a very weak but positive relationship as attested by the Pearson correlation coefficient of 0.136.

These results are a bit baffling because from theory, one would have expected a very strong positive relationship between food security level and household income. Nevertheless it should be noted that low income is a common characteristic among the semi arid households. Income therefore is more of a unifying factor than a discriminating one. Further, estimating rural households incomes was problematic. The respondents found it a bit hard to define their incomes as well as estimating it. They were also not comfortable to disclose transfer payments receivable.

Income Sources Diversification

Respondents were asked to enumerate their possible sources of incomes. This was in a bid to establish whether the number of possible sources of income, however meager in contribution, influenced households' food security status. The results of ANOVA are presented in table 4.7 below. The calculated value of F is 2.668, which is more than the critical value of 1.75 at 5 percent level. Therefore, we conclude that the difference in food security due to household possible sources of income is significant and cannot be as a matter of chance. Households with multiple sources of income face a lower risk of food insecurity since they can afford to acquire more food supplies.

Table 4.8: Food Insecurity and Income Sources Diversification

	Sum of Squares	DF	Mean Square	F	Sig.	F Critical
Between Groups	35.542	15	2.369	2.668	.001	1.75
Within Groups	221.995	250	.888			
Total	257.538	265				

Grain Selling and Non-Food Expenditure

Households' expenditure on non-food items such as healthcare, education, housing, household supplies, clothing and transport, among others, is thought to affect the households' degree of food security. To meet these non-food expenditures, and given limited income sources, most households revealed that they are compelled to dispose grains and sometimes at uncompetitive prices because of exploitative market channels (table 4.8). Seventy five (75) percent of the respondents disclosed that they sell grains. Households rely on grains for food and as well as incomes in the semi arid lands. The main grain produced is maize. Indeed 99 percent of the respondents consumed maize with 85 percent growing the grain. Many farmers because of various reasons[6] do not grow some crops like sorghum and millet that are likely to do well in ASALs and also could serve as additional sources of income.

Table 4.9: Grains Marketing Channels[7]

Channel	Percentage
National Cereal and Produce Board (NCPB)	2.7
Local Cereal Dealers- home	12.6
Local Cereal Dealers- market place	63.9
Door-to-door merchants	5.4
Open Markets	8.5
Other Outlets	7.0

The proceeds from sell of grains are mainly used to finance education, health services and household grocery supplies. Even though the prices of livestock are usually high at harvest time, farmers prefer to sell grains and spare their animals. Livestock is kept for insurance purposes to bail out the family when there is a major drought or a member of the family is seriously sick. However, it is worthy noting that at such times livestock prices are indeed very low. Most ASAL farmers are yet to embrace commercial farming whereby they can sell livestock when prices are high and save their money for alternative use.

In this study, non-food expenditure classification was specifically based on a household's expenditure on education and health services. Households whose non-food expenditure constituted more than 20 percent of their total monthly expenditure were placed in the high non-food expenditure category The rationale was that if a family spends more than 20 percent of its monthly income on education and health, then the remaining 80 percent of the relatively small income would hardly be sufficient to meet the other regular household needs including food.

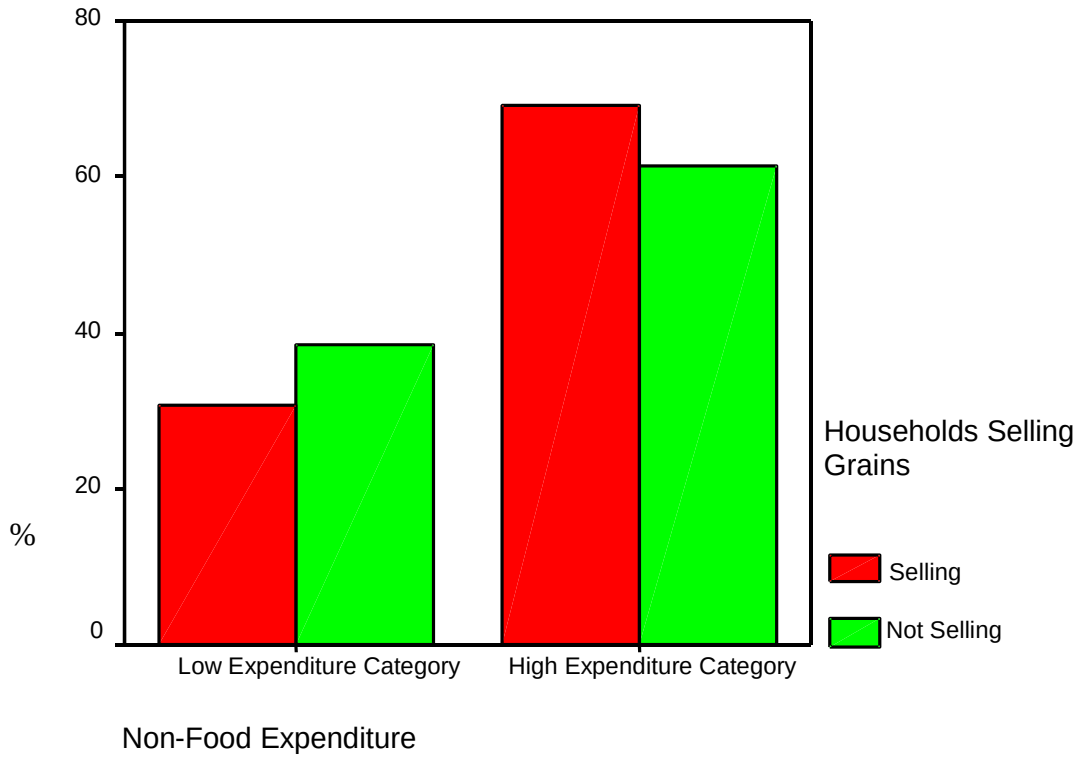
The graph below (figure 4.1) shows that more than 60 percent of the high non-food expenditure category households sold grains. Considering the nature of social needs, for

[6] Some respondents argued that as a result of the introduction of formal schooling system, there is limited human labor to scare away birds from farms. Others said that they are no longer growing such crops because meals resulting from such grains are tedious to prepare since they are labor intensive and time consuming. Further, millet and sorghum meals go hand in hand with milk products like ghee and sour milk, which are not readily available because of the declining livestock in semi arid lands unlike in the past. Also these foods are regarded as inferior and stereotyped as signs of abject poverty, especially among the young generations.

[7] Among the channels, the NCPB pays the fairest price for the cereals. However, it was established that its stores are located in big market centers (usually district headquarters), which are not accessible to most of the farmers. The farmers therefore fall prey to the dealers who come to them with ready cash and wiling to transport the cereals.

example sicknesses or school fees, most semi arid families have no alternative other than selling grains. Households that sell maize are more vulnerable to food insecurity than ones that do not on availability basis. Selling maize would reduce the stocks of maize available for family use.

Figure 4.5: Non-Food Expenditure Levels and Food Insecurity



To determine whether grain selling had a significant statistical effect on households' food security status, cross tabulations and chi-square tests are carried out, with the following results emerging. Of all households engaged in grain selling, a staggering 71.8 percent were food insecure and only 28.2 percent were food secure. Nevertheless it is also worthy to note that of those households which did not indicate to have been selling grains only 36 percent were food secure. The calculated chi-square value is 0.653, which is lower than the critical of 3.841 at 5 percent level of significance. Thus, grain selling does not significantly influence the households' food security status among the households in the study area based on the composite index.

To determine whether households' non-food expenditure affects its food security status, ANOVA tests are carried out. The results reflect a weak relationship between food security and non-food expenditure at a household level. The F value of 1.368 is lower than the critical value (1.75). In light of this we fail to reject the null hypothesis and conclude that the difference in food security occasioned by a household's level of non-food expenditure is insignificant and is just by a matter of chance.

From the foregoing, even if a strong link between food security on one hand, and grain selling and level of non-food expenditure on the other hand is missing, it is clear that there is over dependence on grains to meet most of the household non-food financial needs. In the absence of reliable alternative sources of income, households must seek

ways to optimize crop farming. Besides, there is need for more efficient grain markets that can offer better returns to farmers.

Distance to the Nearest Shopping Center

On one hand, if the distance to the nearest shopping center is short, chances of accessing the market for household supplies such as grains, vegetables and fruits (assuming availability of financial resources) in case of shortages, are high. Transport expenses incurred when accessing distant shopping centers reduce financial resources available to secure household food supplies. Nearby shopping centers also give a wide range of channels for households to dispose off their farm surplus at competitive prices.

On the other hand, short distances to market places can tempt households to dispose of their farm produce to meet non-food expenditure. This may happen even when the households are not assured of grain supplies thus compromising their food security.

From this study, it was established that 38 percent of the households are less than two kilometers to the nearest shopping centers. Twenty eight (28) percent are between two and five while 19 percent are between six and ten kilometers away. Only 15 percent are located more ten kilometers away from the nearest market center.

To establish whether nearness to shopping centers influences food security, cross tabulation and chi-square is used. The results are baffling in that the nearer a household is to the shopping center, the higher the chances of being food insecure (table 4.9).

Table 4.10: Food Insecurity and Distance to the Market

			Distance to the nearest market in kilometers				Total
			0-2 KM	More than 2 and below 5 Kms	More than 5 and below 10 Kms	More than 10 KMs	
Food Security	Food Insecure	Count	82	58	32	18	190
		% Within Distance to the nearest market	80.4%	76.3%	61.5%	46.2%	70.6%
	Food Secure	Count	20	18	20	21	79
		% Within Distance to the nearest market	19.6%	23.7%	38.5%	53.8%	29.4%
Total		Count	102	76	52	39	269
		% Within Distance to the nearest market	100.0%	100.0%	100.0%	100.0%	100.0%
	Pearson Chi-Square			**DF**		**Asymp. Sig. (2-sided)**	
	19.206			3		0.000	

With 80 percent of those who are placed less than two kilometers away being food insecure. A significant 76 percent of those within two to five kilometers are also food insecure. Sixty-two (62) and 46 percent of those households within 6-10km and over ten kilometers respectively are food insecure. The calculated chi square value (19.206) is higher than the critical value (7.815) at 5 percent level. This means that the two variables are not independent of each other. Proximity to market centers significantly influences a household's food security status. This scenario may partly be as a result of relatively small farms among the communities living near the sub-urban areas. Alternatively, the situation could be as a result of farmers being tempted to sell most of their grains given proximity to markets.

4.2.3 Crop Production and Consumption

Crop Husbandry

Majority of the respondents (83 percent) grow crops in two seasons annually, with only 17 percent planting once a year. Even though the majority plant in the two seasons annually, the percentage of those who harvest in both seasons drops down to 78 percent.

Given the unreliability of rainfall in semi arid areas, 75 percent of the respondents practised dry planting (plant before the rains commence). Those who plant after the rains (25 percent) gave reasons like the need to confirm the true onset of rains while others lack planting equipment and have to seek assistance from neighbours after sometime. Seemingly, early planting is the norm in semi arid lands and the first rains are well timed. Even with this accuracy in timing, some 7 percent of the respondents reported that they had harvested nothing in the two seasons prior to the study.

A variety of sources of planting seeds were identified. Ninety four (94) percent of the respondents use uncertified seeds. Such sources included use of seeds from previous harvests (39 percent), open markets and retail shops (47 percent), or borrowed from their neighbours (one percent). Only a minority used certified (hybrid) seeds in semi-arid regions. The implication of this is that only a small percentage is assured of a good harvest in a relatively good season. The rest rely on chance and therefore risk very low yields. Respondents gave various reasons for using presumably unreliable seeds: certified seeds are too expensive; seeds always not available in shops when required; while others claimed that most of the hybrid seeds are not suitable to their peculiar soils.

Who decides what and when to plant in a household? In 55 percent of the cases, women (women household heads) make decisions regarding what to plant while cases of shared responsibility (between husband and wife) constituted only 30 percent. Only 12 percent represented cases where farming decisions were made by husbands living in the household. One percent of the cases reported, absentee husbands, in-laws and other close family members make such decisions. This shows that women, who are the principal agriculturists in rural Kenya, do not necessarily have to wait for their husbands working elsewhere to make decisions on what and when to plant. They are empowered to make decisions regarding all farm enterprise and work. Perhaps, this could be attributed to the fact that the onset of the rains is critical in semi arid lands and thus any hesitation to plant early has a remarkable negative impact on crop yield.

It is worth noting that land preparation, actual planting, harvesting and preparation for storage are shared responsibilities. In most cases all family members including the husband, wife and children participate share in such activities. In any case, there is a degree of urgency involved lest the family is late for planting, harvesting and storage. Any delay in any of these activities has a dire consequence on food security.

Crop Diversification and Quantity of Grains Harvested

The average number of crops grown by the households in the entire sample is five, with minimum and maximum of two and nine respectively. In a bid to establish whether the

number of crops grown influences households' food security status, one-way ANOVA is carried out. The results are presented in table 4.10. The calculated value of F is 2.931, which is more than the critical value of 1.75 at 5 percent level. Therefore, we conclude that the difference in food security due to crop diversification is significant and cannot be as a matter of chance. A household, which grows a variety of crops, is not only likely to have a higher harvest but also increases chances of alternative income from grain sells.

Table 4.11: Food Insecurity and Crop Diversification

	Sum of Squares	DF	Mean Square	F	Sig.	F Critical
Between Groups	84.174	16	5.261	2.931	.000	1.75
Within Groups	459.460	256	1.795			
Total	543.634	272				
Pearson Correlation = 0.311 Correlation is significant at the 0.01 level (2-tailed).						

Further, the two variables bear a very weak positive though significant correlation as attested by the Pearson correlation coefficient. This means there is only one chance in 100 that no correlation exists in the population, and thus this relationship can be generalized to the all semi arid households in the study area.

Does the annual quantity of harvest influence household food security status in the arid lands? Respondents were asked to estimate the quantity of maize harvested annually. Maize harvest was used as a proxy for the total grain harvest since 85 percent of the respondents reported growing maize as the main food crop. The average quantity of maize harvested annually per household in the entire sample is 1,617.59 kilograms. The minimum being no harvest at all and while the maximum is 55,250 kilograms.

Then ANOVA test is carried out to determine the relationship between the quantity of maize harvested and households' food security status. From the results, it is established that the calculated value of F is 0.69, is lower than the critical value of 1.75 at 5 percent level. Thus, we conclude that the difference in food security due to household annual quantity of harvest is insignificant. It is rather interesting that high harvest do not significantly improve food security in ASALs. This can partly be explained by loss of grains especially while under storage or disposal (selling) to cater for non-food needs.

Grain Losses

While in the field, grains are subject to destruction by rodents (29 percent), wild animals[8] (27 percent), weevils (24 percent), domestic animal (3 percent) and theft (3 percent). Other causes contributed a smaller percentage to grain loss.

Several constraints experienced during harvesting led to grain losses. These included lack of enough manpower (29 percent of the cases), destruction of grains by early rains (28 percent), spillage of grains during harvesting (9 percent) and lack of means of transporting harvest from the field (0.3 percent). Some 2 percent of the respondents asserted that they faced a double tragedy of lack of manpower and destruction of crops by early rains. The above constraints have a negative effect on the quantity of crop yields.

[8] In Makueni District (particularly in Kibwezi and Makindu Divisions) it was reported that there is a big conflict between human and wild animals from neighboring Tsavo National Park and Chyulu Game Reserve

While under storage, grains are subject to destruction by weevils (reported by 85 percent of the respondents), rodents (7 percent), humidity (6 percent), and leakages from the storage facilities (one percent). The loss of grains to weevils while in storage could be attributed to use of inappropriate pesticides (62 percent) or use of traditional methods (14 percent) such as ashes, herbs, pepper, and smoking.

Poor storage and inappropriate pesticides are the major causes of grain losses in semi arid areas. Evidence of huge grain losses as a result of damage caused by the larger grain borer[9] was common across the three districts. Farmers have tried all sorts of 'insecticides' including, ash, cow dug, herbs and pepper to no avail. Owing to this, many farmers are compelled to dispose off their cereals very cheaply (sometimes as low as Ksh.2 or US$0.03 per kg.) immediately after harvesting to minimise inevitable losses.

Owing to the destruction caused by the weevil and households' desperation to safeguard their produce, unscrupulous businessmen have taken advantage of the situation and some have earned themselves fortunes by selling adulterated insecticides. The situation is worsened by some dishonest public quality control agencies[10] that are endorsing ineffective insecticides. Given that only a small percent of the respondents had access to agricultural extension services, the loss of stored grains due to use of inadequate and ineffective insecticides was enormous thereby exacerbating the problem of food insecurity.

Table 4.12: Extent of Grain Loss at Three Handling Levels

Level/Extent	Harvesting	Field	Storage
Great	6.2	34.1	83.2
Less	74.7	58.6	12.1
Negligible	17.9	6.2	3.7
No Answer	1.1	1.1	1.1
Total	100.0	100.0	100.0

From table 4.11, it is evident that the greatest grain losses take place during storage. In a bid to establish whether this phenomenon has effects on households' food security status a cross tabulation and chi square test is performed. The results (table 4.12) indicate that out of the 227 households that lost the highest volumes of grain during storage, 70 percent of them are food insecure. Eighty five (85) percent of the 33 households that reported negligible loss were found to be food insecure. The calculated chi square value is 5.393, which is lower than the critical 5.991 at 5 percent level of significance. Thus, the extent of grain loss during storage does not interfere with the households' food security status among the households in the study area. But if we were to consider the critical chi-square value of 4.605 at 10 percent level of significance, household food security status is significantly influenced by the extent of grain loss during storage.

Table 4.13: Food Insecurity and Extent of Grain Loss in Storage

[9]Which has been given various nicknames such *tutu* (meaning *posho* mill), *Scania or Osama* across the study area, signifying its immense destructive force. This is a unique breed of the larger grain borer, which not only damages grains and storage bags but also the granaries.

[10] A case was reported of agents from a certain chemical company and agricultural officers from the Ministry of Agriculture who have formed a symbiotic relationship to market some of the untested insecticides.

			Extent of loss- storage			Total
			Great	Less	Negligible	
Food security category	Food insecure	Count	158	28	5	191
		% within Extent of loss- storage	69.6%	84.8%	50.0%	70.7%
	Food secure	Count	69	5	5	79
		% within Extent of loss- storage	30.4%	15.2%	50.0%	29.3%
Total		Count	227	33	10	270
		% within Extent of loss- storage	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square	**DF**	**Asymp. Sig. (2-sided)**
5.393	2	0.067

Credit and Extension Services Availability

Credit facilities targeted for farmers were not generally available. Only 13 households in the entire sample reported that they had access to credit facility (in kind as well as cash). Cross tabulations were run to establish the relationship between food security and credit availability. The results show that among the 13 households only 8 households (61.5 percent) were found to be food secure. Drawing conclusion from these households, (though too few) one could conclude that even though availability of credit across the entire sample was minimal, making it accessible to ASAL households can improve their food security status. This argument is further reinforced by the calculated chi square value of 4.840, which is higher than the critical of 3.841 at 5 percent level of significance.

Only 132 respondents reported presence of agricultural extension workers in the entire sample. Cross tabulation revealed that out of this number, only 32 households (representing 24 percent) were food secure. Most households reported problems in accessing agricultural extension services. In certain parts, extension officers were charged with a responsibility of covering large areas while in other areas the services had seemingly been commercialised[11].

The calculated chi-square value is 4.239, which is higher than the critical of 3.841 at 5 percent level of significance. This means that the two variables are dependent on each other, and extension services availability significantly influences a family's food security status. Hence engaging the services of extension workers can significantly improve the food security status of a family. It should be appreciated that extension officers can give appropriate advice whether in terms of land preparation or post-harvest crop handling.

Land Holding and Soil Conservation

The average land holding per household in the study area is 7.5 acres with a standard deviation of 8.3. Some households are landless while the maximum land holding reported is 60 acres. Of all households interviewed, 49 percent have land sizes measuring less than four acres. Thirty (30) percent have total land sizes ranging between 5 and 10 acres.

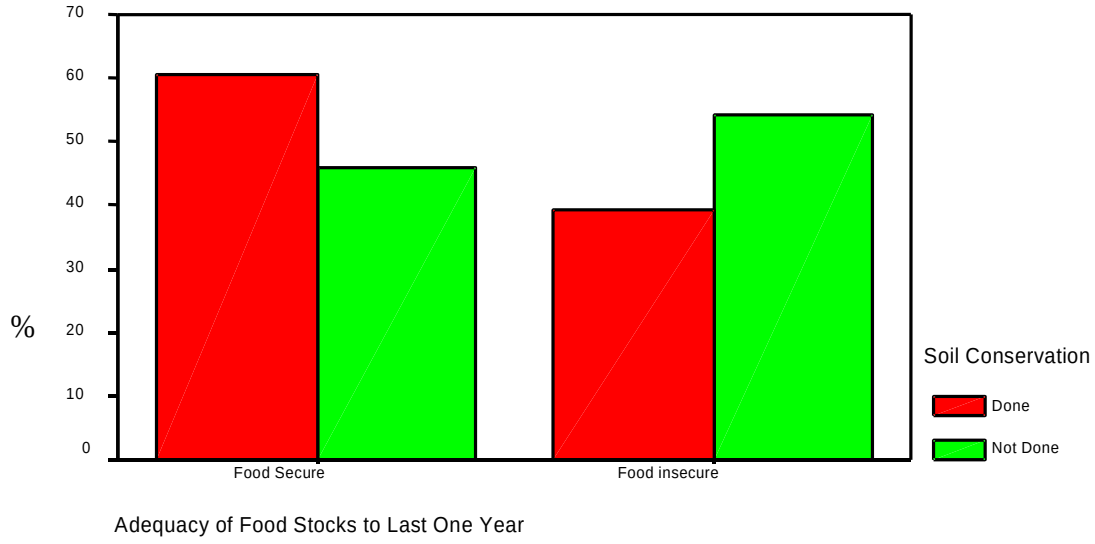
[11] Some households reported that they had to pay for their services even when such services were supposed to be offered for free. This limited access of their services by majority of the ASAL farmers owing to their low incomes.

Around 73 percent of the households interviewed have less than four acres while 22 percent have between 5 and ten acres of cropland. Out of the total households, only one percent relies on borrowed land for crop farming. Six percent revealed that they have leased out land to others. It could be argued that households with small farms usually have minimal harvests considering that harvest in ASAL is more of a function of farm acreage. Therefore, households with large farms are likely to have huge harvests. Around 40 percent of the households do not have pastureland while 39 percent have pastureland of below four acres.

To establish whether household land holding influences food security status in ASALs, ANOVA test is carried out. From the results, the calculated F statistic is 1.046 while the critical F is 2.18. Therefore, we conclude that the difference in food security due to a household's farmland size is insignificant, though Pearson correlation coefficient (0.012) indicate that the two variables bear a positive relationship.

In order to ensure increased food production, certain farming practices need to be adopted particularly those that deal with soil conservation or improvement. In the three districts under study, 76.2 percent of the respondents reported that they practiced soil conservation. Soil conservation practices adopted range from terracing, planting grass, to arranging trash lines. Respondents learnt these conservation measures from extension workers (26.5 percent), NGOs/CBOs (19.0 percent) or from neighbours (8.8 percent). Others said that they learnt the practice from their parents.

Figure 4.6: Soil Conservation and Food Stocks Adequacy Profile



The households, which undertook soil conservation, were more likely to harvest enough stocks to last a year after the short rains. Among the soil conserving households, 67.4 percent described their stocks to be either very adequate or adequate to last for one year while 44 percent of the non-conserving households described their stocks to be either inadequate or very inadequate. Soil conserving households were more likely to be food secure on stock adequacy basis than non-conserving ones (figure 4.2). Of all food-secure households, 58 percent conserved their soils while only 33 percent of the food insecure reported to conserve soils. Irrespective of farm size, soil conservation helps to increase farm productivity. Where soils are well conserved water is retained for long leading to

improved crop performance. It is not surprising therefore that even among ASALs the households who conserve their soils have adequate food stocks.

A joint analysis of household food security status using the composite index on one hand, and soil conservation on the other is done by way of cross tabulation. Of the 264 households visited only 30 percent were food secure while 70 percent being food insecure. Out of the 205 soil conserving households, 68 and 32 percent were found to be food insecure and secure respectively. About one fifth (22 percent) of all households visited did not practice any form of soil conservation. Of these, 78 percent were found to be food insecure while only 22 percent were food secure.

These results show there are higher chances of a household experiencing food insecurity if it does not conserve soil. However it should be noted that soil conservation is a necessary but not a sufficient condition for attaining food security. For instance 53 percent of the entire sample were food insecure even though they practiced soil conservation. Results of the chi-square test reflect a value of 2.06, which is less than the critical value of 3.84 at 5 percent level. This means that soil conservation does not significantly determine the food security status of a household based on the composite index. Therefore the observed relationship could be as a result of chance. Nevertheless one cannot underestimate the contribution of soil conservation to increased crop yield and adequacy of stocks (figure 6 above) especially where the practice is institutionalized.

Knowledge of Daily and Annual Food Requirements

Precise knowledge of family daily and annual food requirements was thought to affect a household's food security status. One would expect farmers to put more efforts in a farm enterprise especially if they had an idea of by how much their output falls short of the annual consumption needs consume annually. It could also be said that if a household was well informed of its food requirements on daily and annual basis, chances of economizing on the use of their harvested stocks would be high and this could lead to sufficient stocks. To shed more light on this issue a cross tabulation is done to relate household food security status on one hand, and knowledge of daily and annual food requirement, on the other hand.

Out of the 248 households that had knowledge of their daily food requirement, 69 and 31 percent were found to be food insecure and secure respectively. And out of 25 households who did not know their daily food requirement, 84 and 16 percent were found to be food insecure and secure respectively. The calculated chi square value is 2.351, which is smaller than the critical of 3.841 at 5 percent level of significance. This means knowledge of daily food requirement and households food security status are independent of each other.

Further, out of the 92 households that had knowledge of their annual food requirements, 74 and 26 percent were found to be food insecure and secure respectively. And out of 181 households who did know their annual food requirement, 69 and 31 percent were found to be food insecure and secure respectively. This disproportionate outcome is the opposite of what we could consider as the norm, as information on family needs is assumed to confer a better food security planning benchmark for the family. The calculated chi square value is 0.693, which is far below the critical value (3.841) at 5

percent level of significance. Thus, knowledge of annual food requirement does not significantly influence a household's food security status.

4.3 Transitory Food Insecurity Coping Mechanisms in Semi Arid Lands

A drop in crop production is likely to subject a poor household to severe stress because of strong production-income-consumption links. A production shortfall can lead to a reduced food intake especially if compensatory income adjustments fail to take place.

Difference in endowments such as skills, employment, resource access, asset accumulation and access to steady transfers, contribute to variation in response choices and coping mechanisms (Von Braun 1998). Households with few income sources and assets are particularly vulnerable. This, of course, is not solely a function of income or asset base; it is also a function of human skills and resources. How successful households are in pursuing and attaining insurance against food insecurity plays a large role in determining the outcome of subsequent crises.

In semi arid lands, when food shortage strikes, most households resort to buying foodstuffs from local shops, grain stores and vendors. This is only possible if the affected households can afford it. Respondents were asked to name and rank various sources of income during food shortages. The most common sources of income (ranked from the most important) among the non-formally employed households include: proceeds from livestock sales; casual labour near home; charcoal burning, remittances from relatives and retailing manufactured products. Other sources of income observed include bee keeping, basketry, firewood selling, illicit alcohol brewing and selling, and tobacco and *miraa* (khat) selling.

Remittances come basically from relatives particularly husbands, sons and daughters. They take different forms including dowry that was commonly reported among the Mbeere. Some respondents reported migrating to towns to look for wage employment. Given the high rate of unemployment in Kenya today in most cases these immigrants find it hard to find meaningful employment.

Some 19 percent of the respondents look for non-farm casual employment. This non-farm work is very rare to find particularly during famine. Other respondents (41 percent) look for farm based casual labour. The rate per day for such farm and non-farm work is too low in the ASAL areas and rages between Kshs. 50-100 (US$ 0.6 – 1.2). As a result, farm and non-farm work cannot adequately enable the people to meet their food requirements. This exacerbates the food insecurity situation in ASALs.

Traditional liquor brewing is illegal in Kenya. Although few of the respondents admitted openly being brewers and sellers, the practice is common in ASALs with 5 percent of the respondents admitting candidly of being brewers. Despite government efforts to stop the practice, it is still widespread in ASALs. The locals admitted that the brew was a quick way of earning income to cater for households needs especially school fees and groceries as well as militating against transitory food shortages.

Some of the minor income sources mentioned above were only prevalent within a particular locality. For example *khat* (*miraa)* farming was common in *Gachoka* and *Kituburi* divisions in Mbeere district. Basketry and rope making was prevalent in

Makueni district. Bee keeping was more common in Kitui district than in the other districts; however this was undertaken using traditional beehives and harvesting methods, which could not optimize honey harvesting.

Other coping mechanisms entail sale of household assets. At the household level women are involved in selling the less valuable items such as chicken as reported by 66 percent of the respondents. Fifty three percent (53) said that women sell eggs while men make decisions regarding more valuable possessions like cattle (27 percent), goats and sheep (31 percent) and land (28 percent). It should be noted that cases of shared responsibility between the husband and wife regarding sale of the above items is very significant. This suggests existence of a male-female economy with men controlling the most valuable assets in the family. This may at times discourage women from utilising these assets to their maximum potential.

To establish whether the number of coping mechanisms adopted by a household influenced its food security status, ANOVA test is carried out. From the results (table 4.13), the calculated F statistic is 2.830 while the critical F is 1.75. Therefore, we conclude that the number of coping mechanisms available significantly influences a household's food security situation. Further, the two variables bear a weak positive, though, significant correlation as attested to by the Pearson correlation coefficient. This means there is only one chance in 100 that no correlation exists in the population, and thus this relationship can be generalized to the entire semi arid population.

Table 4.14: Food Insecurity and Number of Coping Strategies

	Sum of Squares	DF	Mean Square	F	Sig.	F Critical
Between Groups	50.291	16	3.143	2.830	.000	1.75
Within Groups	284.325	256	1.111			
Total	334.615	272				
Pearson Correlation = 0.193 Correlation is significant at the 0.01 level (2-tailed)**						

Charcoal Burning and Selling

Charcoal burning was identified as a source of income and one of the survival strategies adopted by households during inter-seasonal food gaps. Respondents claimed that although charcoal burning is illegal, it is an important source of income during times of famine. One respondent in Kalia Katune Sub-location (Mutha Division- Kitui District) said: *makaa ila kwi nzaa nimo kahawa witu* (loosely translated as: ``*during famine charcoal is our coffee''*). This implies that charcoal is just as important as coffee (cash-crop) in coffee growing areas.

It is important to note that in Kenya, charcoal business is extremely complex and surprisingly an emotional issue (SOFEM, 2002). Environmentalists are quick to condemn charcoal for the destructive trail it has left across Kenya's woodlands and forests. The government seems to be overly concerned about charcoal's ruinous potential on he environment. Despite the impact charcoal burning has on the environment, it is evident that it plays a very important role in the economy of the ASALs. Kenya consumes an estimated 2.4 million tonnes of charcoal per year, generating around Kshs 23 billion per year. Eighty-two (82) percent of Kenya's urban population depends largely on charcoal as source of energy (SOFEM, 2002).

The Government of Kenya has consistently declined to officially recognize charcoal as anything more than an embarrassing inconvenience. The government has no clearly defined overall policy or law governing the charcoal industry. It is governed by arbitrary provincial administration decrees that characterize some Western anti-narcotics laws: it is illegal to produce or traffic charcoal, but it is in order to consume it. Based on this ambivalence and field observations it is clear that the percentage of those burning charcoal in ASALs is more than admitted (table 4.14).

Table 4.15: Charcoal Burning Practice by District

District	Percentage
Kitui	53.6
Makueni	28.6
Mbeere	17.9

Of the three districts surveyed Kitui emerged as the leading with 54 percent of charcoal burning instances. Mbeere district followed with 29 percent while Makueni had the least cases of charcoal burning reported constituting only 18 percent of charcoal burning cases. It was observed that the practice is picking up at a very fast rate in Mbeere district. Charcoal burning was only localized within a few divisions in the three districts. For example in Kitui it was common in Mutha, Mutitu and Mwitika divisions, while in Makueni district, it was prevalent in Kathonzweni and some parts of Kibwezi division. In Mbeere, it was prevalent in Siakago and Gachoka divisions. Most of these areas are bushy with lots of natural trees, which explains why these households are tempted to resort to charcoal burning.

A correlation of charcoal burning activity and household food security status was carried out. In every 100 households visited more than ten resorted to charcoal burning. Of all households surveyed 15 percent explicitly revealed that they engaged in charcoal burning as a means of obtaining income, while 85 percent either did not engage in charcoal burning or were hesitant since the practice is outlawed. Among the charcoal burning households only 39 percent were food secure while 62 percent were food insecure. Of the 189 households classified as food insecure, 87 percent did not burn charcoal, while only 20 percent of the 77 households who were food secure engaged in charcoal burning.

Results of the chi-square test reflect a value of 2.01, which is less than the critical value of 3.84 at 5 percent level. This means that charcoal-burning activity does not significantly improve the food security status of a household. Hence rather than significantly solve the food security problems of typical household, the practice simply moderates the extreme severity of hunger. This low potential of charcoal burning as a alternative source of livelihood is derived from the charcoal producer prices in the remote ASALs from the primary consuming urban areas (price differentials of more than 50% are common)

Relief Food

About 57 percent of the respondents reported that they depended on relief food from the government and relief agencies. However the same respondents confirmed that relief food was necessary though not a sufficient solution to transitory food deficits. Fifty-five (55) percent received such relief supplies twice a month while 17 percent asserted that they received relief food once a month. Three percent received such food on occasional

basis. Majority of the respondents had a negative attitude towards relief food distribution; many claimed that the quantities offered were too little to last a household for three days. Others complained that they were only supplied with maize without other accompaniments (such as beans) that can make a complete meal. Some claimed that relief food is used as a political tool in certain circumstances. People perceived as supporters of or aligned to certain political parties were said to be favoured, while those aligned to opposing political camps were discriminated against.

To find out whether relief food has significant impact on households' food security status, cross tabulations and chi-square are used. The results indicate that out of 155 respondents who are beneficiaries of food relief, 73 percent are food insecure. And out of 117 of the households that do not receive food relief, 68 percent are food insecure. The calculated chi-square value is 0.930, which is lower that the critical value of 3.841 at 5 percent level significance level. This means that the supply of relief food in the study area does not significantly determine the food security status of households. Therefore the observed relationship could be as a result of chance. This could be so because of poor coverage and the said low frequency. Besides most of the food relief agencies supply only maize which is basically rich in starch. Even if a household were to receive relief food regularly, the household would still be considered food insecure given that the food security index is based on quality and quantity.

5.0: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study was conducted in three ASAL districts in the Eastern Province of Kenya, namely, Kitui, Makueni and Mbeere. The study was designed to identify and analyze the incidence; causes and effects of transitory food insecurity in semi arid lands. In particular the study sought to identify factors that expose such households to seasonal food insecurity; explore mechanisms adopted to cope with the phenomenon, and identify strategies for improving the food security situation in such areas.

The concept of food security has evolved over the years from simply a preoccupation with international supplies of food to national self-sufficiency and ultimately a household's ability to feed itself. Transitory food insecurity therefore implies a temporary decline in household's access to adequate food supplies. Thus a household is said to be food secure if it has the capacity to procure adequate food supplies, and maintains food supplies that can be described as sustainable.

While food crises in Kenyan semi arid lands have always been attributed to adverse climatic and environmental conditions there are other equally important factors that explain the situation. This study sought to go beyond the agro-climatological factors traditionally blamed for food insecurity in the semi arid areas to other attributes intrinsic to the family household socio-economic and demographic characteristics. Such factors fall into various categories including; household profile and related social-cultural issues; farmland attributes; farming technology; market infrastructure; and policy issues.

Generally the results of the study show that the factors contributing to the food insecurity situation in Kenyan ASALs range from policy failures to natural catastrophes. They include; insufficient and erratic rainfall, age of household head, limited alternative sources of income, exploitative grain marketing channels, unavailability of quality drought and disease resistant crop varieties, limited crop diversification (over-reliance on maize), poor storage methods, lack of quality insecticides, lack of credit services, inaccessibility to agricultural extension services, illiteracy and poverty.

Among these factors however, the damage caused by weevils upon grains both in the field and under storage has significantly contributed to food insecurity since 1996. Farmers have tried all sorts of insecticides from the local market to fight the larger grain borer without much success. Cases of farmers losing more than 30 percent of their maize harvest to weevils were reported in the sample districts. Owing to this, many farmers in the last two seasons have been disposing off their cereals to opportunistic traders at very low prices. Farmers are so discouraged that some of them are contemplating to abandon growing maize, the staple food crop.

The second important factor that greatly contributes to food insecurity is limited alternative sources of income. Semi arid communities mainly rely on crop farming and livestock keeping. The income from these activities is not sufficient to support the demands of modern life. There are isolated cases where some households engage in basketry, bee keeping, charcoal burning, growing vegetables, and micro retail trade as means of supporting their livelihoods. However most of these activities by their very nature (small scale, less remunerative and unstable) are not reliable alternatives either.

Further the results reveal that farmers concentrate mainly on growing maize with limited or no alternative food crops at all. Considering the fact that semi arid areas experience erratic rainfall, relying on one crop over exposes a household to food insecurity in the event of a crop failure. Besides the havoc caused by the large grain borer particularly on maize has only served to exacerbate the food insecurity situation.

The cost of social services is yet another factor influencing the food security situation. The study revealed that the cost of education and health care have risen tremendously over the years. Given the limited alternative sources of income farmers have no choice but to sell their hard earned cereals and family households to pay school fees and meet medical expenses. These expenses sometimes take a significant proportion of family income as high as 40 percent in a month. The cost of social services is usually based on market rates and the revenue farmers earn from the sell of cereals in most cases is not sufficient to squarely meet such needs. This experience often throws families off balance to the extent that children are often withdrawn from school and the sick are left to fate to die at home.

However it was surprising that some factors that were expected to influence food security did not yield significant results in this regard. Some of these factors include, household size, level of education of household head, household annual income, farm size, and soil conservation. It is important to note that even though the sample size of 294 households used could be small to generate representative findings, some of these factors may only influence food security when the appropriate moderating and or intervening variables are in place. For example an educated farmer will still need to have access to quality farm inputs to improve farm productivity.

Food insecurity has therefore become part of normal life to Kenyan semi arid communities. More than two thirds of households in the sample area were found to be food insecure based on quantity and quality of meals taken. Across the three districts households were more or less equally exposed to the incidence of transitory food insecurity.

To counter this tragedy households have devised strategies to improve on their alternative incomes. The coping mechanisms adopted include among others; charcoal burning, brewing and selling illicit liquor, selling firewood, basketry, casual labor-away from home area, *miraa* and tobacco growing, and retailing manufactured products by the road side. Most of these activities are not sustainable by their very nature. Some of them are regarded illegal by the government, for example charcoal burning and brewing illicit liquor. Given the addictive nature of the later, most of the families are loosing their men both old and young to the brew. This has not in any meaningful way improved the food insecurity situation, if anything it may worsen it.

The progress to attaining food security has been slow and uneven and the situation is likely to prevail unless concerted efforts are made to remove the obstacles to food security and promote overall rural development and poverty eradication. Despite the inherent difficulties and limitations of policy formulation and implementation at micro level, it is apparent that implementation of any meaningful interventions should be participatory, emphasizing decentralization of control, and taking account of local circumstances. Food insecurity should be treated as a multifaceted phenomenon not in

isolation from the multidimensional problem of poverty and underdevelopment, but which more often could be the root cause of the problem.

Food security strategies for Kenyan semi arid areas must therefore embrace a broad range of political, social and economic parameters taking a multi-sectoral approach in its implementation. To be sustainable such a strategy must address transitory food insecurity at three levels starting with the household, regional, and the national level.

5.2 Policy Recommendations

Based on the findings it is evident that most of the causes of food insecurity are reversible. Food security programmes should take a multidimensional approach to address all manifestations of poverty. For the case of Kenyan semi arid lands issues of cereal marketing channels, crop diversification, cost and access to quality seeds, cost of and access to quality insecticides, grain storage technology, access to credit facilities, access to both formal and technical education, access to health services, nutrition, land rights, cost of farm inputs and implements, regulating charcoal burning and local brews, and streamlining cereal marketing should be looked into within the broad framework of eradicating poverty.

It is therefore recommended that the government in collaboration with other stakeholders should consider the following strategic options when designing a food security policy for semi-arid lands communities in Kenya:

- Revive technical support services to rural farmers in order to improve crop husbandry and livestock management.
- Encourage crop diversification.
- Establish community cereal banks to improve storage of cereals and stabilize market forces. Community cereal banks also serve as channels for marketing surplus farm produce to milling companies at reasonable prices. The cereal boards run by the government are located mostly at district headquarters, which are sometimes too far from the rural farm folk.
- Subsidize the cost of social services especially education and health in semi-arid lands communities to ease pressure on limited household resources. Primary and secondary education levies should be abolished to enable children access at least basic education. Public health services in semi arid areas need to be revived as well. Currently private `self-declared doctors' (quacks) seem to be making a fortune out of the collapse of public health facilities. The quality of their services is wanting, given that most of them are not qualified medics.
- Research on the control of destructive large grain stock borer that is prevalent in semi-arid lands.
- Strengthen chemicals standards institutions to guard against sale of ineffective insecticides.
- Formalize and regulate sustainable charcoal burning as an option to economically empower rural households. In light of the adverse environmental effects of charcoal burning the state should fully commercialize the practice by leasing out some public forests for this purpose or demand that communities plant more trees

to replace those cut down for charcoal as part of the conditions for licensing charcoal burning.

- Establish credit facilities suitable to semi arid farmers both in kind and cash. The relevant ministry and development partners should assist in setting up farm input loan schemes to help farmers' access quality seeds and farm implements.

If the above strategies are implemented effectively the inter-seasonal food insecurity situation in Kenyan semi arid lands is likely to improve.

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