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COPING WITH DROUGHT IN KENYA MAASAILAND: PASTORALISTS AND
FARMERS OF THE LOITOKITOK AREA, KAJIADO DISTRICT

by

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ABSTRACT

This paper examines the effects of the 1972-76 period of drought upon the people of the Loitokitok area of Kajiado District. The relationship between changing land use patterns, social systems, resource availability and the ability of people to cope with drought is discussed for Maasai pastoralists, Maasai agro-pastoralists and non-Maasai farmers. The paper concludes that if contemporary trends in land use are permitted to continue unchecked then the vulnerability of both farmers and pastoralists to future drought will increase.

I. INTRODUCTION

The relationship between drought and famine is not a direct one. In areas subject to recurrent drought the inhabitants have developed strategies for coping with its effects. These strategies mediate between drought and famine, and only when they are unable to cope with the effects of drought does famine occur (Lofchie 1975).

In the past decade many people living in arid and semi-arid areas of east and west Africa have been confronted with the threat of famine following the relative failure of the seasonal rains in successive years. The period known as the "Sahelian drought" was one of extreme hardship for the people of the Sahelian states and many believed that the intensity of the climatic phenomenon - drought - was sufficient to explain the famine. Research has demonstrated however, that the drought in the Sahel, though severe, was not an unusual occurrence in that area (Hare et al 1977) and a breakdown in the strategies designed to cope with a drought may explain the inability of the population to respond to it. (Berry et al 1977, Campbell 1977, Copans 1975)

This paper will examine the impact of a recent drought (1972-76) in Kenya Masailand and will concentrate upon the Loitokitok Division of Kajiado District. This is an area in which three major land uses predominate - wildlife conservation in national parks, pastoralism and farming and the relationship between changing land use patterns, resource availability and the ability of people to cope with the drought will be discussed. The data presented was gathered during a survey conducted in the area at the end of the drought, prior to the heavy rains of March-April 1977. A total of 391 people were interviewed of whom 166 (42%) stated they were Maasai pastoralists, 90 (23%) Maasai farmers, 79 (20%) Kikuyu farmers and 56 (14%) other farmers (Campbell and Mbugua, 1978).

A review of the process of changing land use prior to the onset of the drought will provide the context within which the impact of the drought upon each of these groups and their response to it will be examined. The vulnerability of each group to drought will be assessed and their capacity to adjust to future drought conditions will be discussed.

A word of caution is appropriate as to the use of estimates in this paper. All estimates should be interpreted as an indication of orders of magnitude rather than as more precise figures.

II. REVIEW OF CHANGING LAND USE PATTERNS IN THE LOITOKITOK AREA PRIOR TO 1972.

The area of what is now known as Loitokitok Division of Kajiado District was included in the land allocated to the Maasai Reserve under the agreements between the British Colonial Government and Maasai elders in 1911 which were amended in 1912 to include the area between Loitokitok Town and Rombo which had formerly been part of Coast Province (Great Britain, 1934, p. 190).

There was much official discussion over the appropriateness of Maasai land use practises in the years between World War I and World War II because they appeared to be failing to realise the agricultural potential of their land. The Kenya Land Commission noted that Kikuyu farmers were already occupying land in the Dagoretti area and that cultivation was expanding as

"Many Masai marry Kikuyu wives who frequently bring members of their family along with them, and the Masai husband, as a relation-in-law, seldom or never objects. In this way agricultural settlement begins." (Great Britain, 1934, p. 192).

In the Loitokitok area the in-migration of non-Maasai farmers occurred later than that around Dagoretti and Ngong. In the period between the end of World War II and the Emergency the area under cultivation increased as some local Maasai and also government officers - mostly Kikuyu and some Luo - cleared shambas and invited relatives to join them, and also as other people moved to the area from the overcrowded locations in Central and Western Kenya.¹ With the declaration of the Emergency the majority of the farmers were repatriated to their home regions and the area under cultivation declined.²

The area under crops did not expand rapidly again until after Independence when people were able to move freely and land adjudication enabled individuals to own title to land and to cultivate under conditions of relatively secure tenure. The process of land adjudication has resulted in some areas being demarcated as individual holdings, and others as group ranches. The individual holdings are located mainly on

1. I am grateful to Mr. Mark Kisopia for information regarding the origins of cultivation in the Loitokitok area.

2. Some Kikuyu farmers went through a ceremony of initiation into Maasai society and were thus eligible to remain in the area and to continue cultivation.

the slopes of Mt. Kilimanjaro below the Tanzanian -Kenyan border while the group ranches are found in the plains.

The belt of individual holdings was designed to act as a barrier to movement between Tanzania and Kenya. The original land owners were Maasai chiefs, government officers and others who realised the value of obtaining individual title to land and many acquired large tracts. Initially the local Maasai cultivated small portions of their land but once its monetary value became evident they rapidly subdivided it and rented or sold portions to immigrant non-Maasai farmers. The area has become almost completely cultivated over less than a decade.

Today these lower slopes of Mt. Kilimanjaro are almost entirely cultivated and farmers are beginning to buy or rent land in better-watered localities in the plains e.g. at Kimana and Rombo. As population pressure increases so this process of cultivation of more isolated areas with favourable soil and water conditions is likely to accelerate.

A second change in the pattern of land use in the Loitokitok area since 1945 has resulted from the creation of national parks. The parks enclose grazing and water resources which are available year-round and the exclusion of Maasai from the parks has reduced the dry season grazing resources available to them and increased the pressure on remaining resources. Many Maasai state however that should drought conditions return they will, if necessary, move their animals into the Chyulu Hills, Amboseli National Park³ and Tsavo National Park despite the prohibition against it.

Analysis of the impact of the 1972-76 drought upon farmers and pastoralists in the Loitokitok area must take account of the changing land use pattern in the area and of the favourable climatic conditions prior to the drought. The farmers who had recently arrived in the area had developed their cropping patterns under conditions of adequate rainfall and had planted crops not well-adapted to conditions of low rainfall. The onset of the drought resulted, therefore, in drastically reduced harvests and a threat of famine.

3. It should be noted that though Amboseli National Park was gazetted in 1974 the Maasai were permitted to continue grazing within the park until June 1977. They are now excluded from it.

The pastoralists had been able to maintain their herding system, despite the loss of grazing and water resources to the national parks and the incremental losses to cultivation, because adequate rainfall had resulted in good range conditions. Though the Maasai clearly recognise that cultivation and national parks have resulted in reduced access to grazing resources (Table 1) the full impact was not realised until the drought occurred and animals became concentrated around the remaining water and grazing resources.

Table 1

Reasons for a decline in the access to dry season grazing areas since 1970 - Maasai Pastoralists

(by number and percent of respondents giving each response. N = 110)

CAUSE OF DECLINE	No.	%
Land used for cultivation	76	69
Land is part of national park	56	51
Land is part of holding ground	50	45
Land is part of individual or group ranch	13	12
Other responses	0	0

III THE DROUGHT YEARS 1972-1976

Although the available climatic data suggests that the period 1972-1976 did not represent a particularly severe drought the people of the area regard its effects as having been harsh. Ninety-one percent of the pastoralist respondents stated that the drought was the worst they remembered, and though this may be partially explained by the fact that it was the most recent, it does indicate that its impact was great. For the majority of the non-Maasai farmers interviewed (96%) it was the first drought they had experienced since they had begun farming in the area and the low rainfall drastically reduced their harvests.

The impact of the drought affected people in different ways. For the Maasai, both pastoralists and farmers, the greatest problems concerned their animals while for the non-Maasai farmers water supply and shortage of food and land constituted the greatest difficulties (Table 2).

4.

See Appendix 1 for rainfall data.

Table 2

Principal problems faced by respondents from Loitokitok 1976

(by number and percent of each group giving each response)

PROBLEM	MAASAI PASTORALISTS (N=164)		MAASAI FARMERS (N=90)		KIKUYU FARMERS (N=79)		KAMBA FARMERS (N=33)		OTHER FARMERS (N=23)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Drought/Water Supply	89	54	52	58	58	73	10	30	10	44
Loss/lack/disease of animals	50	30	67	74	2	3	2	6	4	17
Lack of food	25	15	22	24	20	25	9	27	9	39
Land shortage	0	0	34	38	50	63	19	58	15	65
Health	8	5	8	9	6	8	4	12	5	22
Clothing	0	0	1	1	6	8	3	9	3	13
Soil Erosion	0	0	30	33	15	19	5	15	5	22
Lack of Pasture	38	23	0	0	0	0	0	0	0	0
Other	1	1	5	6	1	1	2	6	0	0

While the responses to the survey revealed specific problems it became clear during discussion of the survey results at field seminars (Campbell and Mbugua 1978) that the drought was a period of general social malaise and unrest in the area. It has been noted in other areas also that drought causes social breakdown indicated by depression, irritability, an increase in theft, assault and disagreement between people (Vogel-Roboff 1977).

The respondents' perceptions of the cause of the difficulties which they faced demonstrate that while lack of rain and loss of animals are the major causes, a large proportion of respondents attached some blame for their problems on less tangible forces e.g. God, the laibon or nature (Table 3)

While many respondents speak of the drought as commencing in 1972, the full impact in terms of major livestock losses and reduced harvests was felt in 1976. Discussion of the pre-drought events, therefore, refers usually to the period prior to these major losses.

Table 3

The main cause of problems faced in 1976
(by percent of each group giving each response).

CAUSE	MAASAI PASTORALIST (N=164)	MAASAI FARMERS (N=89)	KIKUYU FARMERS (N=77)	KABBA FARMERS (N=33)	OTHER FARMERS (N=23)
Lack of rain	98	100	95	97	100
Loss of animals	43	0	0	0	0
God/Laibon	26	29	23	30	44
Nature	0	25	16	24	57
Other	2	0	0	3	0

III. A. i. The impact of drought on Maasai Pastoralists

An explanation of the impact of the recent drought upon the pastoral population must be set in the context of the reduction in the availability of dry-season grazing and water resources which had taken place in the years prior to the drought. In section II the changes in the patterns of land use were discussed briefly and it was suggested that cultivation and national parks were the principal factors in reducing the pastoralists' access to these resources.

Table 4 demonstrates the importance of swamps and rivers as dry season sources of water and as these are the type of area favoured by farmers and

Table 4

Seasonal water sources for Maasai Pastoralists

(by percent of respondents giving each response. N = 166)

SOURCE	WET SEASON	DRY SEASON
River/Stream	87	84
Swamp	7	28
Still Pool	11	5
Small dam	9	2
Well/borehole	8	7
Spring	2	4
Other	1	3

enclosed by national parks, the impact of these other land uses on the pastoralists' drought-period resources is evident. During the recent drought a number of smaller swamps became dry and livestock concentrated upon the large ones at Kimana and Amboseli and also in the area around Rombo where rivers continued to flow. The recent exclusion of Maasai from Amboseli Park and the ongoing process of bringing land under cultivation around Kimana Swamp and at Rombo will create even more severe problems for Maasai pastoralists in the event of a return of drought conditions.

The principal effect of the drought upon the Maasai herders was the loss of livestock which resulted in a decline in the food supply of the population. The numbers of animals were reduced both by death (due to disease and starvation) and by sales of animals in order to raise cash (Table 5 and 6).

Table 5

Animal deaths during the drought by ranch-type-Maasai Pastoralists
(by percent of respondents)

ANIMAL	RANCH TYPE	PROPORTION OF HERD DIED					PERCENT WITH DEATHS
		0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	All	
Cattle	Individual	11	75	14	0	0	89
	Group	2	72	20	7	0	98
Sheep	Individual	21	68	11	0	0	79
	Group	23	67	10	0	0	77
Goats	Individual	21	68	11	0	0	79
	Group	24	65	10	1	0	76

Table 6

Animal sales during the drought by ranch-type-Maasai Pastoralists
(by percent of respondents)

ANIMAL	RANCH TYPE	PROPORTION OF HERD SOLD					PERCENT WITH SALES
		0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	All	
Cattle	Individual	7	71	21	0	0	93
	Group	2	83	14	1	0	98
Sheep	Individual	18	61	11	7	0	82
	Group	42	57	12	1	0	58
Goats	Individual	14	68	11	0	0	86
	Group	14	65	10	1	0	86

Both sales and deaths for most herders account for less than one-quarter of their pre-drought herd but the combined losses represent a substantial reduction in herd size. A sub-sample of 58 respondents provided actual numbers of livestock sold and died from which estimates of average losses per herder can be obtained (Table 7). The losses due to sales should not, of course,

Table 7

Sales and deaths of livestock reported by respondents giving actual numbers
(N= 58)

	CATTLE		SHEEP		GOATS	
	Deaths	Sales	Deaths	Sales	Deaths	Sales
Mean	17.64	8.86	7.73	4.46	7.14	7.92
Standard deviation	8.31	9.86	3.22	3.34	3.63	3.18
Maximum	50	60	50	12	30	30
Minimum	2	0	1	0	0	0

be read as total losses but rather as liquidated assets and Appendix 2 shows average income from the sale of livestock for pastoral Maasai was 2976/= in 1976, sufficient to buy substantial amounts of grain.

On the basis of the sub-sample an estimate of the total livestock losses in Loitokitok Division and of their value can be made (Appendix 3). Table 8 demonstrates the extent of the losses and shows that on average Maasai herders lost livestock valued at over 4,000/= due to death while their sales averaged 2,400/=. Of a total estimated decline in the value of the herds of Kshs 17,402,820, deaths accounted for 64% and sales for 36%.

Table 8

Livestock losses - Loitokitok Division - Estimate

ANIMAL	ESTIMATED LOSSES	ESTIMATED VALUE (KSHS)		AVERAGE VALUE (KSHS)	
		SALES	DEATHS	SALES	DEATHS
Cattle	66,825	4,468,400	8,896,600	1,719	3,422
Sheep	23,810	748,170	1,394,730	288	536
Goats	31,582	1,019,460	845,460	403	325
TOTAL	122,217	6,266,030	11,136,790	2,410	4,283

One measure of the severity of the problems is clearly the monetary loss due to death of animals. The losses may also be examined in terms of the ability of the residual herd to provide sufficient food to meet the family's subsistence needs. The traditional strategy of pastoralists is to build up the numbers of livestock in good years in anticipation of the losses which will occur during a drought. A herder will attempt to enter a period of drought with sufficient animals to enable him to provide for his subsistence needs despite animal deaths and sales or loans of animals to others. In order to assess the success of the pastoralists in accomplishing these objectives it is necessary to evaluate the potential subsistence production of the residual herd vis a vis the needs of the family.

Pratt and Gwynne (1977, p. 35 ff) present data concerning the herd size required to provide subsistence under good range conditions (2.5 Standard Stock Units/adult) and poorer conditions (3.5 SSU/adult). It is possible to calculate an adequate herd size to meet the average residual herd of the pastoralists surveyed in the Loitokitok area (Table 9).

Table 9

Estimated herd size and subsistence needs by ranch -type-Maasai Pastoralists, Loitokitok area - Post Drought.^a

	INDIVIDUAL RANCH		GROUP RANCH	
	2.5 ssu per adult	3.5 ssu per adult	2.5 ssu per adult	3.5 ssu per adult
Mean family size	16.2	16.2	13.4	13.4
Adult equivalent	12.8	12.8	10.5	10.5
Cattle required	87	122	71	99
Mean cattle herd	88	88	75	75
Percent of required	101	72	106	95
Sheep & Goats required	118	165	97	136
Mean No. sheep & goats	49	49	72	72
Percent of required	41.5	30	74	53

a. The average numbers of livestock owned used in this table are estimates for the total sample population. More precise data available for 58 respondents (Appendix 3 Table A.3.8) suggests that cattle numbers used and goats may be underestimated.

The above table demonstrates that at the time of the survey both the average individual rancher and the average member of the group ranch had insufficient livestock to produce his subsistence needs even under good conditions (2.5 ssu/adult). Had the drought continued the situation would have become much more serious. The greatest deficit was in the number of sheep and goats which are important source of food in a period of drought when the milk production of the cows decreases. Given the return of favourable conditions which occurred soon after the survey was completed the Maasai should have had enough animals to rebuild their herds and rapidly be able to fulfil their subsistence needs. This has indeed been the case but at the time of the survey the situation was very serious.

The above discussion is in terms of average herd sizes and does not take into account the wide divergences in both family size and herd size among the pastoral Maasai. The impact of the drought upon respondents of different wealth (defined by the number of cattle owned prior to the drought) can be measured by analysis of a sample of 63 respondents for whom actual numbers of cattle losses are available.⁵ In Table 10 each of these respondents is assigned to a decile of the population on the basis of number of cattle owned prior to the drought and the average herd size, percent of animals owned and provision of subsistence for each decile before the full impact of the drought in 1976 and at the time of the survey, is shown.

While losses in most decile groups amounted to between 20% and 30%, among the least wealthy twenty percent of the population the losses were greater - reaching over 50% for those with least cattle. Table 11 makes the same point more clearly. It shows that not only did the poorer members of the community suffer proportionately greater losses but they had to sell proportionately more of their sheep and goats than others, thus adding to the overall decline in their herd.

5. The subsequent discussion focuses mainly on CATTLE. As shown in Table 9 sheep and goat herds produced less than their share of average subsistence requirements at the time of the survey and thus they could not be expected to make up for deficits in cattle numbers. A discussion in terms of cattle while incomplete is clearly indicative of the circumstances faced by the Maasai.

PERCENT OF POPULATION IN DECILES POOREST ²	AVERAGE FAMILY SIZE IN ADULT EQUIVALENTS	PRE-DROUGHT				POST-DROUGHT			POST DROUGHT HERD AS A PERCENTAGE OF PRE-DROUGHT HERD
		AVERAGE NUMBER OF CATTLE	PERCENT OF TOTAL CATTLE	PERCENT OF SUBSISTENCE NEEDS PROVIDED ³	AVERAGE NUMBER OF CATTLE	PERCENT OF TOTAL CATTLE	PERCENT OF SUBSISTENCE NEEDS ² PROVIDED AT		
			% cum %	% cum %		% cum %	2.5 SSU/adult	3.5 SSU/adult	
1 - 10	8.91	27	3.0	3.0	13	2.0	21.5	15.4	48
11 - 20	9.10	19	5.4	8.4	31	4.7	50.3	35.9	63
21 - 30	8.63	59	6.4	14.8	44	6.7	75.3	53.8	75
31 - 40	7.81	72	7.9	22.7	54	8.3	102.1	72.9	75
41 - 50	6.67	81	8.8	31.5	56	8.6	124.0	88.6	69
51 - 60	6.98	86	9.4	40.9	60	9.3	127.0	90.7	70
61 - 70	8.00	96	10.1	51.3	66	10.2	121.9	87.1	69
71 - 80	9.69	109	11.8	63.1	82	12.6	125.0	89.3	75
81 - 90	11.64	121	13.2	76.3	94	14.4	119.3	85.2	78
91 - 100	11.88	217	23.7	100.0	150	23.2	166.5	133.2	69

Wealthiest

Notes:

1. This data is based on a sub-sample of 63 respondents for whom adequate data is available.
2. Respondents are assigned to deciles on the basis of number of cattle owned prior to the drought. Wealth is measured in terms of number of cattle owned.
3. Subsistence needs are calculated according to data provided by Pratt and Gwynne (1977 p. 35 ff) - 2.5 Standard Stock Units (SSU)/adult equivalent) represents good range conditions and 3.5 SSU/adult poorer conditions.

Table 11

Percent Livestock losses by size of herd prior to drought

SIZE OF HERD	CATTLE			SHEEP			GOATS		
	% died	% sold	% decline	% died	% sold	% decline	% died	% sold	% decline
Smallest 25%	37.6	14.9	51.5	29.0	10.0	39.0	25.0	31.0	56.0
25 - 50%	33.2	16.9	50.1	32.2	9.5	41.7	17.0	24.8	41.8
Largest 10%	27.0	15.3	42.3	20.5	3.9	24.4	20.7	19.0	39.7

Table 10 also permits an examination of the ability of different classes of herder to provide for their subsistence needs. Even prior to the major drought losses the poorest 20% had insufficient cattle to meet their requirements, though the majority had sufficient animals, with the wealthiest 10% having more than twice the number required for subsistence.

At the time of the survey, just prior to the end of the drought, the situation had altered. By that time the poorest 30% of the population had insufficient cattle for their subsistence even at the lower rate of 2.5 ssu/adult equivalent associated with more favourable range conditions. At the higher rate of 3.5 ssu/adult equivalent only those who originally had very large numbers of cattle were able to provide for their families. Table 12 shows that while 25.4% of families had insufficient cattle to meet their needs prior to the drought that proportion had risen to 49.2% or 63.5% by the time of the survey depending upon which range condition is specified.

Table 12

Percent of subsistence needs met by cattle herd prior to the drought and at the time of the survey (N=63)

PERCENT OF SUBSISTENCE	PRE-DROUGHT		POST DROUGHT			
		2.5 ssu/adult		2.5 ssu/adult	3.5 ssu/adult	
50 and less	3	4.8%	12	19.0%	17	27.0%
51 - 100	13	20.6%	19	30.2%	23	36.5%
101 - 150	19	30.2%	12	19.0%	15	23.8%
151 - 200	7	11.1%	11	17.5%	5	7.9%
Over 200	21	33.3%	9	14.3%	3	4.8%

A comparison between those who could meet their subsistence needs under the more difficult conditions (N=23) and those who could not (N=40) demonstrates that the former had larger herds prior to the drought and also a larger animal/adult equivalent ratio (Table 13).

Table 13

Pre-drought family and cattle herd sizes - subsisters and non-subsisters compared.

	SUBSISTERS (N = 23)	NON-SUBSISTERS (N = 40)
Mean no. of cattle	118.5	74.475
Mean family size (adult equivalent)	5.8	10.625
Cattle/adult ratio	20.53	7.00

The question of the relationship between numbers of cattle owned and size of family is clearly an interesting one. Table 14 shows that there is a slight tendency for herds to increase in size with size of family but that the animal/adult equivalent ratio decreases with increasing size of family. Thus though large families may have large herds, they may not be overstocked in relation to their subsistence requirements. It is more common to find herds which are overstocked in relation to subsistence among smaller families - of the 23 families which could supply their subsistence under poor conditions (Table 13) 70% had families in the smallest 30%, and 84% of the smallest thirty percent of families could meet their subsistence.

Only 13% of families had herds of a size sufficient to produce more than 1½ times the family's subsistence needs in the post drought period at a ratio of 3.5 esu/adult equivalent and their characteristics are shown in Table 15. The principal difference lies not in the herd size of these families but in the size of the families themselves and thus they are overstocked in relation to subsistence needs.

Table 10 also provides information regarding the distribution of wealth, measured by size of cattle herd, among Maasai pastoralists. While there is a tendency both prior to and after the drought for the wealthy to hold a disproportionate share of animals, the pastoralists

Table 14

Herd Characteristics and Subsistence Needs by Size of Family (in adult equivalents) - Maasai Pastoralists

Percent of population in deciles	Mean Family size (adult equivalent)	mean pre-drought cattle herd	Pre-drought cattle/adult ratio	Pre-drought percent of subsistence 2.5 ssu/adult	Mean post-drought cattle herd	Post-drought cattle/adult ratio	Post-drought percent of subsistence at 2.5 ssu/adult	Post-drought percent of subsistence at 3.5 ssu/adult	Cumulative percent of population	Pre-drought percent of cattle cumulative	Post-drought percent of cattle cumulative	Post-drought herd as percent of pre-drought
1-10	3.42	80.39	23.5	247.25	60.33	17.64	260.60	186.14	3.78	8.9	9.3	75
11-20	4.33	80.95	18.7	276.19	57.29	13.23	195.14	139.60	8.57	17.8	18.1	71
21-30	6.22	88.67	14.3	211.11	58.67	9.43	135.35	99.53	15.45	27.6	27.1	66
31-40	7.07	91.00	12.9	190.15	64.14	9.07	134.03	95.74	23.27	37.6	37.0	70
41-50	8.02	103.17	12.9	189.90	77.83	9.70	143.25	102.30	32.14	49.0	49.0	75
51-60	9.03	101.03	11.2	148.80	57.49	6.37	84.67	60.48	42.13	60.2	57.9	57
61-70	10.03	57.47	5.7	82.12	40.60	4.05	58.23	41.59	53.23	66.5	64.2	71
71-80	11.09	80.50	7.3	107.23	61.50	5.55	81.92	58.52	65.50	75.4	73.7	76
81-90	14.29	90.67	6.3	93.73	68.67	4.81	71.00	50.70	81.31	85.4	84.3	76
91-100	16.89	131.33	7.8	114.87	101.67	6.02	88.92	63.50	99.99	99.5	100.0	77

Table 15

Characteristics of herders able to produce more than 150% of subsistence needs under poor range conditions (N=8)

	PRE DROUGHT CATTLE NO.	POST DROUGHT CATTLE NO.	ADULT EQUIVALENT
Mean	155	110	4.9
Median	97.5	80	3.9
Maximum	380	300	8.75
Minimum	73	56	2.6
Sample Mean	90.53	64.50	8.9

have a more even distribution of wealth than both Maasai farmers (also measured in terms of cattle owned) and Kenya as a whole (measured in terms of income distribution) and shown on Figure 1.

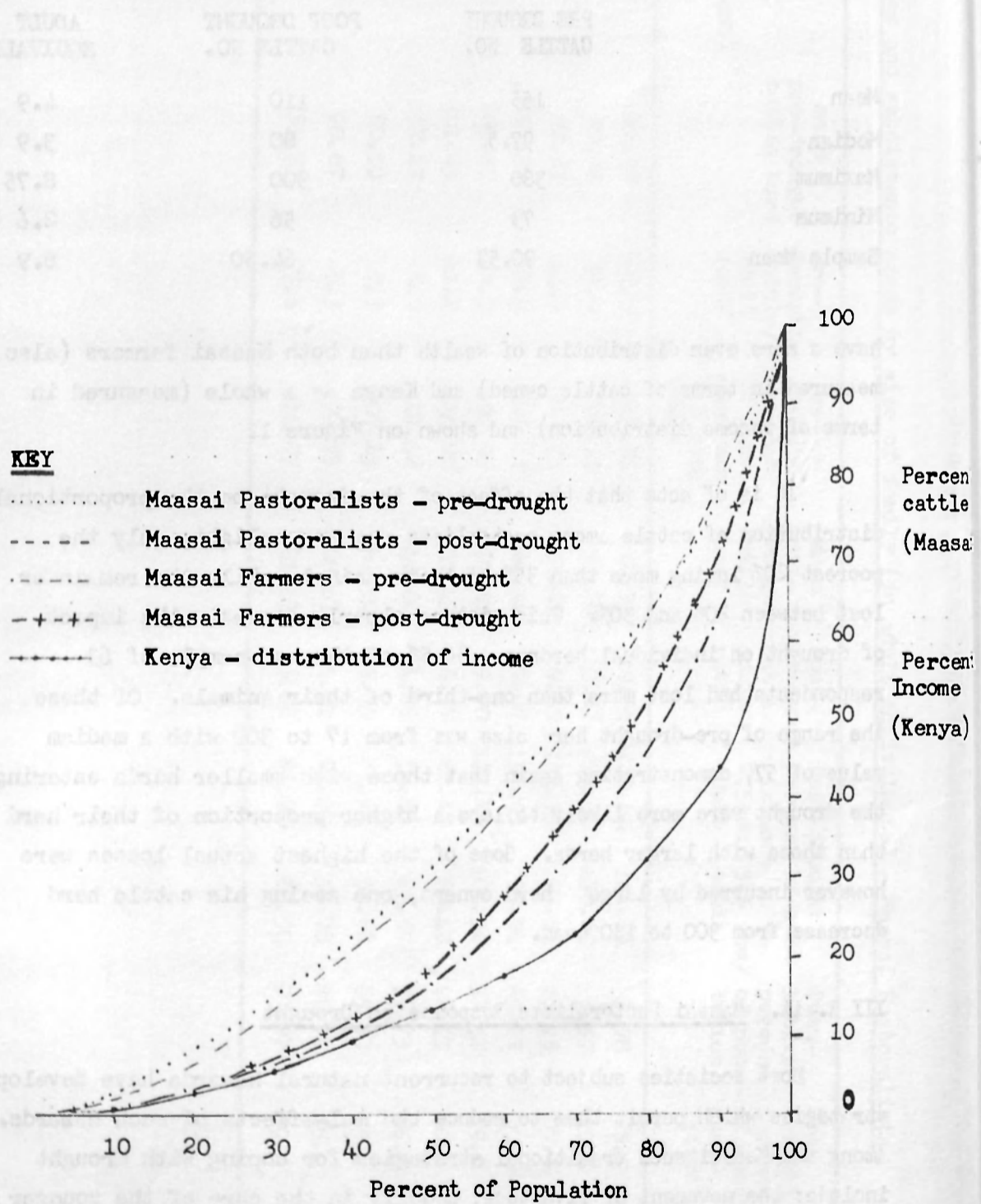
It is of note that the effect of the drought on the proportional distribution of cattle among pastoralists was very slight, only the poorest 20% losing more than 35% of their animals while the remainder lost between 20% and 30%. This picture clearly conceals the impact of drought on individual herders. 36.5% of the sub-sample of 63 respondents had lost more than one-third of their animals. Of these the range of pre-drought herd size was from 17 to 300 with a median value of 57, demonstrating again that those with smaller herds entering the drought were more likely to lose a higher proportion of their herd than those with larger herds. Some of the highest actual losses were however incurred by large herd owners, one seeing his cattle herd decrease from 300 to 130 head.

III 1. ii. Maasai Pastoralists Response to Drought

Most societies subject to recurrent natural hazards have developed strategies which permit them to reduce the mal-effects of such hazards. Among the Maasai such traditional strategies for coping with drought include: the movement of livestock, usually in the care of the younger men and morans, away from the boma in search of pasture and water; increased intra-family assistance in terms of livestock loans and the calling upon of reciprocal grazing arrangements; prayer; increased use of alternative food supplies such as grains and wildlife meat. These

FIGURE 1

Distribution of Cattle for Maasai Pastoralists and Farmers (Pre- and Post- Drought) Compared with the Pattern of Income Distribution for Kenya.



Source: - for income distribution in Kenya:

Kamau, P.N. 1977. "Income distribution in Kenya" unpublished M.A. Thesis, Department of Economics, University of Nairobi.

strategies are not mutually exclusive and thus offer a wide range of alternatives to those affected by drought. An additional source of assistance in more recent droughts has been famine relief provided by the government, missions and international agencies. Information provided by respondents as to their activities during the drought demonstrates that not only did the Maasai pastoralists resort to traditional coping strategies but also that they are continually reviewing the situation and assessing the viability of these coping mechanisms.

Movement of People and Herds. The intensity and frequency of movement of livestock and people is related to the severity of the effects of the drought. In early stages of drought it is unusual for whole families to move their location, it being more common at this stage for the young men to move away with the herds in search of resources. Only when the resources available become totally insufficient will whole families move. In the survey area some grazing and water resources remained available along the lower slopes of Mt. Kilimanjaro and thus there was relatively little need for people to move widely. Only 16.4% of respondents from Loitokitok stated that they had moved in 1976 and half of these had only moved their animals⁶. There was no major movement of Maasai pastoralists from the area towards Nairobi or other main towns.⁷

Reciprocal arrangements for sharing livestock. An important strategy designed to reduce the probability that all livestock will be lost during a drought is to split up the herd and move a proportion of the animals to a different area to be looked after by relatives and friends. This strategy is also a means by which those who have insufficient livestock may 'borrow' animals to help meet their subsistence needs. Table 16 shows that these reciprocal arrangements were common during the drought, being more frequent between relatives than between friends. It also indicates that the balance of such exchanges will be in favour of the

6. This pattern was not true of all areas of Kajiado District however, many herders from the Kaputiei section moved with their livestock to the lower slopes of Mt. Kilimanjaro while in the Ngong area pasture became so scarce that fully half of people interviewed in the area had moved with their herds in 1976.

7. While many Maasai have visited the main town of S.E. Kenya few from the Loitokitok area have relatives living in towns (7.2%) and few express an inclination to move. The majority of the Maasai who moved to Nairobi during the drought came from other areas of Maasailand.

Table 16.

Respondents sharing livestock with relatives and friends -

	Loitokitok Area		Ngong Area	
Sent livestock to relatives	75	45.7%	59	56.2%
Sent livestock to others	37	22.6%	8	7.5%
Cared for relatives' livestock	79	48.2%	39	36.8%
Cared for others' livestock	14	8.6%	10	9.4%

areas with better conditions. Thus the percent of respondents sending animals away from Ngong, where conditions were harsh, is greater than that for Loitokitok which was an area where more people received animals than sent them away.

An interesting aspect of the sharing of animals is that the process involves a higher percentage of individual ranch owners than members of group ranches in the Loitokitok area. In view of the general consensus among Maasai that individual ranchers tend to give up traditional behaviour patterns this degree of participation in reciprocal cattle sharing is surprising. It is possible that due to their location and more careful management individual ranches were in better condition than group ranch areas and that communal pressure was brought to bear to encourage individual ranchers to share their resources with relatives and friends.

Assistance from Relatives. The exchange or loan of animals is not the only form of assistance between family members during periods of hardship. As Table 17 indicates gifts or loans of animals food and money are not infrequent and many other forms of assistance take place.

Assistance from other sources. A number of respondents stated that they gave to, and received, help from other members of the community and many obtained famine relief from the government and the Roman Catholic Mission, mostly in the form of posho. (Table 18)

8. It is remarkable that while 67% of respondents from Loitokitok stated that they had received famine relief only 7.5% of respondents from the Ngong area received such assistance. In view of the greater intensity of the drought in the Ngong area it is surprising that little was done by the government to relieve the situation.

In the Loitokitok area the amount of assistance was less than that received at the time of the 1961 drought. At that time aid came from the USA (or from Kennedy according to the Maasai!) and its distribution was thought to be fair. During the recent drought there were complaints that the distribution of government assistance was not fair whereas that of the Roman Catholic Mission

Table 17

Intra-family assistance during the drought - Loitokitok

(by number and percent of respondents giving each response)

Assistance	Received		Gave	
	No.	Percent	No.	Percent
No. giving/receiving	103	62.8%	109	66.9%
Cattle/Cow	26	25.2	35	32.1
Sheep/Goat	27	26.2	37	33.9
Other Animal	3	2.9	5	4.6
Total Animal-Related	<u>56</u>	<u>54.3</u>	<u>77</u>	<u>70.6</u>
Money	10	9.7	23	21.1
Food	37	35.9	20	18.3
Other (Including: Seeds, Labour, clothing)	10	9.7	7	6.4

Table 18

Assistance from non-family sources during the drought.

SOURCE	NO. RECEIVED	PERCENT RECEIVED
Non-Relatives	27	16.5
Government/Mission	110	67.1

The Maasai relied heavily upon grains to supplement their diet during the drought, often mixing posho with blood. The principal item of famine relief was posho, and an average of 53% of expenditures made in 1976 was to buy food crops (Appendix 2). Many Maasai have taken up cultivation in recent years but with relatively little success and greater attention to livestock rather than cultivation is likely to be paid in future.

A second source of food available to the Maasai is wildlife. 29 percent of respondents from Loitokitok (19% from Ngong) stated that they view wildlife as a food source during bad years - a frequent comment being that it is better than nothing. The most favoured meat is that of eland and of antelopes. The farmers of the area do not eat wildlife meat.

Prayer. Over 90 percent of respondents had prayed for rain while payments to the laibon, in the form of sheep and goats or money, so that he might intercede to end the drought were common. 85 percent of respondents from Loitokitok had made such contributions.

III A iii Expectation of Future Drought and Precautions Against its Effects - Pastoral Maasai

Although the interviews were conducted at the end of a prolonged period of drought and many respondents remembered the drought of 1961 (and a few those of the 1940s and 1950s) surprisingly few stated categorically that they expected drought in the future (Table 19), though none said they would take no precautions against future droughts (Table 20).

Table 19

Respondents' Expectations of Future Droughts
(N=163)

	No.	Percent
Do not expect drought	15	9.1
Don't know	8	4.8
God knows	50	30.3
Expect drought	92	55.8

It is clear both from the responses to the survey and from discussions with pastoralists at follow-up seminars (Campbell & Mbugua 1978) that they are aware of a number of actions which they can take to reduce the impact of future droughts (Table 20). The most frequently stated precautions are associated with the building up of reserves through keeping more animals, growing and storing of crops and the saving of cash.

Table 20

Precautions against future droughts - Maasai Pastoralists
(by number and % of respondents stating each precaution, N = 158)

PRECAUTION	NUMBER	PERCENT
Increase herd size	103	65.2
Grow crops	90	57.0
Save cash	81	51.3
Store food	69	43.7
Decrease herd size	33	20.9
Decrease family size	22	13.9
Fence land	13	8.2
Other (e.g. work in town sell old animals)	9	5.7

Discussion at field seminars of the practicability of implementing these objectives has raised a number of difficulties. In some areas, increased cultivation is incompatible with the keeping of larger herds due to the scarcity of land for cultivation/dry season grazing. At Rombo Group Ranch the ranch committee has decided to institute a seasonal rotational grazing system to preserve dry-season grazing and is carefully monitoring cultivation in the area. The problems associated with food storage and saving of cash are not as easily resolved within the community. There is a need for the government to provide adequate grain storage facilities and a bank in the area so that savings may be effective.

The most commonly observed precautions shown in Table 20 conceal marked differences in the strategies preferred by people of different ages (Table 21).

In the Loitokitok area increasing herd size is the most favoured precaution overall. This is not surprising given the experience of the drought in which those with a high cattle/adult ratio were the most successful in coping with the drought see p.14. This strategy is not accepted by all Maasai however. Table 21 shows clearly that respondents under the age of 30 see the growing of crops and the saving of cash as important strategies and many would actually decrease the size of their herds. Cultivation as a strategy for coping with drought ranks highly among the responses of all age classes in the area and an increase in participation of Maasai herders in cultivation may, therefore, be anticipated in the future.

Table 21

Precautions against future drought by age of respondent
(by rank and percent of respondents in each age class giving each response)

Precaution	AGE													
	Under 20		20 -- 30		31 -- 40		41 -- 50		51 -- 60		61 -- 70		Over 70	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Increase herd size	27	5	37	3	59	1=	83	1	86	1	65	1	69	1
Decrease herd size	64	2=	37	3=	18	5	25	5	25	4=	22	5	23	3=
Grow crops	73	1	57	1	59	1=	75	2	61	2	48	3=	23	3=
Save Cash	73	1=	47	2		1=	50	3	46	3	52	2	15	5
Store food	64	2=	33	5	50	4	37	4	25	4=	48	3=	31	2

III.A.iv. Commentary

The above discussion suggests a number of observations.

- i. there has been a decrease in the availability of dry season grazing and water resources for the pastoral Maasai as a result of the creation of national parks, the expansion of the area under cultivation and of land adjudication. The range of resources available to the herders during the drought was therefore less than in previous droughts and although the most recent may not have been the most intense, its impact was still severe.
- ii. deaths and sales of livestock were widespread, with the number of deaths being almost double the number sold. The total value of livestock deaths in Loitokitok Division is estimated at Kshs 11 million.
- iii. the proportion of sales and deaths of livestock was higher among those with smaller herds. The distribution of animals by size of herd owned altered very slightly in favour of those with larger herds during the drought. There was no major redistribution in terms of animals owned, though loans between herders were common.

- iv. at the time of the survey (at the end of the drought) over 60% of Maasai pastoralists were unable to meet their subsistence needs from their herds. Those best able to do so had a larger livestock/adult equivalent ratio than those who had difficulty. A family of six adult equivalents owning one hundred and twenty cattle prior to the drought is representative of those which had least difficulty. For the survey population to have met this cattle/adult equivalent ratio of 20:1 prior to the drought double the existing cattle numbers would have been needed. It is not surprising therefore that the majority of herders state that as a precaution against future droughts they will increase their herd size.
- v. the majority problems faced by the Maasai were a direct consequence of their loss of animals. Many sold animals to raise cash to buy food but famine relief was a major input to their subsistence needs.
- vi. traditional coping mechanisms are still active, and new ones are being developed to meet the altered socio-economic situation. For example many Maasai practise cultivation and at Rombo Group Ranch the pastoralists are implementing a system of rotational grazing in which land is set aside for use in the dry season.
- vii. there is a propensity among younger Maasai to accept the notion that reduced livestock numbers, increased cash savings and agricultural activity will reduce the ill-effects of drought. Should these views be accepted by future generations then a reduced emphasis on herding and greater emphasis on agriculture may lead to the emergence of a widespread mixed agro-pastoral economy in Maasailand. While it may well be possible for the Maasai to reduce the size of herds they may not be able to find sufficient productive agricultural land to produce crops to make up the deficit in their subsistence. Measures will have to be taken to limit the expansion of non-Maasai cultivation if they are to have sufficient agricultural land to develop a viable mixed economy.
- viii. reduction of livestock numbers is clearly not practicable in Maasailand unless alternative sources of subsistence are available. Any policy designed to reduce grazing pressure on the rangelands must recognise the rationality and effectiveness of the traditional

Maasai herding system in providing subsistence for its population (the Maasai needed more not less cattle in the recent drought) and will have to provide an equally effective alternative source of subsistence if it is to succeed. It is urgent that such an alternative be developed as the continuing reduction in the dry season resources will not allow the expansion of cattle numbers to a level sufficient to meet the subsistence needs of a growing pastoral population without the probability of severe depletion of grazing resources. The evidence of the recent drought is that such an alternative is currently unavailable in the area, though the pastoralists are actively seeking ways of improving their situation.

ix. within the primarily subsistence livestock economy difficulties may be alleviated through a reduction in the rate of population growth thus reducing the need for increasing numbers of cattle but population growth among the Maasai has been estimated at about 2.2% per annum (Dr. Roy Shaffer, personal communication) and is not decreasing. This is not therefore a viable option. Alternatively the range of grazing resources might be increased by curtailing the area already under cultivation or by permitting the Maasai to graze in the national parks. Neither offers a long-term solution and both are clearly politically infeasible.

x. a remaining option is therefore to develop labour intensive industries in the area which will reduce the proportion of the population directly dependent upon livestock for their living. Animal-based industries would utilize the area's natural resource (livestock) and keep the value added in processing within Maasailand, thus hopefully, stimulating further development. The evidence from peoples' responses to drought is that they are ready to change selected aspects of their traditional way of life. If advantage can be taken of this readiness to change then development of Maasailand may be possible. If no action is taken soon however, the incentive to change may weaken (particularly in view of the excellent range conditions which prevail at present and the rapid increase in livestock numbers) and a great opportunity for encouraging the development of Maasailand may be missed.

Maasai Farmers.

The majority of the ninety Maasai respondents who declared themselves to be farmers practise a mixed economy - herding animals and growing mainly subsistence crops such as maize and beans. Cultivation is not new to the Maasai of the area, though it is usually organised by their wives of Kikuyu origin. The designation of Maasai as "farmer" is however a recent phenomenon, most of them growing primarily subsistence crops (Table 22.) and continuing to rely heavily upon livestock. Mixed farming by Maasai is therefore a developing activity in which, as yet, few depend entirely upon cultivation. This contrasts with the non-Maasai farmers of the area who keep very few animals (Table 23) and for whom crop production is the basis of their economy.

Table 22.

Crops grown by Maasai farmers - Loitokitok Area
(by number and percent of respondents. N=89)

Crop	No. Growing No.	Growing %	Food Crop		Cash Crop		Food and Cash	
			No.	%	No.	%	No.	%
Maize	87	98	42	47	0	0	45	51
Millet	16	18	6	7	1	1	9	10
Sorghum	2	2	0	0	0	0	2	2
Beans	84	94	39	44	1	1	44	49
Peas	12	14	10	11	0	0	2	2
Potato	40	45	36	40	0	0	4	5
Cassava	3	3	3	3	0	0	0	0
Banana	6	7	3	3	1	1	2	2
Coffee	7	8	1	1	4	5	2	2
Cotton	5	6	0	0	5	6	0	0
Onions	6	7	1	1	3	3	2	2
Other crops	4	5	1	1	2	2	2	2

23.

Table: / Livestock ownership by farmers - Loitokitok area.

	MAASAI FARMERS		NON-MAASAI FARMERS	
	No.	Percent	No.	Percent
Number of Respondents	90	100	134	100
No livestock owned	4	4	48	35.8
No cattle owned	13	14	126	94.0
No sheep owned	18	20	121	90.3
No goats owned	10	11	96	71.6
CATTLE				
No. owning cattle	77	85.6	8	6.0
Mean no. owned	48.44		15.5	
SHEEP				
No. owning sheep	72	80.0	11	8.2
Mean no. owned	20.17		6.91	
GOATS				
No. owning goats	80	88.9	38	28.4
Mean no. owned	29.60		5.66	

III B: The impact of drought upon Maasai farmers.

For most of the Maasai farmers the period 1972-76 was the first in which they had had to cultivate under drought conditions. The most frequently stated problems during that period concerned the loss of animals, drought/water supply, land shortage, soil erosion and lack of food (Table 23). Thus though they view themselves as farmers their most severe problems concerned their animals.

The livestock continue to provide the bulk of the Maasai farmers' subsistence needs, though their herds are in general smaller than those of the pastoralists. Prior to the drought the average herd was of sufficient size to meet the subsistence needs of the average family but the losses during the drought reduced the herds below the subsistence level (Table 24)

Table 24:

Average herd size and subsistence needs - Maasai farmers before after the drought.

	Before drought	Post - Drought	
	2.5 ssu/adult ^a	2.5 ssu/adult	3.5ssu/adult
Mean family size	9.5	9.5	9.5
Adult equivalent	7.4	7.4	7.4
Calories per day	17072	17072	17072
Cattle required	50	50	70
Mean Cattle herd	84	49	49
% of required	168	98	70
Sheep and Goats required	68	68	95
Mean sheep & Goat herd	68	43	43
% of required	100	63	45

^aCalculations based upon information given in Pratt and Gwynne 1977 p. 35 ff. 2.5 ssu/adult represents good grazing conditions and 3.5 ssu/adult poorer conditions.

A Comparison of farmers with different herd sizes (Table 25) demonstrates that only the largest 20% of herd contained sufficient animals to feed the people dependent upon them at the time of the survey, though prior to the drought 70% of the herds had been sufficient.

The losses incurred during the drought varied remarkably little according to herd size though the smallest and largest herds suffered the greatest percentage losses. Not all the decline in the herd should be interpreted as a loss, however, as livestock sold represents liquidated ^{assets} rather than losses (Table 25). In terms of the contribution of livestock to cash income, for the average family, it amounted to 31% compared with 17% for crops (Appendix 2).

TABLE 24. MAASAI FARMERS - Cattle losses and subsistence needs by size of cattle herd.

Percent of Population in deciles	Average Family Size in Adult Equivalents of cattle	P R E - D R O U G H T					P O S T - D R O U G H T					Post-Doug Herd as Percent of Pre-drought Herd
		Average No.	Percent Total Cattle % cum	Percent of Total Cattle %	Percent of subsistence Needs provided at 2.5 ssu/adult	Average lb. of Cattle	Percent Total Cattle % cum	Percent of subsistence needs provided at 2.5 ssu/adult	Percent of subsistence needs provided at 3.5 ssu/adult			
1-10	4.82	9.10	1.1	1.1	27.9	5.40	1.1	1.1	16.6	11.9	59	
11-20	7.13	19.13	2.3	3.4	39.6	11.38	2.4	3.5	23.6	16.8	59	
21-30	6.74	28.50	3.5	6.9	62.5	19.13	4.1	7.6	42.0	30.0	67	
31-40	5.21	35.63	4.4	11.3	100.9	21.75	4.6	12.2	61.6	44.0	61	
41-50	7.05	46.50	5.7	17.0	97.5	26.25	5.6	17.8	55.0	39.3	55	
51-60	9.52	59.88	7.4	24.4	93.0	42.63	9.0	26.8	66.2	47.3	71	
61-70	7.38	71.88	8.8	33.2	143.8	55.88	11.9	38.7	111.8	79.8	78	
71-80	8.64	94.50	11.6	44.8	161.5	58.25	12.4	51.1	99.6	71.1	62	
81-90	7.97	147.75	18.2	63.0	273.6	95.12	20.2	71.3	176.1	125.8	64	
91-100	9.27	299.88	36.9	99.9	477.5	135.75	28.8	100.1	216.2	154.4	45	
Wealthiest												

- Notes:
1. Respondents are assigned to deciles on the bases of number of cattle owned prior to the drought. Wealth is measured in terms of numbers of cattle owned.
 2. Subsistence needs are calculated according to data provided by Pratt and Gwynne (1977 p. 35 ff)
 - 2.5 Standard Stock Units (ssu)/adult equivalent represents good range conditions and
 - 3.5 ssu/adult equivalent poorer conditions.

Table 26.

Average drought sales and death of livestock - Maasai farmers

	CATTLE		SHEEP		GOATS	
Pre-drought herd size	83.69%	100%	26.70	100%	41.03	100%
Sales	10.71	11.6%	1.70	6.5%	5.42	13.2%
Deaths	25.26	29.5%	8.82	33.0%	8.20	200%
Post drought herd size	58.86	49.3%	16.13	60.42%	27.41	66.8%

Table 25 demonstrates also that the losses incurred in the drought altered the distribution of wealth (measured in numbers of cattle owned) slightly towards a more equal distribution (see Figure 1). It is probable therefore that, as with the Pastoral Maasai, the effect of drought conditions upon the distribution of wealth has been very slight, although in both groups the poorest and richest fared worst.

The second source of subsistence for Maasai farmer is crop production. While some crops are sold, most of the production is for home consumption. The Maasai have a very similar cropping pattern to that of non-Maasai farmers, though they pay less attention to growing sweet potatoes, a drought resistant crop.

Throughout the area crop production was estimated to be well below normal and using estimates presented in Appendix 4 it is possible to estimate the percentage of subsistence provided by the principal subsistence crops—maize and beans. Table 27 shows that both beans production and maize production was below the minimum required: Maize production reached only 64% of the Maasai needs, the deficit being more severe for farmers in the drier, lower areas.⁹

The combination of livestock and crop production appears, however, to have been able to cope better with drought conditions than economies based entirely on crops or on livestock. As will be shown later, while the Maasai farmers did call upon traditional strategies for reducing the effects of drought they received famine relief proportionally less than other people, demonstrating an ability to provide for most of their own subsistence needs.

9. Crop production produced only one-third of the subsistence needs of the Maasai farmer in the lower areas. In the absence of their herds which continued to provide a substantial proportion of the subsistence needs (Table 23) the Maasai farmers particularly those in the lower zones would have been in severe difficulty. In the event, the combination of livestock and crop production appears to have been more successful in overcoming drought-related shortages than either activity practised alone.

Table 27.

Subsistence production for Maasai farmers (percent).

	MAIZE	BEANS
Total area (ha)	262.6	241.0
Area - higher land (ha)	163.4	150.0
Area - lower land (ha)	99.3	91.3
Total % of subsistence grown	64.	5.4
% of subsistence - higher land	85.6	6
% of subsistence - lower land	28.5	5

While the major specific effects of the drought were felt in livestock losses and in reduced harvests, the Maasai farmers, and all farmers, complained of a general feeling of unease and social disturbance during the period of the drought (see p. 5 above).

III B ii Maasai Farmers' response to Drought.

The majority of Maasai farmers retain close links with the pastoral community both through relatives and through the ownership of shares in group ranches. The responses of the farmers to drought conditions reflect the importance of livestock in their economy and the continued links with the pastoral Maasai, in that many of the strategies adopted by the pastoralists (section III. A. ii) were also followed by the farmers.

Movement of people and herds. As explained previously, the Maasai move their livestock in response to the availability of water and grazing resources. This remains true of the farmers as well as the pastoralists. At the time of the survey over 30% of the farmers' cattle and 20% of their sheep and goats were away from the farm (Table 28) being cared for either by relatives and friends or by members of the family who had moved with the livestock. Twenty-three percent of Maasai farmers reported that members of their family

Table 28.

Proportion of herd kept at the farm during drought-Maasai farmers.

	CATTLE	SHEEP	GOATS
Percent on farm	63.81	79.20	78.34
Percent elsewhere	36.09	20.80	21.66

(usually sons) had moved away with the livestock in search of pasture, particularly to swampy areas e.g. Kimana and Olkaria where pasture and water was available.

Reciprocity among relatives and friends. The movement of livestock away from the farm reflects the continued willingness of Maasai to allow livestock from other, less-favoured areas, to graze on their land. This is particularly well-developed among the pastoral Maasai, while sharing of foodstuffs is also important for the farmers. Forty-two percent of Maasai farmers stated that they had given food to relatives and 19% that they had received food from relatives, while 37% of pastoralists said they had received food from relatives. It appears likely therefore that the relatively advantageous position enjoyed by the Maasai farmers due to their mix of resources enabled them to provide a great deal of assistance to their less-fortunate relatives during the drought.

Assistance from other sources. The principal off-farm sources of food during the drought were purchases at the market, gifts from relatives and famine relief (Table. 29)

Table 29.

Source of food in 1976 - farmers of Loitokitok area.
(by no. and percent of respondents in each group giving each response)

Source	MAASAI (N=90)		KIKUYU (N=79)		OTHER (N=56)		TOTAL (N=225)	
	No.	%	No.	%	No.	%	No.	%
Market	87	97	72	91	51	91	210	93
Stored food	46	51	35	44	28	50	109	48
Famine Relief	37	41	41	52	30	54	108	48
Relatives	17	19	12	15	9	16	38	17
Used cash savings	7	8	5	6	11	20	23	10
Other	0	0	2	3	3	5	5	2

In order to raise cash with which to buy food at the market the Maasai farmers engage in a number of activities. 36% of the average cash income came from 'biashara', 31% from the sale of livestock and only 10% from the sale of crops. The type of activity differs from one member of the family to another: the head of household is most likely to trade (particularly in livestock), the sons to work in town and the wives sell food.

It is noteworthy that fewer Maasai farmers (41%) than non-Maasai farmers (53%) and Maasai pastoralists (67%) received famine relief, an indication that their mixed economy enabled them to cope relatively well during the period of drought.

The Maasai farmers continue to maintain strong links with the pastoral economy and to respond to drought in traditional ways. However, their mixed economy appears to allow them more versatility in time of drought as they are dependent on neither livestock nor crops for their entire subsistence needs.

III B ii Expectation of future drought and precautions against its effects - Maasai farmers.

The years 1961 and 1970-76 stand out clearly in the minds of Maasai farmers as being years of drought. Drought is not an unexpected event for them and it is anticipated again by many, although they are uncertain as to when it might occur. A surprising number of respondents (44%) stated however, that they do not anticipate drought in the future. That Maasai farmers should be so optimistic may reflect the fact that the most recent drought affected them less than other groups in the area. Their optimism does not lead to complacency, they have a good idea of the strategies they will use to reduce the impact of future droughts and not one respondent said he/she would take no precautions. (Table 30).

Table 30.

Precautions against future droughts - Maasai farmers (N=57)

PRECAUTION	NUMBER	PERCENT
Increase herd size	41	72
Save cash	37	65
Cultivate more land	17	30
Store food	10	18
Work off farm	2	4
Other	7	12

That keeping more livestock is the most frequently mentioned precaution emphasises the continued importance of herding to the Maasai farmer. The mixed nature of their economy is indicated by the 30% of respondents who said they would cultivate a greater area - a response common among Kikuyu and other non-Maasai farmers in the area.

The saving of cash is also seen as being a useful precaution against drought. People of the area, particularly Maasai, had great difficulty raising cash to buy food during the drought as their savings (livestock) were devalued against the commodity they wished to buy (food), as the quality of livestock declined giving a poor selling price while scarcity drove up the price of food. Cash saved from the sale of healthy livestock would thus buy more food than that realised from the sale of low-quality animals. A number of problems affect the viability of this precaution however. Most people cannot afford to save money as school fees, clothing, and day to day costs use up most of peoples' available cash and even if they did have money to

save there is no bank in the Loitokitok area at which they could do so.

A feature of the precautions listed by Maasai and other farmers in the area is that most concern activities which the people can implement themselves with little assistance being required from outside sources, such as the government. It became apparent at the follow-up field seminars (Campbell and Mbugua 1978) that people did recognise that there was much which they could do themselves to alleviate drought-related problems but that they also realised their own limitations. For example while they can increase herd size or plant different crops without external help they could not open a bank without such assistance.

II D iv Commentary.

- i. Farming by Maasai represents a recent departure from traditional herding activities and Maasai farmers still have a strong attachment to their livestock which may increase as a consequence of their experience in the most recent drought.
- ii. Maasai farmers appear to have coped more successfully with drought conditions than either the pastoralists or the non-Maasai farmers. Their mixed economy offers a range of inputs to their subsistence needs and while both their animals and crops could provide subsistence prior to the drought neither was able to do so alone at the time of the survey. The combination of livestock and crops did however ^{mitigate} major difficulties and permitted many farmers to help less fortunate Maasai relatives.
- iii. Whether a mixed economy is a feasible alternative for all the people of the area is doubtful as there is insufficient arable land for the farmers who are already there (52% stating land shortage to be a major problem) and the area into which cultivation might expand, without threatening the viability of the pastoral side of the economy, is limited.

III C Non-Maasai Farmers.

The majority of non-Maasai farmers in the Loitokitok area are Kikuyu and Kamba people who are recent arrivals in the area (Table 31) having come from many parts of Kenya (Table 32) but primarily from Central and Rift Valley provinces. About one-fifth of the farmers in the survey had come to the area from Tanzania, many being of Kenyan origin who moved due to various policies enacted by the Tanzanian government.

Table 31.

Date of commencement of farming in the Loitokitok area - non-Maasai farmers.

DATE	KIKUYU		KAMBA		OTHER		TOTAL	
	No.	%	No.	%	No.	%	No.	%
pre- 1962	2	3	1	3	2	9	5	4
1962-1966	7	9	2	6	4	18	13	10
1967-1971	31	39	8	25	7	32	46	35
1972-1976	39	49	21	65	9	41	69	52

The early years of rapid immigration in the post-independence period - 1967-1972 - were characterised by favourable rainfall conditions and the farmers tended to plant crops best-suited to areas with relatively high rainfall. The decline in rainfall amounts after 1972 resulted therefore in a more severe reduction in harvests than might have been the case had crops more suited to the area's environmental conditions been planted. For most of the non-Maasai farmers 1972-1976 was the first period of drought which they had experienced in the Loitokitok area, though many had done so in their areas of origin.

Table 32.

Origin of non-Maasai farmers in the Loitokitok area

(percentages are of column totals)

LOCATION	KIKUYU		KAMBA		OTHER		TOTAL	
	No.	%	No.	%	No.	%	No.	%
<u>KENYA</u>								
<u>Central Province-total</u>	48	69.6	1	3.6	0	0.0	49	42.6
Nairobi	13	18.8	0	0.0	0	0.0	13	11.3
Kiambu	28	40.6	1	3.6	0	0.0	29	25.2
Muranga	3	4.3	0	0.0	0	0.0	3	2.6
Nyandarua	2	2.9	0	0.0	0	0.0	2	1.7
Nyeri	2	2.9	0	0.0	0	0.0	2	1.7
<u>Coast Province-total</u>								
Taveta	0	0.0	1	3.6	1	5.6	2	1.7
<u>Eastern Province-total</u>	0	0.0	10	35.7	0	0.0	10	8.7
Kitui	0	0.0	3	10.7	0	0.0	3	2.6
Machakos	0	0.0	7	25.0	0	0.0	7	6.1
<u>Nyanza Province-total</u>	0	0.0	0	0.0	3	16.7	3	2.6
Kisumu	0	0.0	0	0.0	3	16.7	3	2.6
<u>Rift Valley Province-total</u>	11	15.9	13	46.4	5	27.8	29	25.2
Eldoret	1	1.4	0	0.0	0	0.0	1	1.0
Kajiado	8	11.6	13	46.4	5	27.8	26	22.6
Nakuru	2	2.9	0	0.0	0	0.0	2	1.7
<u>TANZANIA</u>	10	14.5	3	10.7	9	50.0	22	19.1

The non-Maasai farmers concentrate on growing maize and beans but also cultivate a variety of crops both for subsistence and for sale (Table 33) but unlike the Maasai they keep very few animals (Table 23).

Table 33.

Crops grown by non-Maasai farmers-Loitokitok area
(by number and percent of respondents - N=135)

CROP	NO. GROWING		FOOD CROP		CASH CROP		FOOD & CASH	
	No.	%	No.	%	No.	%	No.	%
Maize	135	100	57	42	0	0	78	58
Millet	42	31	14	10	4	3	24	18
Sorghum	7	5	2	1	3	2	2	1
Beans	130	96	61	45	7	5	62	46
Peas	12	9	7	5	0	0	4	3
Potato	86	64	69	51	2	1	15	11
Cassava	13	10	11	8	2	1	0	0
Banana	20	15	14	10	1	1	5	4
Coffee	1	1	0	0	0	0	1	1
Cotton	9	7	0	0	9	7	0	0
Onions	14	10	2	1	10	7	2	1
Other Crops	27	20	7	5	10	7	10	7

The non-Maasai farmers are found in two main zones in the area. The Kikuyu are predominantly in the "buffer zone" immediately below the Tanzanian border while the Kamba are found mainly around Kimana where they cultivate under irrigation.

III C i The impact of drought on non-Maasai farmers.

The most frequently mentioned problems affecting these farmers during the period of drought were water supply, land shortage and lack of food which are clearly interrelated (Table 2). These specific issues arose within a context of general unrest in the area exemplified in an increase in robbery, assault and disagreement between people.

In the absence of significant numbers of livestock, crop production is the mainstay of the non-Maasai farming economy. The majority of farmers have small plots (Table 34) and are thus able to produce a surplus only in good years, while during the drought hunger was widespread.

Table 34
Area of farm - non-Maasai farmers. (N=135)

AREA	NO	PERCENT
Under 2 ha	84	62
2 - 4 ha	40	30
4 - 6 ha	8	6
Over 6 ha	3	2

Table 35, shows the area under the principal subsistence crops for the sample population and using estimates of subsistence requirements and crop production (Appendix 4) a crude estimate of the food deficit faced by the non-Maasai farmers in 1976 can be obtained (Table 36).

It appears that while those in the higher areas may have been able to grow threequarters of their maize needs, those in the lower lying area had greater difficulty. This was particularly true in areas where irrigation was made difficult by the irregular flows of the streams and the poor water-holding performance of dams such as those built at Kimana.

Table 35
Area under principal subsistence crops - non-Maasai farmers (N=134)

CROP	TOTAL AREA (ha)	AREA/FAMILY (ha)
Maize	239.4	1.79
Beans	207.6	1.55
Millet	70.5	0.53
Sorghum	5.8	0.04

Table 36
Subsistence production for non-Maasai farmers (percent)

	MAIZE	BEANS
Total crop area (ha)	239.4	207.6
Area-higher land (ha)	143.6	124.6
Area-lower land (ha)	95.8	83
Total % of subsistence grown	55	15
% subsistence - higher land	73	16
% subsistence - lower land	26	14
TOTAL % of subsistence provided by maize and beans	Higher land 89 Lower land 40	

Table 37 demonstrates that the larger the farm size the better able was the farmer to provide for the needs of his family. As there appears to be no relationship between farm size and family size (Pearson's $r = -0.066$) it is clear that those with large farms fared better irrespective of family size.

It would appear therefore that in terms of provision of subsistence the non-Maasai farmers faced a more difficult situation than either the Maasai farmers or many Maasai pastoralists in 1976. The farmers in the lower lying drier areas encountered the most severe problems indicating the need for provision of a water supply which may reduce their dependence upon rainfall but it is open to question whether the returns in terms of crop production would be sufficient to justify the investment in water schemes in all of those areas.

Table 37

Estimated subsistence production (percent) and farm size (ha /ⁱⁿ percentiles)
- non-Maasai farmers Loitokitok area^a

AREA CULTIVATED (ha)		SUBSISTENCE PRODUCTION		
PERCENTILE	MEAN	% BEANS	% MAIZE	TOTAL %
1-10	0.56	3	13	16
11-20	0.88	4	13	17
21-30	1.28	7	43	50
31-40	1.78	10	46	56
41-50	2.25	11	49	60
51-60	2.52	11	49	60
61-70	3.11	16	55	71
71-80	3.91	18	55	73
81-90	5.22	24	113	137
91-100	8.99	37	137	164

^a See Appendix 4 for method of estimation

III C ii The response to drought among non-Maasai farmers.

In areas prone to recurrent drought the population has usually developed mechanisms for reducing the impact of the drought. Such mechanisms, or strategies, are integrated within the socio-economic framework of the society but increase their importance once drought threatens the system. People become more vulnerable to drought when their society is undergoing a process of adjustment to altered social, political, economic or environmental conditions as, particularly if good rainfall conditions prevail, they are more

likely to concentrate on adaptations to meet immediate needs than on those required to alleviate a less immediate situation.

The majority of non-Maasai farmers are recent immigrants to the Loitokitok area and the period 1972-76 was the first in which they had experienced inadequate rainfall, as the years prior to 1972 had been ones of adequate precipitation. Prior to 1972, therefore, the farmers had concentrated upon settling into the area and developing their farms to produce sufficient crops to meet their subsistence and cash requirements. The crops planted by the farmers did not produce sufficient harvests to meet subsistence needs during the drought and though many people had stored some food it was insufficient to offset the deficit in the harvest. Discussion with farmers as to precautions which they could take to reduce the impact of future droughts (Section III C iii) demonstrated that while they know what precautions might have been useful, they had not taken them prior to 1972, though after the experience of the 1972-76 period more drought-resisting strategies are likely to be implemented.

In order to overcome the food shortages the non-Maasai farmers had to depend upon purchases at the market, the use of stored food and famine relief. The purchase of food ^{was} the largest cash expenditure of most farmers, accounting for 46% and 41% of the average Kikuyu and Kamba cash expenditures respectively (Appendix 2).

The principal source of income to pay for this food for the Kikuyu were off-farm business activities such as shopkeeping, and remittances from wage earners in town, though crop sales accounted for about one quarter of the average income. Crop sales were also an important source of income for the Kamba respondents who, unlike other groups also earned cash through wage labour.

Assistance from relatives is not as well-developed among the non-Maasai as among the Maasai. This is probably due to their having fewer relatives in the immediate area and any that were there were also affected by the drought. Thus as Table 38 shows relatively few non-Maasai farmers gave or received help from relatives.

Table 38

Assistance between relatives - farmers Loitokitok area.

	MAASAI FARMERS (N=69)		KIKUYU FARMERS (N=79)		KAMBA FARMERS (N=33)		OTHER FARMERS (N=23)	
	No.	%	No.	%	No.	%	No.	%
Received Assistance	17	19	12	15	3	9	6	26
Gave Assistance	37	42	11	14	3	9	9	29

The lack of nearby relatives is also reflected in the low number of people who moved to stay with relatives. Only one Kamba family reported a move (and that was of a lady who went to cultivate in another area) while about 10% of Kikuyu families reported that a member of the family (usually sons) had moved away to stay with relatives. Most of the latter left the Loitokitok area and returned to the districts from which the family originally came.

Assistance from sources other than relatives was restricted mainly to famine relief provided by the government and by the Roman Catholic mission and distributed according to need as decided by the leader of the community. The distribution of relief was widespread in the area, though pastoralists and non-Maasai farmers received it more than Maasai farmers (Table 39).

Table 39

Percent of respondents receiving famine relief.

MAASAI PASTORALISTS (N=164)	MAASAI FARMERS (N=90)	KIKUYU FARMERS (N=79)	KAMBA FARMERS (N=33)	OTHER FARMERS (N=23)	TOTAL (N=389)
67.1	41.1	51.9	54.5	52.2	56.0

Off-farm activities. The range of off-farm activities practised by non-Maasai farmers is shown in Table 40. Not all farmers had off-farm income, however, and the table reflects the responses of the 45% of the sample that declared such income. It demonstrates a variety of activities, based principally upon local resources, which are engaged in/ diversify the farmers' sources of income, though sales of crops/food was the most frequent response.

Table 40

Sources of off-farm income - non-Maasai farmers (N=61)

	NUMBER	PERCENT OF SUB-SAMPLE (N=61)	PERCENT OF SAMPLE (N=225)
Sold food/crops	26	43	19
Work in town	25	41	18
Biashara	13	21	9
Sold charcoal/firewood	11	18	8
Duka	8	13	6
Sold beer	6	10	4
Labour on another farm	6	10	4
Other	7	11	5

The non-Maasai farmers had to rely heavily upon their own agricultural resources during the drought. Intra-family ties were weak as most had only recently moved to Loitokitok from other parts of the country and famine relief was of great importance in offsetting deficits in crop production.

III C iii Expectations of future droughts and precautions against its effects - non-Maasai farmers.

As the 1972-1976 drought was the first many respondents had experienced in the area it is not surprising that they are uncertain as to the possibility of drought conditions recurring in the future (Table 41).

Table 41
Expectations of future drought - non-Maasai farmers (N=135)

	NUMBER	PERCENT
Do not expect drought	39	29
Expect drought	40	30
God/laibon knows	43	32
Do not know	13	10

This uncertainty does not prevent them from having clear ideas as to which precautions might be effective in reducing the impact of any future drought. The responses from the survey (Table 42) and discussion at field seminars¹⁰ indicate that a wide range of responses are under consideration. Many of these are implementable by the people themselves but they realise that for others to be successful assistance from outside sources will be required.

Table 42
Precautions against future drought - non-Maasai farmers (N=103)

PRECAUTION	NUMBER	PERCENT OF RESPONDENTS
Save cash	86	83.5
Cultivate more land	47	45.6
Store food	24	23.3
Work off-farm	9	8.7
Nothing	2	1.9
Other	7	6.8

10. In addition to the strategies indicated in Table 42 the field seminars concluded that activities to improve water supply, food storage facilities and the planting of a variety of drought - resistant or evading crops would reduce the farmers' vulnerability to any future drought.

The most widely accepted response is that of saving cash with which to buy food during a drought. They recognise a number of difficulties with this strategy namely the ability of people to save cash and the lack of a bank at which they might save. Most of peoples' earnings are gained directly after the harvest when purchasers pay low prices and much of what is earned is spent on immediate needs such as school fees and clothing. Discussion at field seminars indicated that farmers might receive better prices for their produce if they organised themselves into seller-cooperatives so that they could negotiate a higher price for their crops. Many suggested that the planting of cash crops e.g. coffee would be a way of raising their incomes. The need for a bank to be established at Loitokitok was accepted by most people at the seminars but they realised that government action would be needed to accomplish this.

A second strategy is that of cultivating more land. It became clear during the drought that those who planted the greater area had more food and since the drought many people have planted the entire area of their farm, leaving no land fallow, while others have bought or rented more land for cultivation.¹¹ The cultivation of wider areas in the higher land and of greater areas in the lower lands¹² may increase soil erosion (already a problem indentified by one-third of the respondents as being serious in the area), increase the farming population at risk to drought (those in drier areas were less able to cope with the drought) and curtail the resources available to herders thus increasing their vulnerability. This strategy therefore, though it may appear practical in view of the drought experience, may in the long term increase the difficulties faced by the area's population.

Many farmers also expressed an interest in storing food crops. The amount available for storage is, however, limited as many have to sell any surplus to raise cash and thus this may not be a viable strategy for many farmers. For those who do have sufficient surplus to store there are difficulties which arise in the storage process due to losses to the activities of vermin and insects. The people of the area recognise a need for the government to construct a suitable storage facility in the area to which they could contribute surpluses for use in time of drought.

11. The areas in which most new land is being cultivated are Rombo and Kimana. These were areas of livestock concentration during the drought as they are well-watered. Expansion of cultivation into these areas may reduce the problems of the farmers but will increase the difficulty for the pastoralists as it further reduces the area available for dry-season (or drought) grazing-see p.3.

12. Farmers cultivating around the swamps were able to produce crops such as beans, Katumani maize, bananas and onions throughout the drought period. Although they were frequently troubled by wildlife, their relative success in crop production during this period has acted as an incentive for others to move into the margins of the swamps. These farmers are at less risk to drought than those farming less well-watered land.

A number of other strategies were suggested including: the growing of drought - resistant crops, with which the people are familiar from their experience of drought in their areas of origin; the construction of a reliable water supply - in both Kimana and Kikololwa the people have attempted to improve their water supply but failed. In Kimana the dams which they constructed could not hold water while in Kikololwa the funds contributed for a water scheme have disappeared; family planning; and migration to towns - the viability of this alternative is limited by the low probability of migrants obtaining work in the town

It is clear that the farmers of the area are actively seeking ways of reducing their vulnerability to drought. Many strategies can be accomplished with their own resources, but government assistance is required on specific projects such as the provision of a bank, a grain store and in the creation of a reliable water supply.

III C iv Commentary.

- i. Non-Maasai farmers are, in general, recent immigrants to the Loitokitok area and the years 1972-76 represent the first period of drought faced by these people in the area.
- ii. Most cultivate small areas of land and prior the drought little specific attention had been paid to the growing of drought resistant crops as a precaution against drought.
- iii. During the drought period, particularly 1976, poor harvests led to severe shortage of food and famine relief played an important role in preventing widespread difficulties.
- iv. Farmers on the drier lower slopes had more severe problems than those on the upper slopes. As contemporary expansion of cultivation tends to be towards the drier areas there is a possibility that showed drought conditions return a larger number of people farming in the drier lands will be at risk.
- v. Farmers, like the pastoralists, are actively seeking ways of reducing their vulnerability to drought conditions. While many such strategies can be accomplished using local resources there are others which require assistance from government if they are to be effective.

IV CONCLUSION AND RECOMMENDATIONS

The period of 1972-76 was one of reduced rainfall in the Loitokitok area resulting in severe shortages of food for the population due to reduced harvests and deaths of livestock. The severity of the impact of the drought was in part due to the inability of the societies of the area to cope adequately with the conditions as they were adjusting to altered social and economic conditions which reduced their capability to deal with drought.

The pastoralists' dry-season resources had been severely curtailed prior to 1972 through the extension of national parks and the expansion of cultivation. While some pastoralists had adjusted to the situation by taking up cultivation themselves, the majority had continued with their traditional pastoral economy. When the drought came the area available for grazing was limited and deaths of livestock were widespread. As the process of expansion of the area under cultivation is continuing, and as the Maasai human and animal populations increase, so the pressure on grazing resources will become greater, and the pastoral population will become more vulnerable to future drought. There is some indication that younger Maasai are looking to a mixed agro-pastoral economy in the future but in the absence of some form of land use planning they may be prevented from realising this objective by the expansion of non-Maasai agriculture.

The non-Maasai farmers of the region are new to the area and are in a process of adjusting to its socio-economic and environmental conditions. The farming population is already large enough to create a situation of land shortage, which, together with soil erosion, is seen as giving rise to major problems in the near future. In response to this shortage of land many farmers are moving to the lower-lying drier areas and cultivating land along river valleys and around the edges of swamps. The evidence from the recent drought suggests that those farming in the drier areas were least able to meet their subsistence needs and required famine relief to assist them. Any increase in the numbers of people farming in the drier areas will not only reduce the dry season grazing resources of the pastoralists but will increase the farming population at risk to drought.

For both pastoralists and farmers the situation is serious. There is room for expansion of agriculture - particularly along river valleys where irrigation may be possible - but it is limited and can provide only a short-term respite from the area's problem of land shortage. The use of such areas for agriculture would certainly interfere with the pastoral system of the area, and further reduce its viability. Some form of land

use planning is required for such areas, planning which will evaluate the regional costs and benefits of each land use and the importance of these riverine and swamp resources to each. Uncontrolled or ill-conceived land use changes in the area will only serve to increase the vulnerability of the population to drought.

Both the pastoralist and farming people of the area are actively seeking ways to reduce their vulnerability to drought. Most of these strategies can be accomplished with local resources, though some require specific help from the government. The emphasis upon local efforts to reduce the impact of drought is to be encouraged but the government should be consciously seeking ways in which it can assist local people in meeting these objectives:

"a relatively low cost and high benefit approach for the government in dealing with drought problems is to build upon the local patterns of adjustment to drought which have grown up in the different ecological zones of the country. fostering those which seem to be effective, discouraging some which seem wasteful, introducing new ones...."

(Wisner and Mbithi, 1972, p. 14).

Among the specific activities which the people view as important in reducing the impact of drought but which cannot be implemented without government assistance are:

1. The provision of grain storage facilities at Loitokitok
2. The provision of a bank at Loitokitok
3. Technical assistance with the creation of a reliable water supply in the region
4. Technical assistance with the choice of drought - resistant or evading crop species suitable for the area.

While the provision of these facilities would certainly improve the ability of the people of the area to cope with drought only effective land use planning can provide a long-term solution to the problems of the area. Contemporary trends suggest that the gradual reduction in the dry-season grazing resources will continue as cultivation expands in the area. Its consequences for both farmers and pastoralists are likely to be that both groups become more vulnerable to drought. A development plan should therefore be prepared for the area which aims to reduce the pressure on the land resources while improving the peoples' ability to meet their subsistence needs. Such a plan should assess contemporary trends in land use in terms of their continued viability and should propose changes compatible with local aspirations as well as national goals. In the absence of careful planning contemporary trends will continue and the costs to the national economy of recurrent famine relief will increase and outmigration to Nairobi of people seeking alternative means of support is likely. In view of the severe problems already facing the city such a situation is clearly undesirable.

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APPENDIX 1

RAINFALL FIGURES FOR STATIONS IN THE LOITOKITOK AREA
1975-1977

Rainfall data is available for only two stations in the study area, though attempts at data collection at Kimana and Kuku have been made by the Meteorological Department. The data for the Outward Bound School at Loitokitok (elevation 6050 feet) shows that rainfall was consistently below normal during 1975 and up to the rains which began in October 1976. The figures for Rombo Mission (elevation 3700 feet) reveal a similar pattern except that it was not until the end of 1976 that the drought broke.

1. Normal is defined as being within 20% of the long term average.

Table A1.1
RAINFALL FIGURES FOR ROMBO CATHOLIC MISSION, 1975-1977^a (in millimetres)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
1975	98.7 ⁺	18.5 ⁻	102.5	91.9 ⁻	6.5 ⁻	0.0 ⁻	0.0 ⁻	0.0 ⁻	14.0	1.5 ⁻	207.0	147.1 ⁺
1976	37.1 ⁻	3.1 ⁻	69.4 ⁻	161.9	48.6 ⁺	2.6 ⁻	0.0 ⁻	5.7 ⁻	63.1 ⁺	38.1 ⁻	97.3 ⁻	111.7 ⁺
1977	64.0	106.6 ⁺	105.3	198.8 ⁺	13.7 ⁻	3.6 ⁻	4.4	6.0 ⁻	47.9 ⁺	78.3 ⁺	259.9 ⁺	119.9 ⁺
Long-term Mean ^b	54.7	66.7	114.2	155.3	31.8	7.1	5.0	21.0	17.3	55.1	172.6	92.8

Table A1.2

RAINFALL FIGURES FOR OUTWARD BOUND SCHOOL, LOIPIOITOK, 1975-1977 (in millimetres)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
1975	117.3 ⁺	38.9 ⁻	84.8 ⁻	84.0 ⁻	3.7 ⁻	0.0 ⁻	3.4 ⁺	1.4 ⁻	0.9 ⁻	16.7 ⁻	86.8 ⁻	201.6 ⁺
1976	35.4 ⁻	139.1 ⁺	73.2 ⁻	149.5	14.8 ⁻	0.0 ⁻	0.0 ⁻	0.0 ⁻	23.1 ⁺	61.1 ⁺	256.2	129.3
1977	45.1 ⁻	59.9 ⁻	113.3	257.3 ⁺	53.7 ⁺	0.0 ⁻	0.0 ⁻	0.0 ⁻	16.1 ⁺	23.4 ⁻	193.7	198.5 ⁺
Long-term Mean ^b	71.1	80.4	130.5	155.4	26.1	17.7	2.1	4.4	7.9	41.3	219.5	158.9

Notes: a) Data was provided by Mr. Nyamutale of the Kenyan Meteorological Department, Nairobi.
The symbols (+ and -) indicate months in which the rainfall was higher (+) or lower (-) than normal (defined as within 20% of the longterm mean).

b) Data are available for Rombo Mission for 13 years and for the Outward Bound School for 14 years.

APPENDIX 2

INCOME AND EXPENDITURE TABLES FOR 1976

The following tables represent an estimate of the average cash income and expenditure in the year prior to the survey. Each item is the mean of the total amount earned/spent by each group within each category, and the totals are the sums of these means.

It is clear from these tables that both the Maasai farmers and pastoralists were able to sell livestock sufficient to meet their food requirements in 1976. The other farmers of the area had few livestock which they could sell through 47% used food which they had stored and over 10% of these respondents used cash savings to buy food.

Apart from the purchase of food, school fees and clothing are the principal items of expenditure for all groups, while the principal off-farm source of income is "business" an all-inclusive term for any money earning activity involving trade.

All figures are Kenya Shillings.

TABLE A2.1

MAASAI PASTORALISTS

INCOME 1976

SOURCE	₤ AMOUNT	% OF TOTAL
Cattle	2167	66.27
Sheep	347	10.61
Goats	462	14.13
Milk	34	1.04
Hides	45	1.38
TOTAL LIVESTOCK - RELATED	3055	93.43
Relatives	12	1.28
Business	78	2.39
Labour	47	1.44
Other	48	1.47
	3270	100.01

EXPENDITURE 1976

SOURCE	₤ AMOUNT	% OF TOTAL
Food	1401	53.04
Clothing	408	15.45
Livestock	489	18.52
School fees	207	7.83
Travel	125	4.83
Tax	11	0.42
Other	0	0.00
	2641	99.99

Expenditure as percent of Income = 80.76

TABLE A2.2

MAASAI FARMERS

INCOME 1976

SOURCE	X AMOUNT	% OF TOTAL
Livestock sales	1764.54	32.90
Crop sales	531.40	9.91
Milk sales	131.40	2.45
Egg sales	66.86	1.25
Handicrafts	0.00	0.00
Duka	348.84	6.50
Sale of wood/charcoal	0.00	0.00
Labour	426.70	7.96
rent of land	221.02	4.12
Business	<u>1872.09</u>	<u>34.91</u>
	<u>5362.85</u>	<u>100.00</u>

EXPENDITURE 1976

SOURCE	X AMOUNT	% OF TOTAL
food	1688.89	39.81
seeds	165.00	3.89
fertilizer	10.00	0.24
stock feed	172.78	4.07
ploughing	368.89	8.70
petrol	129.44	3.05
travel	233.33	5.50
school fees	387.78	9.14
tax	3.89	0.09
household goods	241.11	5.68
clothing	356.11	8.39
charcoal	81.67	1.93
paraffin	135.56	3.20
labour	267.78	6.31
	<u>4242.23</u>	<u>100.00</u>

Expenditure as percent of Income = 79.10

TABLE A2.3

KIKUYU FARMERS

INCOME 1976		
SOURCE	\bar{x}	% OF TOTAL
livestock sales	63.57	2.45
crop sales	667.61	25.76
milk sales	13.38	0.52
egg sales	59.15	2.28
handicrafts	0.00	0.00
duka	380.28	14.68
sale of wood/charcoal	54.22	2.09
labour	376.97	14.55
rent of land	28.95	1.12
business	947.18	36.55
	<u>2591.31</u>	<u>100.0</u>
EXPENDITURE 1976		
SOURCE	\bar{x} AMOUNT	% OF TOTAL
food	2094.23	46.41
seeds	158.33	3.51
fertilizer	37.18	0.82
stock feed	73.08	1.62
plowing	156.41	3.46
petrol	66.02	1.46
travel	235.26	5.21
school fees	464.10	10.29
taxes	19.87	0.44
household goods	427.56	9.48
clothing	600.00	13.30
charcoal	14.10	0.31
paraffin	121.15	2.68
labour	44.87	0.99
	<u>4512.16</u>	<u>99.99</u>

Expenditure as percent of Income = 174.13

TABLE A.2.4. OTHER FARMERS
INCOME 1976

SOURCE	X AMOUNT	% OF TOTAL
livestock sales	42.41	3.68
crop sales	346.90	30.07
milk sales	20.75	1.80
egg sales	9.43	0.82
handicrafts	1.89	0.16
duka	66.04	5.73
sale of wood/charcoal	6.60	0.57
labour	211.32	18.32
rent of land	64.15	5.56
business	383.96	33.29
	<u>1153.45</u>	<u>100.00</u>

EXPENDITURE 1976

SOURCE	X AMOUNT	% OF TOTAL
food	1336.60	40.50
seed	124.76	3.78
fertilizer	5.36	0.16
stock feed	8.93	0.27
plowing	53.37	1.62
petrol	2.68	0.08
travel	212.50	6.44
school fees	432.14	13.09
tax	3.57	0.11
household goods	333.93	10.12
clothing	558.93	16.93
charcoal	79.46	2.41
paraffin	120.54	3.65
labour	27.68	0.84
	<u>3300.45</u>	<u>100.00</u>

Expenditure as percent of Income = 286.14

APPENDIX 3

ESTIMATED LIVESTOCK LOSSES DURING THE PERIOD 1973-1976
FOR LOITOKITOK DIVISION, KAJIADO DISTRICT

This appendix provides estimates of livestock losses and their value for Loitokitok Division based upon data provided by 58 respondents who gave actual numbers of livestock sold and died (Table A.3.1- A.3.7). The accuracy of this data is considered to be high as the enumerators who obtained this information were very familiar with the areas in which these respondents lived.

These estimates derived from this sub-sample are then compared with estimates derived from a survey reported by Metson (1974) which was carried out in December 1973 and from aerial surveys conducted by the FAO/UNDP/Ministry of Wildlife and Tourism Wildlife Management Project.¹ These comparisons demonstrate that the estimates for cattle losses derived from the survey in the Loitokitok area are of a similar order of magnitude to those obtained from aerial monitoring (Table A.3.8, A.3.9), though those for losses and sheep and goats are far greater in the Loitokitok ground survey than in the aerial survey. This maybe explained by the fact that shoats continued to reproduce during the drought while the chances of calves surviving were much lower. Births are not accounted for in Tables A.3.1-A.3.7.

METHOD OF CALCULATING ESTIMATES OF LIVESTOCK LOSSES FOR LOITOKITOK DIVISION

A three stage process is followed in order to take account of those members of the population who own no cattle or no sheep or goats.

1. for the sub-sample of 58 respondents, of all whom own livestock, a mean was calculated for cattle and for sheep and goats owned.
2. these means were then multiplied by the number of respondents in the sample (N=166) who owned cattle, sheep and goats.
3. There are approximately 2600 families registered as members of ranches in Loitokitok Division² and the sample of 166 respondents thus represents 6.38% of the total population. The sample estimates are then used to calculate an estimate for Loitokitok Division.

1. I am grateful to Dr. Harvey Groze for these data and for his assistance in interpretation.
2. I am grateful to Mr. Juma, District Officer, Kajiado for this information.

Table A.3.1

Average sales and deaths of livestock for sub-sample (N=58)

LIVESTOCK	AVERAGE SALES	AVERAGE DEATHS
Cattle	8.86	17.64
Sheep	4.46	7.73
Goats	7.92	7.14

Table A.3.2

Estimates of livestock sales for survey population (N=166)

LIVESTOCK	NO. REPORTING SALES	SAMPLE ESTIMATE
Cattle	161	1426
Sheep	119	531
Goats	141	1117

Table A.3.3

Estimates of livestock deaths for survey population (N=166)

LIVESTOCK	NO. REPORTING DEATHS	SAMPLE ESTIMATE
Cattle	161	2840
Sheep	128	989
Goats	126	900

Table A.3.4

Estimates of livestock sales and deaths, Loitokitok Division (N=2600)

LIVESTOCK	ESTIMATED SALES	ESTIMATED DEATHS	ESTIMATED TOTAL DECLINE
Cattle	22335	44482	66817
Sheep	8317	15490	23807
Goats	17495	14096	31591

Table A.3.5

Estimated value of livestock sales, Loitokitok Division, (N=2600)³

LIVESTOCK	ESTIMATED SALES	AVERAGE SALE PRICE (Kshs)	ESTIMATED VALUE (Kshs)
Cattle	22335	200	4,467,000
Sheep	8317	90	748,530
Goats	17495	60	1,049,700
			<u>6,265,230</u>

3. Sales prices are estimates obtained from discussion with respondents regarding average sale prices in 1976.

Table A.3.6.

Estimated value of livestock deaths, Loitokitok Division (N=2600)

LIVESTOCK	ESTIMATED DEATHS	AVERAGE SALE PRICE (KSHS)	ESTIMATED VALUE (KSHS)
Cattle	44482	200	8,896,400
Sheep	15490	90	1,394,100
Goats	14096	60	845,760
			<u>11,136,260</u>

Table A.3.7

Estimated average value of sales and deaths Loitokitok Division (N=2600)

LIVESTOCK	VALUE OF SALES (KSHS)	VALUE OF DEATHS (KSHS)
Cattle	1718	3422
Sheep	288	536
Goats	404	325
TOTAL	<u>2410</u>	<u>4283</u>

Table A.3.8

Average herd size Kajiado District December 1973 (Motson Survey) compared with Loitokitok Area February 1977 (Campbell survey)

AVERAGE NO. LIVESTOCK	DECEMBER 1973	FEBRUARY 1977	PERCENT CHANGE
Cattle	108	70	-35
Sheep and Goats	99	99	0

Table A.3.9

Livestock population, Ilkisongo, Aerial Survey Estimates 1974-76

LIVESTOCK	POPULATION ESTIMATE			TOTAL	PERCENT DECLINE
	1974	1975	1976		
Cattle	159,780	103,320	111,180	48,600	30
Sheep & Goats	91,690	111,890	82,740	8,950	10

APPENDIX A

ESTIMATION OF SUBSISTENCE PRODUCTION FOR NON-MAASAI
FARMERS

I. MAIZE

1 kg of maize gives 3200 calories
1 adult needs 2700 calories/day
1 adult needs 0.84 kg maize/day
Annual requirement/adult = 308kg.

Assumption: A farm on the better-watered, higher slopes, will produce more maize/hectare than one on the drier, lower slopes.

From Hesselmark-(unpublished) estimates of the yields in the more productive areas are 667 kg/ha and in the drier areas 222 kg/ha.

To estimate the percentage of all calorie requirements provided by maize the following formulae were used.

(1) Wetter areas: $\frac{\text{Area under crops} \times 667}{\text{Population} \times 308} \times 100$

(2) Drier areas: $\frac{\text{Area under crops} \times 222}{\text{Population} \times 308} \times 100$

II Beans

- 1 kg of beans give 875 calories
- 1 adult needs 2700 calories/day
- 1 adult needs 3.1 kg of beans/day
- Annual requirement/adult = 1126 kg.

Similar assumptions as for maize apply as to differences in yields on upper and lower slopes.

From Schonher and Mbugua (1976) estimates for yields on upper slopes of 180 kg/ha were taken and on lower slopes 150 kg/ha.

To estimate the percentage of all calorie requirements provided by means the following formulae was used

- (1) Upper slopes:
$$\frac{\text{Area} \times 180}{\text{Population} \times 1126} \times 100$$
- (2) Lower slopes:
$$\frac{\text{Area} \times 150}{\text{Population} \times 1126} \times 100$$