Aspects of livestock productivity in Maasai group ranches in Kenya*

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SUMMARY

A STUDY WAS MADE *of livestock productivity in three group ranches of the Maasai pastoralists in southeast Kenya. Eighty households were studied in detail, and the size of the production unit was found to affect most important production parameters. The output of animal products was measured by cattle and smallstock productivity studies and through household studies. The cow–calf operation of the Maasai pastoralists was found to produce an annual growth of 20 to 30%, which is higher than production indices measured in West African pastoral systems.*

The total livestock output from Olkarkar, the northernmost ranch studied, was 29 kg/ha of which 11 kg/ha was `real' offtake for sales and slaughter. Since the stocking rate averaged 80 kg LW/ha, the real offtake was about 14% of the total biomass. The gross income from livestock products was equivalent to Ksh 176/ha. Maasai productivity per unit of land was shown to be similar to that of a commercial ranch, but production in the Maasai system is at a much lower cost, with household labour being the major investment.

INTRODUCTION

Research was conducted among Maasai pastoralists in three group ranches[1] located in the Kajiado district of southeast Kenya during the period 1981 to 1983. The aim of this research was:

- To determine how the Maasai in these semi-arid rangelands manipulate their livestock to achieve their production goals;
- To elucidate the causal relations within the production system; and
- To identify the constraints on production and the opportunities for increased output.

Pastoral systems appear technically simple, but are organisationally complex and represent sophisticated forms of adaptation to highly variable and risky environments. A systems approach to research was therefore adopted (ILCA, 1981).

[1].Olkarkar and Merueshi are located in the north and Mbirikani in the south of the study area

In this paper the environment of the group ranches is briefly described together with the major parameters of the human and livestock populations. An analysis of the output of the Maasai pastoral system is attempted: first in terms of output per animal, and of household cash and

subsistence income from livestock for large- and small-scale producers; and second in terms of output per unit of pastoral land.

The setting

People and livestock

The total study area covers 1600 km^2 and supports an estimated population of 3500 pastoralists who own about 50 000 cattle and 30 000 sheep and goats. Thus, the average population density is 2.2 people per km^2, and the average livestock holding is 12.6 livestock units (LSU) per caput.

Land availability within the ranches ranges from 250 ha per household and 3 ha per LSU in the north to 650 ha per household and 4 ha per LSU in the south. However, pastoralists are often forced to move away from their registered ranches during prolonged dry seasons. In 1982, over 70% of people having households in the southern area moved to better grazing outside their territory (Peacock et al,1982).

Rainfall

The study area includes parts of the arid and semi-arid zones as defined by Braun (see Sombroek et al, 1982). Rainfall is bimodal with peaks in November/December and April/May, followed by a 4- to 5-month dry season from June to October. The mean annual total varies from 750 mm in the north to 450 mm in the south. There was a large seasonal and spatial variability in rainfall during the 30 months of the study, with the number of dry months ranging from 11 to 17 (out of 30) from north to south.

Soils

The landscape of the area consists of undulating plains at an average altitude of 1200 m a.s.l. and hills rising from 100 to 200 m above the plains. Although the area is underlain by a Precambrian basement complex, large parts are covered by more recent lava flows and volcanic ash deposits. Over these basaltic parent materials, soils range from stony cambisols on the upper slopes to cracking vertisols in valleys and bottomlands, while on the basement complex lighter textured reddish luvisols predominate. Further south the plains feature dark clays with vertic and saline-sodic properties, whereas the foothills in the southeast show mixtures of andosols, cambisols and luvisols (Sombroek et al, 1982).

Range resources

In spite of this diversity of soils, the vegetation has a fairly uniform appearance. Over half of the area is covered by grassland. Woody cover rarely exceeds 20%; dense woods and shrublands are confined to the granitic hills, to lava flows at higher altitudes and to steep-sloped river valleys. Grasslands consist mainly of perennial grasses admixed with variable proportions of annual grasses, forbs and dwarf shrubs. On the better drained soils, short to medium tall perennial grasses *(Digitaria, Chloris* spp.) predominate, while on heavier soils these are replaced by the taller, coarse *Pennisetum spp.* Further south the cover is much more sparse, in particular on salinesodic soils where small, tufted grasses *(Sporobolus* spp.) are common. The

woody cover is rich in species; species of Acacia are the most common and increase in importance towards the south.

Herbaceous plant cover varies with season, site and grazing use. Bare ground is mainly found in `sacrifice' areas around settlements, water points and along cattle tracks. Low-altitude aerial surveys showed that in the north 10 to 20% of the land had little ground cover (0–10%) and 25 to 30% was well covered (<50%). In the south, due to the greater aridity and poorer soil conditions, at least half the land area is sparsely covered (Peacock et al,1982).

Because of the variable rainfall, the amount of biomass available for grazing was difficult to estimate. After the peak rainfall (200–400 mm) in late 1982, standing biomass of 1.5 to 3.5 t DM/ha was measured in the short and medium range types. This range of yields is within the limits predicted from relationships between rainfall and herbage growth in similar areas (Braun, 1973; Sinclair, 1979). The same holds true for the nutritive value of the biomass. In general, the shorter grasses are relatively leafy, in particular when grazed regularly (McDowell et al, 1983). Crude protein content in grazed herbage rarely falls below 5%, but digestibility only exceeds 50% for 3 to 6 months of the year.

Water resources

The study area is well endowed with man-made and natural water facilities. These include a high-capacity spring in the northernmost ranch, a pipeline with several public and private water connections, four boreholes and a cluster of shallow wells along the principal seasonal river. However, the proportion of grazing land within 5 km of permanent water points varies from 30 to 90% between ranches. Rainfed water points comprise shallow pools in riverbeds and ponds. These seasonal sources account for only 20 to 25% of total use.

Productivity

Size of operation

Out of the 280 producer units in the study area a sample of 80 households was chosen and stratified into large-, medium- and small-scale categories on the basis of the number of livestock owned in proportion to the number of people supported.

Table 1 shows that the size of the production unit affected virtually every important production parameter. In the northernmost ranch (Olkarkar), small-scale producers, who accounted for 35% of the households, owned only 10% of the livestock units whereas large-scale producers, who accounted for 30% of all households, owned 73%. Small-scale producers had proportionally more smallstock, showing a smallstock to cattle ratio of 1.5 as compared with 0.7 for large-scale producers.

Table 1. *Demographic parameters of small-scale and large-scale producers in the Olkarkar ranch*.

Parameter	Producer type[a]	
	S-S	L-S
No. of households	14	12
Percentage of total households	35	30
No. of residents/household	7.6	14.3
No. of adult men and women/household	2.6	5.8
No. of cattle/household	35	367
No. of smallstock/household	54	252
Percentage of total ranch livestock ownership	10	73
Total no. of workers/household	6.3	11.1
No. of cattle/worker	5	40
No. of LSU/caput	4.3	21.0

[a] S-S = small-scale producers; L-S = large-scale producers.
Source: Grandin (1983).

On average, 37% of the animals in a herd were adult females and 20% were young females more than 1 year old (King et al,1983). Herd composition varied with cattle wealth in that large-scale producers kept more weaned steers (23%) than small-scale producers (16%). These cattle herd structures are characteristic of a subsistence mode of production with milk as the primary output on a year-round basis combined with a high and frequent offtake of male animals to satisfy cash needs.

Large-scale producers had more household members, but because they had far more animals per worker (25 cattle per worker as compared with 5 for small-scale producers), they sent fewer children to school and worked longer hours on livestock management. They benefitted both from economies of scale and from their ability to marshall non-household labour. Whereas each worker of small-scale producer units devoted more than 1 hr/day/LSU, workers of large-scale producer units spent only 0.25 hr/day/LSU.

System output

The output of animal products from the system was measured in two ways. First, cattle and small-stock productivity studies measured reproductive parameters such as cow and calf mortality, growth of offspring and milk offtake for human consumption. Second, household studies determined animal offtake and acquisition, and subsistence consumption of livestock and milk.

The first study produced data which were integrated in a cow production index as shown in Table 2. Because of lower cow and calf mortality, faster calf growth and higher milk offtake, the reproductive efficiency in the northern ranches was 39% higher than in the southern one. Average milk offtake was about 24% of the total lactation yield, if 1 kg of calf growth is equivalent to 9 litres of milk. However, seasonal fluctuations in milk consumption were large,

particularly for the large-scale producers (Table 3). In general this means that the cow–calf operation of Maasai pastoralists produces an annual growth of 20 to 30%, which is higher than the production indices measured in West African pastoral systems which range from 17 to 22% (de Leeuw and Konandreas, 1982).

Table 2. *Productivity indices for the northern and southern group ranches*.

Productivity index	Northern ranches	Southern ranch
Calving (% p. a.)	63	62
Cow survival (% p. a.)	98	90
Calf survival (% p. a.)	95	87
Calf weight at 1 year (kg)	98	90
Cow weight[a] (kg)	240	253
Milk offtake per cow to weaning (kg)[b]	193	172
Productivity per 100kg cow per year[c] (kg)	29	21

[a] Weaning at 7 months.
[b] Cow weight from King et al (1983). [c] Calculation of productivity per 100 kg cow per year taken from Trail and Gregory (1981).
Source: Semenye and de Leeuw (1984).

Table 3. *Milk consumption per adult equivalent for small-scale and large-scale producers in the three ranches studied*.

Producer type	Milk Consumption (litres/adult/day)		
	Wet season	Dry season	Mean
Small-scale	0.84	0.66	0.75
Large-scale	1.75	1.03	1.39
Mean	1.30	0.84	1.07

Source: ILCA (unpublished data).

The components of income derived directly from livestock show marked differences between producers (Table 4). The large-scale producers can afford to increase their herds, as they need proportionally less of their resources for subsistence in spite of their much higher milk and meat consumption (Table 3). Large-scale producers have to sell a smaller proportion of their animals to support their higher levels of expenditure.

Table 4. *Annual income per household from livestock for small-scale and large-scale producers at Olkarkar.*

Income from livestock	Producer type[a]		Total for ranch
	S-S	L-S	
Gross income ('000 Ksh) Of which:	15.2	90.8	1810.2
Herd and flock increase (%)	33	54	45
Livestock sales (%)	26	21	24
Subsistence consumption (%)	41	25	31

[a] S-S = small-scale producers; L-S = large-scale producers.
Source: ILCA (unpublished data).

In the northernmost ranch there was a rise in livestock numbers of 14% p. a., indicating that herds are still expanding even though their numbers have regained the levels recorded before the 1976 drought (Njoka,1979). In the southern ranch cattle numbers dropped by 2 to 5% because of a minor drought during 1982.

Little milk was sold: most was consumed by the household. If income from livestock sales and home consumption of meat are taken at market value and combined, they account for half of the total income; the other half consists of milk consumed by the household.

Output of land

The determination of the output of a pastoral system per unit area of land is usually difficult because of the mobility of stock and people in semi-arid environments. However, on the northernmost ranch studied the members rely almost entirely on its fixed land area. For this ranch the total livestock output was 29 kg/ha of which 11 kg/ha was `real' offtake by sales and slaughter (Table 5). Since the stocking rate during the period 1981 to 1983 averaged 80 kg LW/ha, real offtake was close to 14% of the total biomass. Gross income from livestock products was equivalent to Ksh 176/ha (US$ 13.5/ha).

Table 5. *Annual productivity per ha on the Olkarkar ranch.*

Source	Productivity	
	kg/ha/year	Ksh/ha/year
Increase in herd	17.6	79
Livestock sales	9.3	42
Subsistence slaughter	1.8	8
Total livestock[a]	28.7	129
Subsistence milk[b]	14.8	47
Total productivity per ha		176

[a] LW price/kg = Ksh 4.50
[b] Milk price/kg = Ksh 3.20
Source: ILCA (unpublished data).

This output is difficult to compare with that from other livestock enterprises such as commercial ranches, which usually consist of a mixed cow-calf enterprise and fattening of purchased steers (Semenye and Chabari, 1980). However, in this case a comparison is worthwhile with a commercial cow–calf ranch in the Athi Plains of Kenya, where the climate and range conditions are similar to those of the group ranches (McDowell et al,1983). This ranch was planned to be stocked at 3.6 ha/LSU for a herd consisting of 600 Boran cows producing an offtake of steers, surplus heifers and culled cows. Expected gross output was calculated at 25 kg LW/ha or Ksh 178 (at Ksh 7/kg) while costs were Ksh 143/ha, leaving a net revenue of Ksh 35/ha. This comparison shows that the Maasai productivity is similar to that of a commercial ranch, but production is at a much lower cash cost, household labour being the major input. Actual cash expenditure amounted to only Ksh 12.4/ha, of which 55% was used for the purchase of drugs and animal health care, while the remainder was spent on the acquisition of livestock.

Discussion

This analysis has shown that in spite of over a decade of development efforts aimed at commercialisation, the production strategies of the Maasai pastoralists are still geared primarily to satisfying their subsistence needs with a relatively low level of market offtake (Tables 4 and 5). However, distinct trends in management patterns have emerged recently which point to accelerated changes in traditional production goals. These are:

A much greater reliance on purchased grain in the diet, particularly during the dry seasons when subsistence milk is in short supply (cf. Table 3);

Contraction of grazing orbits within ranch boundaries and an increasing reluctance to grant grazing rights to non-ranch members; and

A trend towards privatisation of grazing land and watering facilities, particularly by the large-scale producers. Claims to exclusive grazing rights in reserved grazing areas for calves and smallstock have become recognized, while investment in private water pipelines is increasing.

However, contrary to developments elsewhere in Africa (e.g. Botswana), a difference in producer goals between smallscale and large-scale producers is not yet apparent. Although differences in livestock wealth have become more pronounced with time, large-scale producers are no more commercialised than smallscale producers (cf. Table 4). The question of whether this is due to a lack of alternative investment possibilities or is linked to low livestock prices in Kenya needs further analysis.

It is difficult to ascertain whether the land tenure reform through the creation of group ranches has led to better resource utilisation. At present herds and flocks are increasing in size, the few largest producers increasing their share of ranch resource use. If there is an irreversible trend towards further privatisation of land use, a major question will be how group resources are shared among group ranch members. If each producer is allotted an equal share of the ranch territory (i.e. 250 to 600 ha per household), a redistribution and possibly a reduction in total livestock holding may result as the large-scale producers are forced to invest in the purchase of land or grazing rights and therefore must increase their offtake, at least temporarily. If, on the

contrary, the land is subdivided according to family size or stock wealth (which are highly correlated with one another), the process will force out the small-scale producers and will concentrate resource management and allocation in the hands of a few large-scale producers. In the long term both scenarios may lead to a more balanced and conservative use of grazing resources at the expense of small-scale producers.

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