SOME ECONOMIC ASPECTS OF SMALL RUMINANT PRODUCTION BY SMALL SCALE FARMERS IN THE ASAL - A CASE STUDY OF WEST LAIKIPIA

BY

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DECLARATION

I, Martin M. Mucuthi, hereby declare that this thesis is my original work, and that the thesis has not been submitted for a degree to any other University.

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We, Dr. Kimpei Munei, and Dr Kailash C Sharma hereby declare that this thesis has been submitted for examination with our approval as University Supervisors.

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DEDICATION

To my children Thomas Maina Mucuthi and Catherine Wanjiru Mucuthi

with this message.

Education is:- Investing for a better tomorrow, today.

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LIST OF ABBREVIATIONS USED IN THE THESIS

AEZ	-	Agro Ecological Zone
ASAL	-	Arid and Semi Arid Lands
DAP	-	Di-ammonium Phosphate
ECF	-	East Coast Fever
ECZ	-	Ecological Climatic Zones
et al.	-	et alii (and others)
FAO	-	Food and Agricultural Organization
GOK	-	Government of Kenya
IDS	-	Institute of Development Studies
IFAD	-	International Fund for Agricultural Development
ILRAD	-	International Laboratory for Research on Animal Diseases
IRS	-	Integrated Rural Survey
LH	-	Lower Highland
LPP	-	Livestock Production Personnel
LRP	-	Laikipia Research Programme
MOLD	-	Ministry of Livestock Development
n.d.	-	no date
SR-CRSP	-	Small Ruminant - Collaborative Research Support Programme
TLU	-	Tropical Livestock Unit
UNDP	-	United Nations Development Programme
VP	-	Veterinary Personnel

ABSTRACT

It is estimated that 82% of Kenya's population is living in the rural areas (GOK 1991 p 2), mainly as small scale farmers. Those (the small scale farmers) in the ASAL have to depend a lot on livestock production for their household income. As their farms are small, and their capital bases are low, many of these small scale farmers depend a lot on small ruminant production as a source of household income. Therefore, this study looked at some of the important socioeconomic aspects that affect decisions in small ruminant production enterprises in West Laikipia, and the contribution of these enterprises to household income and net farm income.

The secondary data for this study were from Laikipia Research Programme and Ministry of Livestock Development, and to a lesser extent, from other Ministries. Primary data, on the other hand, were from a survey of 65 small scale farmers in Salama and Muruku, in West Laikipia.

Descriptive and cross tabulation methods were used in data analysis. The results of the study revealed that small scale farmers preferred sheep to goats; they outnumbered goats by 2:1. The study found that small ruminant production was an significant source of household income; small ruminant production was one of the two most significant sources of household income. The study also found that one third of the household income was contributed by income from small ruminant production. However, small ruminant production was hampered by disease and lack of water. At the same time, it received very little extension advisory service from Ministry of Livestock Development.

Therefore, the current study recommends firstly, that projects on small ruminant production, and especially those that will promote sheep production, should be initiated in order to improve the productivity of small ruminant production

enterprises. Secondly, extension advisory service of Ministry of Livestock development needs to be improved.

Finally, small scale farmers did not consider insufficient grazing to be a major problem because of the grazing available in the unoccupied farms. Nevertheless, nutrition is an area which needs to be addressed by the Ministry of Livestock Development, because grazing area will continue to diminish as the unoccupied farms in the study area are settled.

CHAPTER 1

BACKGROUND INFORMATION AND PROBLEM STATEMENT

INTRODUCTION

In this chapter the study will show how the government is coping with the development of the Arid and Semi Arid Lands (ASAL) and especially those areas where there have been an in-migration of subsistence small scale farmers. It discusses various options open to the government and also to the small scale farmers in improving the incomes of the latter. Finally, it states the problem that will be investigated and the objectives of the present study.

1.1 BACKGROUND INFORMATION

1.1.1: Agricultural Production in Kenya

Kenya is predominantly dependent on agriculture with small scale farmers playing a big role in the agricultural economy of the country. It is estimated that 82% of the population is living in the rural areas (GOK 1991 p 2), and that they are mainly small scale farmers. For instance, there were 1.5 million small scale farmers (with less than five hectares) in Kenya in 1976 (Heyer *et al.* 1976 p 187). This number has been increasing because of the sub-division of the large scale farms and ranches.

Due to this sub-division, small scale farming has extended to Agro Ecological Zone (AEZ) IV. However, crop yields in this zone are less reliable but livestock

(cattle, sheep, goats and camels) are abundant (Jaetzold *et al.* 1982 p 337). This area is also referred to as the Arid and Semi Arid Land[1].

The ASAL occupy 80% of the land surface in Kenya, carry 25% of the nations population, and 50% of the livestock (GOK 1989a p 132). Cattle ranching by European settlers and by African pastoralists was the major enterprise of the ASAL before the in-migration of small scale farmers from the high potential areas (AEZ II and III).

In this study, the size of the livestock herd rather than land size was used to classify small scale farmers. The study used 50 and 10 head of small ruminants and cattle respectively to determine who the small scale farmers were. These herd sizes were used because Kohler (1987b p 28) reported that small scale farmers in West Laikipia owned a maximum of 50, and 8 head of small ruminants and cattle respectively. The current study is in the same area. Flock size classification was considered to be a better criterion for this study than farm size. While the fact that land size is the standard measure in farm classification recognize, it can be a deceptive classification criterion in some instances; in the ASAL, animals are not always grazed on own farms. For instance, when farm size is small, most of the grazing is normally outside the farm.

In the ASAL, there are two types of agropastoral small scale farmers. There are those that were originally pastoralists turned agriculturalists, for example, the Njemps of Baringo (since 1920). There are also those that were originally agriculturalists but have adopted extensive livestock management; most of the small scale farmers in Laikipia fall in the latter category.

[1] A more detailed historical background of the ASAL is found in IFAD/UNDP (1988 p 23-32) and in GOK (1979 p 12-15).

1.1.2 The Kenya Sheep and Goat Development project

The first major Project[2] on small ruminant production was in 1971, when the main emphasis was on training of extension staff, veterinary research studies on breeding, production economics, and marketing. The aim of the breeding studies was to provide the first line crossbreeds (F1) to the farmers. The main thrust of phase I was to direct effort towards increasing sheep and goat production in dry areas. Multiplication centers for different breeds of small ruminants for example Dorpers, Galla, and Blackhead Persian were therefore established. The Ministry of Livestock Development also planned to conduct a nationwide small stock health survey especially on economic losses attributed to disease, mismanagement, genetic factors, and the economics of applying remedial measures. Livestock Marketing Division and Kenya Meat Commission were to be involved in the marketing of the stock.

For phase II, the long-term development objective was to raise the standard of living of the lowest income groups in the rural and pastoral areas. This would be done by increasing the annual production of sheep and goat meat from 54,000 tones in 1976 to 232,000 tons by 1988. The following were the immediate objectives:- a) to establish more multiplication flocks of major meat producing small ruminant breeds for supply of improved breeding stock to ranchers and pastoralists; b) to implement pilot marketing operations in representative low and medium rainfall areas, and assist in the development of both local and export markets; c) to implement strategic extension activities in selected small stock priority areas, and monitor the cost effectiveness of each area; d) to improve the methods of control and prevention of small stock diseases; and e) to establish more small ruminant breeding and research centers. This programme however, was revised to emphasize less on research and more on multiplication. It was also to provide marketing facilities, activities, and channels.

[2] This section is derived from the UNDP/FAO (1985) report.

However, because the funding was not as high as the programme had envisaged, not all of the above objectives were reached at the desired levels. The emphasis on small ruminant production was therefore directed towards the pastoral areas and towards dual purpose goat production in the sub-humid zones of Kenya[3].

1.1.3 Background information on Laikipia

Laikipia District is classified as an ASAL district because 80% of the District is in Ecological Climatic Zones (ECZ) IV - VI (Pratt *et al.* 1977) classification. The rainfall pattern is bi-modal with a annual precipitation of 850 mm, but it is scattered during the year; none of it is enough for any season. But to a casual observer, these rainfall figures may be deceptive. Rainfall may be high but erratic both within and between seasons and have a high incidence of storms[4]. Only the area at the top of Laikipia escarpment, which comprises 11% of the District has reliable rainfall, hence some cropping. The rest of the District has a probability of getting a maize crop failure in four out of every ten years. However, it is most suitable for, and was used for, extensive livestock production by the former European settlers (Jaetzold 1982).

However, extensive livestock production changed when many of these European commercial farms and ranches were bought by land buying companies and subdivided into small scale farms. These farms range in size from 1 to 8 hectares. For example, Chart 1.1 (left pie) shows that by 1987, 73% (46+27) of all ranches in the District had been bought by land buying companies. While 63% (right pie) of these ranches had already been subdivided into small scale farms, the rest were in various stages of subdivision (GOK 1987).

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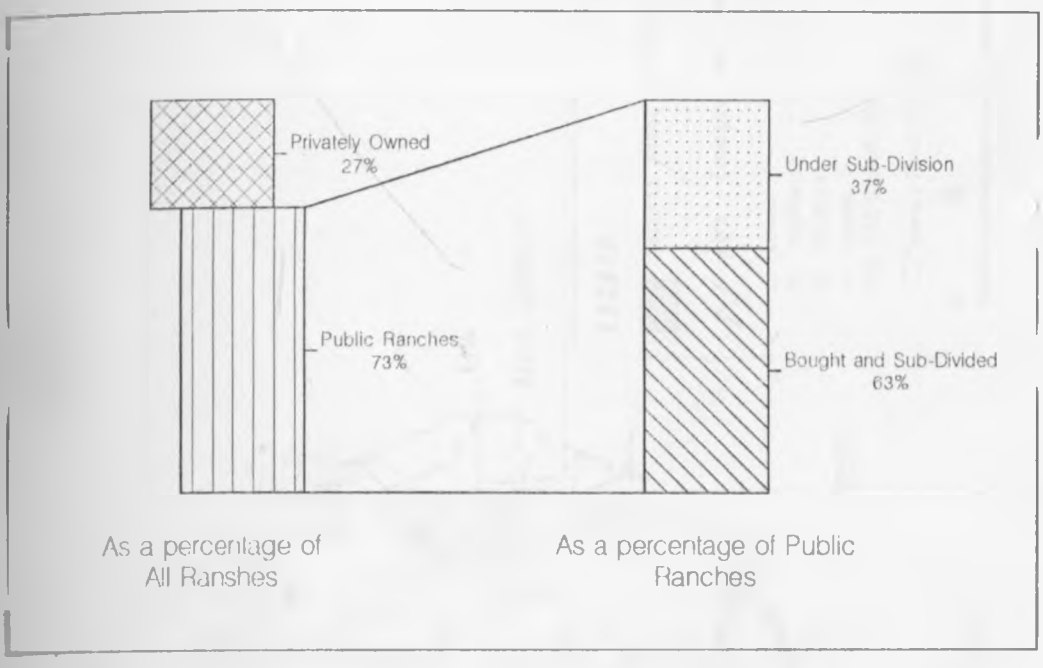
[3] Small ruminant research in humid areas is carried out by Small Ruminant - Collaborative Research Support Programme (SR-CRSP) Nairobi, Kenya.

[4] During the present survey in the study area in May 1991, the author witnessed a storm of 235 mm in one day.

Chart 1.1: Percent of European Ranches Bought by Land Buying Companies



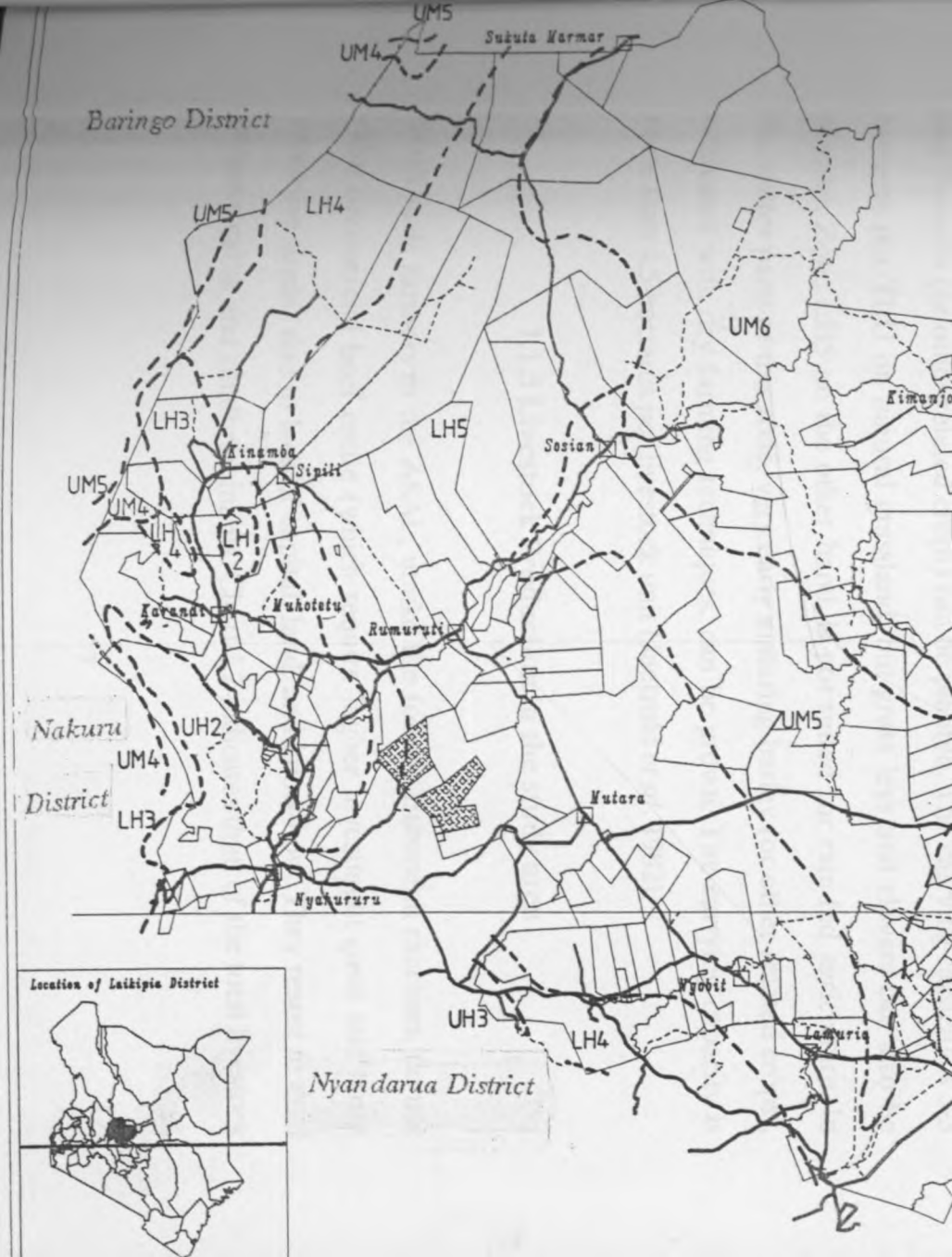
Source: GOK (1987)

In Laikipia, private ranches are owned by a few individuals. Further, only 11% of the District is high potential. Therefore, the majority of the population in Laikipia[5] is made up of small scale farmers who are living in the ASAL.

1.1.4 The ecology of The study area

Although the ASAL of West Laikipia falls under Ecological Climatic Zones IV and V according to Pratt *et al.* (1977 p 41) ecological classification, the present study is concerned with ECZ IV. The study focused on zone IV because sub-division of land into small scale farms has been extended up to this zone, and it is the driest zone where agriculture is still possible; although marginally. Otherwise, it is a very productive rangeland for livestock production.

[5]The population of Nanyuki town is 9% therefore 91% of the population lives in the rural areas (GOK 1991 p 33).


UM5
UM4
Suiuta Marmar
Baringo District
UM5
LH4
UM6
LH3
LH5
Kinamba
Sipili
Sosian
UM5
UM4
LH 4
LH 2
Kabarnet
Mukoteta
Rumuruti
Nakuru
District
UH2
UM4
LH3
UM5
Nutara
Nyahururu
Location of Laikipia District
UH3
LH4
Nyahuru
Nyandarua District

Laikipia District, Kenya

SALAMA AND MURUKU RANCHES

LOCATION

LEGEND:

Testarea Salama and Muruku

Agro – Ecological Zones boundaries

- L Lower
- H Highland
- M Medium
- U Upper
- 2-6 AEZ Classification

Towns / Rural Centers

0 10 20 30 40

KILOMETER

Source:
Basemap: S.Taiti,1990. Landuse and Land Ownership
ARC-INFO Application: E. Itote
Copyright: LRP, Nanyuki
Universities of Bern and Nairobi

The zone has *Acacia* as a very distinct woodland, they include, *A. gerrardii*, *A. lockii*, and *A. seyal*; it may also include *Tarminalia* and *Albaizia* species. Bushlands include *Lantana*, and shrub species of *Combretum*; fringing the forest zone, *Euclea* and *Tarchonanthus* are important constituents of semi-evergreen shrub land (Pratt *et al.* 1977 p 59).

Jaetzold *et al.* (1982 p 9), on the other hand, recognized seven Agro Ecological zones based on the probability of meeting temperature and water requirements of the main leading crops. According to this classification, the study area falls in the classification of Lower Highland Zone (LH), LH4 and LH5. The LH4 zone is a transitional zone between Pratt's *et al.* (1977) (ECZ) III and IV. The LH5 zone is the semi arid zone IV proper. Most of the West Laikipia ASAL fall under LH4 and LH5 classification.

The LH4 zone is classified as a fair yield potential where early maturing wheat like Tumaini (or other related crops) can be planted. The carrying capacity is 3-5 hectares per TLU on natural grassland, but grass leys and clovers can also be planted. Zone LH5 on the other hand, is not suited for rain-fed agriculture. In the wetter parts of this zone, very early maturing barley (or other related crops), cultivated with dry farming techniques, can be grown. The carrying capacity is more than 4.5 hectares per livestock unit (Jaetzold *et al.* 1982).

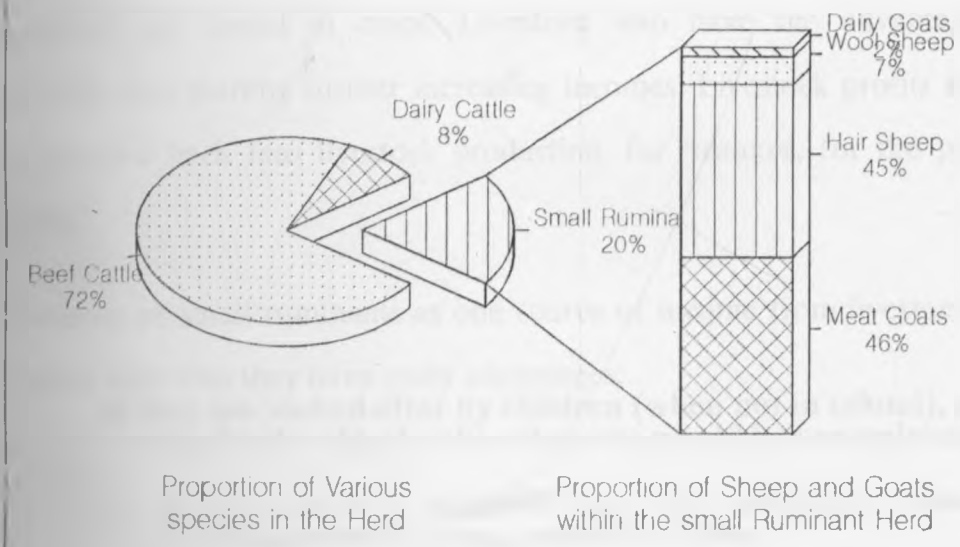
1.1.5 Livestock Production in the study area

Small scale farmers in the ASAL, unlike the former European ranchers, do not raise commercial beef cattle (which require higher investment costs and more extensive areas) due to lack of capital, land, and know-how. They resort to dual purpose cattle and small ruminants. Chart 1.2 indicates that, of the total livestock

bio-mass in the district, beef and dairy cattle account for 72% and 8% (left pie) respectively. Small ruminants account for 20% of he livestock bio-mass.

Looking at only the small ruminant bio-mass, the chart (right pie) shows that there is a slight difference between the total sheep and goat herds with the former being more than the latter. Hair sheep (45%) and meat goats (46%) make up the bulk of the small ruminant herd.

Chart 1.2: Proportion of Various Livestock Within the Laikipia District Livestock Herd



Source: GOK (1989b)

Small scale farmers in Central Laikipia own 20% of the District's small ruminant bio-mass; large scale farmers and pastoralists own 21% and 59% respectively (Taiti 1991). However, they (small ruminants) account for 40% of the small scale farmers' livestock bio-mass. Indeed, Kohler (1987a p 22, and 1987b p 28) found that in West Laikipia, most families kept small ruminants whether they had cattle or not.

1.1.6 Small Scale Farming in the Study Area.

In West Laikipia, small scale farmers have three livestock options; cattle, small ruminants, or both. Like many of their counterparts elsewhere, they are faced with two major constraints, low capital base and low land productivity. With income from off-farm employment, and any income from livestock and crop enterprises, they can either invest in crop production (improve technology or increase acreage under crops, as the income may not be enough to buy more land), or invest in livestock production. Since land productivity is low, it is logical for them to invest in livestock production because livestock have a growth potential not found in crops. Livestock also have the advantage of self reproduction thereby further increasing incomes. Livestock profits too, can be re-invested back into livestock production, for instance, for the purchase of feeds.

Focusing on small ruminants as one source of income from livestock, previous studies show that they have many advantages:

a) **they are looked after by children (when not in school), and also by the elderly who otherwise would be unemployed.**

b) **they are easier to establish than large ruminants, because the investment costs per animal are lower.**

c) **they are easier to dispose.**

d) **they have a higher reproductive rates per head than large ruminants.**

e) **they have better survival rate than large ruminants (Mburu 1988, Ngategize 1989, Andangachew 1990).**

This is confirmed by table 1.1 below which shows livestock slaughter records for Salama and Muruku during the last four years. These two centers are in a small scale farming community, in the ASAL of Rumuruti Division in Laikipia. The table shows that the butcheries in the two centers did not slaughter any cattle in

1987 and 1988. However, of the animals slaughtered in 1989 and 1990, small ruminants accounted for 86% and 89% respectively.

Table 1.1: Number of Livestock Slaughtered at Salama and Muruku Centers - Rumuruti Division, Laikipia.

Year	Small Ruminants		Cattle	
[1]	Frequency	Percent[1]	Frequency	Percent
1987	332	100	0	0
1988	285	100	0	0
1989	433	86	7	14
1990	423	89	5	11

[1]Calculated as a percentage of total TLU slaughtered.

Source: GOK 1990a

Assuming that the animals were sold by the farmers to meet their immediate cash needs, one can see that small ruminants contributed the bulk of the stock slaughtered. However, the table does not account for live animal sales inside or outside the location, which also catered for some cash needs.

Even with this apparent contribution by small ruminant production to household income, there are no small ruminant upgrading programmes in Laikipia District. One dual purpose goat programme, started in 1985 by Laikipia Rural Development Programme, showed little impact with the small scale farmers and was therefore discontinued. An unpublished evaluation report on the causes of failure of the programme showed that there was lack of proper implementation

and follow-up (Muragoli *et al.* 1989). There could also have been lack of interest in dual purpose goat production.

The fact that small scale farming in the ASAL is new may be one of the reasons of having no small ruminant programmes (for small scale farmers). This lack of emphasis on small ruminant production in general and especially for small scale farmers in the ASAL, is not a problem of Laikipia District alone; it is also there at the national level. Previous studies show that the promotion of small ruminant production has not been as intensely followed as that of the large ruminant production. Indeed, they show that very little attention[7] has been given to research and extension in relation to (small ruminant) problems of feeding, management, breeding, and disease control (Winrock International 1982 p 8). Yet, some of these studies indicate that improved livestock husbandry measures can considerably increase the output from small ruminant production (Skea n.d. p 54).

1.2. THE PROBLEM

1.2.1. Problem Formulation

The small scale farming area of West Laikipia (an ASAL), like many small scale farming areas in the Kenya, is a food deficit area. Food deficiency for small scale farmers is caused by many factors. For instance, they have relatively small quantities of capital and little access to credit. They also operate at subsistence level, therefore, they usually have low incomes (Nyaribo 1983, IFAD/UNDP 1988 p 4).

[7] SR-CRSP does research on dual purpose goat production in the sub-humid areas.

For an ASAL, the problem of food deficiency is aggravated, on the one hand by the high population growth rate because of in-migration. For example, the Economic Survey (1991 p 32-33) showed that, while the national growth rate for 1979-89 was 3.3%, Laikipia registered a growth rate of 4.6%; it was among the top four leading Districts, behind Narok 6.5%, Kajiado 5.6%, and Isiolo 4.9%. These four Districts are all in the ASAL. The above average population growth aggravates the two constraining factors of ASAL development, a fragile ecology and low level of government investment. This was noted in the 1979-83 development plan as reported by Muriithi that:

> **"... they (ASAL) have major problems of increasing population pressure on a fragile ecology which has lead to significant resource degradation and low risky income opportunities with widespread poverty"** (Muriithi 1979 p 2).

Food deficiency, on the other hand, is also aggravated by low Government research input into these areas. Initially, government policy was to invest the scarce resources where there was the highest returns. The ASAL therefore were not a priority area. This was the reason why in the past, there was no meaningful investment in the ASAL. Previous studies indicate that:

> **"Major past research work has focused attention on solving the problems of medium and high potential areas. Other than the development and the release of Katumani composite at the National dry land research station at Katumani (Machakos) some years ago (....), no major research finding affecting marginal/semi arid areas has been released"** (GOK 1979 p 53).

Fortunately, in the recent past, the government has been committed to re-examining its policy on ASAL areas in order to ensure that their full potential is realized (GOK 1989a p 132). Indeed, a new Ministry of Water, Arid and Semi Arid Lands and Wastelands has been Created to focus Development in these areas.

Apparently, the new small scale farmers that are migrating into the ASAL are not psychologically prepared to face the new kind of climate that they find. It has been observed that they tend to transfer agricultural production techniques (and crops especially maize) of the high potential areas to the ASAL, sometimes with dismal results. But, they still continue growing these crops. For instance, Kohler (1991) observed that it was very difficult to grow maize in Matanya in Central Laikipia, which is an ASAL; but the farmers still grown it year after year. He wrote that:

> **"Given the low amount of rainfall and its variability in onset and duration, maize production in Matanya proves an exceedingly difficult endeavor and a matter of trial with a very high chance of error. The reason (for growing maize under such condition) lies in the importance of the crop as a staple food"** (Kohler 1991 p 86).

Therefore, one of the reasons for its (maize) continued production is its importance as a staple food. Indeed, even though livestock production, both large and small ruminants, is recommended by the Ministry of Livestock Development, livestock can only supplement but not replace crop (maize) production.

The new small scale farmers are also not financially able to cope with the challenges associated with the acquired land. Most of them obtained the land through allocation in government settlement schemes or through land buying companies. These land buying companies provided the shareholders with a cheap way of buying land. For many small scale farmers, this land is the only investment they have. This is the reason why their resources are too low to provide the necessary farm improvements that enhance capital growth.

1.2.2. The problem statement

One of the main problems of the small scale farmers in West Laikipia is that of low incomes. Indeed literature on Central Laikipia showed that net farm income was only sufficient to guarantee physical survival for only 33% of the small scale farmers (Kohler 1987c p 109). Therefore, there is need for the government to look for ways of improving the small scale farmers' incomes.

It is because of this importance of small scale farming in Laikipia that Laikipia Research Programme (LRP) oriented its research towards this type of farming, but in the ASAL. The importance of improving small scale farmers' incomes was aptly explained by Winiger *et al.* (1983) when they wrote that:

> **"... the continuous influx of the small scale farmers and the ensuing expansion of small scale farming area will, in future, without doubt, enhance the importance of any programme which aims at assisting their (small scale farming) sector within the District Agricultural scene"** (Winiger *et al.* 1983 p 25).

One of the ways that small scale farmers' incomes can be increased is through promotion of small ruminant production.

A paper on ASAL Development in Kenya summed up the need for livestock research when it stated that:

> **"... livestock ruminants are threatening the very survival of the owner. How to balance livestock needs with the supportive production capacity of grazing, while at the same time meeting the needs of the livestock owner, is the equation to be solved"** (GOK 1979 p 53).

To address this issue, LRP has focused some of its research on small ruminant production. The programme is required to provide the Laikipia Rural Development Programme and the District authorities with relevant information

in order to prepare and execute technical projects. Therefore, its research is mainly application and action oriented (GOK 1986 p 59).

In order to find ways of improving small scale farmers' incomes in West Laikipia, the present study will look at small ruminant production with the following objective.

1.3 THE OBJECTIVE

The overall objective of the study is to look at some of the important sociological and economic aspects that affect small scale farmers' decisions on small ruminant production. The study will be confined to LH4 and LH5. It will determine the contribution of small scale farmers' income from small ruminant production to household income, and the influence of the latter on the former. The following will be the specific objectives of the study:

a) **to determine whether there were any significant differences of proportions of:**
   (i) cattle and small ruminant herd sizes
   (ii) net farm incomes
   (iii) incomes from small ruminant production.

b) **to describe some of the important sociological and economic aspects that affect small scale farmers' decisions on, and also identify constraints to, small ruminant production.**

c) **to determine the relationship of cattle and small ruminant production as it relates to the choice of the species in livestock production.**

d) **to determine the relationship of sheep and goat production as it relates to the choice of the small ruminant species.**

e) **to determine the proportion of household income and net farm income, that is contributed by income from small ruminant production.**

1.4 THE ORGANIZATION OF THE THESIS

In chapter one, the study has given an overview of agricultural production in Kenya and, more specifically, in the study area. The problem statement and the objective of the study have also been stated. In Chapter two the study will review literature on small ruminant production by small scale farmers. More specifically, literature related to sociological and economic factors that influence decisions on, and the constraints to, small ruminant production will be reviewed. Literature that is related to the influence of net farm income on income from small ruminant production will also be reviewed. In chapter three the study will describe the methods used in data collection. Analytical framework and the mathematical model that will be used in the analysis of the data will be also described. The findings of the present study will be discussed in chapter four and five, while in chapter six, the summary of the findings, the conclusions, and the recommendations will be given.

CHAPTER 2

LITERATURE REVIEW

INTRODUCTION

In this chapter, firstly, literature that is related to important socioeconomic aspects that affect decisions on, and the constraints to, small ruminant production in the study area will be reviewed. Secondly, the study will review literature on the relationship of small ruminant and cattle herd sizes, especially the relationship of cattle herd sizes with the ratio of small ruminant to cattle herds sizes. Finally, this study will review literature on the contribution of income from small ruminant production to household income and the influence of the latter on the former.

2.1 THE RELATIONSHIP BETWEEN AEZ AND THE SMALL RUMINANT FLOCK SIZE

Rainfall affects the type of vegetation available in an area. This means that the ratio of bushes and shrubs to grass increases with decreasing rainfall. Therefore, vegetation will affect the species of animals a small scale farmer can keep because livestock species vary in the choice of the plants that they feed on. While cattle and sheep prefer grass, goats prefer browsing on bushes and shrubs. Thorpe *et al.* (1990 p 180) found that goats out-numbered sheep by 3:1 in the arid zone of Kilifi. But, instead of this ratio decreasing in the sub-humid zone according to expectation, the ratio increased to 9:1.

Kohler (1987a p 22 and 1987b p 22), on the other hand, in his study in Wiumiririe and Ng'arua (West Laikipia), did not indicate the proportion of sheep to goats. However, he observed that the ratio of small ruminants to cattle within the total household herd increased as rainfall decreased. This could be due to reduction of household incomes, causing inability to purchase cattle, or a decrease in the grass cover.

Since LH5 is drier than LH4, it is expected there will be more dependence on livestock, and small ruminant production in particular, in the former than in the latter zone. Further, it is expected that there will a higher ratio of bushes/shrubs to grass in LH5 than in LH4, therefore, it is expected that there will be a significantly higher ratio of small ruminants to cattle, and a significantly higher ratio of goats to sheep, in the former than in the latter zone. The current study will provide further understanding of the effect of climatic differences on the ratio of small ruminant to cattle, and the ratio of goats to sheep, in the two zones of the study area.

2.2 SOME SOCIOECONOMIC ASPECTS THAT AFFECT DECISIONS ON SMALL RUMINANT PRODUCTION

Although the present study is on socioeconomic aspects that affect decisions on small ruminant production by small scale farmers in the ASAL, it will be necessary to refer to some studies on small ruminant production by pastoralists. The reason for this is that, previous studies indicate that small scale farmers in the ASAL, like pastoralists, employ the extensive system of management in small ruminant production (Stotz 1983 and Kohler 1987b). Additionally, there are very few studies on small ruminant production by small scale farmers in the ASAL.

Previous studies show that for pastoralists, whose main livelihood is livestock raising, small ruminant production contributes more to cash income than cattle

production. This is especially marked for those families without off-farm income (IPAL 1978 p 121 and Herren 1990 p 120). Herren, in particular, found the dependence on small stock (small ruminants) income for the Mukogodo pastoralists to be more marked in the medium income than in the upper and lower income groups. He found that the upper income groups relied on cattle income to cater for their cash needs and the lower income groups relied on remittances from off-farm income. The middle income groups, however, relied heavily on small stock sales. This indicated that small stock production was a major source of cash income for this middle income group.

The Njemps, who are small scale agropastoralists in Baringo, also depended a lot on small ruminant production. While livestock production accounted for 60% of the gross farm income, small ruminant production accounted for two times as much income as cattle. Small ruminant sales were highest in the dry season when cash needs were highest, because of the decline in milk production, and hence increased dependance on grain (Little 1981 p 11).

Small scale farmers are both cultivators and livestock raisers, therefore, the two enterprises are complimentary as well as supplementary in providing household income. Within the livestock production enterprise, small ruminant production has many important uses for the small scale farmers. For instance, goats may not compete to any extent with cows as a source of commercial milk production, but they help in increasing the farmers' income by releasing all cows' milk for sale. Small ruminants also produce manure and to a lesser extent, act as "poor" man's cows. This importance of small ruminants was demonstrated by Lagemann (1977 p 77) in a study of traditional African systems in Eastern Nigeria. He found that small ruminants were kept as financial reserves, as hedges against crop failure, and also for financing children's' education. Other uses were for home consumption, for conversion of non-marketable products (like peelings) to better use, and as a source of manure.

At Maseno research station, goat manure was found to be just as good if not better than Diammonium phosphate fertilizer (DAP[1]) in providing nutrients for maize. The study observed that maize planted with goat manure yielded four times more grain than that planted with DAP. However, in other clusters under field conditions, there was no significant difference between the yield from clusters treated with DAP and those treated with goat manure. At the same time goat manure had an added advantage over DAP in that it had a residual effect (Onim *et al.* 1990 p 160).

Contagious Caprine Pleuro Pneumonia (CCPP) and helminths have been indicated as the main disease constrains to small ruminant production. In his study on small stock production by Mukogodo Maasai, Herren (1990 p 126) found that CCPP and helminths were the major small ruminant diseases in that area. They were the causes of 36% and 30% of the deaths in sheep and goats respectively.

Other previous studies have identified worms as the single greatest constraint of small ruminant production in both range and sub-humid areas (Sidahamed *et al.* 1985 p 121, Shavulimo *et al.* and 1986 p 218,). Additionally, the meat inspection report from the study area indicated that helminths were the main cause of livers and intestines condemnation[2] (GOK 1990a). This is seen in table 2.1 which shows the number of livers and intestines condemned in Muruku, a market center in Rumuruti Division of Laikipia District.

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[1] recommended maize fertilizer in many parts of the Kenya.

[2] All meat slaughtered for sale must be inspected and passed as fit for human consumption. During this inspection, internal organs found to be unfit for human consumption are condemned for destruction while the other meat is passed for sale, if fit for human consumption.

Table 2.1 Number of Small Ruminant Livers and Intestines Condemned in Muruku in 1987-1990

Year	Organs Condemned Due to Helminths Infestation			
	Livers	Percent[1]	Intestines	Percent[1]
1987	56	27	12	6
1988	16	20	3	4
1989	22	9	19	7
1990	98	33	21	10
Average loss in four years	48	22	11	7

[1]As a percentage of total stock slaughtered within the year.

Source: GOK (1990a).

The table indicates that helminths caused an average of 22% and 7% loss of livers and intestines respectively. In 1990 alone, the loss from helminths was 33% and 10% for condemned livers and intestines respectively.

Cited literature in this section has indicated the importance of small ruminant production, however, most of these studies are on small scale farming in the humid and sub-humid areas or in the pastoral areas. They have also indicated the major small ruminant diseases in pastoral areas. This study will provide information on the importance of, and constraints to, small ruminant production for small scale farmers in the ASAL, and West Laikipia in particular.

2.3 RELATIONSHIP BETWEEN THE SMALL RUMINANT AND CATTLE HERD SIZES

De Souza *et al.* (1984 p 289) studying the use of reserve grazing for small ruminants in Merueshi, Kajiado District, observed that 60% of the cattle were owned by only three owners. The three, however, owned only 25% of small ruminants. They observed that the ratios of small stock to cattle herd sizes on the one hand, and the small stock flock sizes on the other hand, were inversely related; the poorer stock owners had proportionally more

Table 2.2: Comparison of Small Stock and Cattle Herd Size Ratios in Merueshi Ranch Using Cattle Ownership Classification[1]

Cattle Ownership Class	Number of HH[2]	Ratio[3] SS/ Cattle	Proportion % [4] Total Cattle	Total SS
< 49	6	2.5	4	13
50- 99	6	1.4	13	22
100-199	6	1.3	27	41
Over 200	3	0.4	56	24

HH = household.
SS = small ruminants.
[1]Based on 21 HH - one had no SS on the ranch.
[2]Number of households per class of cattle owned.
[3]Ratio derived from total number of small stock and cattle per ownership class.
[4]Proportion % derived from total households.

Source: De Souza (1984 p 294)

small ruminants than cattle. As table 2.2 below shows, small ruminant to cattle ratio declined with increasing cattle herd sizes. The table further shows that while the poorest six farmers owned only 4% of the total cattle herd, they owned

13% of the total small ruminant herd. Small ruminants too, were more normally distributed than cattle.

These results indicate that, *ceteris peribus*, small ruminant improvement programmes may be accepted more easily by the poorer farmers. They depend more on small ruminant production than the richer farmers. However, the study did not indicate whether this change in the ratio of small ruminant to cattle herd sizes was due to pastoralists investing their extra income in cattle or whether the pastoralists had less need for small ruminants, as their cattle herds increased.

This trend of having low proportions of small ruminants by the rich households was also observed by Herren (1990 p 120) in his study on the socioeconomic stratification and small stock production in Mukogodo Division of Laikipia. He observed that the poor owned proportionately more small ruminants than cattle. The proportion of small ruminant herds within the household livestock herds were 49%, 62%, 71%, 77% for the rich, medium, poor, and the very poor households respectively. The study, like that of De Souza *et al.*, indicated that as the cattle herd sizes increased, the proportion of small ruminants to cattle decreased. The findings, however, were related to a pastoral area where herds are large.

The study by Thorpe *et al.* (1990 p 179), on other hand, was on small holder farmers (small scale) in Kaloleni Division of Kilifi District. They found that in the "livestock-millet" zone, which has similar climate to the study area, small ruminant flock sizes tended to increase with increasing herds of zebu cattle. However, there was no tendency for presence or absence of small ruminants to be associated with the size of the cattle herds. But the study did not indicate whether there were any changes in the proportion of small ruminant to cattle herd sizes; the two herds could increase at varying rates.

Further findings of the study were that 60% of the small holder farmers in the Division had small ruminants while only 20% owned cattle. A similar skewed ownership of small ruminant and cattle had also been observed in Wiumiririe and West Laikipia; more small scale farmers there owned small ruminants than those who owned cattle (Kohler 1987a p 22, and 1987b p 22).

The first two studies cited in this section indicate that there was a negative correlation between the proportion of small ruminant and cattle herd sizes. This will appear to be at variance with Thorpes' *et al.* (1990) study because the latter found a positive relationship between the small ruminant and cattle herd sizes. However, Thorpe *et al.* (1990) did not show the changes in the proportions of the two herd sizes. It was possible for the two herds to be positively correlated while the ratio of small ruminant to cattle herd sizes was negatively or positively correlated with the cattle herd size.

The present study will focus on small ruminant production, by small scale farmers in West Laikipia and will provide information on the relationship between the small ruminant and cattle herd sizes. It will determine the ratio of small ruminant to cattle herd sizes in relation to the two herds. It will also provide reasons for the choice of either cattle or small ruminants.

2.4 THE PREFERENCE FOR SHEEP OR FOR GOATS

Some previous studies on pastoralists indicate that they keep more goats than sheep (O'Leary 1985 p 118, Herren 1990 p 119, Field *et al.* 1984 p 302). Others, like that of De Souza *et al.* (1984 p 290), indicate that the opposite is true[3]. The preference for goats has also been observed among the small holder agropastoralists of the semi-arid zone of Kilifi in the Kenyan coast (Thorpe *et al.*

[3] Herren (1991) indicated to me that the preference of sheep to goats in Kajiado was likely due to the range condition; Merueshi has a lot of grass but few shrubs and bushes for goats.

1990 p 179). They found that there were more goats than sheep, out-numbering them by 3:1. They further observed that while there were many farmers with goats but no sheep, there were none with sheep and no goats, but sheep increased as rainfall decreased. Wilson (1986 p 39) also found similar results in Mali where agropastoral Bambara had more goats than sheep.

The last two studies on agropastoralists that have been cited were at variance with what was observed by Little (1981 p 9) and Kohler (1987c p 80) about other small scale agropastoralists. They reported that sheep out-numbered goats by 2.6:1 and 1.5:1 in Baringo, and West Laikipia respectively.

All the studies cited in this section gave no reasons why the pastoralists or the agro pastoralists preferred either sheep or goats. However, Little (1981) observed that a high goat mortality rate through CCPP may have caused the difference in sheep and goat herds in his study area. However, it cannot be ruled that the preferences can also be culturally based.

There are other factors that may determine the choice of the breed, for instance, the growth rate, the hardiness of the breed, or the ability to provide milk. Some previous studies indicate that sheep grow faster than goats because the latter are milked (Wilson 1982 p 188 and IPAL 1978 p 5). Therefore, *ceteris peribus*, small scale farmers keeping small ruminants for meat may prefer sheep to goats. If on the other hand they need milk, they will prefer goats. Another factor small scale farmers consider is the mortality rate; they will choose the species and breeds that have low mortality rates. While Table 2.3 below shows that the mortality rates for sheep and goats are almost the same, the mortality rates for the Dorpers (an exotic sheep breed) are twice as high as those of the Tswana-Dorper crosses and three times as high as those of the indigenous Tswana sheep.

The table also shows that the mortality rates for the Boers (an exotic goat breed) are twice as high as those of their Boer-Tswana crosses or the indigenous Tswana goats.

We expect that most of the small ruminants in the study area will be the indigenous breeds, for instance, the East African goat and the Red Maasai sheep, and some Indigenous-Exotic crosses but few exotic breeds. The reason for this is that, *ceteris peribus*, the indigenous breeds or their crosses will be more preferred than the exotic breeds, because the latter have higher mortality rates.

This section has shown that previous studies are inconclusive on the issues of the preference of sheep and goats among the pastoralists and even among the agropastoral small scale farmers. The preference for any of the small ruminant

Table 2.3: Small Ruminant Mortality Rates By Species

Mortality Rate (%)		Source		
Sheep	Goats	Country	Author	Year
Figures not available	25-40 (kids)	W. Africa	Reynolds	1985
75 (Dorper)	45 (Boer)	Botwana	Senyatso	1986
27 (Dorper X Tswana)	28 (Tswana)	"	Senyatso	1986
30 (Indigenous Tswana)	26 (Boer X Tswana)	"	Senyatso	1986
36 (Indigenous)	45 (Indigenous)	Mali	Wilson	1986
34 (Indigenous)	34 (Indigenous)	Kenya	Kohler	1987a
29 (Indigenous)	29 (Indigenous)	Kenya	Kohler	1987b
37 (Indigenous)	41 (Indigenous)	Kenya	Herren	1990

Source: Compiled by Author[4]

[4]Compiled from Reynolds (1985), Senyatso (1986), Wilson (1986), Kohler (1987a and 1987b), and Herren (1990)

species is an important consideration as far as extension messages from Ministry of Livestock Development to the small scale farmers are concerned. One objective of this study is to determine whether there is any preference for sheep or goats, or for the indigenous-exotic crosses.

2.5 RELATIONSHIP BETWEEN INCOME FROM SMALL RUMINANT PRODUCTION AND HOUSEHOLD INCOME

Small scale farmers are likely to purchase small ruminants from the balance of household income after meeting what they consider as household living expenses. Household income is a function of off-farm income and net farm income, while net farm income is a function of income from cattle production, crop production, and small ruminant production. Therefore, income from small ruminant production has an associative effect on household income because it contributes to net farm income. The study also expects that household income influences income from small ruminant production because small scale farmers with high household incomes are likely to invest some of this income in small ruminant production.

Smith, as reported by Muriithi (1979 p 30), in his study in the cotton zone of Machakos and Kitui Districts (the cotton zone is an ASAL), found that off-farm income increased net farm income. He also found that the contribution of off-farm income to household income increased, the drier the area became. However, he did not indicate the level of contribution of these sources of household income.

Kohler (1987c p 109), on the other hand, in his study of small scale farming in Central Laikipia, reported that net farm income on its own was only sufficient to guarantee physical survival to 33% of the households. He also reported that only 30% of households were able to meet both their physical survival (calorific) and

other household (education, clothes) needs and still have surplus household income. Lastly, he found that there were more small scale farmers in the latter category in the higher potential area (Mia Moja) than in the lower potential area (Matanya). Although he indicated the sources of net farm income as crop and livestock sales, he did not show the contribution of these sources of income to household income. Nonetheless, he found that net farm income had a very low contribution to household income and hence concluded that without off-farm income small scale farmers could not survive. He wrote:

> **".... without financial backing provided by off-farm income, sustained small scale farming though not widespread would practically disappear."** Kohler (1987c p 110).

Similar sentiments had been expressed by Lagemann (1977) about small scale faming in Eastern Nigeria when he observed that:

> **".... non farm employment is the only way to escape low income level equilibrium trap."** Lagemann (1977 p 109).

The studies cited in this section indicate that off-farm income is a major contributor to household income and that the contribution of net farm income to household income decreases with decreasing rainfall.

One of the aims of the current study is to quantify the contribution of income from small ruminant production to net farm income and to household income. Further, the study will determine the influence of net farm income to income from small ruminant production.

CHAPTER 3

METHODOLOGY

INTRODUCTION

This chapter, starts with a description of Farming Systems Research, which is the theoretical basis of this study. The method of sample selection and how the data were collected is then explained. Later, the method used in analyzing the data is described and finally, a description of the variables that will be used in this study is given.

3.1 THEORETICAL FRAMEWORK OF THE ANALYSIS

3.1.1 Farming Systems Research

Small scale farmers face many challenges in the small ruminant production. Therefore, to provide them with appropriate advice on small ruminant production, a study of some of the existing sociological and economic aspects that affect decisions on their production is essential. Lagemann (1977) saw the need to first identify what the farmers were doing before embarking on new research or giving advice on changes in technology. Quoting Cleave, he wrote that:

> **".... before any consideration can be given to possible development on African small holdings and the means by which they can be brought about, it must be determined what farmers are doing, what factors govern their actions and what pressures there are to change the pattern of agriculture that results."** (Lagemann 1977 p 1).

Thomas *et al.* (1985), on their part, identified three steps in a programme for village research:

a) a descriptive and diagnostic research of existing technology.
b) a design of new appropriate technology through research.
c) an evaluation of created technology. (Thomas *et al.* 1985 p. 163).

The two studies were referring to the research method that is referred to as Farming Systems Research[1] or FSR in short. Farming systems is, " .... **a result of a complex interaction of interdependent components .... (i.e.) crop production, livestock production, and off-farm enterprises.**" (Norman 1978 p 814). Welsh (1978 p 819) added production for the household among the interdependent components enumerated by Norman (1978).

Farming Systems Research, is research in farming systems, and recognizes the interaction of the technical and human elements. It is characterized by the 'bottoms-up" approach to farmers' problems rather than the traditional "top-down" approach. FRS recognizes the need to have research tailored to a specific area by disaggregating the study areas into homogeneous subgroups. These subgroups can be in terms of the differences in the ecological system, the technical elements or human elements. The results of FRS become the focal points of developing strategies to overcome or to reduce the limiting constraints. The strategies do not necessarily involve new technology; they could be organizational, for instance, in irrigation. In FSR, the farmer is the central figure. It is based on the farmer's knowledge and traditional experimentation, therefore change involves adjustment of the farmer's farming system and not a complete change to it. However, these adjustments must be in accordance with the national policy in respect of which the farmer is making the adjustments.

[1] The explanation on FSR is based on Norman (1978 p 813-818).

change to it. However, these adjustments must be in accordance with the national policy in respect of which the farmer is making the adjustments.

Some shortcomings of FRS are that, short-run private gains may conflict with long-run social goals. There is also a time lag in the recognition of the problem, finding the relevant solution, and its adoption by the farmer. Because it is locationally specific, it is inherently expensive. Finally, because the researcher's training is in a different setting from that of the farmer, he (researcher) sometimes does not appreciate the local wisdom and values.

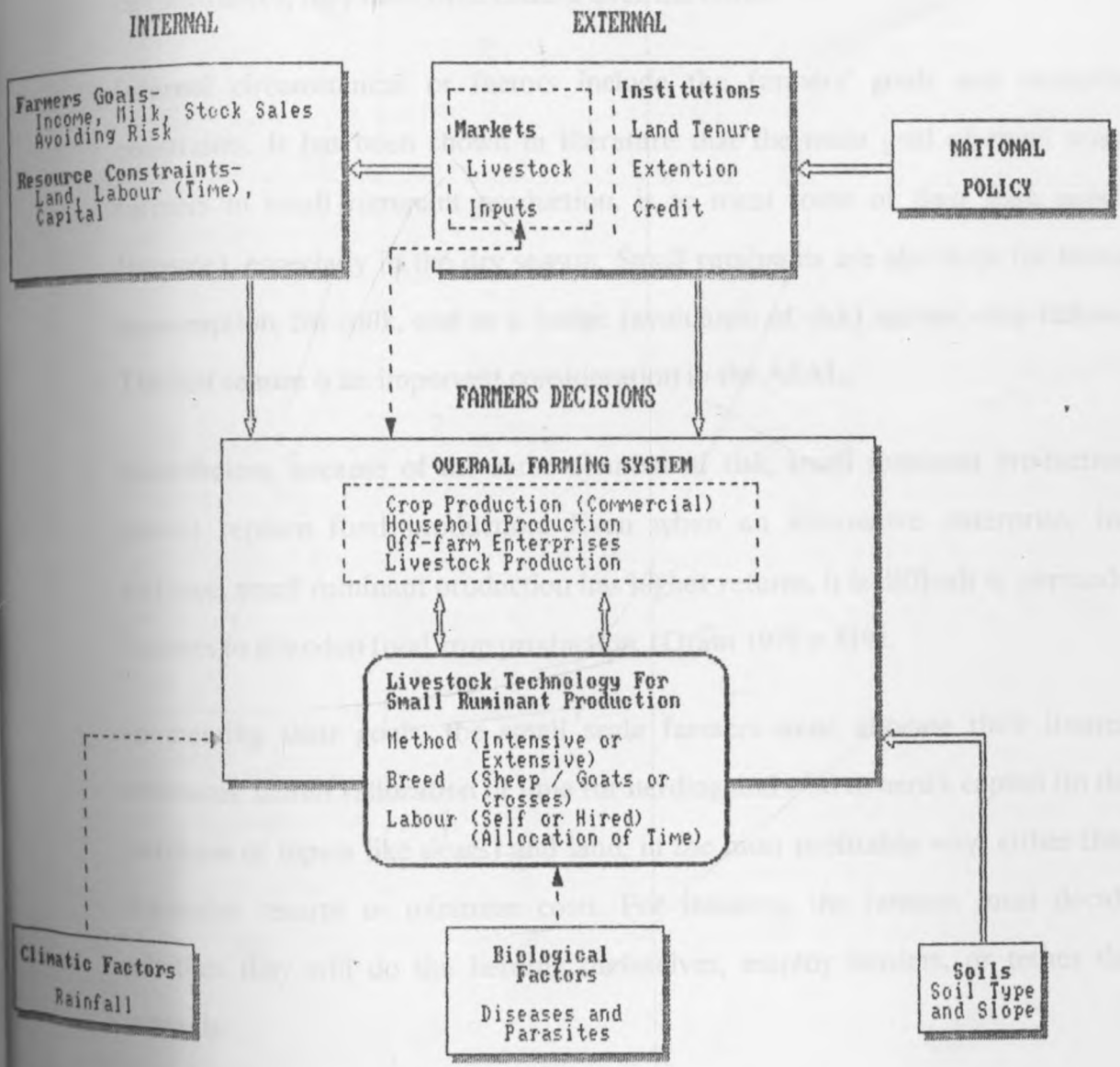
However, the advantage of FSR is that, only adjustments that are compatible with the farmer's endogenous factors are introduced. Hence, the adjustment is not likely to be in conflict with his way of life. FSR too is consistent with rural economic development because, it builds on, rather than destroys, the farmer's development techniques.

FRS is relevant to LRP research priorities as the priorities of the latter are application and action oriented. The present study will therefore use this method to identify important sociological and economic aspects of, and constraints to, small ruminant production. The study will also recommend possible solutions to the constraints that will be identified.

3.1.1 Circumstances Affecting Small Scale Farmers' Choice of Livestock Technologies for Small Ruminant Production

The first task was to identify the circumstances under which small scale farmers made their decisions regarding small ruminant production. Byerlee *et al.*, (1980 p 8) identified various circumstances affecting farmers' choices for crop technologies. Using their model, this study undertook to identify the various

Figure I: Various Circumstances Affecting Small Scale Farmers' Choice of Livestock Technologies For Small Ruminant Production



Shows the flow of influence

Also shows circumstances which are often a major source of risk and uncertainty for decision making

1 = Socioeconomic Circumstances

2 = Natural Circumstances

Source: Adopted from Byerlee et al (1980 p 9)

case, they will be with respect to the use of livestock technologies for small ruminant production. Farmers' decisions on small ruminant production are affected by socioeconomic and natural circumstances or factors. The socioeconomic circumstances can be sub-divided into internal and external circumstances. While the farmers can exercise some control over the former circumstances, they have little control over the latter.

Internal circumstances or factors include the farmers' goals and resource constraints. It has been shown in literature that the main goal of small scale farmers in small ruminant production, is to meet some of their cash needs (income), especially in the dry season. Small ruminants are also kept for home consumption, for milk, and as a hedge (avoidance of risk) against crop failure. The last reason is an important consideration in the ASAL.

Nonetheless, because of the same element of risk, small ruminant production cannot replace food production. Even when an alternative enterprise, for instance, small ruminant production has higher returns, it is difficult to persuade farmers to abandon food crop production, (Oram 1975 p 319).

In meeting their goals, the small scale farmers must allocate their limited resources, labour (allocation of time for herding and who to herd), capital (in the purchase of inputs like drugs) and land, in the most profitable way; either they maximize returns or minimize costs. For instance, the farmers must decide whether they will do the herding themselves, employ herders, or tether the animals.

The small scale farmers' goals are set subject to the economic environment as depicted by the external factors. These factors include inputs and product (livestock) markets, and institutions. While manufacturers can control the progress of their production processes, hence their ability to set prices for their

products, farmers have no control over the progress of their production processes. Therefore, it is difficult for them (farmers) to set prices. For instance, once animals are mated, farmers cannot postpone the growth of the fetus. The output (milk or meat) is sold at the prevailing price at the time of its production. Farmers too have no control over the price of the inputs.

The inability of farmers to set prices for their produce is caused by the fact that, in most cases, animals are sold only when need for cash arises (as opposed to sale in regular markets): More times than not, they accept the price the butchers offer. Therefore, produce and input markets are sources of risks and uncertainties to the small scale farmers.

Other external factors are, land tenure, extension services, and availability of credit. The first affects the management system in that, where sub-division or settlement is not complete, or where there is unlimited grazing land, small scale farmers mostly employ the extensive system in small ruminant production. Livestock extension personnel on their part, impart knowledge to the small scale farmers. Therefore, they too have the ability to affect small scale farmers' decisions.

Availability of credit can improve small scale farmers' production, unfortunately, many have no collateral (like title deeds) to enable them to get credit from the financial institutions. Additionally, at the present time (1991) in the ASAL, no livestock credit is available for small ruminant production by small scale farmers.

All socioeconomic factors are subject to the national policy. For instance, it has been shown in literature that there are no small ruminant improvement programmes for small scale farmers in the ASAL. Such government policies affect the performance of the small ruminant enterprises. Government also controls the livestock extension services, and in the recent past, the producer and

consumer prices for meat and milk. Such policies directly affect small ruminant production.

Natural circumstances include climate, soils, and biological factors. Climate and soils affect the type of grazing available and hence the species that can be kept. Biological factors like helminths and diseases too have already been indicated in the cited literature as the greatest constraints to small ruminant production. Like markets, climatic and biological factors are also sources of uncertainly in small ruminant production because, at the present time, small scale farmers have little control over them.

Socioeconomic and natural circumstances affect the farmers' final decision on the overall farming system. Within this context of the overall farming system are specific decisions on small ruminant production. For instance, decisions on the method of management will be based on land tenure and the resources at the disposal of the small scale farmers. Resource constraints and the expected output (stock sales, meat, or milk) determine the level and frequency of inputs used in small ruminant production. Indeed, literature cited indicated that small scale farmers, employing the extensive management system, use negligible amount of money on drugs (Stotz 1983).

Farmers must also decide on the type of labour to allocate to small ruminant production. For instance, during the cultivation season, they may decide to tether the animals so as to devote all their time to crop production. On their part, climate and soils dictate the vegetation and hence the species that grow in a given are most suited for an area. A good example is in Meruesbi (section 2.4) where it was shown that the postoralists kept more sheep than goats, even though other cited literature indicated that pastoralists kept more goats than sheep.

Finally, small scale farmers must take into account the fact livestock production technologies change over time. They must keep abreast of these changing

technologies. Ideally, this information is provided by the extension personnel of the Ministry of Livestock Development. The present study is an input into this Laikipia District "Information-Data-Base".

3.2 SELECTION OF THE SAMPLE

In 1990, there were 28 former European ranches and five government settlement schemes in West Laikipia which were in various stages of sub-division, and or settlement. In eight of the former European ranches, sub-division was complete and maps were available. Therefore, for sampling convenience, and using the stratified sampling method to select the two ranches used in this study, one ranch each from LH4 and LH5 was selected from this group[2]. After this initial selection of the ranches, cluster and systematic sampling was used to select the representative farms or sampling units.

The criteria for choosing the representative ranch was that, it had to be in zones LH4 or LH5, and it had to be accessible by vehicle both into and within the ranch. The ranch had to be settled. For logistic reasons, after Salama was chosen to represent LH4, Muruku was chosen to represent LH5 because it was close to Salama (see map 1 to 6).

The map shows that part of Salama is in LH5, but on physical observation[3] the vegetation was found to consist of evergreen trees and shrubs especially *Juniperus* ssp. but few *Acacia* ssp., for the former, and *Tarchonathus* ssp, *Euclea* ssp., and *Combretum* ssp., for the latter (see plates 1 and 2). This is the vegetation that is characteristic of the area between ECZ III and IV or LH4. Muruku is in LH5 or ECZ IV proper

[2] Farmers who were in government settlement schemes were excluded because they were given the farms (on soft loan) as opposed to the other immigrants who had to buy their farms.

[3] The author is grateful to Jackson Mwihuri, a colleague and a range officer, who helped in the identification of the different species of trees and shrubs.

as confirmed by the physical observation which showed that there was an abundance of *Acacia* ssp., and shrubs like *Carissa edulis*, and *Rhus natalensis*, which are the characteristic vegetation for this zone (see plates 3, 4, and 5).

Each selected ranch (cluster) was sub-divided into four equal sub-clusters and the farthest two sub-clusters to each other, that is one from each ranch, were chosen as the starting points.

This study was carried out together with LRP overview survey[4] in which 50 respondents from each ranch were to be interviewed. However, only 49 and 43 respondents were interviewed in Salama and Muruku respectively. Only data from 26 and 39 respondents from Salama and Muruku respectively, who qualified as small scale farmers (see section 1.1) was used. Some of the respondents interviewed had to be dropped out for one reason or the other, therefore those that remained represented 53% and 91% of the respondents interviewed in the former and latter ranch respectively or 9% of the potential respondents in each ranch.

[4]Overview survey is an exploratory baseline study carried out by LRP in all test areas before they carry out any research activity.

Plate 1: A Combination of *Euclea* ssp. (foreground) and *Tarchonathus* ssp. (background)

Plate 2: A close-up of *Euclea ssp.*

Plate 3: *Acacia gerrardii*

Plate 4: A close-up of *Carissa edulis*

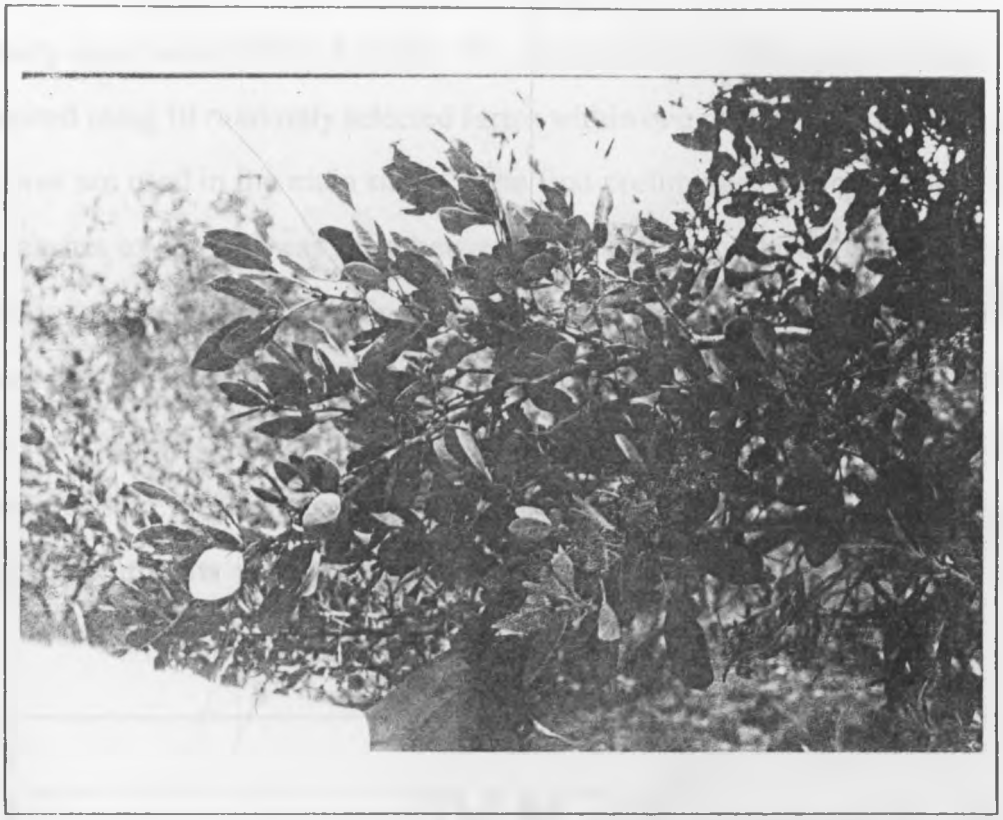


Plate 5: *Rhus natalensis*

3.3 SOURCES OF DATA

In the present study, this study utilized both secondary and primary data. Secondary data was obtained from published and unpublished government reports mainly from Ministry of Livestock Development, at the District and at the Ministry Headquarters, and to a lesser extent, from other Government Ministries. Other secondary data was obtained from published and unpublished reports from Laikipia Research Programme. Personnel from the Ministries of Livestock Development and Agriculture were also interviewed. Secondary data were on climate and topography, and on general livestock and agricultural production practices; this study also obtained specific data on livestock production.

Primary data were collected by use of a questionnaire[5]. The questionnaire was pretested using 10 randomly selected farms within one of the Salama sub-clusters that was not used in the main survey. The first preliminary survey of identifying the ranches to be used was done between 13th and 14th March 1991; pretesting was done between 18th and 22nd March 1991. The main survey started on 26th March and ended on 10th May 1991. Interviews were conducted by the author and four trained research assistants from Laikipia Research Programme therefore, there was no need for prior training on how to conduct interviews. No prior appointments were made for visits, but the husband or the wife, or in

Plate 6: The Author (foreground) Conducting an Interview.

[5] The questionnaire appears in appendix I.

facto head of the farm was interviewed. Otherwise, the enumerator move to the next farm.

For the convenience of recording the answers, and to save on stationery, the answers were not entered into the questionnaire sheet but in a field notebook which every enumerator carried. This method is used be Laikipia Research Programme because it saves on stationery. It also saves time as it is quicker for data entry into the computer. In the evening, when the answers were still fresh in the enumerators mind, all the questions for the day were coded in a code sheet. Any clarifications from the respondents were done the following day before other respondents were interviewed.

3.4 METHOD OF DATA ANALYSIS

3.4.1 Testing The Difference of Proportions and of Means

For the first and fourth objectives, this study will test the difference of proportions and of means [6]. It will determine whether the samples from Muruku and Salama were from the same or different population by testing the following differences of proportions:

- **The difference of proportions of the small ruminant herds within the livestock herds.**
- **The difference of proportions of the cattle herds within the livestock herds.**
- **The difference of proportions of the goats and the sheep herds within the small ruminant herds.**
- **The difference of proportions of the income from small ruminant production and of net farm income.**

[6] The explanation in this section is derived from, Gilbert (1981 p. 190-194).

This will be achieved by two-tail hypothesis tests in the following areas:

- **The differences of proportions of small ruminants and of cattle herd sizes.**
- **The differences of proportions of sheep and of goat flock sizes.**
- **The differences of proportions of income from small ruminant production and of net farm income.**

The Central Limit Theorem for difference of proportions states that the sample sizes must be large enough for the sampling distribution of difference of proportions to be approximately normal. In practice, the sampling distribution of, difference of proportions is assumed to be normal if the products of $n_m * p_m$, $n_m * q_m$, $n_s * p_s$ and $n_s * q_s$ are all more than or equal to 15 (Gilbert 1981 p 191). Where:

n_m & m_s = **Sample sizes for Muruku and Salama respectively.**

p_m & p_s = **Sample proportion for Muruku and Salama.**

q_m & q_s = **$1-p_m$, and $1-p_s$ respectively.**

For the fourth objective, this study shall test whether there was any difference of means of the sheep and goat flock sizes in the study area and in the two ranches independently.

Since the variance of the population is not known, the t distribution will be used. The t distribution assumes that **"X is normally distributed with mean O and variance 1, and Z is distributed as chi square with N degrees of freedom"** (Pindyck 1981 p 33).

The null hypothesis' to be tested will be that:

a) $H_0: p_S = p_M$

$H_1: p_S = p_M$

Where p_S and p_M represent the herd sizes of different livestock species in Salama and Muruku respectively.

and,

b) $H_0: U_S - U_M = 0$

$H_1: U_S - U_M = 0$

Where U_S and U_M represent the means of net farm incomes or that of incomes from small ruminant production, in Salama and Muruku as the case may be.

the t score is calculated as shown below.

$$t = \frac{(S - M) - (U_S - U_M)}{0_{(S-M)}} \qquad 3.1$$

where
t = t score
S = sample mean of Salama
M = Sample mean of Muruku
$(S-M)$ = difference in sample means
U_S = population mean of Salama
U_M = population mean of Muruku
$(U_S - U_M)$ = difference in population means
0_S = standard deviation of Salama sample
0_M = standard deviation of Muruku sample
$0_{(S-M)}$ = standard error of the difference of means

Since it is assumed that the populations of Salama and Muruku are normally distributed and that $U_S - U_M = 0$, the t score reduces to:

$$t = \frac{S - M}{0_{(S-M)}} \qquad 3.2$$

The two tail t score for $P < 0.05$ with 63 degree of freedom, is 1.64. Therefore, if the t score is found to be less than 1.64, the null hypothesis will not be rejected. However, if it is more than 1.64, the null hypothesis will be rejected and the samples treated as coming from different populations. For the one tail test, the reject/fail to reject t score is 1.96.

3.4.2 Descriptive Analysis

In line with the second objective of the present study, this study will use descriptive statistics such as means, frequencies, percentages and cross-

tabulation tables. The aim of the descriptive analysis is to identify important small scale farmers' sociological and economic aspects that affect decisions on small ruminant production, and the constraints to their production. For some variables, the ranking method will be used.

The order in which the three most important enterprises in the study area, maize production, cattle production, and small ruminant production were established will be described. The reasons why small scale farmers keep or do not keep small ruminants will be compared.

This method will also be used to explain important economic animal husbandry practices related to small ruminant production, for example, herding, marketing, grazing and breeding. Further, it will be used to determine small ruminant mortality rates, and the causes of this mortality. Lastly, it will be used to identify constraints to small ruminant production, as the small scale farmer sees them, then categorized them in order of their (constraints) significance.

3.4.3 Definition of the Variables used

a) Small Ruminant Herd: This is the total number of grazing sheep and goats at the time of the survey, excluding unweaned lambs/kids. The latter use up very little grazing.

b) Cattle Herd: This is the total number of grazing cattle at the time of the survey, it includes calves up to six months of age.

c) Household Income: This is the revenue accrued from on-farm operations (net farm income) and off-farm enterprises. To calculate net farm income, only three major enterprises will be used, maize production, cattle production, and small ruminant production. Maize production was picked

as the crop for comparison because all farmers in the area were growing the crop irrespective of whether they were growing any other crops like pulses and potatoes. During the initial survey, it was found that maize was grown both for home consumption and for cash sales. There was some income from other crop production enterprises but, the respondents indicated maize was the major cash crop.

It was found to be very difficult, in some instances, to get the actual amount of revenue earned from the three enterprises. The respondents either could not remember, or were unwilling to give the actual amount of money received from farm produce or livestock sales. However, they willingly gave the expenses, and in some cases inflated the costs. In such cases, the average of the cost incurred by all respondents was used. The same method was used for revenue. Averaging of these costs and expenses was a shortcoming this study had to live with for lack of a better alternative as the time available for the study, in order to collect the actual costs, was short. Therefore, for the interpretation of the results, this has to be borne in mind.

Calculation of the different incomes is shown below.

i) Net income from maize production:

Net Income	=	Total maize output (bags)	X	Price per bag	-	Total production expenses

All maize was assumed sold. The rationale is that all respondents required maize as it was the staple food; if they did not have it, they bought it. The price used for a bag of maize was farm gate price because in most cases, buyers of maize come to the farm. However, the normal weight of this bag is approximately 100 kilograms because it is

filled to the top. The expenses were calculated as the mean expenses for the respondents as detailed by them during the interview.

ii) Only revenue from milk sales was considered in this study. Revenue from livestock by-products like hides, and culls was difficult to estimate. At the same time, as livestock herd sizes were very small, this study excluded these, also natural increases and gifts from the calculations as it considered their contribution to total revenue negligible. All milk was assumed sold. Milk for home consumption was considered as "bought" for household consumption. This assumption was made because respondents bought milk for home consumption when it was not available on the farms.

Milk production was calculated using the average of the peak production (one and half months into the lactation) and at lowest production (one month before the end of the lactation). Since the respondents did not keep any records it was found to be difficult to get the milk production for all the cows. Therefore, they were asked for the milk production of any three cows .[8] This production was then extrapolated to one year's production, thus:

Total milk Production per year	=	daily production at six weeks after calving [9]	+	daily production at one month before drying [9]	X	Total days of lactation {2 X 2} [10]

[8] The mean TLU was 2.3 cows.

[9] This was the average production for any three cows and was also compared with the actual daily production at the time of the survey to verify the figures given.

[10] It was assumed that half of the cows were dry at any one time.

This calculation was better than extrapolating the years' milk product from a single day's production, (Lindstrom 1972), or from one week's production (Sands *et al.* 1982 p 25). Milk output varies with the stage of lactation, therefore, the latter two methods estimate the production at only one point on the production curve. No allowance was made for calves as all sucked.

iii) Small ruminants off-take was calculated as the value of sales, home consumption, and gifts. Where the revenue from sale was not available the average price of KS 300.00, which was the average price received per goat or sheep was used.

iv) Incomes from the wife and the husband were used in calculating the farm income.

Income from contract work: This income was calculated thus:

Total income per year	=	daily wages	X	number of days worked per year	-	costs	+	income in kind

Income from employment: Income from employment was calculated thus:

Total income per year = monthly salary X 12

In some cases, it was difficult to get the actual monthly salary, in such cases, income was calculated from the estimated salary of the type of job the respondents or wives/husbands were engaged in. This method

was also used when calculating income from self employment. For the husbands who did not reside on their farms, their salaries were adjusted to account for this fact as follows:

O full farm resident	= 100% salary included
O visiting weekly	= 75% of salary included.
O visiting monthly	= 50% of salary included
O longer than 1 month	= 25% of salary included.

This was the estimation of the proportion of the salaries that would be available to the households; the other proportions were used to maintain the other residences.

v) The main costs that have been considered are the costs of anthelmintics drugs, cost of minerals, veterinary costs, and dipping costs.

Anthelminths: Expenses on anthelminths were calculated as shown below.

Total cost per year	=	actual amount given per animal	X	number of animals	X	frequency of drenching	X	cost pe centile

Minerals: Animals fed from the same trough therefore the costs were proportionally shared amongst cattle and small ruminants thus.

Total cost per year	=	Minerals expenditure TLU on the farm	X	TLU of Small Ruminant or cattle

Veterinary costs: Since farmers kept no records, it was difficult to get the actual amount of money spent on disease prevention and treatment. Farmers who did not know how much they used on drugs were shown a price range [11] and asked to estimate the amount of money they used in 1990.

Dipping Costs: Cost of dipping cattle was easy to estimate; it was KS 1.50 per head per week. Cost of dipping small ruminants was more difficult to estimate. Many respondents said that they sprayed small ruminants weekly but Ministry of Livestock personnel said farmers rarely sprayed small ruminants. It was mandatory to dip/spray cattle, therefore, the respondents may have indicated that they sprayed small ruminants to avoid victimization. From literature, it is recommended that small ruminants be sprayed three times a year which amounts to KS 6.00 per year. Because of the discrepancy mentioned above and the negligible cost involved. This cost was excluded.

Net farm income was calculated thus:

Net farm income	=	Net income from milk production	+	Net income form small ruminant production	+	Net income from maize production

[11] Price ranges shown:
Cattle:- KS 0-500, 501-1000, 1001-1500, 1501-2000, and over 2000.00.
Small Ruminants:- KS 0-100, 101-200, 201-300, 301-400, 401-500, and over 500.00.

CHAPTER 4

IMPORTANT SOCIOLOGICAL AND ECONOMIC ASPECTS INFLUENCING SMALL RUMINANT PRODUCTION

INTRODUCTION

The first task will be to determine whether the samples from Salama and Muruku were from the same, or different populations. This is done in the first section of the chapter by comparing the difference of proportions and of means of the various variables. Later, important sociological aspects that affect small scale farmers' decisions on, and the constraints to, small ruminant production are described. Lastly, important economic aspects that affect small scale farmers' decisions on small ruminant production, are also identified and explained.

4.1. TESTING IF THE SAMPLES WERE FROM THE SAME POPULATION

4.1.1 Difference of Proportions, of Net Farm Income and Income from Small Ruminant Production; and of Small Ruminant and Cattle Herd Sizes

In order to test the differences of proportions, the products of $n_M * p_M$ and $n_S * p_S$ have to be more than fifteen. However, in the present study, the tests were not done because the products were less than 15, that is:

$n_M * p_M$, (respondents with goats) = (21) X (.48) = 10

$n_M * p_M$, (respondents with sheep) = (25) X (.55) = 14

$n_M * p_M$, (respondents with cattle) = (22) X (.56) = 13

$n_S * p_S$, (respondents with goats) = (13) X (.52) = 10

$n_S * p_S$, (respondents with sheep) = (19) X (.45) = 14

$n_S * p_S$, (respondents with cattle) = (12) X (.44) = 6

For the same reason, the tests for the differences of proportions, of income from small ruminant production and of net farm income was also not done. Only 13 and 11 respondents in Salama had positive incomes from the former and latter sources respectively.

4.1.2 Difference of Means of Small Ruminant and Cattle Herd Sizes.

Though it was not possible to test the differences of proportions, the differences of means were tested. As with the differences of proportions, the tests of differences of means were to be two-tail tests. The null hypothesis to be tested were:

a) $H_o: X_{M(C)} = Y_{S(C)}$
$H_1: X_{M(C)} = Y_{S(C)}$

b) $H_o: X_{M(SR)} = Y_{S(SR)}$
$H_1: X_{M(SR)} = Y_{S(SR)}$

c) $H_o: X_{M(G)} = Y_{S(G)}$
$H_1: X_{M(G)} = Y_{S(G)}$

d) $H_o: X_{M(S)} = Y_{S(S)}$
$H_1: X_{M(S)} = Y_{S(S)}$

Where

$X_{M(C)}$ = mean cattle herd sizes in Muruku

$Y_{S(C)}$ = mean cattle herd sizes in Salama

$X_{M(SR)}$ = mean small ruminant flock sizes in Muruku

$Y_{S(SR)}$ = mean small ruminant flock sizes in Salama

$X_{M(G)}$ = mean goat flock sizes in Muruku

$Y_{S(G)}$ = mean goat flock sizes in Salama

$X_{M(S)}$ = mean sheep flock sizes in Muruku

$Y_{S(S)}$ = mean sheep flock sizes in Salama

The results[1] of the null hypothesis tests (a) and (b) are shown in tables 4.1A and 4.1B. They show that, in the two

Table 4.1A: Difference of Mean of Small Ruminant Flock sizes.

Small Ruminants	Salama	Iruku
mean (TLU) Standard deviation Sample size	1.6 1.7 26.0	2 4 0

t statistic = 1.07 (D.F., 63)

Probability = 0.14

Source: Sample data

areas, and at 5% level of significance, the differences of means of small ruminant and cattle herd sizes were not different from zero.

Table 4.1B: Difference of Mean of Cattle Herd Sizes

Cattle	Salama	Iuruku
Mean (TLU) Standard deviation Sample size	2.6 2.8 26.0	2.1 2.7 9.0

t statistic = 0.59 (D.F., 63)

Probability = 0.28

Source: Sample data

[1]All statistical calculations were done using the "MICROSTAT" programme.

4.1.2 Differences of Mean of Goats and Sheep Flock Sizes.

The results of the hypothesis tests (c) and (d) are shown in tables 4.2A and 4.2B. They also show that, in the two areas, and at 5% level of significance, the differences of means of the goat and the sheep flock sizes were not different from zero.

For the results to be relevant, sample sizes need to be at least 30. Only 26 of the respondents that were interviewed in Salama qualified as small scale farmers but, those from Muruku that qualified as small scale farmers were more than 30.

However, the null hypothesis' tested indicated that, in the two areas, and at 5% level of significance, the difference of means of (a) the cattle herd sizes; (b) the small ruminant flock sizes; c) the mean goat flock sizes; and (d) the mean sheep flock sizes were not significantly ($P<0.05$) different from zero. The explanation of this insignificant differences of means of the variables tested is that, the two groups of samples were in the same ECZ although in different AEZ. It has been indicated in chapter one that the former type of zoning is relevant to livestock production and distribution, while the latter is

Table 4.2A: Differences of Mean of Goat Flock Sizes.

Goats	Salama	Muruku
Mean (TLU)	0.6	0.4
Standard deviation	1.0	0.5
Sample size[1]	26.0	37.0

t statistic = 1.30 (D.F., 61)
Probability = 0.10

[1]Two respondents in Muruku did not have goats.

Table 4.2B: Differences of Mean of Sheep Flock Sizes.

Sheep	Salama	Muruku
Mean (TLU)	1.0	0.8
Standard deviation	1.2	1.0
Sample size	26.0	39.0

t statistic = 0.60 (D.F., 63)

Probability = 0.27

Source: Sample data

relevant to crop production. Therefore, while the samples were drawn from two different AEZ, the livestock potential of the two AEZs were the same. In view of these results, it was concluded that the two samples from Salama and Muruku were from the same population. It is necessary to point 'more respondents were interviewed in Muruku than in Salama. However, to test the difference of means of the livestock herd sizes for the third and forth objects, the two samples were combined. This increased the sample size to sixty five.

4.2 SOME SOCIOECONOMIC ASPECTS THAT AFFECT DECISIONS ON SMALL RUMINANT PRODUCTION IN THE STUDY AREA

4.2.1 Age of the Small Ruminant Owners.

Table 4.3 shows that the age of the small ruminant owners was between 20 and 70 years but most of them (51%) were aged between 31 and 50 years. However, age was neither significantly ($P<0.05$) associated with ownership of small ruminants, nor with the small ruminant flock sizes.

Age was not associated with flock size because most the small ruminant owners (86%) were the original settlers, therefore, their attitudes towards small

ruminant production were similar. However, where men head of households were involved in herding, 75% were over 50 years. No men heads of household, who were under 40 years, were involved in herding. This points to the fact that, the younger small ruminant owners were engaged in more strenuous work or were involved in off-farm enterprises.

Table 4.3: Age of the Small Ruminant Owners.

Age Category in Years	Frequency	Percent
10-20	3	4
21-30	13	20
31-40	18	28
41-50	15	23
51-60	11	17
61-70	5	8
Total[2]	65	100

Source: Sample data

4.2.2 Farm Sizes and Small Ruminant Production

The age of the settlement was about 25 years as some of the farms visited had been settled as early as 1964, even before sub-division. However, most had

[2] In some instances, the sample size will change depending on the variable that is being tested.

Table 4.4A: Information on the Human Settlement in the Study Area

	Frequency	Percent
Number of settled farms Number of unsettled farms	605 390	61 39
Total number of farms	995	100

Source: Sample data

settled around 1975 when sub-division of the ranches was completed. But, as table 4.4A shows, only 61% of the farms were settled by 1990.

On the other hand, table 4.4B shows that, for the settled farms, 60% of the land was available for grazing. Thirty 36% was used as crop land while the homestead occupied 4%. The mean farm size was 5.3 hectares.

Table 4.4B: Mean Land Sizes for Various Land Uses in the Study Area

Type of Land Use	Land (Ha.)	SD	% of Total
Mean grazing land	3.2	1.9	60
Mean crop land	1.9	1.8	36
Mean size of homestead	0.2	0.1	4
Mean land holding	5.3	2.3	100

SD Standard Diviation

Source: Sample data

Most of the farms visited were (77%) between 3.7 and 7.2. hectares of land (Table 4.5.). However, land was neither significantly ($P<0.05$) correlated with the flock size nor with the presence or absence of small ruminants. This

confirmed the earlier assumption that land size can be a deceptive criterion for classifying small scale farmers for livestock related studies.

Table 4.5: Land Ownership by Farm Sizes

Size of farm in Hectares	% of Small Ruminant Owners
Under 1.8	3
1.8-3.6	9
3.7-4.8	40
4.9-7.2	37
over 7.2	11
Mean 5.3	100

Source: Sample data

4.2.3 Availability of Grazing land

We found that most of the small ruminant owners (84%) utilized their farms and the unoccupied farms for grazing. Therefore, they kept as many animals as they were able because there were no grazing restrictions. To calculate the stocking rate, firstly, the total TLU in the study area was estimated. This was done as shown in table 4.6. The calculations revealed that there were 1496 TLU[3] in the study area comprising of 835 TLU and 661 TLU of cattle and small ruminants respectively

[3] We appreciate the fact that the total TLU can be more than this number; only respondents whose livestock were equal to, or less than 50 and 10 small ruminants and cattle respectively, were considered in this study.

Secondly, the grazing area was calculated as 4217 hectares; 2175 and 2042 hectares from the unsettled, and settled but uncultivated land respectively (Table 4.7). The stocking rate[4] was calculated by dividing the grazing land available by the total TLU. This was 2.8 hectares per TLU, which was less than the recommended carrying

Table 4.6: Estimation of Tropical Livestock Units in the Study Area

	Cattle	Small ruminants	Total
(1) Mean TLU per farm visited	2.3	1.4	3.7
(2) Number of settled farms			605.0
(3) % respondents with stock[1]	60.0	78.0	-
(4) Total TLU (1) X (2) X (3)	835.0	661.0	1496.0

[1]Total is not equal to 100% because some had both cattle and small ruminants.

Source: Sample data.

capacity[5] for this area. The recommended carrying capacity is 3-5 hectares per TLU (Pratt *et al* 1977 p 43).

When the stocking rate was calculated using only the grazing land available in the settled farms, the results were even more dramatic. The stocking rate was 1.4 hectares per TLU. Therefore, an alternative source of feed to supplement grazing is necessary.

[4]Stocking rate is the number of hectares available for grazing divided by the TLU.
[5]Carrying capacity is the number hectares that will support one TLU for one year.

Table 4.7: Estimation of Grazing Land Available in the Study Area

Type of Land Use	Hectares
(1) Total land available	5578.0
(2) Settled area - 61% of (1)	3403.0
(3) Grazing in settled land 60% of (2)	2042.0
(4) Grazing in unoccupied land 39% of (1)	2175.0
(5) Total grazing land (3) + (4)	4217.0
(6) Stoking rate	
all available grazing (5)/Total TLU	2.8
in settled farms only (3)/Total TLU	1.4
(7) Recommended carrying capacity[1]	3-5

[1]Jaetzold *et al.* (1982)

Source: Sample data.

Insufficient grazing was apparent when the grass cover in the occupied and unoccupied farms was compared. Grass cover was determined by the amount of bare soil observed.

We estimated less than 10%, 10-30%, and 30-50% bare soil cover for, good, medium, and bad grass cover respectively. Using this estimate, it was found that 59% of the occupied farms had good grass cover, and only 11% had poor grass cover. The unoccupied farms had medium soil cover or worse. The observation indicates that, there will soon be very little grass available in the unoccupied farms.

We have indicated that the mean grazing area available per respondent is 3.2 hectares. Therefore, the current carrying capacity for the study area requires

that, if respondents don't provide any feed supplementation to livestock, the area will only support an average of one cow or 10 small ruminants per respondent. However, only 27% of the respondents gave any form of supplementary feed to small ruminants because there was still grazing available in the unoccupied farms.

Therefore, there is need to improve the farms' carrying capacity. This can be done by either of three possible ways, improving the productivity of the available grazing, reducing the livestock numbers, or improving the productivity per animal through upgrading with better small ruminant breeds like Dorpers; this may encourage reduction in stock numbers.

Since lack of enough grazing, at least for small ruminants, was not seen as an important constraint to production, it will be difficult to convince them (respondents) to plant fodder for small ruminants, especially where the fodder will compete with food crop production for land and labour requirements. Nonetheless, a start should be made by improving the keeping quality of available fodder, for instance, maize stover, through preservation. Planting fodder trees like *leucaena* and *sesbania* along the fences and on terraces will also increase the amount of available fodder.

4.2.4 Effect of Small Scale Farmers' Off-farm Occupations on Small Ruminant Production

Respondents engaged in off-farm occupations because farming in the ASAL is unreliable. In some instances, off-farm work was the main occupation; in such cases, the head of the household was engaged in permanent off-farm work. However, the fact that respondents can also engage in farming to supplement off-farm income occupations cannot be ruled out.

We found that, 60% of the respondents depended solely on net farm income while 40% were engaged in off-farm work. The percentage of respondents dependent on net farm income was higher than that found by Kohler (1987c). He found that in Central Laikipia, only 33% of the respondents depended on net farm income. The lower dependence on off-farm work in the study area than in Central Laikipia was because the former respondents were farther away from the main central places than the latter.

In half of the farms visited, both spouses were engaged in off-farm work. Most of the men (91%) were engaged in permanent off-farm work while 9% were engaged in part-time work but in non-farming sector. While all the men were engaged in the non-farming sector, most women (78%) were engaged in farming related off-farm work, for instance, weeding, planting, or harvesting; the rest were engaged in permanent but non-farming work.

One of the objectives of the current study was to quantify the respondents' income from small ruminant production. The study therefore compared the levels of income from small ruminant production for respondents with off-farm income and those without. This is shown in table 4.8. Thirty eight respondents out of the 43 with positive household income had small ruminants; only data from the latter respondents were used for this test.

The table shows that the mean income from small ruminant production is significantly ($P<0.05$) higher for respondents without off-farm income than those with off-farm income. This means that, where there was no off-farm income, small ruminant production was the alternative source of income. It is necessary to point out that the sample size was low (19 respondents), and the standard deviations was very high. However, large variations across observations do occur in cross-section studies (Pindyck 1981 p 64).

Respondents without off-farm income sold an average of four small ruminants per year while those with off-farm income sold, on average, only two animals. There was no significant ($P<0.05$) difference in the mean small ruminant flock sizes for those with or without off-farm income. Therefore, the results indicate that those without off-farm income had to depend more on the sale of their small ruminant for cash needs.

Table 4.8: Comparison of Differences of Mean of Income From Small Ruminant Production, for Respondents with and without Off-farm Income

	Without OFI	With OFI
Mean (KS)	1326	523
Standard Deviation	1344	942
Sample size	19	19

Probability = 0.02

t = 2.13, (D.F., 36)

OFI = Off-farm income

KS = Kenya Shillings

Source: Sample data

They indicate too that small ruminant production played a significant role in providing the additional cash needed for the family expenses. It is shown later in chapter five that small ruminant production and off-farm income were the most important sources of income for daily, as well as development expenses.

4.2.5 Effect of Livestock Extension Services on Small Ruminant Production

Ministry of Livestock Development personnel are expected to visit farmers regularly. There are two types of extension staff, those that advice on animal husbandry, hereafter referred to as Livestock Production Personnel (LPP), and those in-charge of treatment, hereafter referred to as Veterinary Personnel (VP). Sometimes advisory and treatment work is done by the same person. While the LPP are expected to visit the farmers on regular basis, the VP are expected to stay at predetermined places where farmers can get to them. At the time of the survey, the Location was manned by five Ministry of Livestock personnel, three LPP and two VP. However, their roles were interchangeable as the basic training is the same.

Table 4.9 shows the number of visits by the LPP as reported by the 50 respondents who had small ruminants; one respondent did not answer questions on extension service. It indicates that 74% of the respondents were never visited at all, while 20% were visited whenever need arose.

The response was similar for the respondents who had cattle, 76% said they were never visited while 21% said they were visited whenever need arose.

Table 4.9: Reported Visits by the Livestock Production Personnel

Response	Frequency	Percent
Never visited	37	74
Whenever need arises	10	20
Fortnightly	2	4
Weekly visit	1	2
Respondents Interviewed	50	100

Source: Sample data

Table 4.10: Respondents Need for Visits by Livestock Production Personnel

Response	Frequency	Percent
Should start visiting	29	58
Current visits enough	9	18
Not bothered about the visits	9	18
Need to visit more frequently	3	6
Respondents Interviewed	50	100

Source: Sample data

When the respondents were asked if they were satisfied with the visits, more than half (58%) indicated that the LPP should start visiting (table 4.10). Only 18% were satisfied with the visits while 18% were not bothered either way; they had already learned to cope without the services.

Table 4.11: Reported Visits of the Veterinary Personnel

Response	Frequency	Percent
Whenever need arises	39	78
Never visited	11	22
Respondents interviewed	50	100

Source: Sample data

For the VP, table 4.11 shows that 78% of the respondents were visited whenever need arose; only 22% were never visited. Respondents were satisfied with the

visiting arrangement of the VP because they (VP) were found at predetermined places. (table 4.12)

The staff strength (five livestock extension personnel in the Location) indicated that the problem of lack of visits was not due to lack of personnel but due to the priority given to the two services by these personnel. When one person is doing

Table 4.12: Respondents Need for visits of Veterinary Personnel

Response	Frequency	Percent
Current visits are enough	37	74
Should start visiting	11	22
Need more visits	2	4
Respondents interviewed	50	100.

Source: Sample data

both advisory and treatment work, it is obvious that the advisory work will be neglected because the personnel cannot visit farms and wait for the farmers concurrently.

Visits by Ministry of Livestock Development extension personnel are expected to have an impact on the small scale farmers' management through improved livestock husbandry, for instance, lowering of the mortality rate. However, there was no significant ($P<0.05$) correlation between contact of the extension services personnel and small ruminant production. For instance, it was found no correlation between the frequency of visits by the LPP or the VP on the one hand, and small ruminant mortality rate on the other.

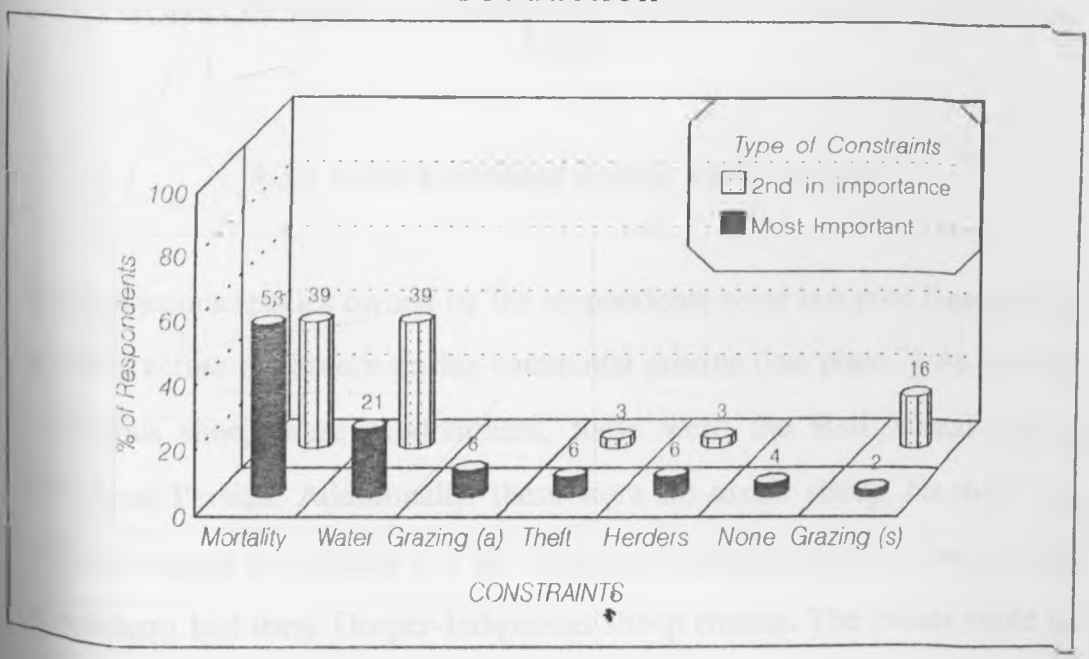
reported that diseases were the major constraint, nor with the small ruminant flock sizes.

This problem of poor extension services by LPP may be solved by separating the roles of the VP and LPP; separation will create accountability. As it is now, when the advisory services decline, the personnel will claim to have been doing treatment work. The other alternative is to charge fees for both services and let the small scale farmers decide on which services they require.

4.2.6 Constraints to Small ruminant Production.

The respondents were asked to indicate the most important constraints to small ruminant production and prioritize them. They indicated that mortality through disease, not enough water for livestock, stock theft, difficulty in getting herders, and lack of enough grazing were the main constraints. Graph 4.1 shows that mortality through disease (53%), and lack of enough water for livestock (21%), were the most important constraints to small ruminant production. The two constraints were still ranked as the most important by the respondents who

Graph 1: Constraints to Small Ruminant Production



51 respondents had Small Ruminants, 33 gave a 2nd reason.
Grazing (a) = shortage in dry seasons, Grazing (b) = shortage all seasons
Source: Sample data

indicated more than one constraint. This confirms what had been reported in other studies that diseases are among the most important constraints to small ruminant production (Herren 1990 and GOK 1990b).

We have indicated in the previous section that there was no significant ($P<0.05$) correlation between the frequency of visits by the extension personnel and the respondents who said that diseases were a major constraint. The explanation to this is that most respondents were satisfied with treatment but not the advisory services on small ruminant production; while the effects of the former services were similar, the effect of the latter services were undiscernible. Later, in this chapter, it will be shown that diseases were the main causes of small ruminant mortality in the study area.

Insufficient grazing was not seen by the respondents as a major constraint to small ruminant production, however, this was only an illusion. It was showed in sub-section 4.2.3 that the area is already overstocked. Action to correct this problem of overgrazing should be taken sooner than latter.

4.3 SOME IMPORTANT ECONOMIC ASPECTS THAT AFFECT DECISIONS ON SMALL RUMINANT PRODUCTION IN THE STUDY AREA

4.3.1 Small Ruminant Breeds and Breeding

The indigenous species owned by the respondents were not pure breeds due to breeding across the breeds during communal grazing (see plate 7). As expected, indigenous sheep were predominant, these were the Red Maasai and the Blackhead Persian. Additionally, there were no exotic sheep, but there were crosses between the Dorper and the indigenous sheep breeds; six percent of the respondents had these Dorper-Indigenous sheep crosses. The crosses made up a

negligible 3% of the total sheep herd. However, those who kept them said that, for offsprings of the same age as indigenous sheep, they were heavier, grew faster, and were more preferred by butchers, hence they fetched better prices. However, one problem the respondents experienced in keeping Dorper crosses was lack of breeding Dorper rams. Other studies have also reported that Dorper-indigenous crosses perform better than the exotic Dorpers or the indigenous breeds (c.f. Senyatso 1986 p 66). The high performance of these crosses needs to be exploited.

Because of the same reasons of communal grazing, indigenous goat species owned by the respondents - like the Galla and the East African goat - were not pure breeds. But, unlike sheep, there were no obvious exotic-indigenous crosses;

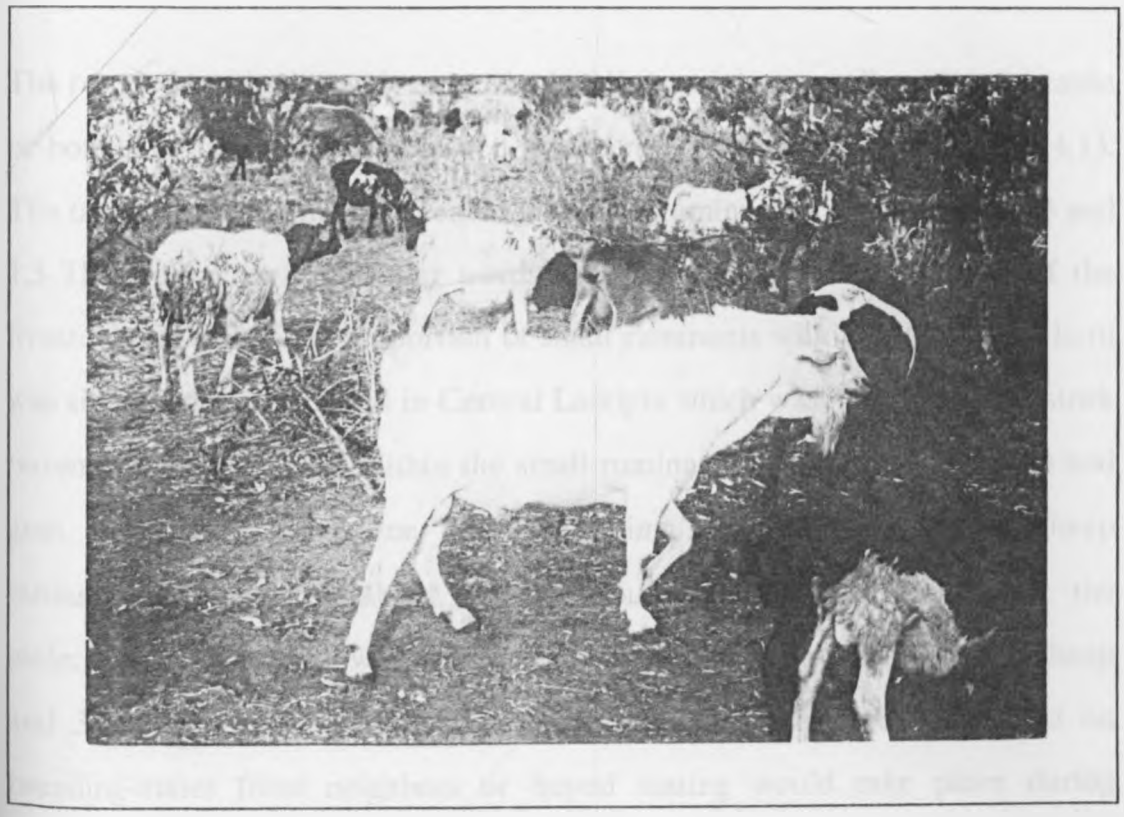


Plate 7: A flock of Small Ruminants in the Study Area. It shows a Galla goat (foreground); Dorper Crosses, and Red Maasai sheep (background)

as expected, all were indigenous breeds. Flock composition results are similar to those reported in the District annual report that indigenous breeds make up 91% of the total small ruminant bio-mass in the District (GOK 1989b). None of the respondents practiced any controlled breeding, therefore kidding and lambing occurred throughout the year. The respondents indicated that they could not separate the animals into male and female herds because flock sizes were small. The effect of separation too, would be nullified by the communal form of grazing management that they employed; they also indicated that they did not see any economic benefit in controlled breeding. Other studies too have indicated that breeding throughout the year enhances flock growth (Field 1984, Wilson 1984 and 1986)

4.3.2 Livestock Herd Sizes

The respondents in the study area who had livestock kept small ruminants, cattle or both. The mean livestock owned by the respondents is shown in table 4.13. The table shows that the mean cattle and small ruminant flock sizes were 2.3 and 1.3 TLU respectively. In other words, small ruminants comprised 36% of the livestock bio-mass. The proportion of small ruminants within the livestock herd was similar to that reported in Central Laikipia which was 40% of the livestock bio-mass {Taiti (1991)}. Within the small ruminant herds, the mean sheep and goat flock sizes were nine and five animals respectively. Hence, sheep outnumbered goats by about 2:1. We found that in the study area, the male:female ratio was low. Table 4.14, shows that about a third (35% for sheep and 37% for goats) of the respondents kept no males, they depended on breeding-males from neighbors or hoped mating would take place during

Table 4.13: Mean Livestock Owned by Respondents in the Study Area

Species (TLU)	N	Mean	SD	Min.	Max.
Indigenous sheep	65	0.8	1.0	0	3.7
Dorper sheep	65	0	0.4	0	3.7
Indigenous goats	65	0.5	0.7	0	3.0
Total Small Ruminants	65	1.3	1.5	0	3.0
Cattle	65	2.3	2.6	0	9.0

SD = Standard deviation,
N = Sample size
Min. = Maximum
Max. = Maximum

Source: Sample data

Table 4.14: Number of Males Within the Small Ruminant herds

Males in the herd	Respondents with Sheep (%)	Respondents with Goats (%)
None35.3	7.0	
1	16.0	30.0
2	13.5	20.0
3	22.0	6.5
More than 3	13.5	6.5

Source: Sample data

communal grazing. Most of the respondents, 65% and 87% for those owning sheep and goats respectively, had less than three males. Only 13.5% and 6.5% for sheep and goat owners respectively, had three or more males. The proportion of males within the flock was 14% and 16% for sheep and goats respectively. This was lower than 23% that was reported by Wilson (1982) in the Sahel, or 40-45% reported by Thorper *et al.* (1990) in Kilifi District of the Coast Province of Kenya. The explanation to this is that when the flock sizes are small, there is an advantage in keeping females instead of males, while both can be sold when need for cash arises, the former also reproduce.

4.3.3 Labour Management for Small Ruminant Production

Livestock in the ASAL are taken out to pasture during the day and housed at night. Therefore, somebody has to be available to herd the animals. It was found that, due to the small sizes of the two flocks, all respondents herded cattle and small ruminants together. Herding was either by the owner (wife or husband), other members of the family (children or relatives), or employee. However, table 4.15 shows that most respondents, used family members for herding. The table further shows that 31% of the respondents used hired labour while 10% of the respondents penned the animals. Hired labour was not preferred by many respondent because flock sizes could not economically justify employing herders.

For family labour, table 4.16 shows that women (wives) were more involved in herding livestock than men (husbands). It is significant to note that women (wives) were involved in herding when the flock sizes were small, in all cases

Table 4.15: Type of Herding Labour

Type of labour	Frequency	Percent
Family members	30	59
Hired labour	16	31
No labour (stock penned)	5	10
Respondents with Small Ruminants	51	100

Source: Sample data

where they were involved, the small ruminant herds were less than 10 head. Children (school dropouts and those without gainful employment) and relatives were the major sources of herding labour; they represented 25% and 20% of the labour force respectively.

Table 4.16: Persons involved in herding

Persons Involved in Herding	Percent
Wife	35
Husband	20
Children	25
Other family members	20
Respondents interviewed	100

Source: Sample Data

4.3.4 Cost of Inputs Used in Small Ruminant Production

We found that the respondents did not know how the various anthelmintic drugs that they gave to their animals were supposed to be used. They were under-dosing (30%) while others were overdosing (30%), the animals. Only 40% of the respondents were drenching according to the manufacturers recommendations. On the frequency of drenching too, only 37% of the respondents gave the drench at the recommended frequency (Table 4.17). The amount of drench given, the frequency of administration of the drenches, and its cost per dose[6], influence the final cost of the total inputs used in small ruminant production.

Table 4.17: Frequency of Anthelmintic Use

Frequency of drenching (%)	Respondents
No drug used	6
Once per year	26
Twice per year	31
Three times per year	37
Respondents interviewed (51)	100

Source: Sample data

[6] Some costs of anthelmintic drugs used by respondent (1991 prices).

Type of drug	Average Cost of Drenching a 25 kg Animal	cost/cc or tablet(KS)
Vermofas	8.75	0.35
Nilzern	8.75	0.35
Levafas	7.60	0.91
Nilzern tablet	7.00	27.90
Valbazen	4.00	1.60
Wormcide tablet	4.00	9.60
Systemix	2.25	0.75
Wormcide	1.50	0.15

We found that all respondents used the same type of mineral (Sodium Chloride), but the amount fed was a negligible one kilogram per year. Treatment costs, on the other hand, depended on the disease incidence and frequency of prophylactic treatment. In the study, no respondent practiced prophylactic treatment. The main reason being that, prophylactic treatment was only recommended but not compulsory (Kabatha 1991).

Table 4.18 shows the level of costs of some inputs used in small ruminant production; 62% of these costs were for anthelmintic drugs.

Table 4.18: The Mean Cost of Inputs Used in Small Ruminant Production

	Amount Used per Head (KS)			(%)
Type of Input	Mean	Minimum	Maximum	of Total Inputs
Anthelminths	11.30	0	38.00	62
Treatment drugs	5.00	0	40.00	28
Minerals	1.80	0	6.50	10
All Inputs	18.10	0	64.90	100

KS = Kenya Shillings.

Source: Sample data

These input costs were not significantly ($P<0.05$) correlated with mortality rate, although a negative and significant correlation was expected. Nevertheless, the correlation coefficient was negative as would be expected.

Three reasons can be given for this insignificant correlation. The first one is that respondents showed high inputs costs not because of the frequency and amount of drug used, which will directly affect livestock mortality, but because of the price of the drug. Anthelmintic drugs do not have the same cost per dose, and respondents did not necessarily use the same drug.

The second reason is that the major component of input costs was the cost of anthelmintic drugs, yet helminths were not the main causes of small ruminant mortality. Respondents indicated that Pneumonia (and CCPP) rather than helminths were the main causes of small ruminant mortality. The third reason is that many respondents were neither aware of the dosage rates for the different drugs they used, nor of the recommended frequency of drenching of these drugs.

The government has recommended the use of various acaricides for different zones; this can be done for anthelmintic drugs too. This zoning will help the small scale farmers to remember the dosage rate as they will be using only one type of drug. Proper use of the drug too, will reduce the likelihood of resistance by helminths to these drugs.

4.3.5 Small Ruminant Mortality Rates

Low livestock mortality rate *ceteris peribus*, is one of the measures of good livestock management. Table 4.19 shows that, in the study area, small ruminant mortality rate for 1990 was 12% and 27% for mature small ruminants and lambs/kids respectively. This is lower than what was reported in literature already cited in section 2.4. One reason for the low mortality rate is that, this study depended on the respondents power to recall the number of deaths within the year under review; this can cause

Table 4.19: Mortality Rate (%) 1990

Type of Stock	Mean	SD	Min	Max	No Mort.
Mature stock	12	13	0	52	24
Lambs/Kids	27	35	0	100	51

SD = Standard Deviation.

Min = Minimum.

Max = Maximum.

Mort = Mortality

Source: Sample data

errors because some respondents will not remember all the livestock deaths within the year. Another reason is that, there were many cases of no mortality (24% and 50% in mature and young stock respectively) because flock sizes were small; no mortality lowered the mortality rates.

When the respondents were asked to indicate the main causes of small ruminant mortality, the majority reported Pneumonia as the main cause. This was either Pneumonia, which is an inflammation of the lungs, or CCPP, a peculiar type of pneumonia, affecting only goats. It is accompanied by pleurisy[7], hence the name. Since the respondents could not tell the difference between the two diseases, they described both as pneumonia.

Table 4.20 shows that the two diseases were the main causes of mortality in mature stock. They accounted for 69% of the small ruminant mortality, while

[7] A More detailed explanation on these two diseases can be found in any book on livestock diseases.

[8] Chi square is not as powerful a test as say the t test because it misses to measure the numerical value. For example, it will not show by how much the two types of off-take differ. However, it is appropriate for categorical variables. (Wonnacott et al., 1984 p 495).

Table 4.20: Main Causes of Mortality in Mature Small Ruminants as Reported by respondents

Cause	Frequency	Percent
Pneumonia and CCPP	27	69.0
Helminths	3	8.0
Malnutrition	1	2.5
Diarrhoea	1	2.5
Other unspecified Causes	7	18.0
Total	39[1]	100.0

[1]12 respondent reported no deaths

Source: Sample data

Table 4.21: Main Causes of Mortality of Lambs and Kids as Reported by Respondents

Cause	Frequency	Percent
Pneumonia and CCPP	10	40
Diarrhoea	7	28
Helminths	5	20
Other unspecified Causes	3	12
Total	25[1]	100

[1]26 respondents reported no deaths.

Source: Sample data

helminths accounted for only 8%; 17% of the mortality was from unknown causes. Though the mortality rates for young and old small ruminants were computed, it was not possible to compute the mortality rates for exotic crosses and indigenous stock; only four respondents had Dorper-indigeneous crosses.

We appreciate the fact that the respondents were not technically qualified to diagnose the causes of stock mortality. Therefore table 4.21 is only an evaluation of what the farmers considered as the main cause of mortality. Nonetheless, going by the postmortem reports as indicted in the monthly reports from the Division, the two diseases were the most prevalent causes of small ruminant mortality. In these monthly reports, deaths from helminths were indicated as "not known," while all deaths reported in each month were indicated as caused by either, CCPP or Pneumonia (GOK 1990b). It was not possible to establish whether the "not known" meant that there were no deaths reported or that no postmortems done.

These mortality rates may appear to be at variance with what was reported in previous studies where helminths were indicated as the main causes of small ruminant mortality (Sidahamed *et al.* 1985 and Shavulimo *et al.* 1986). However, these studies were in the high rainfall areas. Herren (1990) found similar results like the current study that CCPP and helminths were the main causes of stock mortality in Mukogodo Division, Laikipia. Therefore, from the results of these studies, it can be stated that in the ASAL, CCPP and Pneumonia rather than helminths, are the main causes of small ruminant mortality. Earlier in the chapter, it was shown that these diseases were among the main constraints of the small ruminant production enterprises in the study area.

4.3.6 Small Ruminant Marketing

Marketing channels are important in the development of any enterprise. Markets and infrastructure encourage trading and in the case of small ruminant production, will result in higher off-take rates. In an organized livestock marketing system, small scale farmers are likely to get higher prices than when the markets are not organized; this is because of the inherent competition created when there are many buyers and sellers. Where livestock markets are organized, livestock auctions are held regularly or animals are taken to a known livestock market where buyers and sellers meet on pre-arranged days of the month.

In the study area, there were no organized markets, the butchers either went round looking for slaughter animals or the respondents took the animals to the butcher when need for cash arose. Sometimes, the respondents advised butchers to fetch animals from the respondents *bomas*. Butchers would then arrange to collect the animals at their own time. In this kind of arrangement, where there is only one buyer and seller, the animals will not fetch competitive prices. In many cases, the small scale farmers receive low prices for the livestock because, the butchers are more business oriented than small scale farmers, hence, the former are better at price negotiations than the latter.

4.3.7 Small Ruminant Off-take

Net Income from small ruminant production is a function of gross off-take. Therefore, *ceteris peribus*, high off-take means high income from small ruminant production. Table 4.22 shows that the largest group of respondents

Table 4.22: Total Small Ruminant Off-take for 1990

Number of Animals	Frequency	Percent
No off-take	9	18
1-3	19	37
4-8	15	29
9-12	5	10
13-16	2	4
more than 16	1	2
Respondents interviewed	51	100

Source: Sample data

(37%) had an off-take of 1-3 animals. Twenty nine percent of the respondents had an off-take of 4-8 animals, while only 16% (10 + 4 + 2) of the respondents had an off-take of nine or more animals. Therefore, most respondents (66%) had an off-take of eight or less animals; 18% had no off-take in 1990.

Table 4.23: Small Ruminant Off-take in Various Classes

	Number of Animals Disposed				
Off-take Classes	1 - 3	4 - 8	9 - 12	> 12	Total
Consumption (gifts)	77	18	9	0	104
Sold for Cash	32	56	21	15	124
Total	109	74	30	15	228

Chi square = 56.57 (D.F., 3)
Probability = 4.48E-7

Source: Sample data

The 42 respondents who reported an off-take in 1990 indicated two types of off-take, home consumption (or gifts) and sale for cash needs. This can be seen in Table 4.23 which shows that more respondents reported off-take for home consumption than those who reported off-take for cash needs. However the mean for the former was less than the mean for the latter.

Contingency table 4.24, shows off-take values in proportional rather than the absolute terms. Table 4.24A shows that 74% of the respondents consumed three or less animals, and that very few respondents (9%) consumed or gave away more than eight animals. The table further shows that, while 74% (45 + 17 + 12) of the respondents sold more than four animals, the biggest group of

Table 4.24A: Small Ruminant Off-take in Various Classes

	Number of Animals Disposed				
Off-take Classes	1 - 3	4 - 8	9 - 12	> 12	Total
Consumption (gifts)	74	17	9	0	100
Sold for Cash	26	45	17	12	100

Table 4.24B: Small Ruminant Off-take for the Various Classes

	Number of Animals Disposed			
Off-take Classes	1 - 3	4 - 8	9 - 12	> 12
Consumption or (gifts) Sold for Cash	71 29	24 76	30 70	0 100
Total	100	100	100	100

Source: Sample data

respondents (45%) is the one that sold 4-8 animals. On the other hand, table 4.24B shows that, off-take of 1-3 were mainly for animals consumed at home (71%). However, off-take of more than three animals was mainly for animals sold for cash needs. Indeed, off-take of more than 12 animals was only associated with a sale for cash needs.

Off-take rate can be increased if more attention is given to the problem of Pneumonia and CCPP in order to reduce the loss from the two diseases. Reduction of the mortality rate will increase the quality and the number of animals sold, directly increasing income from small ruminant production.

CONCLUSIONS

In Conclusion, the results from the survey indicate that agro ecological zoning is not good in determining the livestock potential of an area. This zoning is more appropriate for crop production. The study has also shown that small ruminant production is an important enterprise for small scale farmers, but, they are not conversant with the administration of anthelmintic drugs. One reason for this ignorance is that visits by the LPP, for advisory service on small ruminant production, are very infrequent. Additionally, Pneumonia and CCPP, are more of constraints to small ruminant production than helminths, yet, the latter took up the biggest share of the cost of inputs. The study has also indicated that high off-take is associated with sale for cash needs rather than home consumption.

CHAPTER 5

THE CHOICE BETWEEN SHEEP AND GOAT PRODUCTION ENTERPRISES AND THE IMPORTANCE OF SMALL RUMINANT PRODUCTION TO HOUSEHOLD INCOME

INTRODUCTION

In this chapter, the study will determine the relationship between small ruminant and cattle production enterprises as it relates to the choice of species. It will identify the order in which cattle production, and maize production, small ruminant production, enterprises were established and show the priority investment among the three enterprise options. For small ruminants in particular, the reasons why the respondents kept them will be identified.

Finally, the study will identify the relationship between sheep and goat production enterprises as it relates to the choice of species, and the contribution of their joint incomes to household income.

5.1 RELATIONSHIP BETWEEN SMALL RUMINANT PRODUCTION AND CATTLE PRODUCTION

5.1.1 Distribution of Cattle and Small Ruminants

Cattle and small ruminants are intermediate assets and are among the major assets in the study area. Seventy eight percent of the respondents owned small ruminants while 60% owned cattle. A breakdown of the one-species-ownership category indicated that 83% had small ruminants while only 17% had cattle. The explanation is that while all respondents grew maize and beans, those who were

unable to acquire cattle and small ruminants together either preferred or could only afford to keep small ruminants.

To identify the pattern of ownership of cattle and small ruminants in the study area, the respondents were classified into categories of wealth using cattle herd sizes. Cattle herd sizes were used because, together with small ruminants, they were the main livestock enterprises. Additionally, they also had higher monetary value per head than small ruminants. Four cattle ownership categories were established; those who had no cattle, those who had 1-4, 5-7, and 8-10 TLU of cattle respectively. The reader will recall that, according to the classification used in this study, only respondents with 50 or less, and 10 or less head of small ruminants and cattle respectively were considered as small scale farmers.

Table 5.1, shows cattle and small ruminant distribution among these cattle ownership categories. The table shows that the respondents who owned no cattle (40%), still owned 12% of the small ruminant bio-mass. Further, those with the

Table 5.1: Distribution of Livestock Using Cattle Ownership Categories

Cattle ownership Category (in TLU)	Proportion of respondents per category	Proportion of small ruminants per category	Proportion of cattle per category
0	40	12	0
1-4	34	44	31
5-7	17	32	36
8-10	9	12	33
Total	100	100	100

Source: Sample Data

largest cattle herds (9%), owned 33% of the cattle bio-mass but only 12% of the small ruminant bio-mass. Additionally, the mode of the cattle owning categories is 1-4 TLU of cattle, this category own 31% of the cattle bio-mass, and have the largest proportion (44%) of small ruminants.

The results also indicate that ownership of small ruminant has a more normal distribution than ownership of cattle; the latter is negatively skewed. The proportions of cattle and small ruminants within the livestock herd are similar to those reported by Herren (1990) and De Souza (1984) although the two studies were in pastoral areas.

In table 5.2, these cattle ownership categories have been used to indicate the relationship of the mean cattle and small ruminant flock sizes. The table shows that as the cattle herd sizes increased, the mean small ruminant flock sizes also increased because the respondents became more affluent. But, after seven cattle

Table 5.2: Mean Livestock owned by respondents, Using Cattle Ownership Categories; and the Small Ruminant : Cattle Ratios

Cattle ownership category (TLU)	Mean S/Rum. size flock (in TLU)	Mean herd cattle size (TLU)	S/Rum. Cattle: Ratio
0	4	0	-
1-4	18	1.5	12.1
5-7	26	4.9	5.3
8-10	17	8.4	2.0

S/Rum. = Small Ruminants

Source: Sample data

TLU, the mean small ruminant flock size started to decline. This indicates that the need for small ruminant production enterprises declined as the respondents became more affluent, hence they kept relatively low small ruminant flock sizes.

This livestock ownership trend is confirmed by the correlation of small ruminant flock sizes and cattle herd sizes; with the ratio of small ruminant to cattle. The correlation coefficient between the small ruminant flock sizes and this ratio is significant ($P<O.05$) and positive while the one between cattle herd sizes and this ratio is significant ($P<0.05$) and negative.

This finding is similar to that reported in the cited literature (De Souza 1984, even though this study was in a pastoral area) that the ratio of small ruminant to cattle herd sizes is negatively correlated with the cattle herd sizes.

5.1.2 Establishment of Cattle and Small Ruminant Enterprises.

The livestock distribution pattern is as a result of the way the enterprises were established. When the respondents came to settle in the study area, some brought with them cattle and small ruminants. Cattle mortality however, was very high due to tick borne diseases. According to the earliest settlers, there were no dips for effective tick control. Also, there was no cure for the major tick borne livestock killer disease - East Coast Fever (E.C.F.). Other reasons for preferring small ruminants over cattle was that there were a lot of bushes and shrubs for goats to browse on and small ruminants too were not affected by E.C.F.. Some respondents too, could not afford to buy cattle because they did not have much money[1].

This preference is apparent from table 5.3. The table shows the number of livestock enterprises started each year since the ranches were first settled in

[1]Most of the small scale farmers who bought these farms as shares in land buying companies could not afford to buy land in any other way.

1964. The period has been divided into seven five-year groups; from 1964 to 1990.

Table 5.3: Years That the Livestock Enterprises were Established

	Small Ruminants		Cattle	
Year Started	Percent	cumu-lative percent	Percent	cumu-lative percent
Between 1964-1968	8	8	11	11
" 1968-1972	12	20	5	16
" 1972-1976	14	33	8	14
" 1976-1980	24	57	19	43
" 1980-1984	12	69	16	59
" 1984-1988	22	90	17	86
" 1988-1990	10	100	14	100

Source: Sample data

The first column under each enterprise shows the proportion of respondents who had established livestock enterprises within each five-year period. The second column shows the cumulative percentage. The table indicates that during the initial years, 1964-1968, slightly more respondents (11%) had established cattle production than had established small ruminant production (8%) enterprises. The respondents had brought these cattle with them from their home Districts.

However, in later years, there were more respondents establishing small ruminant than cattle production enterprises. For instance, Between 1968 and 1972, 12% and 5% of the respondents had established small ruminant and cattle

production enterprises respectively. Between 1972 and 1976, they were 14% and 8%; while between 1976 and 1980 they were 24% and 19% respectively. The trend changed between 1980 and 1984 and between 1988 and 1990 when more respondents established cattle production enterprises than those that established small ruminant production enterprises.

Cumulatively, the table shows that by 1976, 33% and 14% of the respondents had started small ruminant and cattle production respectively. By 1984, there were still more respondents who had started small ruminant production enterprises (69%), than those that had started cattle production enterprises (59%). However by 1988, this gap had narrowed to 90% and 86% for small ruminant and cattle production enterprises respectively.

This, indicated in the last two preceding paragraphs, corresponds with the respondents explanation that, in the initial years, there were problems of ECF and shortage of capital. This explains why cattle production enterprises were more between 1964 and 1968; respondents brought the animals with them. Later, they changed to small ruminant production due ECF, however, they are gradually shifting the emphasis back to cattle production because ECF can be treated using drugs or controlled through dipping; they are also more affluent than they were before.

5.1.3: The Order of Starting Maize, Cattle, and Small Ruminant Production Enterprises

In the previous sub-section, it was indicated that, during the early years of farm establishment, respondents started with more small ruminant production enterprises than cattle production enterprises. In this sub-section, the order in which these enterprises were established will be determined. Respondents showed an obvious preference of starting with small ruminant production rather

than with cattle production (Table 5.4). While five respondents (10%) started

Table 5.4: Order in which Maize, Small Ruminant, and Cattle Production Enterprises were Established by Respondents

	Respondents with Small Ruminants		Respondents with Cattle	
Choice	frequency	percent	frequency	percent
Was the 1st enterprise alone	5	9.8	1	2.6
Were 1st enterprises with maize	9	17.7	4	10.3
Were 1st enterprises with cattle	1	2.0	-	-
Were 1st enterprises with s/rum	-	-	1	2.6
Established all three together	4	7.8	1	10.3
1st enterprises Sub-total (1)	**19**	**37.3**	**10**	**25.8**
Was 2nd enterprise alone	19	37.3	0	0
Were 2nd enterprises with cattle	8	15.7	-	0
Were 2nd enterprises with small ruminants	-	0	8	20.5
2nd enterprises Sub-total (2)	**27**	**53.0**	**8**	**20.5**
Were Last enterprises (3)	**3**	**5.9**	**20**	**51.3**
Don't know the starting order	2	3.9	1	2.6
Total (1 + 2 + 3)	**51**	**100.0**	**39**	**100.0**

Source: Sample data

with small ruminant production alone as the first enterprise, only one respondent (3%) started with cattle production alone as the first enterprise. The table further shows that 37% and 26% of the respondents had small ruminant and cattle production respectively among their first enterprises {sub-total (1)}.

Small ruminant production was the favorite second choice enterprise; 37% of the respondents chose it as the second enterprise while none chose cattle as the second enterprise. Indeed, 53% of the respondents indicated that it was among the second enterprise established, while only 26% of the respondents indicated the same for cattle production {sub-total (2)}. Cattle production was mainly established last; 51% of the respondents with cattle said cattle production was the last enterprise to be establised.

The results show that it was difficult to establish cattle production alone without the support of maize and/or small ruminant production. Therefore, small ruminant production is very important in the initial years of farm establishment. It is apparent that respondents moved from maize (and beans) production to small ruminant production and finally to cattle production in that order.

5.1.4 Some Reasons Given for Choosing Small Ruminant Production

Small scale farmers start livestock enterprises because these enterprises enable them to fulfil specific goals. These goals determine the livestock husbandry practices that the farmers will adopt and may not necessarily appear rational to a casual observer. Therefore, in order for the government to formulate livestock policies that will benefit small ruminant production by small scale farmers in ASAL, she needs to know is why small scale farmers keep or do not keep small ruminants.

Table 5.5: Reason for Not Having Small Ruminants

Reason	Frequency	Percent
Had no money	8	57
Discontinued due to small ruminant diseases	3	22
Sold for food or other expenses	2	14
New immigrant	1	7
Total	14	100

Source: Sample data

There were two categories of respondents in the survey area, those with small ruminants, (78%), and those without (22%). Starting with those that had no small ruminants, the aim was to identify the reasons for not keeping them. Table 5.5 shows that 57% did not have money to purchase small ruminants, while 22% discontinued the enterprise due to small ruminant diseases. Although only 14% said that they sold all their stock to meet cash

Table 5.6: Reason for Having Small Ruminants

Reason	main reason		second reason	
	frequency	percent	frequency	percent
Main source of income	23	41	7	29
Easy to dispose in emergency	13	29	8	33
As an investment	8	16	4	17
For home consumption	6	12	5	21
For milk	1	2	0	0
Respondents with small Ruminants	51	100	24	100

Source: Sample data

needs, lack of capital is confirmed, as the major constraint to small ruminant production, by the fact that 79% of the respondents that had no small ruminants, had no cattle either.

The respondents who had small ruminants (table 5.6) indicated that small ruminants were a major source of income (41%), and that they were easy to dispose in an emergency (29%). Other reasons were that they were an investment (16%), or were kept for home consumption (12%).

The first two reasons were still the major reasons for those respondents who indicated a second (or subsidiary) reason for keeping small ruminants. They accounted for 29% and 33% for the first and second reasons respectively. By considering the two reasons jointly, it can be seen that 70% of the respondents kept small ruminants because of the cash income accruing from them. The explanation to this is that they could be sold at any time of the year. Cattle were less reliable because, cash could be required when the cows were dry, yet the mean herd size was too low (2.3 TLU) for any sale without jeopardizing the enterprise. These results confirm what other studies had observed earlier that, small ruminant production is a major source of cash income for poor pastoralists (Herren 1990 p 120) and small scale farmers alike (Little 1981 p 11).

Although previous studies have shown that goat manure is a good source of crop nutrients (Onim *et al.* 1990 p 160), none of the respondents indicated this as a reason for keeping small ruminants, indeed none of the respondents indicated that they used any kind of manure.

5.1.5 Investment Priorities Between Maize, Cattle, and Small Ruminant Enterprises, when Lump Sum Capital was Available

The respondents had three options of investing money on the farm, cattle, small ruminant, and crop (maize and beans) production. It was shown earlier in the

chapter that respondents started with maize production, and moved to small ruminant production and cattle production in that order. It has also been shown

Table 5.7: **The Priority Enterprise for Investing KS 5000.00**

	Respondents	
Investment portfolio	frequency	percent
(1) Cattle production	37	56
(2) S/ruminant production	14	22
Sub-total (1 + 2)	-- 51	-- 78
(3) Maize & beans production	12	18
(4) Business	2	4
Total (1 + 2 + 3 + 4)	-- 65	-- 100

Source: Sample data

that as the respondents became wealthier, the emphasis on livestock production shifted away from small ruminant production towards cattle production.

This shift is apparent from table 5.7 which shows the respondents' choices of the enterprises they would invest in if they had KS 5000.00[2] to invest. The results show that the majority of the respondents (56%) would invest in cattle production; and 22% and 18% would invest in small ruminant production and maize (and beans) production respectively. This was irrespective of the size of the livestock herd owned at the time of the survey.

These results indicate that livestock production (78%), rather than crop production (18%), is the priority enterprise for investment. The advantage of investing in livestock rather than crops is that, livestock appreciate in value.

[2] This is the minimum amount of money that can be economically invested in cultivating one hectare of maize and beans, or purchasing one TLU (one cow, or 10 breeding small ruminants).

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investing in livestock rather than crops is that, livestock appreciate in value. Their profits too, (in form of milk, calves, kids, lambs, meat etc.) can be re-invested back into livestock production. As the study area is an ASAL, investment in livestock production was also less risky than investment in crop production.

The other explanation is that respondents would rather invest the money in cattle production because small ruminant and maize production enterprises could be expanded even with less capital. For instance, while it took KS 4500.00 - 5000.00 to buy a cow, the respondent could buy one breeding sheep/goat for KS 300-500.00. They could also expand the crop enterprise in smaller units than one hectare. Therefore, when deciding on the enterprises to invest in, profitability of the enterprise is not the only consideration. There were also other considerations like, need for diversification, investment possibilities available , and avoidance of risk.

The results further strengthen what was established earlier in the chapter that, respondents graduate from small ruminant production to cattle production but not vice versa. The results too indicate that, as the respondents become more affluent, the need for small ruminants only declines but is not extinguished. Hence, neither cattle nor small ruminant production could completely replace the other but rather, small ruminant production was complimentary to cattle production. This complementarity needs to be borne in mind when planning any livestock development projects in the area.

5.2. THE CHOICE BETWEEN SHEEP AND GOAT PRODUCTION ENTERPRISES

5.2.1 Distribution of Sheep and Goats in the Study Area

In table 5.7, the small ruminant flock sizes have been divided into two groups representing the two species. The table indicates that except in the largest small ruminant ownership category, the mean goat flock sizes were less than ten. In this category, representing 9% of the respondents, the mean goat flock size was 20 head. As for sheep, 48% (34 + 14) of the respondents had mean flock sizes of less than ten head while, 30% (9+12+9) of the respondents had sheep flock sizes of more than 19 head. In all small ruminant ownership categories, the mean sheep flock sizes were larger than the goat here sizes.

Turning to the ratios, the table indicates that, when respondents had less than ten head of small ruminants, the ratio of goats to sheep was close to 1:1 (with sheep on the higher side). But, as the small ruminant flock sizes increased, sheep flock

Table 5.8: Mean Small Ruminants Ownership in the Study Area

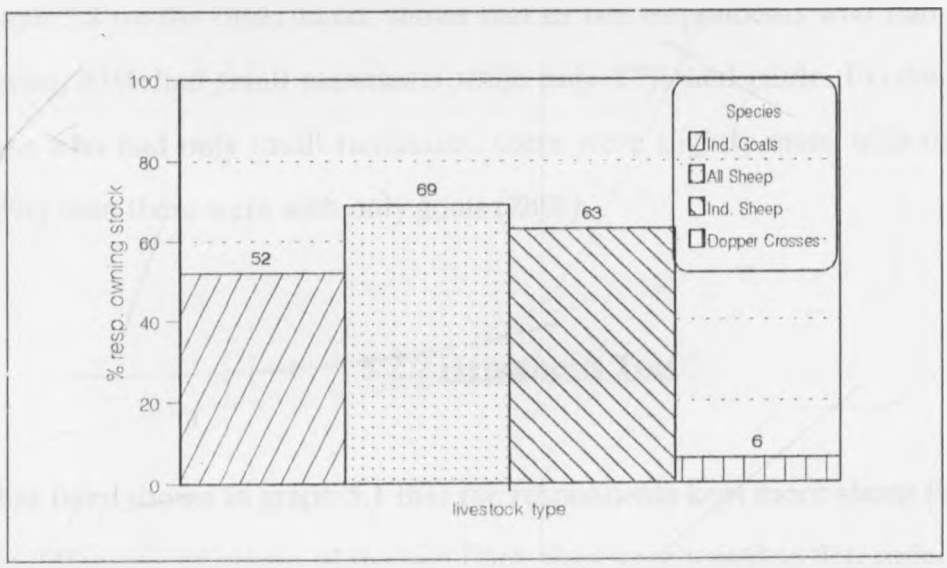
number of Small Ruminants Owned	Proportion of respondents	Mean sheep flock size	Mean goat flock size	Ratio sheep: goat
0	22	0	0	0
1- 9	34	3	2	1.5
10-19	14	7	6	1.1
20-29	9	19	4	4.8
30-39	12	25	7	3.6
40-50	9	27	20	1.4
All categories	100	14	7	2.0

Source: Sample Data

sizes were larger reaching a ratio of 1:4.8 for the 20-29 flock size category. However, this ratio decreased for the largest flock sizes (40-50 head), but sheep flock sizes were still larger.

The table further shows that 30% (9+12+9) of these respondents had more than ten sheep but only 9% had this many goats. Again, while 21% (12 + 9) had more than 20 sheep, only 9% had as many goats. Indeed, it was found that 57% of the respondents keep more sheep than goats while only 35% kept more goats than sheep. Moreover, flocks of more than 30 small ruminants were associated with sheep only; 9% of the respondents had more than this number but only 1.5% had as many goats. On average, sheep outnumbered goats by 2:1.

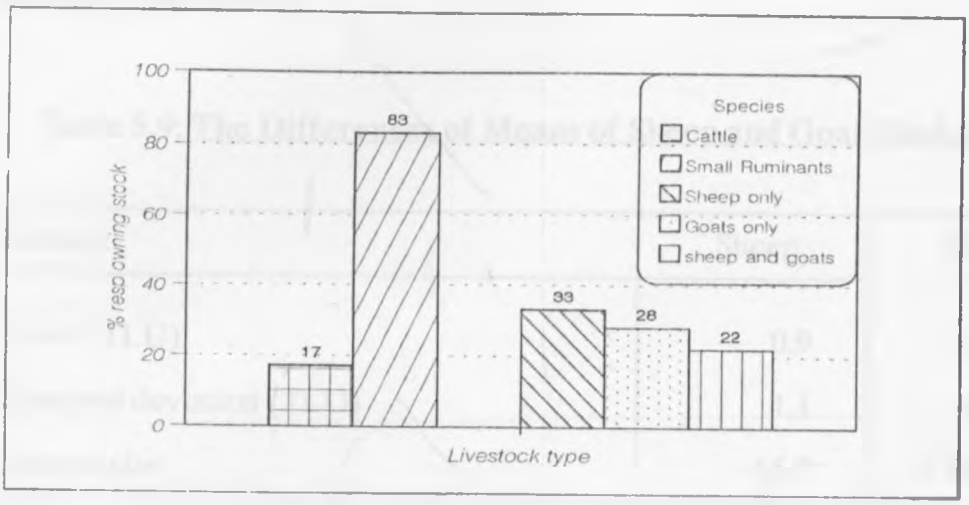
Graph 5.1: Small Ruminant Ownership by species



resp. = respondent = 65
total % not = 100 -some have all species
Source: Sample data 1991

This preference of sheep can also be seen in graph 5.1 and 5.2. Graph 5.1 shows that there were more respondents owning sheep (69%) than those owning goats (52%). Because of this preference for sheep, 6% of the respondents had already upgraded their indigenous sheep with Dorper rams while none had upgraded goats.

Graph 5.2: Respondents with only One Animal Species



Resp = Responent = 18
SOURCE: Sample data

Graph 5.2 on the other hand, shows that of the respondents who had only one species, 83% had small ruminants while only 17% had cattle. Furthermore, of those who had only small ruminants, there were slightly more with only sheep (33%) than there were with only goats (28%).

5.2.2 Hypothesis Test

It has been shown in graph 5.1 that the respondents kept more sheep than goats. The difference of means of the two flock sizes were tested to determine whether it was significantly ($P < 0.05$) different from zero. This is a one-tail test because it has already been shown in the earlier sub-sections that sheep flock sizes were larger than goat flock sizes. The null hypothesis that will be tested:

HO: In the study area, the difference of means of sheep (X_S) flock sizes and goat (Y_G) flock sizes is not different from zero.

H1: The mean sheep flock size (X_S) is greater than the mean goat flock size (Y_G).

Level of significance = 0.05.

The results, as shown in the table 5.9. It indicated that sheep flock sizes were significantly ($P<O.001$) larger than goat flock sizes. Therefore, the null hypothesis was rejected.

Table 5.9: **The Differences of Means of Sheep and Goat Flock Sizes**

Statistic	Sheep	Goats
Mean (TLU)	0.9	0.5
Standard deviation (TLU)	1.1	0.8
Sample size	65.0	65.0

t = 2.609 (D.F., 128)
Probability = 0.075 E-3

Source: Sample Data

The results confirm what was found by Kohler (1987a) and Little (1981) in Laikipia and Baringo respectively; for small scale agropastoralists, sheep outnumber goats.

5.2.3 Reasons Given by Respondents for Preferring Sheep or Goats

The fourth objective was to find out the relationship of sheep and goat production in the study area as it relates to the choice of species. Cited literature indicates that small ruminants are kept for meat and sometimes for milk. Other reasons are based on the preferences of the buyers and of the individual small scale farmers; the performance of the breed (whether actual or as perceived by the small scale farmer) is also a consideration.

In the foregoing sub-section it was determined that sheep were more than goats. This sub-section will determine whether there was a preference of sheep or goats among the respondents, and the reasons for such preference if any.

Table 5.10: Preference of Sheep or Goats

	Number of Respondents	
Species preferred	Frequency	Percent
Sheep	22	43
Goat	11	22
Neither	18	35
Respondents interviewed[1]	51	100

[1]Only respondent with small ruminants were asked this question.

Source: Sample data

Fifty one respondents, who had small ruminants, were asked to indicate their preference for the two species; the results of these preferences are shown in table 5.10. They indicate that the large sheep flock sizes were not due to sampling error, twice as many respondents preferred sheep (43%) as those that preferred goats (22%). Thirty five percent of the respondents, however, had no preference of either species. This preference of sheep was surprising considering the fact the vegetation in this area favoured goats over sheep.

The rationale of this preference, though, became obvious when the reasons given for preferring sheep or goats (tables 5.11A and 5.11B) examined. Table 5.11A shows that 82% of the respondents who had sheep kept them because sheep were docile and hence could be herded together with cattle.

Indeed, all the respondents who had both cattle and small ruminants herded them together. The small flock sizes dictated that only a single flock could be economically kept. The table further indicates that, 14% said they preferred

them because they were more resistant to diseases than goats. This is probably because of the incidence of CCPP in goats in the area.

Table 5.11A: The Reasons Given for Preferring Sheep

	Number of Respondents	
Reason for Preference	Frequency	Percent
They are docile to herd	18	82
Are more resistant to diseases	3	14
Do not destroy trees	1	4
Total that preferred sheep	22	100

Table 5.11B: The Reasons Given for Preferring Goats

	Number of Respondents	
Reason for Preference	Frequency	Percent
Survive better during draught	6	55
Have higher birth rates	3	27
For milk	2	18
Total	11	100

Source: Sample data

The other explanation for the preference of sheep is that livestock were grazed within cultivated areas and as such, herding goats was a problem as they tended to stray into crop lands. This can explain why those who preferred sheep said that they were docile and more manageable than goats.

The preference for sheep has policy implication in the introduction of small ruminant programmes by the government. As 43% of the respondents preferred sheep and 36% had no special preference for either species, it means that 79% of the respondents would be receptive to sheep improvement programmes. On the other hand, only 58% would be agreeable to goat improvement programmes (that is 22% who preferred goats and 36% who had no special preference for either of the species).

For the respondents who had goats, 54% preferred them because goats survived better in drought conditions, while 27% said that goats had higher birth rates than sheep. Goats have a better ability to survive droughts than sheep because, during a drought, shrubs and bushes which are preferred by goats, are the last to dry. The respondents had good reason when advancing this answer as 71% of those who gave this answer started the small ruminant production enterprise between 1967 and 1969. Being among the first respondents to settle in the study area, they had been through many drought years.

It was surprizing to observe that, although there were no milk goats, 18% of the respondents said that they preferred goats because of their milk. Milk production in goats therefore did not appear to be an important consideration in deciding whether to keep goats but, when goat milk was available, respondents had no objection to drinking it. Indeed, 45% of the respondents said that they sometimes milked goats, usually when there was a shortage of cows' milk or when goat kids diarrhoea because of taking excessive milk. Milking of non-milk goats has also been observed in other studies (Field 1986 p 5),

It has been observed that the main reasons for respondents to prefer goats was the ability of goats to survive drought conditions and their higher birth rates than sheep. Therefore, improving small ruminant productivity and nutrition, especially during the dry seasons, will increase the number of respondents

preferring sheep. However, the problem of goats being unmanageable, as far as herding is concerned, is more difficult to correct.

To increase income from small ruminant production, Ministry of Livestock Development should encourage sheep rather than goat production. It should also emphasize on improvement of sheep productivity and small ruminant nutrition; the latter is necessary because sheep compete with cattle for feed.

5.3 THE CONTRIBUTION OF INCOME FROM SMALL RUMINANT PRODUCTION TO HOUSEHOLD INCOME

The last objective was to quantify the contribution of income from small ruminant production to household income[4] and net farm income and to determine the effect of net farm income on income from small ruminant production. When determining the effect of household income on income from small ruminant production, off-farm income will overshadow the effect of net farm income. Therefore, the study will determine the effect of net farm income rather than household income, on income from small ruminant production.

5.3.1 The Contribution of Income from Small Ruminant Production to Household Income and to Net Farm Income

The contribution of income from small ruminant production to household income and net farm income was examined from two viewpoints; from the respondents' point of view, and from calculations of household income and net farm income based on survey data. Ideally, the two should give similar results.

a) <u>The Respondents Point of View</u>

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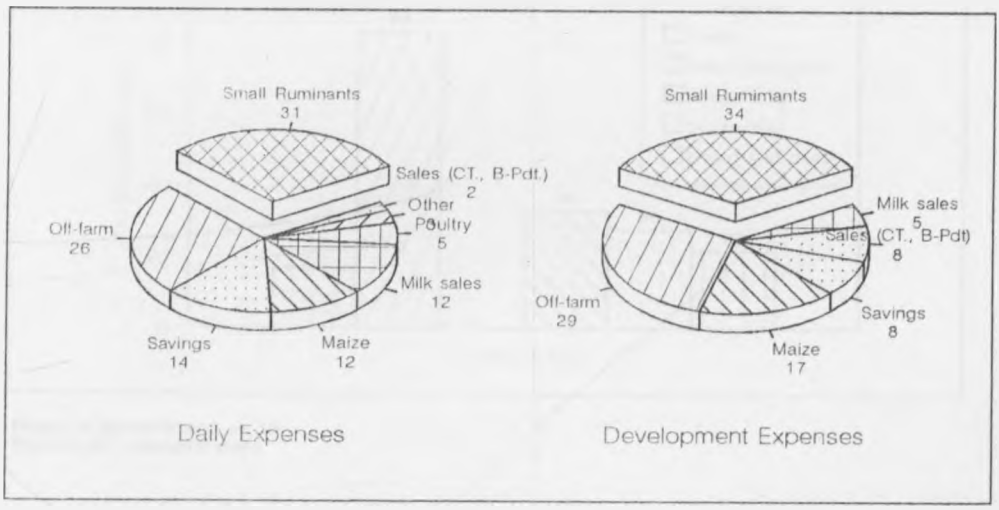
[4] Household Income = Off-farm Income + Net Farm Income
Net Farm Income = Net Income from Milk + Net Income from Maize + Net Income form Small Ruminant Production

The respondents were first asked to indicate their main sources of income used for development, that is, the income which they usually required in a lump sum; for instance, to fence their farms. The responses were ranked according to their importance. Chart 5.1 (second pie) shows that small ruminant production was ranked first by 34% of the respondents followed by off-farm income (29%), and maize sales (17%).

Moreover, of the respondents who indicated net farm income as a source of income used for development, 54% indicated that small ruminant production was the major source (Chart 5.2 - first pie). Even for the respondents who had indicated more than one source of income used for development purposes, small ruminant production was still leading among the second income sources.

Chart 5.1: Source of HHI for
Daily and Development Expenses



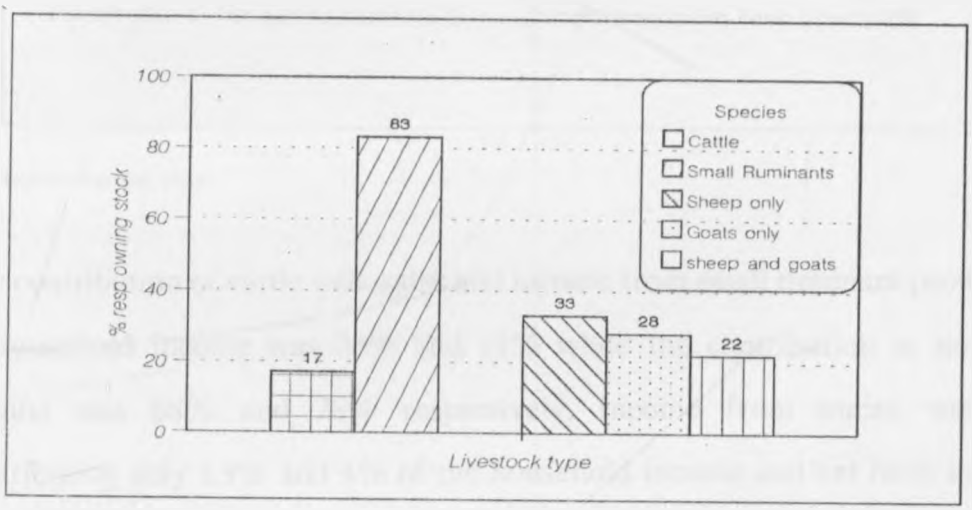
RSP = Respondents, CT. = Cattle
HHI Household Income, B-Pdt. = Livestock bi-products
Source: Sample Data

Next the respondents were asked to indicate the sources of income used for daily expenses, for instance, expenses on food and clothing. When the sources of this income were ranked according to their importance, it was found that more respondents (31%) still ranked small ruminant production as the leading source

(Chart 5.1 - first pie). Further, of the respondents who indicted net farm income as a source of income used for daily expenses, 50% indicated that small ruminant production was the major source (Chart 5.2 second pie). The results indicate that respondents consider small ruminant production as a major source of income for daily expenses as well as for development expenses.

Sale of cattle and livestock by-products accounted for 2% and 8% of the household income used for daily and development expenses respectively. This contribution rose to 12% for the sources of net farm income used for development but was only 2% for the sources of this

Graph 5.2: Respondents with only One Animal Species



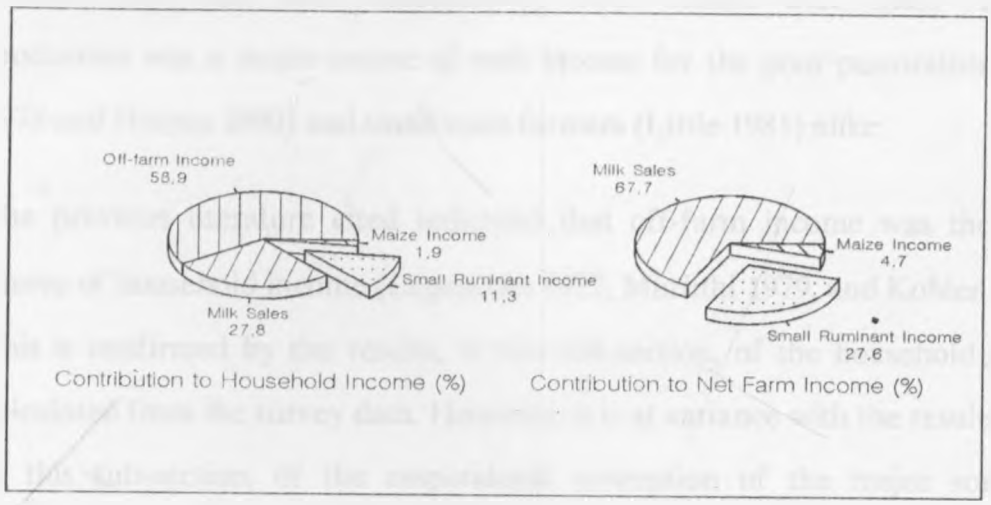
Resp = Responent = 18
SOURCE: Sample data

income used for daily expenses. Considering that the mean cattle herd sizes were only 2.3 TLU, these sources of household and net farm incomes were negligible. The results confirm the earlier assumption of excluding sale of cattle and livestock by-products as a source of income in the calculation of net farm income.

b) **Household Income Calculated from the Survey Data**

The 1990 household income was only calculated for the respondents with positive household income[5]. The different sources of this income are shown in Chart 5.3.

Chart 5.3: Distribution of Household Income Across Enterprises (Sample data)



Source Sample data

The contribution of cattle milk sales and income from small ruminant production to household income was 28% and 11% while the contribution to net farm income was 68% and 28% respectively. Income from maize was low, contributing only 1.9% and 4% of the household income and net farm incomes respectively. This was not surprising because 1990 was a drought year in the study area. The major contributor to household income and net farm income was off-farm income; it accounted 59% and 68% for the former and the latter sources respectively.

For an ASAL, this dependence on livestock and small ruminant production in particular is noteworthy. The results indicate that during a drought year, small

[5]Negative income can give misleading results (c.f. Muriithi 1979 p. 72)

ruminant production may be the only source of net farm income for those respondents (23%) who had no other livestock enterprise.

Although the income calculated from survey results was at variance with the farmers' perception of the enterprise that was most important as far as household income was concerned, it is noteworthy that small ruminant production contributed close to one third of the net farm income. The results confirm what had been observed by other studies that, small ruminant production was a major source of cash income for the poor pastoralists (IPAL 1978 and Herren 1990) and small scale farmers (Little 1981) alike.

The previous literature cited indicated that off-farm income was the major source of household income (Lagemann 1977, Muriithi 1979, and Kohler 1987c). This is confirmed by the results, in this sub-section, of the household income calculated from the survey data. However, it is at variance with the results, again in this sub-section, of the respondents perception of the major source of household income. Results from the sub-section indicate that the highest proportion of the contributions to household income was that of income from small ruminant production.

One of the reasons for this discrepancy, that is, the respondents viewpoint and the results calculated from the field data, is that the respondents did not give all the information about their household incomes; this is usually a problem in income related studies (GOK 1977). The discrepancy also occurred because the respondents looked at these income sources from the point of view of source of income that was readily available when need for cash arose. Incomes from milk production and off-farm income may be available on daily/monthly basis. But, there were times when the cows were dry or when off-farm work, which was most abundant during planting/weeding and harvesting seasons, was not available. Income from maize production too, was more abundantly available at

specific times (during harvesting). Income from small ruminant production, on the other hand was available all the time; even at a moments notice.

The last observation worth to note is about the low value of income from maize production. 1990 was a drought year in the study area hence the low value of this income. Income from maize production in a good year will change the proportional contribution of the other sources of income, nevertheless, the fact that in this area there is a probability of getting a maize crop failure is four out of every ten years (Jaetzold 1982 p 335), validates the significance of these results. Indeed, Kohler (1991) reported that in Matanya (Central Laikipia), which is in a similar zone to the study area, maize production was a matter of trial, with a high chance of error.

CONCLUSIONS

This study has established that sheep are more preferred than goats. However, if the nutrition for small ruminants is improved, and the productivity of sheep is enhanced through upgrading with Dorpers, preference for sheep can be increased even further. Improved sheep production will increase off-take from small ruminant production, hence, the total household income.

The current study has found the contribution of income from small ruminant production to household income and net farm income, calculated using the survey data, to be lower than what the respondents' perceived as its contribution to household income and net farm income. Nevertheless, its contribution to household income and net farm income is still apparent. The results calculated using the former method, show that income from small ruminant production contributes close to one third of the net farm income. These results are noteworthy as they are for a drought year. Drought years are an expected occurrence in the study area, in four out of every ten years.

CHAPTER 6

CONCLUSIONS

There were two drawbacks to this study: One, the time available for the study was very short. Therefore, some important issues that also affected decisions on small ruminant production, for instance, lambing/kidding rates, fertility rates, and small ruminant production costs, based on actual data, were not investigated. Two, it was not possible to determine the separate contribution of sheep and goats to household income. Therefore, it was not possible to determine whether the larger sheep flock sizes also contributed larger proportions of income from small ruminant production than goats. Contribution of sheep and goats to household income and to net farm income could only be inferred. However, the following conclutions can be made from this study:

1) The was no significant ($P<0.05$) difference in the livestock herd sizes in AEZ, LH4 and LH5. This indicates that agro ecological classification is not appropriate in determining the livestock potential of an area; the classification is based on the crop rather the livestock potential.

2) Socioeconomic aspects that were found to affect the respondents' decisions on small ruminant production were, availability of grazing, off-farm occupations, Ministry of Livestock Development extension services and the disease incidences. The study established that, when all available grazing land was considered, the stocking rate was 2.8 hectares per TLU, but when only the grazing land in the settled farms was considered, it was 1.4 hectares per TLU! The stocking rate was even lower than the figures shown above; only respondents with less than 10

and 50 cattle and small ruminants respectively were considered in the current study. Therefore, when the respondents indicated that insufficient grazing was not a constraint, it was only an illusion.

Very little small ruminant production advisory extension services were provided to the respondents. Most respondents said that they were never visited by the LPP and that these personnel should start visiting. However, they were satisfied with the VP services. They identified diseases and lack of water as the most important constraints to small ruminant production.

3) Other socioecomic aspects were; flock size, breeds and breeding, labour management, cost of inputs, mortality rate and off-take rate. The respondents only kept indigenous small ruminants but a few had Dorper-indigenous crosses. Those keeping these crosses indicated that, they (the crosses) performed better than the indigenous breeds. Breeding was not controlled because flock sizes were very small. Due to these small flock sizes, many respondents herded the stock themselves (husband or wife) or used other family members.

Whereas the main input cost in small ruminant production was on anthelmintic drugs, the level of input costs was not associated with mortality rate. The reason for this lack of association was that, the price per dose (of the anthelmintic drug) contributed much to the total cost of the drug administered. Further, Pneumonia and CCPP, rather than helminths, were the main cause of stock mortality. However, small ruminant mortality rate was similar to that quoted in similar studies.

Respondents without off-farm income sold significantly ($P<0.05$) more animals than those with off-farm income. Whilst significantly more small ruminants were sold for cash that those consumed at home, sales were not through organized livestock markets but by private negotiations; this depressed livestock prices.

4) Though maize yields were unreliable, maize production was still the priority enterprise because it was also a staple food for all respondents. Nevertheless, when they started livestock investments, they moved from small ruminant production to cattle production. This was the reason why cattle ownership distribution was negatively skewed, while that of small ruminants had a more normal distribution. Still, cattle rather than maize production or small ruminant production was the enterprise of choice when they had large amounts of money to invest.

5) The respondents kept significantly more sheep than goats. Indeed, sheep outnumbered goats by 2:1. The main reason for preferring sheep was that they were more manageable. Sheep were easier to manage in cropped areas than goats; most of the herding was in cropped areas.

   Goats were mainly preferred because of their ability to withstand drought and also because of their higher birth rates. Milk production was not a priority although many respondents milked them.

6) Respondents put a lot of importance to small ruminant production because it provided a major source of ready cash. Indeed, small ruminant production and off-farm income were considered as the major sources of cash for daily as well as development expenses.

Household income calculated from the survey data showed that the contribution of income from small ruminant production to household income was surpassed by off-farm income and income from cattle production. Nevertheless, the results indicated that, in a drought year like the year under review, close to one third of the net farm income accrues from income from small ruminant production. Therefore, considering that in this area, there was a probability of getting a maize crop failure in four out of every ten years, the contribution of income from small ruminant production was noteworthy.

The major conclusions of this study are that firstly, small ruminant production cannot replace maize or cattle production but it is a necessary supplementary source of net farm income for small scale farmers in the ASAL. The enterprise is especially important in the initial years of farm establishment. Secondly, small scale farmers prefer sheep to goats. Therefore, more small scale farmers would be more receptive to sheep rather than goat improvement programmes. Finally, the recommended stocking rate for the study area has been surpassed, therefore, action needs to be taken to reduce the stocking rate, or alternatively increase the carrying capacity without reducing the small scale farmers' income.

RECOMMENDATIONS

In light of the conclusions that have been drawn from the study, the following recommendations have been made.

1) For the purposes of initiating livestock development projects, agro ecological classification is not an appropriate indicator of the livestock potential of an area because it is based on the crop rather than the livestock potential.

2) Extension advisory services, on small ruminant production in the study area, should be improved. Livestock advisory personnel should increase the frequency of their visits and include small ruminant production messages in their extention messages to small scale farmers.

3) Destocking as a method obtaining the optimum carrying capacity is very unpopular among livestock raisers. Therefore, the alternative to destocking is to improve the carrying capacity of the land. This should be done by proper utilization and preservation of the available fodder crops and planting fodder trees.

4) To increase income from small ruminant production, small scale farmers have to increase the number and value of the off-take. This should be done by improving the productivity of small ruminants especially sheep. There should also be a concerted effort by the extension service personnel of Ministry of Livestock Development to advice small scale farmers on small ruminant management, for instance, helminths control. As the main causes of small ruminant mortality are Pneumonia and CCPP, the extension service should address itself to this problem through prophylactic and treatment measures.

5) Sheep more than goat production should be promoted as sheep are more preferred than goats. Previous studies indicate that Dorper-indigenous crosses are superior to the indigenous sheep, therefore, they should be introduced to improve the small ruminant off-take. However, since many small ruminant production enterprises are managed by women (wives), such a program should be aimed more towards women than men. An example of a small ruminant programme for small scale

farmers that is working is the dual purpose goat programme by SR-CRSP in Western Kenya.

6) If small ruminant programmes are to be beneficial to the small scale farmers in the ASAL, a study to determine the actual profitability of small ruminant (sheep) enterprise is necessary. Using the actual small ruminant production data[1], it will be possible to identify the source of the discrepancy found in the current study. That is, the discrepancy of the major contributors to household income and net farm income as perceived by the small scale farmers and as it was calculated using survey data.

This study, has established the fact that small ruminant production, by small scale farmers in the ASAL, contributes significantly to household income. However, it will be necessary to carry out detailed research in areas like the lambing/kidding rates, fertility rates. Other researchable areas are on the small ruminant production costs based on actual data including research on the separate contributions of sheep and goat production enterprises to household income.

[1] As opposed to data based on the respondents power to recall, which, some of the times, may be incorrect or biased. This problem not withstanding, and due to unavailability of actual data, these types of data are still used but interpreted with caution.

BIBLIOGRAPHY

Andagachew, K. 1990: Sheep Marketing in the Central Highlands of Ethiopia. Unpublished MSC Thesis Alemaya University of Agriculture, Ethiopia.

Byerlee, D., Michael Collinson *et al.* 1980: Planning Technologies Appropriate to Farmeres-Concepts and Procedures. CIMMYT, Mexico.

De Souza, De Leuw P.N. 1984 : "Small Stock Use of Reserved Grazing Areas on Merueshi Group Ranch," in Proceedings of the 3rd SR-CRSP Workshop. (P 289-299).

Dahl, Gudrun and Anders Hjort 1976: Having Herds, Pastoral Gerd Growth and Household Economy. Department of Social Anthropology, University of Stockholm.

Field C.R., J. Crees, G. Njiru, T. Rutangwenda 1984: "Management Proposals for Sheep and Goats in Western Marsabit District," in Proceedings of the 3rd SR-CRSP Workshop. P 301-312.

Gilbert, N. 1981: Statistics (second editon) Saunders College Publishing, Philadelphia, USA.

Government of Kenya 1977: Integrated Rural Survey, Basic report. Centra Bureau of Statistics, Ministry of Planning, Nairobi.

Government of Kenya 1979: Arid and Semi Arid Lands Development in Kenya. Ministry of Planning, Nairobi. (p 12-15)

Government of Kenya 1986: Joint Evaluation Mission, Phase 1. Laikipia Rural Development Programme, Nanyuki & Swiss Development cooperation, Nairobi.

Government of Kenya 1987: "Subdivision of Group Ranches in Laikipia District," District Livestock Development Office, Nanyuki.

Government of Kenya 1989a: Kenya Development Plan 1989-93 Government Printer, Nairobi.

Government of Kenya 1989b: Laikipia District Annual Report. District Livestock Development Office, Nanyuki.

Government of Kenya 1990a: Muruku and Salama Butchers Slaughter Register. care of Locational Health Office Rumuruti Division (Laikipia District), Rumuruti.

Government of Kenya 1990b: Rumuruti Division Annual Reports. Rumuruti Divisional Veterinary Office (Laikipia District), Rumuruti.

Government of Kenya 1991: Economic Survey. Government Printer, Nairobi.

Herren, U.J. 1990: "Socioeconomic Stratification and Small Stock Production in Mukogodo Division, Kenya," in Research In Economic Anthropology. Vol. 12 (p 111-148).

Herren, U.J. 1991: Laikipia Research Programme, Personal Communacation.

Heyer, J., J.K. Maitha, W.M. Senga, 1976: Agricultural Development in Kenya: an Economic Assessment. Oxford University press, Nairobi.

IFAD/UNDP 1988: Arid and Semi Arid Issues Options, and Sectorial Programmes. UNDP, Nairobi.

Integrated Project in Arid Lands 1978: Preliminary Report on the Impact of Sheep and Goats on the Vegetation in the Arid Zones of Northern Kenya. UNEP-MAB (IPAL), Technical Report EE-2.

Jaetzold, R., H. Schmidt; 1982: Farm Management Handbook of Kenya Vol II/B. Ministry of Agriculture and German Agricultural team, Nairobi.

Kabatha, J.M. 1991: Veterinary Officer, Ministry of Livestock Development, Laikipia District Headquarters, Personal communication.

Kohler, T. 1987a: Wivumiririe: Portrait of a Small Scale Farming Community in Laikipia District and Suggestions of How it Could Be Developed, Laikipia Reports No 7, University of Bern Switzerland and Laikipia Research Programme, Nanyuki.

Kohler, T. 1987b: West Laikipia: Report on small scale farming and how it could be assisted in development. Laikipia Reports No 8, University of Bern Switzerland and Laikipia Research Programme, Nanyuki.

Kohler, T. 1987c: Land Use in Transition: Aspects and Problems of Small Scale Farming in New Environment, the Example of Laikipia District, Geographica Bernensia Vol A 5, Bern.

Kohler, T. 1991: "Farming in Two Different Ecozones of Western Slopes of Mount Kenya," in Proceedings of the International Workshop on Ecology and Socioeconomy of Mount Kenya Area. by Ojany F.F., W. Lusigi *et al.* (eds). Universities of Berne, Bonn and Nairobi.

Lagemann, Johaness: 1977: Traditional African Systems in Eastern Nigeria. Weltforum Verlag, Munchen.

Lindstrom, U.B. and K.E. Lindstrom 1972: Survey of Breeding on Small Scale Farms in Kenya. University of Nairobi, Kabete.

Little, Peter D. 1981: "Effects of increased crop production on livestock investment in Semi-Arid area: Some example of Baringo District." WP No. 386 IDS, Nairobi.

Mburu, J.W.S. 1988: Reflections of Livestock Production Strategy Under District Focus for Rural Development. Ministry of Livestock Development, Nairobi.

Muragoli, I., S. Keter 1989: Small stock evaluation report (draft unpublished report), Laikipia Rural Development Programme, Nanyuki.

Muriithi, C.N. 1979: Factors affecting farm income in Marginal areas of the lower cotton zone in Eastern Kenya (Machakos, Kitui & Mbere Division - Embu) unpublished MSC thesis, University of Nairobi.

Mwihuri, Jackson 1991: District Range Management Officer, Laikipia, personal communacation.

Ngatengize, P.K. 1989: "Constraints Identification and Analysis In African Small Ruminant Systems," in African Small Ruminant .Research and Development. by R.T. Wilson, M. Azeb (eds) ILCA, Addis Ababa, Ethiopia.

Norman, D.W. 1978: "Farming System Research to Improve the Livelihood of Small Farmers" in American Journal of Agrcltural Economics. December 1978, (p 813-818)

Nyaribo, F. 1983: Analysis of household consumption in Western Kenya during the short and long rains with comparison of on- farm produced foods and off-farm food purchases. SR-CRSP Maseno, Kenya.

O'Leary, Michael F. 1985: The Economics of Pastoralism in Northern Kenya: The Rendille and Gabra. Report F-3 UNESCO-MAB FRG Integreted Project in Arid Lands.

Onim, J.F.K., P. Ochola *et al.* 1990: "Potential of Goat Manure as a Valuable Fertilizer for Small Scale Farmers," in Proceedings of the Eighth SR-CRSP Scientific Workshop. SR-CRSP, Nairobi (p 157-170).

Oram, P.A. 1975: "Livestock Production and Integration with Crops in Developing Countries," in Proceedings of the 3rd World Conference on Animal Production. by R.L. Reid.

Pindyck, R. and Daniel Rubinfeld 1981: Econometric Models and Economic Forecasts. (second edition), McGraw-Hill Book Company, New York.

Pratt, D.J. and M.D. Gwynne (eds): Rangeland Management and Ecology in East Africa. Hodder & Stoughton, London.

Reynolds, L. 1985: "Small Ruminant Production: Present Situation and Possible Interventions of Improvement," in Zimbabwean Journal of Agricultural Economics p 159.

Sands, M.W., H.A. Fitzhugh, J. Kehovole, and P. Gachuki 1982: "Results of a Farm Survey with implications to the Potential for Dual Purpose Goat on Small Scale Farms in Kenya," in Proceedings of the firt Small Ruminant CRSP Kenya Workshop SC-CRSP. Nairobi (p 12-34).

Senyantso, E.K. 1986: "Performance of Sheep and Goats in Botswana, Comparative Studies II" in Proceedings of the Workshop on Improvement of Small Ruminants in Eastern and Southern Africa. by K.O. Adeniji, Jackson A. Kategile (eds) OAU and IDRC (P 61-66).

Shavulimo, R.C, Rirangirwa F. Mcquire T.S. Chema 1986: "A review of Helminths in Goats in High, Medium, and Low Rainfall Areas of Kenya in Proceedings of the fifth Small Ruminant CRSP Kenya Workshop. SR-CRSP. Nairobi (122-130).

Sidahamed, J.F.K. Onim, A.W. Mukhebi, R.S. Shavulimo, A.J. De Boer, and H.A. Fitzhugh 1985: "On farm trials with dual purpose goats on small farms in Western Kenya," in Research Methodology in Livestock On-farm trials. by Thomas L. Nordblom *et al.* (Eds). IDRC 242e Ottawa, Canada (P 101-132).

Skea, Ian W., n.d.: Goat Production in Kenya. Ministry of Livestock Development, Nairobi.

Stotz, D. 1983: Production Techniques and Economics of Small Holder Livestock Production System in Kenya. Ministry of Livestock Development, Animal Production Division, Nairobi.

Taiti, S.W. 1991: Programme Manager, Laikipia Research Programme, personal communication.

Thomas, N., T.W.N Mathius, and M. Sabrani 1985: "Small Ruminant in Java, Methodology and Initial Results," in Livestock in Asia: Issues an Policies, by Jeffrey C. Fine and Ralph G. Lattimore (eds), IDRC-202e Ottawa Canada (p 161-166).

Thorper, W., R. Nyambaka, F. Chabari, M. Olemaki, and E. Rugema 1990: "Small Ruminant in the Farming Systems of Coastal Kenya," in Proceedings of the Eighth SR-CRSP Scientific Workshop, CRSP Nairobi (p 178-183).

UNDP/FAO 1985: Sheep and Goats Development Project II, Project Findings and Recommendations, Rome.

Welsh, Delane E. 1978: "Farming Systems Research to Improve the Livelihood of Small Farmers: Discussion," in American Journal of Agricltural Economics, December 1978 (p 819-820).

Wilson, R.T. 1982: "Husbandry and Productivity of Sheep and Goats in the Sahel states of West Africa and in the arid north Africa," in Animal Production in the Tropics, by Mohamed K. Jousef (ed), Prager publishers, New York.

Wilson, R.T 1984: "Types of Productivity of Indigenous African Small Ruminants," in Proceedings of the Third SR-CRSP Workshop, SR-CRSP, Nairobi (p 279-289).

Wilson, R.T 1986: Livestock Production in Central Mali: Long term Studies on Cattle and Small Ruminants in the Agropastoral Systems, ILCA Report No.14, Addis Ababa, Ethiopia.

Winiger, M. (ed) 1983: The actual ecological and social economic situation in Nanyuki area (Laikipia District Kenya), Institute of Geography, University of Bern, Switzerland.

Winrock International 1982: Sheep and Goats in Developing Countries: Their present and potential Role, World Bank Washington D.C.

Wonnacott, R.J., T.H. Wonnacott 1984: Introductory Statistics for Business and Economics, (third edition), New York.

APPENDIX I

THE QUESTIONNAIRE
March 1991
Researcher: M. Mucuthi
Research assistants: J. Mworia
W. Wandere (Mrs)
M. Kamundi
J. Theuri (Miss)

1. RESPONDENT'S PERSONAL PARTICULARS (by interview and observation)

a) Farm No .....

b) Name ..... Age ..... Sex M/F

c) District of origin .....

d) Size (Hectares) of, Plot .... Cropland .... Homestead ...

e) Grass cover (observation) - tick only one.
0 = no pasture
1 = good grass cover (less than 10 Percent of bare soil cover)
2 = medium grass cover (10 - 30 percent of bare soil cover)
3 = bad grass cover (30 - 50 percent of bare soil cover
4 = very bad grass cover (> 50 percent of bare soil cover

f) Give year of enterprise establishment on the farm.

Small Ruminants	Cattle	Maize and Beans

2. LIVESTOCK

HERD COMPOSITION (NUMBER)						
Type						
	Male	Female	Castrates	Heifers	Young < 6 mths	T.L.U.
Zebu						
Dairy Crosses						
Indigenous Sheep						
Dorpers						
Dorper Crosses						
Indigenous Goats						
DPG						

DPG = Dual Purpose Goat

3. Reasons for not having small ruminants. Ask "Any other reason? and show priority.
   0 - not applicable
   1 - no herding labour
   2 - no money
   3 - discontinued due to disease
   4 - costs are more than returns
   5 - I am a new immigrant
   6 - other

4. Reasons for having small ruminants. Ask "Any other reason?" (show priority).
   0 - not applicable
   1 - It's the major source of income from sales.
   2 - As an investment (for accumulation of capital).
   3 - For home consumption.
   4 - Easy to dispose in an emergency
   5 - for milk
   6 - Other (specify).

5. Do you have preference for either sheep of goats?
   0 - not applicable
   1 - Yes
   2 - No

6. If you prefer goats why?
   0 - not applicable
   1 - survival rate in drought is higher
   2 - they have better meat than sheep
   3 - more resistant to diseases than sheep
   4 - they have a higher birth-rate
   5 - Other (specify)

7. If you prefer sheep why?
   0 - not applicable
   1 - sheep are more docile to herd
   2 - they fetch better prices
   3 - they are more resistant to diseases the goats
   4 - goats destroy trees
   5 - other

8. When were daily goats introduced? (if any)
   0 - not applicable
   1 - Year

9. If bought, reasons for buying. Ask "Any other reason?" (show priority).
   0 - not applicable
   1 - Provides a cheaper source of milk
   2 - enables me to sell all my cows milk
   3 - feeds the calves and sells all the cows milk
   4 - cows don't survive here
   5 - other (specify)

10. If gift reason for still keeping them. Ask "Any other reason?" (show priority).
   0 - not applicable
   1 - Provides a cheaper source of milk
   2 - enables me to sell all my cows milk
   3 - feeds the calves and sells all the cows milk
   4 - cows don't survive here
   5 - other (specify)

11. When were Dorpers or Dorper crosses (specify which) introduced? (year)
   0 - not applicable
   1 - Year

12. How introduced.
   0 - not applicable
   1 - Gift
   2 - Bought
   3 - ewe mated by neighbor's ram
   4 - Other (specify)

13. If bought, reasons for buying. Ask "Any other reason?" (show priority).
   0 - not applicable
   1 - Faster growth from offspring
   2 - bigger offspring
   3 - twinning rate hire
   4 - other (specify)

14. Do you practice controlled breeding?
   1 - Yes
   2 - no

15. If yes, how?
   0 - not applicable
   1 - kidding/lambing in wet season
   2 - kidding/lambing in dry season

16. Why do you have no controlled breeding? Ask "Any other reason?" (show priority).
   0 - not applicable
   1 - the herd grows faster
   2 - I cannot afford to keep two herds
   3 - cannot know when they are on heat
   4 - other.

17 Why do you have controlled breeding? Ask "Any other reason?" (show priority).
   0 - not applicable
   1 - to reduce mortality of lambs/kids
   2 - other

18. What herding labour do you use?
   1 - Animals penned (go to Q. 2.3.6)
   2 - Hired labour
   3 - Own children
   4 - Relative

5 - Self - husband
- wife
6 - Other (specify)

19. Are small ruminants herded together with cattle?
1 - yes 2 - no

20. Do you milk sheep? 1 = Yes, 2 = No

21. Do you milk goat? 1 = Yes, 2 = No

22. What type of grazing do you have?
0 - not applicable
1 - Own plot
2 - Communal grazing/ neighboring plots
3 - Hired grazing
4 - road reserve
5 - Other (specify)

23. Do you supplement small ruminants grazing?
1 - Yes
2 - No

24. If yes with what? ask "Any other type?" (show priority of importance)
0 - not applicable
1 - with maize stover and crop residue after harvesting
2 - Supplement with nappier
3 - other

25. Dipping
1 - Never
2 - Weekly
3 - Irregularly.

26. If never, why? Ask "Any other reason?" (show priority).
1 - no dip
2 - " " and no money to spray
3 - dip available but no acaricide
1 - no money
2 - not supplied to the dip (government maintained.)
3 - not supplied to the dip (community maintained.)
4 - other (specify)
4 - spray at home

27. How many animals died during the year 1990?

28. Cause of death and Number in the last 3 years (show priority).
0 - no deaths
1 - Worms
2 - Malnutrition
3 - Pneumonia (CCPP)
4 - Diarrhoea
5 - Other (specify).
999 - Unknown

29. How many animals died during the year 1990?

30. Causes of death of lambs/kids and number in the last (show priority).
1 - Pneumonia (CCPP)
2 - Diarrhoea
3 - internal parasites
4 - Other (specify)
999 - unknown

31. Number of stock disposed other than sale in 1990.
0 - none
1 - Gifts/ Home consumption
2 - Other (specify)

32. Selling of stock (starting with most common)
0 - no sale
1 - Take to the market
2 - Traders come to buy
3 - Other (specify)

33. What are the major constraints to production of small ruminants? Ask "Any other constraint?" (show priority)
1 - not enough grazing all the time
2 - herders are difficult to find
3 - Disease
4 - stock theft
5 - I am unable to market my stock
6 - Lack of know-how
7 - wildlife
8 - no major constraint
9 - problem of water
10 - lack of capital
11 - shortage of grazing in the dry season
12 - Other (specify)

34. What cash crops do you grow here?
0 - not applicable
1 - maize and beans
2 - potatoes
3 - bananas
4 - fruits
5 - wheat
6 - other (Specify)

35. When did you last have a total crop failure? (Year) Ask " and the year before that one?

36. Do you have a source of income outside the farm?
1 - yes
2 - no

37. If yes, what type?

Wife

1.1 Contract (farming) daily wages .....
1.2 Approximate days worked per month .....
1.3 Contract (non farming) daily wages .....
1.4 Approximate days worked per month .....
1.5 Part-time employment .....
1.6 Type of work .....
1.7 Approximate months worked per year .....

38. Husband

1.1 Contract (farming) daily wages .....
1.2 Approximate days worked per month .....
1.3 Contract (non farming) daily wages .....
1.4 Approximate days worked per month .....
1.5 Part-time employment .....
1.6 Type of work .....
1.7 Approximate months worked per year .....

39. I you had KS 5000.00 to invest, where would you invest first?

1 - small ruminants
2 - cattle
3 - maize and beans production
4 - off farm investment
5 - other

40. What is the major source of development income? (eg. for building residential house, for school fees, fencing, buying livestock, buying land etc). Ask "Any other source?" (show priority)

1 - Immediate sale of milk
2 - " sale of cattle
3 - " sale of small ruminants
4 - " sale of maize
5 - Savings
6 - Off-farm income
7 - Other (specify)

41. What is the major source of income for daily expenses (eg. for wages, farm inputs, food, uniforms and clothes, minor medical bills, transport, etc). Ask "Any other source?" (show priority)

1 - Immediate sale of milk
2 - " sale of cattle
3 - " sale of small ruminants
4 - " sale of maize
5 - Savings
6 - Off-farm income
7 - poultry
8 - Other (specify)

42. How often do the following extension staff visit you?

1 AGRICULTURAL; 2 LIVESTOCK; 3 VETERINARY; 4 HOME ECONOMICS:

1 - weekly
2 - Fortnight
3 - Monthly
4 - Whenever need arises
5 - Infrequent
6 - Never

43. Opinion on frequency of visit

1 - Need more visits
2 - Current visits are enough
3 - Other (specify)

DATA SHEET

1990 LIVESTOCK REVENUE (in KS)

Species .....(cattle or small Ruminants) Farm No. ..... Name .....

Today's Production (3 cows)	1st cow.....(lt)	2nd cow .....(lt	3rd cow ...(lt)	Total....(lt)
1st Month's Production (3 cows)	1st cow.....(lt)	2nd cow .....(lt	3rd cow ...(lt)	Total....(lt)
5th Month's Production (3 cows)	1st cow.....(lt)	2nd cow .....(lt	3rd cow ...(lt)	Total....(lt)
Average Production	(3 cows).....(lt)	Cost o milk (KS)	Per lit	or Per bottle
Milk to Calves	Suckle...Yes/No		Bucket fed.....(lt)	

LIVESTOCK COSTS (in KS)

Dewormers (tick one)	Valbazen		Nilzern	Wormcide		Other (.....)	
Frequecy/ year (tick one)	Once		Twice	Thrice..		Other (.....)	
Amount/ head (cc/ml)	Mature stock			Young stock			
Minerals	Amount (Kg)			Price/Unit			
Dipping costs	Price per head KS						
Veterinary Costs (tick one)	<100	101-200	201-300	301-500	501-1000	1001-2000	> 2000
Fertilizer (for fodder)	Amount Kg			Price/Unit KS			
Manure (man-days used in application)	Man-days			Cost per man-day			
Concentrates/ year	Total (Kg)			Total cost (KS)			
Cost of A.I / Bull Service	1st cow KS		2nd cow KS.....			3rd cow KS.....	
Other costs (specify)	.....		.....			.....	

MAIZE REVENUE (1990)

Area Planted (Hectares).....	1st season (Bags)	2nd season (Bags)....
Expected Price KS ...../90kg	Total revenue KS.....	

MAIZE COSTS

Cost of hiring land.....	Hectare hired.....	Per Hectare KS.....	
Plowing	1st KS	2nd KS	Total KS...
Seed	Kgs/acre	price/kg	Total KS ..
Fertilizer		Total cost	
Cost of planting		KS	
Cost of weeding	1st KS	2nd KS	Total KS ..
Chemicals		KS	
Transport		KS	
Other (specify)			