

A / SOCIO-ECONOMIC ANALYSIS OF
SMALL-HOLDER CATTLE PRODUCERS
IN KWAZULU

BY
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I declare that: A Socio-Economic Analysis of Small-holder Cattle Producers in KwaZulu is my own work, that all the sources used or quoted have been indicated and acknowledged by means of complete references, and that this thesis was not previously submitted by me for a degree at another university

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SUMMARY

A Socio-Economic analysis of Small-holder Cattle Producers in KwaZulu

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Summary: In common with most of sub-Saharan Africa, the KwaZulu grazing resources are held to be overstocked and degraded, and the values of the off-take parameters for the herd are low. These two problems were the origin of the study, and are typical of the common property problem, although the theory suggests that it is better described as an assurance or game theory case. To provide data, a total of 444 respondents was interviewed using schedules and the data were rounded off by a series of structured meetings with both groups of farmers and knowledgeable informants.

Analysis of the data was hampered by the paucity of values in the variables being measured. By aggregating the data into four groups based on herd size it was possible to use the Chi-squared test to determine the probability of an animal, or owner, being involved in a transaction. The analysis showed that transaction activity was proportionately greater in the smaller herds than the larger; that smaller herds tended to grow more rapidly than larger; and that sales was a minor use of cattle, the major uses being home-slaughter and lobolo exchanges. The most important product according to the owners was milk. At the present stocking rate the herd is at least as productive as it would be, if operated at recommended stocking rates, according to an appropriate ranching regime. There is evidence that cash, where it is available, is being substituted either directly or indirectly for cattle in traditional functions.

The grazing resource is not threatened by imminent ecological collapse, and soil erosion as a consequence of overgrazing is not as serious as is commonly assumed. This together with the already high value of products supplied to the cattle owning communities suggests that drastic, externally induced interventions such as changes in land tenure cannot be justified. Low key incremental improvements in output based on technology change will provide the inducement for institutional change which would facilitate larger shifts in the long term.

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CHAPTER 1

INTRODUCTION

s-Ehla ngesilulu; sa-Landela iziNtete

Anonymous

1949

1.1 The origin of the Zulu people

This study is about the relationships between the Zulu people and their cattle. The Zulu are a segment of the Nguni group, whose origin, and time and manner of arrival on the south-east African littoral remain unknown. The enigmatic statement above, given to Bryant (1949) by one of the Nguni clans as a statement of origin, is a sample of the known history of the group. Bryant (1949: 20) translates it as "We came down on account of the grain baskets; following behind the locusts". He believes it applies to a relatively minor migration of one clan from the region of present-day Botswana to KwaZulu, but beyond this can interpret the statement no further. Relying on oral history from Zulu informants and on his own interpretation of linguistic and other evidence, Bryant (1949: 1-69) believed that the forebears of the present Zulu people, accompanied by their distinctive cattle, began a major migration from the vicinity of Lake Tanganyika in about 1450 A.D. The group, numbering about 100 strong, proceeded southwards by way of the east shore of Lake Tanganyika, through present day Malawi and Zambia and around the headwaters of the Zambesi. They arrived there in about 1500, by now 300 strong, and between 1500 and 1550 settled in the area of what is now Botswana, and the Transvaal. By 1589, the Portuguese reported that the area from Delagoa Bay to the Cape was occupied by Nguni clans, carrying the same names and in approximately the same areas as they now inhabit (Bryant, 1949: 13). Part of Bryant's evidence is the pattern of occurrence of Nguni cattle "of the short-horned type, smaller in size and infinitely more graceful

..." than the long-horned type occurring in the southern part of Africa. They were found by Livingstone south of the Zambesi at Victoria Falls, on the upper Okavango, the Kafue and the Congo, "right along what we imagine must have been the ancient Nguni line of march" (Bryant, 1949: 37). He notes that, because of tsetse and climatic factors, this is the only route along which the migrating Nguni could have moved their cattle - they could hardly have left them behind, since the Nkulunkulu (God) had provided them to the Nguni as food, clothing and currency (Bryant, 1949: 36).

Regrettably, Bryant's appealing synthesis has not survived archaeology and modern interpretation of linguistics. His and other contemporary theories on Nguni origin were dismissed by van Warmelo (1974: 61) as fanciful and not worth repeating though he himself offers no improved version. Later workers using archaeological, linguistic and pottery evidence have difficulty in synthesising an unarguable origin for the Nguni, based on migration from the north. Ehret (1974) quoted by Inskip (1979: 123) showed that based on linguistic evidence, cattle and sheep had been introduced to central and southern Africa by a people speaking a Central Sudanic Language, prior to the spread of Bantu-speakers to the area. It seems clear that Bantu-speaking Early Iron Age farmers were well distributed in the area between the eastern escarpment and the sea by the end of the third century A.D., much earlier than Bryant's (1949) proposition (Maylam, 1986: 3-6). They had cattle and sheep, although the cattle apparently did not play a major role in the economy. By the Late Iron Age (1000 to 1200 A.D.) Bantu-speaking farmers had spread up to the highveld, and cattle had become numerous and an important part of the economy. (Maylam, 1986: 9-17, Inskip, 1974: 134). The causal mechanism for this spread cannot be established but Inskip (1979: 134) has suggested that the introduction of milking and the increase in productivity resulting could have led to a change in attitudes among the owners. Given a motivation to hold cattle, and their capacity to

increase in numbers at a rate greater than the owners, dispersal in search of more land might have become a necessity forced upon the Late Iron Age people.

While evidence for continuity between the Late Iron Age Bantu-speakers and the modern inhabitants is overwhelming (Maylam, 1986: 16), there is an hiatus between the Early and Late Iron Age which makes continuity over this period less certain (Maylam, 1986: 9). Early Iron Age Bantu-speaking farmers cannot therefore be shown to be the progenitors of the modern Nguni tribes. Modern science can make no more explicit a statement than Bryant's unknown informant, nor does it tender an explanation for the long-established occurrence of the distinctive Nguni cattle along what Bryant (1949: 37) terms the Nguni line of march. The cattle are of a type so characteristic and persistent, that 16th century Portuguese descriptions of animals found on both the west and east coasts of Africa are unmistakably of Nguni cattle, and an illustration referred to by Inskeep (1949: 134) as a clay figurine of an ox dating from the Late Iron Age, could have been modelled on a modern Nguni bull.

The modern day cattle of KwaZulu are, as may be expected, variable as to both type and origin. Most of the exotic breeds imported from Europe, America and the East have had an influence in various parts of the region, but the original indigenous animal, called in Zululand the Nguni, still occurs, in some pockets in a fairly unadulterated form. Since the breed is held to represent a valuable genetic resource (Oliver, quoted by Hundleby et al, 1986: Brown, 1959: 285; Bonsma et al, 1950: 12-15) it is worth looking briefly at its origin and characteristics.

The Nguni is held to be a short-horned variant of the Sanga group, which is found in a broad band down Africa, south from the origin of the Nile to the south-eastern littoral of southern Africa. It has been described in similar terms since the

earliest Portuguese contact on the east coast in the 16th century. Archeological evidence suggests that the cattle of the Early Iron Age people (300 A.D.) were similar in form to the contemporary animal.

The principle characteristics of the breed are its small size, distinctive colour pattern, pronounced dairy type and its variability. The latter characteristic may be anticipated from the fact that despite its long history, there has not until recently been any attempt to systematically improve and fix the type. In regard to size, typical body mass for cows varies between 200 and 450 kg, and for bulls 320 to 600kg (Bonsma et al, 1950: 12; Brown, 1959: 283; Maule, 1973: 113). Illustrations provided by the latter two authors and Hundleby et al (1986) show the very distinctive colour pattern - panels varying from light brown through red to black on the flanks, and a clear white top and bottom line. The functional dairy type of the animal has been remarked on by Bonsma et al (1950: 13), Brown (1959: 283) and Maule (1971: 111). The importance of this observation lies in the fact that this physiological form is a result of centuries of natural selection under the pressure imposed by the owners' usage of the animal, primarily as a milk rather than a meat producer (Bonsma et al, 1950: 13). This will feature again in later sections when the utility of the animal to the owner is being considered.

The balance of this chapter will provide background in the form of a comparative description of contemporary KwaZulu, that part of the southern African region specifically owned and occupied by the Zulu people. Some data will be analysed which describe the problem of cattle owning in KwaZulu, and the origin of this study.

1.2 Land areas of KwaZulu

Politically, KwaZulu is a self-governing territory within the southern African group of states. The land areas now known as KwaZulu have been in roughly their present form since the mid 19th century. Up until 1897 the Tugela River was the northern boundary of the Colony of Natal, while north of the river lay the Independent Kingdom of Zululand, and British Tongaland. Following the Zulu War of 1897 Zululand and Tongaland were annexed to the Colony of Natal. A Commission was appointed, which demarcated ten areas comprising 1,57 million hectares as reserves for Zulus, and 1,06 million hectares for occupation by White settlers.

The origin of the Zulu-occupied area south of the Tugela was the Natal Native Commission of 1846/47 which was appointed to make recommendations to accommodate an estimated 100 000 Zulus returning to Natal after the death of Shaka and the end of the Mfecane. The Commission acted on the principle of the division of land between Black and White and allocated 10 parcels of land in Natal for the use of Zulus. Each area was to accommodate 10 000 people, on the basis of 40 hectares of land per family (Thorrington-Smith et al, 1978: 6).

The next major action was the passing of the Native Land Trust and Land Bill of 1936 which created the South African Native Trust, which in turn absorbed the Natal Native Trust and Zululand Native Trust (Buthelezi Commission Report, 1982: 59). The South African Native Trust was empowered to purchase additional land for allocation to Blacks. Its activities, together with those of the previous trusts going back into the last century, resulted in the accumulation, by 1951, of 2 636 677 hectares of land into 48 principal blocks and 157 smaller areas (Thorrington-Smith et al, 1978: 6), which constitute the bulk of present-day KwaZulu.

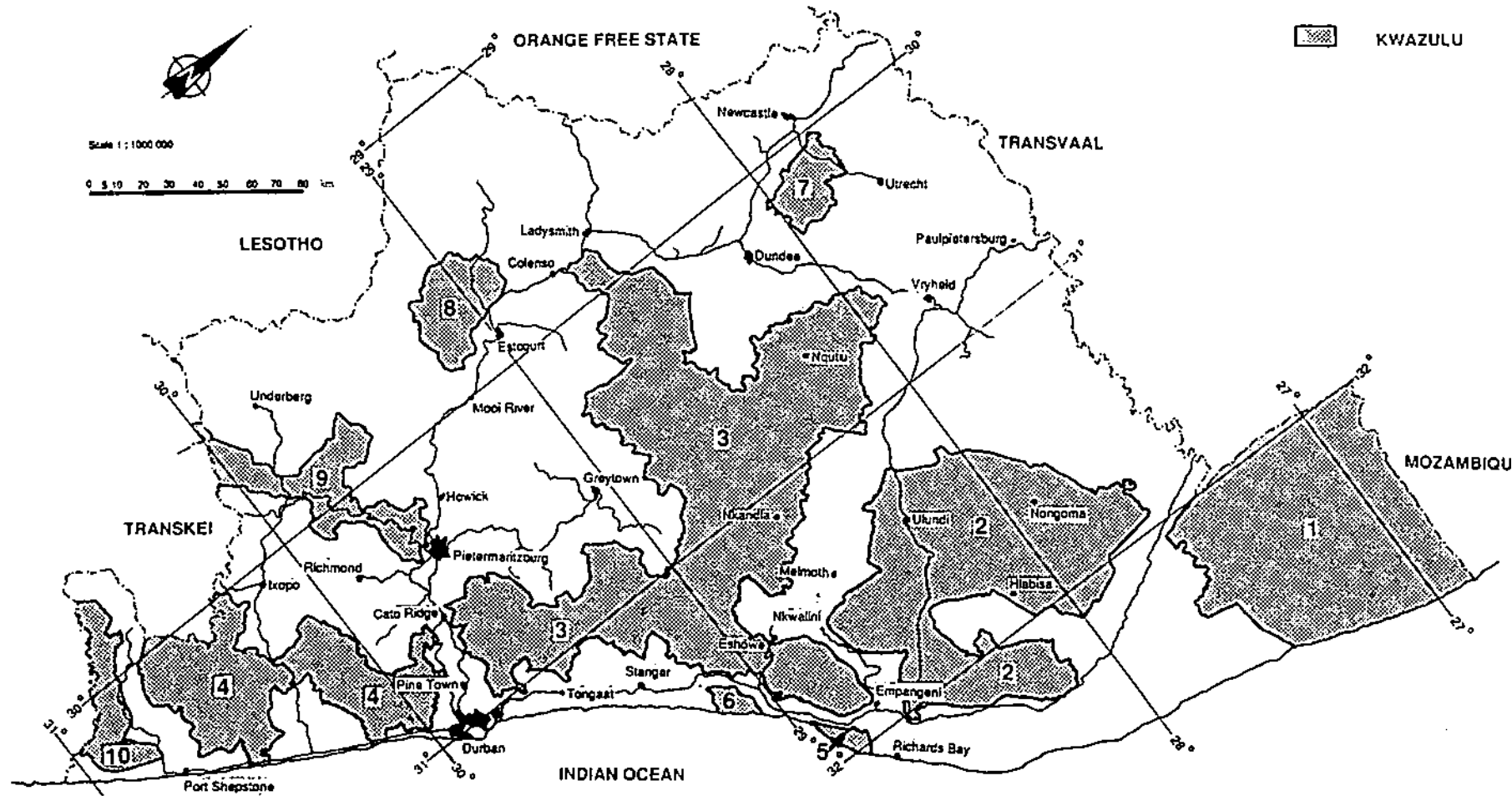
Since that time the Government of the Republic of South Africa has acted to consolidate and increase the land area available to Zulus. At present KwaZulu consists of 10 blocks of land greatly varying in size and totalling 3 316 100 hectares (Thorrington-Smith et al, 1978: 7). These areas are indicated on Map 1 and as described by Thorrington-Smith et al (1978 p.8), "encompass a remarkable diversity of terrain. While the sandy Zululand Plain is flat and featureless, the lower Tugela Valley is a region of stupendous relief and scenic magnificence, where the river has carved out a narrow valley 1 200 metres deep. In the context of Natal, areas in the rain shadow of the Lebombo Mountains are semi-arid, while not far away the Qudeni Plateau, the foothills of the Drakensberg and some of the coastal areas of KwaZulu are among the stretches of South Africa most richly endowed with rainfall. Much of the inland river valleys are steep and stony, clothed in bush and thornveld useful only for extensive grazing or the browsing of goats, but in the forcing climate of the coastal lowlands are fertile soils which can be as productive as any in the sugar belt. The coast is warm or mild throughout the year, but the winters at nTabamhlope and Impendle can be rigorous with snow and frosts. Most of the Homeland consists of traditional rural tribal areas where a subsistence agriculture is practised, but other sections constitute parts of metropolitan regions carrying substantial populations at urban densities, whose residents work in complex and sophisticated industrial and commercial organisations".

1.3 Livestock potential of KwaZulu

In terms of agriculture, and particularly livestock, KwaZulu is a region of high potential. While therefore, sedentary agro-pastoralism is the predominant form of livestock production in the territory, this is not a result of the dictates of ecological conditions, as is the case in the more typical Sub-saharan pastoral countries.

MAP 1

KWAZULU IN THE CONTEXT OF NATAL



In a comprehensive report published in 1980, the Department of Agriculture of KwaZulu (KDA) described and quantified the agricultural potential of the country. In doing so it made use of Phillips' (1973) system of bio-climatic regions, which is a widely-used inventory describing the agricultural potential of both Natal and KwaZulu. Phillips (1973) demarcated 35 sub-regions "of significant climatic and biological affinity" and grouped them into 11 Bioclimatic Regions, of which 10 occur in KwaZulu. KDA (1980: 30) has taken the Bioclimatic Region as being synonymous to a Homogeneous Farming Area, for the purpose of estimating and quantifying the agricultural potential of KwaZulu. The results are summarised in the report, in a series of tables and figures from which the information presented below is extracted.

In Table 1.1 the bioclimatic regions have been grouped into the categories High, Medium and Low potential based primarily on rainfall, evaporation and soil type.

Table 1.1 Area of high, medium and low potential in KwaZulu

Potential	Bioclimatic Region	Rainfall mm	area ha	Percent of KwaZulu
High	1-4	>920	1 333 083	40,2
Medium	6,8	750-900	480 317	17,5
Low	7,9-11	450-750	1 402 710	42,3
Total			3 216 110	100,0

Source: KDA (1980) Tables 4 and 14

Perspective on these descriptions can be gained by comparison with the rest of Africa. Pratt (1984: 34) provides a table of the principle livestock zones of Tropical Africa. By his criteria, the "low" potential zone of Table 1 would be described as "arid rangeland" with 250 to 750 mm annual rainfall. The land-use recommended is "Pastoralism and localised ranching and cultivation often with wildlife". The "medium" and "high" potential zones would fall into his "Semi-arid and sub-humid

lowlands of agricultural potential" with 750 to 1 250 mm annual rainfall. The land-use for this zone is "Crop and livestock production with much of the sub-humid zone only lightly used". Allowing for the greater evaporative deficit occurring in the tropics, this land-use pattern equates closely to that recommended for KwaZulu for similar rainfall zones.

The KDA provides the following breakdown of potential land-use for KwaZulu.

Table 1.2: Potential land-use by area of land in KwaZulu

Land use	Hectares	Percent of total
Sugar	140 725	4,3
Other cash crops	132 925	4,0
Sub-tropical fruit and vegetables	12 711	0,4
Livestock	2 369 589	71,3
Timber	295 384	9,0
Waste	364 766	11,0
Total	3 316 100	100,0

Source: KDA (1980) Table 16

The proportion of land suitable for agriculture and timber, 18 percent, is high by the standards of southern Africa. The value of potential output was calculated in 1980 terms as "Net Farm Income" for each of these enterprises.

Table 1.3: Potential Net farm income of enterprises of KwaZulu (1980)

Enterprise	Net farm income	Percent of total
Sugar	28 060 656	27,6
Other cash crops	35 212 125	34,6
Sub-tropical fruit and vegetables	6 355 500	6,2
Livestock	23 358 105	22,9
Timber	8 861 520	8,7
Total	101 847 906	100,0

Source: KDA (1980) Table 16

Some 23 percent of the total value of potential net farm income is attributed to livestock, an indication of its importance in the agricultural sector. From the supporting tables, the relative contribution of the various classes of livestock can be calculated. Beef and dairy production accounts for some 80 percent of the total output of livestock. (KDA, 1980: Tables 4 to 12e).

It should be noted that these are "technical" estimates based on relatively modest levels of output from estimated areas of various land capability types. While an effort was made in the report to calculate the incremental capital costs required to achieve these levels, there was, for obvious reasons, no regard paid to the social inhibitions to achieving these levels of output. The figures do serve to indicate at least, that livestock has the potential to make a large contribution to the agricultural economy of KwaZulu, along with an inherently high cropping potential. Further, of the 23 percent which livestock could contribute, 80 percent is attributable to cattle, accounted for by both dairy and beef production in equal proportions. Given the combinations of crops and livestock available, productive mixed livestock and cropping small-holder enterprises are technically feasible over some 60 percent of KwaZulu.

1.3.1 The KwaZulu cattle herd in perspective

To provide perspective on the scope of the cattle industry in KwaZulu, this section compares the KwaZulu cattle herd with those of some of its near neighbours, on the basis of inventory. South Africa and its subsidiary territories together with its close neighbours Angola, Namibia, Lesotho, Swaziland, Mocambique, Malawi, Zimbabwe, and Botswana are joint members of the Southern African Regional Commission for the Conservation and Utilisation of the Soil (SARCCUS). The region formed by these countries provides a useful framework within which to consider the cattle population of KwaZulu.

In 1982 the SARCCUS region contained 29,4 million head of cattle, of which South Africa and its national states accounted for 12,2 million or 41,5 percent (Hamburger & Ramsay, 1984: Table 9). KwaZulu had 1,35 million or 11,1 percent of the South African total. The holdings of the individual constituent countries of SARCCUS are provided in Table 1.4 for comparison with African and World figures.

Table 1.4: Comparison of cattle inventories in SARCCUS territories with African and World figures (1981)

Country	Number ('000)	Percent
Angola	3 250	11,1
Botswana	3 000	10,2
Lesotho	562	1,9
Malawi	880	3,0
Mocambique	1 430	4,9
RSA White areas (1)	8 400	28,6
National States, exc. KwaZulu (1)	2 450	8,3
KwaZulu (2)	1 350	4,6
Namibia	1 800	6,1
Swaziland	675	2,3
Zimbabwe	5 600	19,0
SARCCUS Region	29 397	100,0
Africa	173 387	
World	1 226 432	

Source: Hamburger and Ramsay (1984) Table 9, except for:

1. Abstract of Agricultural Statistics 1984
2. Annual Report Director of Veterinary Services KwaZulu 1982/83

The size of the KwaZulu cattle herd is significant in relation to the herd sizes of other SARCCUS countries and larger than some in independent states. Informative comparison can also be made with statistics for "sub-Saharan" countries. In their Appendix 5, Simpson & Evangelou (1984) present data for 39 sub-Saharan countries classified into:

Low income, semi arid
 Low income, other
 Middle income, oil importers
 Oil exporters

KwaZulu fits best environmentally into the groups comprising "low income, other", and "middle income, oil importers". Cattle inventories for these countries, KwaZulu and South Africa are presented in Appendix 1.

The cattle inventory for KwaZulu exceeds that of fifteen of the countries listed in this appendix and nineteen of the full list of 39 sub-Saharan countries. Thus, while not featuring as one of the major cattle keeping countries of Africa, KwaZulu nonetheless has a significant herd by sub-Saharan African Standards.

1.4 The origin of the study

The problem described in this section is that perceived by the administrators and advisors who originated the study. It is not, it turns out, the problem of the Zulu cattle owner, which is quite different, and which only became manifest as the study progressed. The recognition that two separate problem sets exist and that they need to be reconciled, is critical to the future of the cattle industry in KwaZulu and will be addressed in detail in later sections of the study. At this stage only the administrators', or what has been called the "planners'" problem is considered. It is aptly described in a Natal Regional Survey report, where Brookes and Hurwitz (1957) wrote: "Despite attempts to check the evils of overstocking and mixed breeding, the tendency to maintain stock at starvation point has continued and many have died through disease and drought. The future prosperity of the reserves depends as much upon the improvement of stock through better breeding and feeding as upon the fight against disease, overgrazing and erosion. Measures taken by the Native Affairs Department, such as fencing, improving of breeds by 'bull and ram camps', compulsory destocking, public sales of cattle, veld management schemes and the eradication of diseases, have had little effect in either reducing stock or improving the veld."

The same themes have recurred in statements over a long period and from a wide range of commentators. Thorrrington-Smith et al (1978: 93) describe KwaZulu as areas where "tribal/traditional men 'pumula' (rest), where women scratch at the soil, where 'wealth' in the form of cattle accumulates to the point of bringing the veld to a state near disaster". KDA (1980: 85) held that "Livestock are generally regarded as a store of wealth and a medium of exchange. The annual growth rate of the herd is minimal but current overstocking is of the order of 100% with an associated mortality rate of 10%. There is practically no 'market' offtake from the herd, ... Under present conditions the offtake from the tribal herd will remain dismally low and can only be described as a tragic waste of natural resources". The Buthelezi Commission (1982: 171, Vol II) recommended that "attempts should be made to change the attitude of the tribal people towards cattle so that they are seen as a productive resource rather than as a store of wealth". Mention is also made of "the fact that so many cattle die each winter".

The position of the KwaZulu Government is provided in the annual policy statements of the Minister of Agriculture. In 1977, the aims of the Department were defined as "to conserve our natural resources in order to increase production from our crops and livestock". (KwaZulu Government, 1977). In addition to this declared intent to conserve resources and increase output, the Minister between 1977 and 1982, repeatedly exhorted farmers to decrease livestock to relieve overgrazing, commenting in 1980 that "The only solution is to decrease our livestock population, introduce scientific grazing methods and upgrade the remaining livestock" (KwaZulu Government, 1980).

The perceived problem is quite clear from these statements:

1. The productivity of the national herd of KwaZulu, defined as recorded formal market sales, is unacceptably low. (In addition mortality is unacceptably high).

2. The grazing resource of KwaZulu is carrying probably twice the recommended number of livestock and is as a consequence degrading, with attendant losses of soil from erosion.

The dimensions of the first of these problems can be gained from the statistics published in the Annual Reports of the Director of Veterinary Services. Although the time series of total inventory can be extended back to 1969 by recourse to the records of the State Veterinarian for Natal, under whose jurisdiction the KwaZulu herd fell at that time, sales figures from KwaZulu are available only from 1974/75, the year after the self-governing KwaZulu administration took control. In 1973/74 there is an hiatus as no records were kept by either department during the handover period.

Table 1.5: Herd inventory, formal sales and mortality for KwaZulu - 1974/75 to 1983/84.

Year	Inventory	Sales		Mortality	
		No	Percent	No	Percent
1974/75	1 272 954	12 994	1,0	127 766	10,0
1975/76	1 311 845	9 749	0,7	N/A	
1976/77	1 348 841	9 606	0,7	156 377	11,6
1977/78	1 424 690	8 615	0,6	98 271	6,9
1978/79	1 430 548	8 060	0,6	111 923	7,8
1979/80	1 467 531	16 945	1,2	97 462	6,6
1980/81	1 357 141	9 634	0,7	154 836	11,4
1981/82	1 350 639	11 729	0,8	72 502	5,4
1982/83	1 447 349	9 048	0,6	67 151	4,6
1983/84	1 351 855	13 364	1,0	140 518	10,4
1984/85	1 343 641	5 862	0,4	63 932	4,7
1985/86	1 416 634	8 745	0,7	70 546	5,3
1986/87	1 483 104	8 201	0,6	67 248	4,7
1987/88	1 515 543	14 595	1,0	77 134	5,2
Mean	1 391 451	10 510	0,8	100 436	7,2

Source: KDA - Director of Veterinary Services Annual Reports

The low recorded offtake level, reaching 1,0 percent in only 4 out of 14 years, and the high mortality rate exceeding the

offtake by 6 to 16 times in any given year represent a loss of welfare which is a legitimate source of the planners concern. By the standards of other countries in Africa the sales figures are indeed low. The Department of Agriculture for South Africa (1984 Table 59) shows that for the years 1980/81 to 1982/83 the average offtake, estimated as slaughterings at abattoirs, was 27,3 percent. This was for all cattle, both beef and dairy. The Department of Agriculture, Natal Region (1983 Table 40263) provides an income and cost budget for a 100 cow herd, in which sales can be calculated as 29,7 percent of average stock holding through the year and mortality at 1,7 percent.

For the other South African National regions, under systems more comparable to KwaZulu, Colvin (1983: Table 3.2) has reported the following offtakes:

Country	Offtake percent
Lebowa	4,6
Bophuthatswana	3,9
Ciskei	3,3
Transkei	0,2

Simpson and Evangelou (1980: 367) show that in the 39 sub-Saharan African countries in 1980, slaughterings amounted to 10,1 percent from 147 million head, and beef production per head amounted to 13,2 kg. A crude estimate based on available data from KwaZulu indicates that sales offtake there represents about 1,75 kg of beef per head. In monetary terms, Crotty (1983: 5) calculated that output per head for KwaZulu was R11,20 and for South Africa R133,37. In respect of the national economy, raising beef output in KwaZulu to the equivalent of that in South Africa would more than double KwaZulu's total agricultural output. By conventional standards therefore the productivity of the herd is low, and the implied loss of revenue is a legitimate concern of the state.

On the second part, the issue of over-grazing, the problem statement suffers from a degree of internal inconsistency. For example, KDA (1980: Table 1) provided an estimate of carrying capacity from natural grazing of 464 740 LSU (Large Stock Unit - equivalent to one bovine of 450 kg mass). Colvin (1983 Table 1) provides estimates of livestock populations indicating that between 1957 and 1981 the Total LSU in KwaZulu fluctuated between 1 463 000 and 1 581 000. This implies, on the base of the KDA (1980) estimate of carrying capacity, overstocking by a factor 3,1 to 3,4. Colvin's own estimates of overstocking however vary from only 21 percent to 34 percent in contrast. This in turn implies a carrying capacity of some 1 237 000, or 2,6 times higher than the KDA estimate. Since Colvin (1983: 4) based his calculation on an estimate made by KDA in 1972, the scale of variation in estimates even within one institution over time, raises questions on the underlying data which are the basis of the concern.

There is nonetheless a deeply felt anxiety over the degraded condition of the grazing resource, and the fact that degradation is continuing. It is self-evident that "the largest portion of KwaZulu is only suitable for grazing" (KDA, 1980: 19), and the asset value of the cattle using the resource represents the largest accumulation of capital owned by the Zulu farmer. If therefore the reported degradation is real, and the effects likely to be permanent, the sustainability of the livestock industry is at risk. The potential welfare loss involved gives substance to the demand for the study.

In summary then, the problems are the "dismally" low offtake from the Zulu national herd, and the environmental degradation being caused by the excess of stock numbers over the maximum sustained carrying capacity of the country. The first of these is interpreted as the system delivering less than the potential welfare possible, and the second as the sustainability of the system itself being under threat. This study was formulated

therefore as an investigation to gain information which would assist in the formulation of policy directed at addressing both these issues.

1.4.1 Research objectives

The mortality and sales rates reflected in Table 1.5 are significant information in determining the research objectives. External parasites and diseases are controlled in KwaZulu by state intervention, and no major outbreaks of disease were recorded in the annual reports of the Director of Veterinary Services for the fourteen years ending 1987/88. It can be argued therefore that the prime cause of mortality was malnutrition caused either by advancing age or drought conditions, evidence for which can be found in the higher rates of mortality occurring in drought years.

The mortality rate being some six to sixteen times the sale rate imputes to the owner a preference to hold cattle off the commercial market, in other words to retain them even in the face of a high probability of loss through mortality. Uys et al (1985) have shown that the low offtake is an outcome of the owner's decision and not simply a function of the stocking rate. Even within land/cattle ratios substantial increases in offtake can be achieved by altering disposal decisions and herd structure. It is reasonable to assume therefore, that the low recorded offtake is the outcome of producer decisions to withhold cattle from the formal market. In none of the documents referenced above was there any recognition of the fact that the Zulu cattle owner may have specific objectives in owning cattle and that he might therefore have his own problem set. He has, by default, been attributed the desire to increase stock turnover and thereby commercialise his herd, thus increasing his own and national welfare. The history of failed exhortations to this effect, however, indicate that he may have a different agenda for his cattle.

It seems likely that an improved understanding of his behaviour could be found in an analysis of the objective function of the cattle owner, and in the constraints which limit his achievement of this objective. Given this understanding, policy formulation to overcome the problem could be expected to be more directed at real problems and therefore more likely to achieve the hoped-for outcome. To contribute to this understanding the research objectives were defined as:

1. To investigate the socio-economic role of cattle in the Zulu household.
2. To identify the factors inhibiting the realisation of the potential of cattle to improve welfare in the rural areas.
3. From this to define guidelines to policy formulation which would not only optimise welfare but secure the sustainability of the system.

1.5 Outline of thesis

Given that the approach to the problem was based on analysing the underlying motivations of the cattle owner and the constraints which inhibit him in achieving his objectives, it was appropriate to place the investigation in the framework of farm systems research (FSR). Norman's (1983) methodology, explained more fully in Chapter 2, was used in planning and conducting the research programme, and it is a useful device to structure the dissertation loosely on the FSR framework. Briefly, FSR makes the farmer and his objective function the centre of the research, and systematically investigates the constraints which may be inhibiting him from attaining his objectives. The constraints are grouped into two broad categories, the Technical and Human elements, and these in turn are subdivided into various factors which are assessed to determine the degree to which they afflict the farmer in achieving his ambitions.

Following the next chapter therefore, which describes the background in which the study is placed, Chapter 3 will lay out the research programme and Chapters 4 and 5 will examine two components of the Technical element, the grazing system which is the basis of any cattle industry in southern Africa, and the productive performance of the herd. Moving into the Human element, Chapter 6 will examine some of the influences of management decisions applied to the herd and Chapter 7 will analyse the effect of community and cultural norms on consumption patterns. Chapter 8 will examine the external institutions which affect output, principally the extent to which policy and policy instruments are in place to promote cattle production. Chapter 9 will suggest a future approach to the promotion of the cattle industry, based on the outcome of the study, and Chapter 10 will provide a summary and conclusions of the study.

CHAPTER 2

BACKGROUND TO THE STUDY

The persistence of native cattle holding on a religious rather than an economic basis, is no doubt no more stupid than certain attitudes towards gold until recently cherished in the City of London and elsewhere, but it is even more hampering to economic development, because religious cattle cumber and overstock the earth, while religious gold is buried in bank vaults where it is at any rate kept out of the way.

Franklin
1948

2.1 The "African cattle problem" and KwaZulu

The perception that there is a code of behaviour towards cattle which is peculiarly African was already well established in the colonial era, probably long before it was codified by Herskowitz as a "cattle complex" in 1926. It has persisted right through the post-colonial period to the present, as has the conviction that it has produced a syndrome which could be described as the "African cattle problem" - a direct consequence of the cattle complex.

As usually described, the problem has three interlocking components:

1. Grazing land used by sedentary or migrating pastoralists is communal, and therefore usually severely overstocked. This in turn has lead to degradation of the grazing resource to the extent (Hodder, 1968, quoted by Doran et al, 1979: 41) that Africa is now held to be the classical case of a

continent suffering from soil erosion caused by overgrazing. Even allowing for the generalisation, this statement is sufficiently true to give cause for concern, implying as it does the destruction of the major portion of the resource endowment of the countries concerned.

2. The economic offtake from the herds is lower than the potential possible according to both the environment and the genetic base of the livestock. As a consequence neither household nor national welfare is being optimised.
3. The combination of these two conditions presents a threat to sustainability which is intractable if not insoluble. This is on account of the fact that the resource degradation is an outcome of the communal grazing system that the pastoralists practice, and an inherent behaviour pattern peculiar to Africa, the main characteristic of which is a propensity to retain cattle rather than make commercial use of them.

One of the more striking features of this viewpoint is the inseparability of the three components in the analyses presented. In almost every source quoted in this chapter the phrases "store of wealth" and "overgrazing and erosion" occur so frequently together that they become an omnibus expression for the whole very complex and involuted condition. It is one of the objectives of this work to show that there are three independent components of that condition, and it is more instructive and informative to analyse them separately, if constructive solutions in the form of policy guidelines are to emerge. Common property is neither a necessary nor sufficient condition for resource degradation; the store of wealth concept (or whatever synonym is used) is neither a necessary nor sufficient condition for the low offtake observed; the low offtake is neither a necessary nor sufficient condition for overstocking observed.

Drawing on the literature, the balance of this section will consider evidence of the generalised cattle problem; the next will consider a view of cattle in pastoralist societies; the third will review the theory underlying the common property problem; and the last will examine some of the contemporary solutions applied in sub-Saharan Africa.

In broad terms, the low level of productivity of African pastoral resources is indicated by the fact that despite having a quarter of the world's grazing lands, Africa produces only 5 percent of the world's beef and 3 percent of its milk, and that these figures would be proportionately even lower if South Africa and Namibia were excluded (Crotty, 1981: 1). Comments on overgrazing are legion. Fowler (1981: 2) reports a comment by the Morse Commission of 1960 to the effect that in Swaziland, "African livestock is excessive in number and deficient in quality", and reports that overstocking is present in all the physiographic regions. In "normal" times the grazing in South West Zimbabwe is "grossly overstocked" to the extent of twice its estimated carrying capacity and in times of stress at 3 to 4 times its capacity (ARDA, 1982: 17). Performance parameters reflect a low technical efficiency in the herd and mortalities are high. Sales offtake, however, at 10,2 percent of the total cattle herd (ARDA, 1982: 22) is high compared to the figure for the southern African group of countries and is attributed by the authors to the need to sell animals to purchase food. Degradation due to communal grazing is reported as widespread "between the Sahel and Botswana", according to Devitt (1982: 2), a statement which does not suffer from lack of generalisation, and which seems to exonerate the southern African group of countries.

In reference to that group of countries, however, Bembridge (1979: 165; 1980: 68), Kotze, Armstrong and Wiid (1982: 2), Hamburger (1978: 2), Hamburger and Waugh (1968: 30), Hofmeyer (1968: 82) have all commented on the prevalence of overstocking and poor performance from the cattle herd. In KwaZulu, the

Buthelezi Commission Report (1982: 177) and the KwaZulu Government (1980: 18) both argue that overstocking is linked to the tribesman's attachment to cattle. "Unfortunately it is numbers of animals and not the quality which give status to the owner. The result being that the communal grazing is overstocked which results in serious deterioration" (KwaZulu Government 1980: 18). Colvin (1983: 4) estimates that the "standing stocks" of livestock are 25 - 30 percent above the sustainable equilibrium level, and attributes to this the low values of the production parameters for the Zulu cattle herd. Erskine (1982: 19) makes the same pair of statements. Brookes and Hurwitz (1957) provide that one of the earlier references to the evils of overstocking, overgrazing and erosion and linking it to the tribal preferences for quantity rather than quality in cattle.

There are notable exceptions to the view of the "cattle problem" outlined above. Surprisingly the World Bank (1980: 13 and 73) makes only the most fleeting references to cattle or livestock, in reference to the argument that deterioration of grazing is attributable to overgrazing rather than secular changes in climate, and to the fact the tsetse excludes domestic livestock from 10 million hectares of sub-Saharan Africa. To the World Bank, livestock apparently presents neither problem nor opportunity for accelerated development. Similarly Eicher (1982: 153) mentions briefly the problem of tsetse and criticises the World Banks' difficulties in designing sound livestock programmes (Eicher, 1982: 164). Both these omissions are noteworthy, especially considering that only 8 percent of the sub-Saharan surface area of 21,6 million square kilometres is "arable and permanent cropland" (Simpson and Evangelou 1984: 364, Appendix 2).

More positively there are both implicit and explicit denials of the overstocking/low offtake syndrome. Simpson and Evangelou (1984: 1-20) in their overview, do not mention overstocking and erosion, stressing rather the need to expand livestock production

in sub-Saharan Africa. Other contributors to the volume maintain this stance. Pratt (1984: 27) stresses the difficulty of defining even a notion as basic as carrying capacity, and according to McDowell (1984: 44) "The first step in designing a livestock development strategy for Africa is to convince those concerned with environmental deterioration that livestock have not been the major contributor to increased desertification".

Moving from the general to the particular case of KwaZulu, it is held that parts of KwaZulu are seriously, if not in fact irreversibly damaged. On the basis of Phillips (1973) system of classification, Thorrington-Smith, et al (1978: 36) describe Bioclimatic Groups 7 and 10, which comprise some 30 percent of KwaZulu as suffering "some of the worst veld deterioration and soil erosion" in the region. There are denuded areas and "Sheet and gully erosion is serious and bush encroachment spectacular because of local heavy stocking on White farms and long continued rise in numbers of livestock in KwaZulu ...".

In regard to the cause of this degradation, while overstocking may not necessarily be the entire cause, it has to be considered as a contributor. By most technical estimates the country is heavily overstocked. Estimates of the degree of overstocking vary from 25 to 30 percent (Colvin, 1983: 4) to well over 300 percent. This latter can be calculated by using Erskine's (1982: 19) figure of 1,62 million Large Stock Units (LSU's) in KwaZulu in 1979, and comparing it with the KwaZulu Government's (1980: 23 Table 1) estimate of carrying capacity from natural grazing, of 464 740 LSU's. This provides an actual to recommended ratio of 3,49, and even given that the potential provided by cultivated fodder and pastures were realised, the ratio improves only to 2,75. The sheer scale of the overload invites comment and criticism along the lines advanced by Sandford (1983: 13). It will be shown in Chapter 4 that, using stocking rate models developed by grassland scientists, in mathematical terms, stocking rate cannot exceed twice the level at which maximum

sustained yield is achieved. This must bring into question either the estimate of stocking rate, or of carrying capacity, or from Sandford (1983) both.

The foregoing notwithstanding it can reasonably be concluded that firstly degradation of the grazing resource has occurred to some degree on at least 30 percent of the surface area of KwaZulu, and that secondly the total carrying capacity recommended for the country is exceeded by a factor somewhere between 130 and 349 percent. KwaZulu therefore suffers at least two of the three components of "the cattle problem". The third will be examined in the following two sections.

2.2 Role of cattle in a subsistence economy

The concept of the "cattle complex" appears to have been articulated first by Herskovitz (1926). In a series of articles he advanced the notion that while cattle-owning people are distributed all over Africa, a discrete group can be identified in East Africa who are characterised, anthropologically at least, by their attachment to cattle. This attachment differentiated them from, for example, the Bushmen and Hottentots, from the West African culture area, and from the Mohammedan - Arabic cultures to the North.

In Herskovitz's description (1926: 249) "East Africa" includes an area bounded on the West by a line running almost straight from the confluence of the Blue and White in the north to a point close to East London. It extends eastwards to the Indian Ocean coast, except that Ethiopia and the Horn of Africa are excluded. It includes approximately a quarter of Sudan, all of Kenya, Uganda, Tanzania, Malawi, most of Zambia, Zimbabwe, Mocambique and southern Africa, east of a line through Bloemfontein and East London. The zone approximates to the area through which the Southern Nguni are held by Bryant (1949: 36) to have migrated with their cattle. The Southern Nguni group includes the Swazi,

Zulu and Xhosa people whose attitudes to cattle are similar in great detail.

It is Herskowitz's (1926) main thesis to show that the group of tribes he is dealing with can be differentiated by its involvement with cattle. He does this with a wealth of anthropological detail, from the high regard, even affection the people have for their cattle, through the animals' role in warfare, politics, birth, marriage and death ceremonies, reluctance to slaughter, the superiority of cattle owners in contrast to agriculturalists, their role in religion, and in regard to the Zulu particularly, the manner in which they dominate inheritance procedures (Herskowitz, 1926: 270). Throughout his narrative there is however constant reference to the economic value of cattle, and it is surprising that this aspect of his findings has been relatively ignored by contemporary writers, compared to the sometimes critical emphasis placed on his findings in regard to the social role. To various tribes they yield milk, blood, skins, meat, trade items, both for services and goods and means of paying fines. In fact he demonstrates quite clearly that the tribes concerned are materially totally dependent on their cattle. Two typical statements illustrate this. "The Masai love their cattle very much and consider that nothing in the world is of equal value if a man has a cow, which he looks after and tends, it bears and by doing so enables him to live, for he can marry, and have children and become rich." (Herskowitz, 1926: 259 quoting Hollis, undated: 23). In regard to the Zulu he observed "Rev. Dugmore remarked of the kaffirs that their wealth consisted solely in cattle - that every young man strove to obtain them, and that the only pay which they would take from chiefs was cattle, since it was only through the possession of these that they were able to marry and establish themselves." (McLean, 1883: 23, in Herskowitz, 1926: 271). The emphasis has been added in both cases to stress the material and economic dependence on cattle. Having at that time no alternative form of capital, the

establishment of a family was dependent entirely on accumulating enough cattle to support a wife and children. In the circumstances, their obsession with cattle is not surprising.

Herskowitz's (1926) influence on his colleagues was strong. The term "cattle complex" has become widely used (Schneider, 1957: 278) and the concept has become part of the folk-wisdom of administrators and commentators up to today. Schneider (1957) while describing a set of powerful economic values in cattle, still adheres to the cattle complex and reports Gulliver (1951: 16) as believing it should be extended to cover sheep and goats as well. Schneider (1957: 283) differentiates between the subsistence and non-subsistence roles of cattle. Under "Exchange" he notes that cattle are used as a medium of exchange and trade both for "rights in persons" and material goods such as grain. The "rights" obtained in other people have a specifically material value as well as prestige. He cites (Schneider, 1957: 285) "Co-operation in such subsistence acts as house building, herding, cultivation (especially irrigation) and the borrowing of milk grain and other goods ...". Plainly cattle are currency exchanged for goods and services in this case. "Consumption" includes widespread use of milk, blood, and the consumption of the animals themselves, mainly steers. Both ritual slaughter and slaughter directly for consumption is practised and he argues that feasts are spread out to provide a non-wasteful flow of meat. He reports "In the end, however, all animals are consumed, consistent with the maintenance of a reservoir". Schneider (1957, 298) concludes that the subsistence use of cattle is general in East Africa, and occurs in conjunction with the "cattle complex". In fact "An ingenious balance is maintained between the various needs, a balance which seems to make possible an almost complete subsistence exploitation of cattle".

In the southern African region, opinion on the value of cattle to peasant owners can be divided somewhat arbitrarily into three

groups. The "monetary" role for cattle is favoured by Doran, Low Kemp (1979: 42) and reinforced in a later paper by the same authors, (Low, Kemp Doran, 1980: 226). Their work in Swaziland led them to postulate that cattle are held primarily as a store of wealth which is liquidated when cash needs dictate. Thus good agricultural seasons, high employment or increased cattle prices would lead to lower sales rates. Their conclusions have been criticised by Jarvis (1980: 606) on the grounds of aggregation of data and the fact that the commercial grazing system in Swaziland can account for all of the herd characteristics cited by them. Mentis (1984: 20) holds that "livestock here must meet daily needs and are banked wealth measured not in performance of animals but rather in number of beasts". Southey (1981: 43) has the same extreme view as Goldschmidt (1975: 3), that cattle are so closely related to monetary wealth that they could be exchanged for stock certificates and medallions "with a bull, or other appropriate facings" (Southey, 1981: 45), but small enough to be worn around the neck (Goldschmidt, 1975: 3). It is argued that the certificates and medallions will not only become the objects of pride currently bestowed on cattle, but will obtain a status of their own, and be transferrable to cash. It is difficult to reconcile this view of the role of cattle with that of Herskowitz (1926) and Schneider (1957), from whose accounts it appears that the utilities flow from the animal itself, not on abstract representation of ownership - a medallion worn round the neck would appear to be a poor substitute for a cow in milk. This argument will be developed more fully in the final section of this chapter.

The second group favours the "numbers only" role. To Hofmeyer (1968: 82) "numbers are still the primary objective" and for Dankwerts (1981: 208) and Dankwerts and Aucamp (1984) "wealth from pastoral farming is not associated with animal production, but with the number of animals being run A man's status is judged by the number, and not the quality of animals he possesses". Hamburger (1978: 4) also stresses the degree to

which numbers of cattle and not quality or production determine the status of the tribesman. In a narrow sense it could be argued that these writers are correct - numbers are important. It is reasonable however to assert that the origin of this desire for numbers lies in the absolute essentiality of cattle before a family could be established (vide Herskowitz 1926, above). The emphasis on numbers has also been construed as an insurance strategy, in that with periodic losses due to drought, a household owning a large number of cattle would come through better than one with few (Chavunduka, 1976: 399)

The third group favour what could be called "the custom and subsistence" role. Included here are Hamburger and Waugh (1968: 30) Groenewald (1973: 12), Kotze, Armstrong Wiid (1982: 8), van Marle (1973: 35), Bembridge (1978: 7 and 1979: 167) and ARDA (1982: 20). It is of interest that the last author recorded that in the South Gwanda district of Zimbabwe 84 percent of disposal of cattle were by sale, of which 82 percent were sold to satisfy specific cash needs. The commonest need specified was food - 60 percent, followed by school fees - 17 percent.

Among writers on the Zulu scene specifically, most recognise a balance between the economic or material role of cattle and their spiritual significance. "Of all the activities which are considered the special sphere of men, the most important in the tribal economy is certainly the rearing and care of cattle. Cattle provide meat and amasi, the mainstay of the Zulu diet, as well as hides for shields and for clothing, while the wealth of a man is always reckoned in cattle, since it is with cattle⁷ that he must acquire wives for himself and his sons, and pay doctor's fees when there is illness in his kraal. Such being the case, it is not surprising to find the greatest case taken of these valuable possessions, the loss of which is the greatest disaster in the eyes of any Zulu" (Krige, 1936: 185, emphasis added). Krige clearly recognises both the currency value of cattle, and the fact that the attachment to cattle arises from their utility,

not an abstract intangible. Reader (1966: 37) adheres to the "quantity not quality" thesis among the Zulu Makhanya tribe. He goes on, however, to provide descriptions of four distinct types of beast given by his informants, based on their milking ability, and follows with the contradictory remark that "Milk yield is still not a standard by which most Zulu judge cattle". He describes slaughter procedures and makes the interesting observation that the requirement to slaughter the best available bull for sacrifice has a detrimental effect on the quality of the Makhanya cattle (Reader, 1966: 39).

In regard to the monetary role of cattle, Vilakazi (1962: 117) introduces the concept that money is "slippery" and tends to disappear. Migrant workers are therefore advised to invest it in livestock to secure it. Goldschmidt (1975: 4) advances the same observation by the Sebei - the money he obtains from selling cattle is "consumed" for taxes, school fees or consumption goods. Bonsma, et al (1951: 11) list the values of cattle as the supply of milk and meat, hides, draft power and lobolo, and remark that the most important reason for the excessive numbers of cattle is the fact that their value is measured not in their capacity to supply milk and meat but simply in terms of numbers. No supporting argument is provided for this contradictory statement and which is at odds with the very specific description of the utilities derived from cattle.

Finally the KwaZulu Government (1980: 19) recognised cattle as a "cherished possession" of the Zulu, and their "very important role in the culture and social life of the people". The "numbers not quality" argument is followed and there is neither implicit nor explicit acknowledgement of any subsistence or utility role. To the contrary, the objectives for development stress the disposal of unproductive units to reduce grazing pressure, and the improvement of quality and marketable output.

It was intended in this section to establish firstly the extent and nature of the African cattle problem and its expression in

KwaZulu, and secondly the existence of an internal contradiction in the analyses of this problem. In all cases, whether the author argues from a social/cultural viewpoint or from a store of wealth basis, a number of economic attributes are identified which clearly indicate that cattle have a far wider and more complex function than the respective analysis can justify. If this is recognised at all it tends to be dismissed or relegated to a "black box" type of mysterious behaviour peculiarly attributed to Africa cattle owners. Thus Doran, Low and Kemp (1979: 42) can dismiss cattle as not falling into the category of conventional disposable productive assets, and after dealing with the sales variable, consign them to a store of wealth which it seems only Swazis (or Africans in a broader sense) adhere to.

Examination of the analyses above suggests an alternative paradigm. They are not entirely a store of wealth nor productive assets, nor do these functions completely describe their role. It will be argued in this study that they fall very closely into the category of non-human wealth of consumption theory. That is to say they comprise both tangible assets (equivalent to money, bonds, fixed property etc) and consumer durables. The stream of benefits they deliver is equivalent to the flow of services which constitute the consumption of consumer durables. This paradigm will be developed as an hypothesis in the last section of this chapter. For the present it is sufficient to note that if this view is valid it implies that the value of cattle lies in owning or retaining them. Since it is universally recognised that the value of cattle to African owners is very high, whatever the source, and if the value resides in retaining them, it presents important implications for the proper usage of the range on which they graze. It is conventional wisdom that this range is a common property, open-access resource. The following section, therefore, deals with some of the implications of this syndrome.

2.3 The open-access, common-property resource

The title of this section might appear to be an over-specification of the more usual loose term "communal grazing", but according to Runge (1981: 596) it might be more in the nature of a contradiction in terms. He holds that "As an institution, common property is distinguished from free and open access, where there are no rules regulating individual grazing rights". This point is made at the outset to illustrate a peculiarity of the southern African communal grazing lands. They are common properties, owned by and with access limited to an identifiable group, yet access for that group is free and open and with few effective rules. Much of the classical economic analyses developed for open-access fisheries, is therefore nominally applicable to the tribal grazing land, as will be seen.

Although tentative approaches to the subject of open-access fisheries had been made earlier (eg Graham, 1943) the origin of the body of theory relating to common property resources is the seminal article by Scott Gordon (1954). He initiated the swing in research on fisheries control from biological to economic analysis, most particularly illuminating the weakness of the (biological) "maximum sustained yield" by comparison with "net economic yield" as a criterion for management. There was considerable hostility among fisheries biologists towards yield being measured in money values as late as 1951 (Larkin, 1977: 2). Scott Gordon pointed out the anomaly that despite the fact that optimum economic fishing intensity is less than that which would produce the maximum sustained yield (MSY), fishing levels consistently exceed the MSY level. The essence of his contribution was to attribute this to the fact that fishing-grounds have no identifiable owner and since, therefore, rent cannot be appropriated it is dissipated in excess investment in effort. "In the sea fisheries, the natural resource is not private property; hence the rent it may yield is not capable of being appropriated to anyone. The individual fisherman has no

legal title to a section of ocean bottom. Each fisherman is more or less free to fish wherever he pleases. The result is a pattern of competition among fisherman which culminates in the dissipation of the rent of the intramarginal grounds". (Scott Gordon, 1954: 130). He demonstrates this by using the example of two fishing grounds of differing productivity to which fishermen have equally free access. In this condition, while the extensive margin should be on that ground where average productivity and average cost were equal, the average cost is the same for all fields, and productivity is reduced to equality by competitive exploitation, so that even extra-marginal fields yield no rent. Inevitably "This is why fisherman are not wealthy ... the only fisherman who becomes rich is one who makes a lucky catch or one who participates in a fishery that is put under a form of social control that turns the open resource into property rights". (Scott Gordon, 1954: 132). This is an echo of Graham's (1943: 155) Great Law of Fishing: "Fisheries that are unlimited become unprofitable".

He goes on to indicate the inadequacy of direct control measures through, for example, gear or catch limitations, in improving the condition of fishermen, as long as the competitive situation exists. Further it is doubtful whether these measures achieve their biological objective of protecting or enhancing the fish stock. He concludes (Scott Gordon, 1954: 135) "A factor of production that is valued at nothing in the business calculations of its users will yield nothing in income. Common property natural resources are free goods for the individual and scarce goods for society. Under unregulated private exploitation they can yield no rent; that can be accomplished only by methods which make them private property or public (government) property, in either case subject to a ... directing power".

Scott (1955: 119-124) elaborated Scott Gordons' thesis by arguing that in the short run there would be diminishing returns to each fisherman and that therefore landings would stop short of the

situation where the value of catches equalled their cost. This, being so he argued that the objectives of a sole owner in the short run (one season) would be identical to that of competitive users and the same level of effort would be employed. Only if the sole owner was assured of long run exclusivity of access to the resource would be optimise economically on the degree of effort expended, and this did not necessarily mean operating at below MSY.

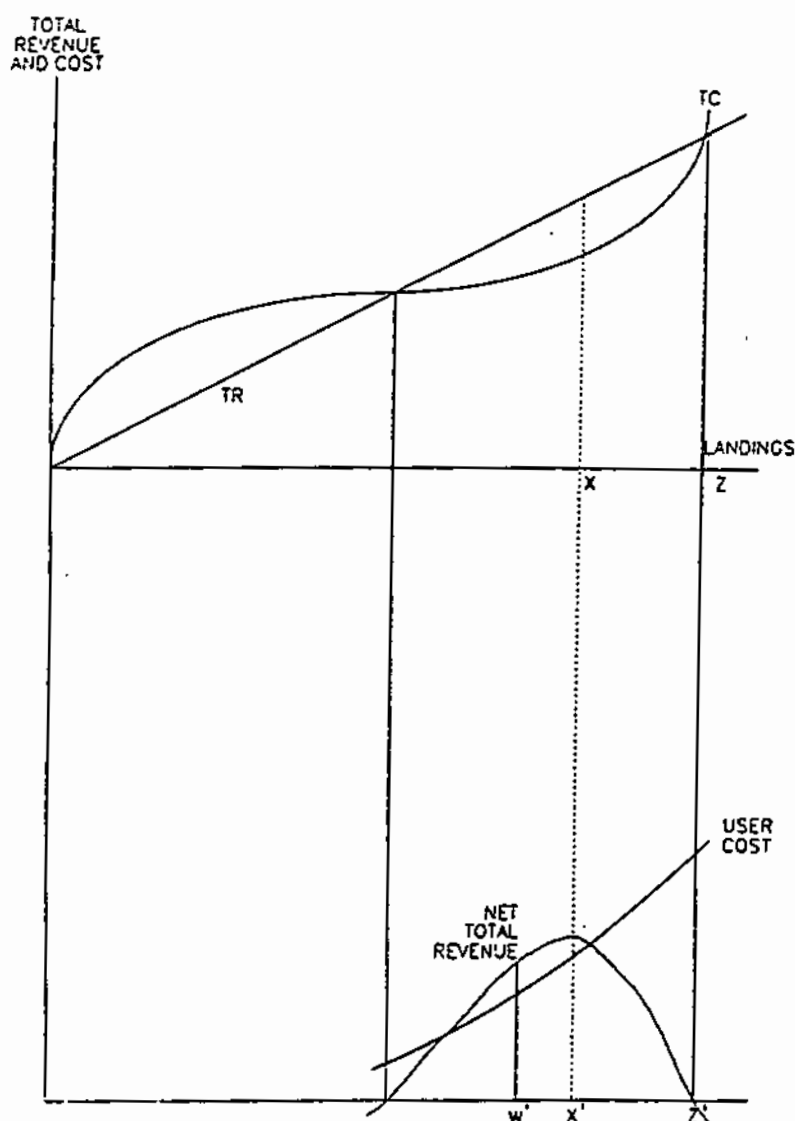


Figure 2.1 Total revenue, costs and user costs in a solely owned fishery

He uses Figure 2.1 to illustrate this, introducing into "user-cost" the concept of rate of time preference of the sole owner. A sole owner's optimising decision will be to maximise net present value of a future stream of landings having regard both for the current rate of discount and for the effect present catches will have on future catches, through their effect on the stock. The higher the discount rate the lower the value of future (lost) catches will be, therefore the lower the "user cost". He introduces the notion that given a high enough discount rate (and therefore a low enough user cost) it would be economically advantageous to deplete the stock, a concept greatly expanded later by Clarke (1973: 630). Should increased present output diminish stocks and therefore future revenues, the user cost curve will slope positively and marginal user cost will equal marginal revenue at a point lower than maximum total net revenue - point w' in Figure 2.1. If increased output should increase future stock the user cost curve will have a negative slope and the output of a sole owner would be situated at a point higher than that indicated for maximum net current return. If present activity had no effect at all on future stocks, there is no user cost and even taking long-run effects into account the point of maximum net revenue, x' in Figure 2.1, is the most profitable. While the latter two conditions may seem unlikely in the light of present knowledge they were not necessarily considered so in the fifties (Scott Gordon, 1954: 127).

Scott Gordon's & Scott's pioneering work caused an upsurge in publications on bionomic models and their applications, mostly elaboration or refinements of the basic theme. (Scott & Southey 1970, Southey 1972, Fullenbaum, Carlson & Bell 1972, Clarke & Munro 1975, Scott 1979, Crutchfield 1979, Moloney & Pearse 1979, Wilen 1979, Andersen 1982, and Koslow 1982 are some examples). Hardin (1968: 1243) in an article mounting a fervent argument in support of birth control succeeded, almost inadvertently it appears, in popularising the concept of "The Tragedy of the Commons" in a spectacular fashion. Apart from this important

achievement Hardin (1968: 1246) introduced the notion that conscience in a competitive situation is self-eliminating according to Darwinian logic, and presented the common-property problem in game theory form, latterly described as "The Prisoners' Dilemma" (Runge, 1981: 595). In this format two prisoners in isolation must make decisions as to whether or not to confess to a jointly committed crime. If neither confesses, both will receive short sentences in prison - 1 year each. If one confesses, turning state evidence, he will get no sentence and the other 10 years. If both confess, both will receive 5 year sentences. The "payoffs" are illustrated in the gain - loss matrix of Table..

Table 2.1 Payoffs in Prisoners' Dilemma

First Prisoner	Second Prisoner	
	Not Confess	Confess
Not confess	(1,1)	(10,0)
Confess	(0,10)	(5,5)

From: Runge, 1981: 597

Patently the most advantageous strategy is for neither prisoner to confess, (1,1). This is however a cooperative strategy and since each prisoner must make his choice independently of the other, it is unstable. To protect himself, not knowing the intentions of the other, each prisoner must confess, giving the (5,5) outcome. This, Runge (1981: 597) refers to as "a Pareto-inferior equilibrium", and is the logical outcome of the N-person prisoners' dilemma of the commons. The individual strategy is strictly dominant. Applied to the commons problem it means that each user will have no incentive to cooperate in stock reduction and agreement to do so would as a consequence be unstable in the absence of enforcement from outside.

Runge (1981: 598) criticises this paradigm on the grounds that, in addition to its non-cooperation assumption, it assumes each

user's costs are separable from other users which they are not, and the assumption of independence excludes recognition of the uncertainty any user has regarding the actions of others. He argues that "uncertainty is the major motivating force in overexploitation of the commons". One user's decision to graze cattle will depend on his expectation of others actions, and therefore the decisions are not independent. This being so the strict dominance of individual strategy no longer holds, and an alternate game structure applies. He offers an interdependent choice format based upon cooperative decision making under a condition of assurance of the action of the other users. Under these rules the game is one of cooperation not conflict, there are two equilibrium points, and there is no incentive to defect. Logically this is valid, but it depends upon assuming away the refusal of the users to cooperate, which seems an overly convenient way of disposing of the problem. In reality it is a strategy which has not yet occurred widely to tribal groups in southern Africa, and attempts to enforce cooperation from outside have been resisted with vigour and occasionally violence.

The attribution of over-exploitation and even extinction to common property and competitive exploitation alone, is challenged by Clark (1973). He demonstrates that even under sole ownership, extinction of a resource rather than exploitation at maximum sustained yield is quite feasible under a policy of economic optimisation. His illustration using the Arctic Blue Whale as an example is simple and appealing. International Whaling Commission scientists estimate that the population of 200 000 blue whales would yield some 6 000 five-year-old whales each year for harvesting. If a whale is worth say \$20 000 the annual income from this source would be some \$120 million. The "capital stock" of 200 000 whales is, however, worth \$4 000 million which at an annual discount rate of say 10 percent would yield \$400 million. Plainly, it is rational to exterminate the whales.

Using the concept of expendable surplus (that portion of the total population which will be harvested immediately) and conservable flow (that portion preserved for future revenue flows) he shows, as did Tisdell (1972) that maximum profit is the sum of revenue from present harvest and the net present value of future revenues. He describes two cases, one where the cost of harvesting the last unit of population exceeds its value and extinction is not feasible, and one where the cost is less than the value of the last unit and extinction is feasible. In both cases as the rate of discount tends to zero so the greater proportion of the population is preserved and rental flows maximised. As the discount rate increases so the exploitation is increased, and the remaining population tends to zero. In the second case, extinction feasible, extinction will occur whenever the discount rate exceeds twice the maximum reproductive potential of the population. It must be noted that this will occur whether the population is exploited competitively or by a sole owner.

There is sufficient contradiction in the foregoing to suggest re-examination of the "givens" in the cattle problem: firstly the propensity to retain cattle may have a far more economic base than tradition suggests; secondly the behaviour of cattle-owners cannot be fully satisfactorily explained by puristic application of classical common property problem and solutions theory; thirdly, not even the universally accepted effect of the problem degradation can be taken as given. With these issues in question an examination of contemporary solutions is useful.

2.4 Proposals for cattle development in sub-Saharan Africa

Given that the traditional African cattle owner places a high value on his cattle (for whatever reason) and that he operates within a common property system which has certain predictable results, it may not be surprising that the image projected by the literature is almost entirely negative. It is so negative, it

invokes some sympathy for Horowitz's (1979: 20) exasperated "portrait" of the African herdsman, derived from development documents. He makes no apology for his caricature, in fact provides extracts to back it up. Apparently, according to the documents, the herdsman's aim is to increase without limit the animals he owns, not as an investment strategy but for prestige; he reacts negatively to the market; he retains male animals beyond the needs of the herd; and has been assisted by modern interventions to increase his herds beyond the carrying capacity of the environment. Furthermore he rapaciously consumes open land, then abandons it in search of new pastures; he avoids the tax collector, medical officer, veterinarian and school teacher and consequently, his existence is miserable. Because he does not own the land, he has no conservation interest, so his grazing practices destroy the desirable species composition; create soil erosion; set fire to the range which reduces the grazing, sterilises the soil, kills nitrogen fixing bacteria, drives out moisture and contributes to drought; and he is only occasionally brought to justice by a drought which reduces his stock and gives the range breathing space.

Horowitz (1979: 24) wonders how a people, practicing so self-destructive an economy based on centuries' old behaviour, could have survived. He concludes: "But the portrait, however persuasive it might appear because of its internal logical consistency and its seeming ability to account for much of what is known, is flawed. Rather than describing the pastoral enterprise, the portrait caricatures it, substituting untested assumption for verifiable hypothesis, rhetoric for analysis, imposing ethnocentric models which project motivations drawn from quite alien environments ... it serves to justify a development posture which, historically has had an exceptionally poor track record, and which has had disastrous, albeit unintended consequences" (Horowitz, 1979: 25).

Horowitz is referring to nomadic pastoralists, but how applicable to KwaZulu could his thesis be? The literature, including Government reports and statements, present the Zulu cattle owner as mindlessly increasing his cattle, failing to utilise his resources efficiently for his own welfare, and in the process destroying the very environment on which his livelihood depends. On the other hand, he has no choice, being the helpless victim of economic forces beyond his control, generated by the circumstances of common-property grazing resources, and a vacuum of institutions which would help him to achieve economic efficiency in his production system.

The Zulu cattle-owner singly or in mass, belies this image. He articulates with precision the values of his system and defends it with vigour. Not only this but he has the institutions in place to sustain it. The economic framework under which he operates is the freest of laissez faire capitalism and should be the envy of those that espouse this system. His production decisions are totally free of both administrative interference and the economic distortions of subsidy or price fixing. The array of markets available to him and his freedom to operate in them exceed those of his contemporary in South Africa. More than this, his benevolent government provides free tick control and inoculation against notifiable diseases.

Horowitz's (1979) portrait is the summation of reasons for most of the interventions listed below. Their appeal in the KwaZulu case can be assumed on the basis of the similarity between his portrait and the official view. Their applicability is less certain - this needs greater insight than that implicit in the official view, to evaluate.

2.4.1 Food and Agricultural Organisation/United Nations Development Programme Kenyan cattle fattening project

Meyn (1970: 174) notes that feedlotting had recently been introduced into Kenya as one donor-directed solution to upgrading

productivity. Crotty (1980: 131) describes it as having been conceived as an appendix to the existing cattle industry, and dismisses it as "nonsense".

The planners were insensitive to the changing contemporary beef marketing situation, and to the implication of the ratio of cattle/grain price. Crotty (1980: 131) gives this as 7.09 for Kenya, and 16.81 for the USA, (from whence the recommendation originated). The implications for the profitability of feedlotting in Kenya are clear, disregarding the relative availability of grain to humans, and pasture for cattle in the area. If Crotty's definition of "cattle price" is related to liveweight, then the southern African ratio is of the order of 5.0, and his strictures on feeding grain to cattle in the face of human want are equally applicable. Grain-based feedlotting has as little place in KwaZulu as in Kenya.

2.4.2 Kenya cattle project

This was reported by Crotty (1980: 134) to have been intended as a pilot project for IBRD cattle projects in the rest of Africa, and is considered by him to be relevant to the evaluation of other IBRD cattle projects in the African sub-continent. The intentions of the project were:-

- i) "apportioning communal grazing to group, company and individual ranches; and
- ii) providing these ranches with water, water holes and finance to acquire breeding stock and feeder cattle for fattening" (Crotty 1980: 134).

As may be expected the alienation of public land to individuals or companies has been politically unpopular, polarisation of stock ownership has increased, and the problem of overuse of resources has been exacerbated. Significantly there is no

mention of an increase in output. Crotty (1980: 136) concludes "Projects based on the extinction of existing rights to land, essential for their existence, and held from the immemorial past by persons who are among the poorest in the world, are not conducive to social well-being and harmony".

2.4.3 Sandfords' proposals for Zimbabwe

Sandford (1982: 26) proposed that "within the general strategy of giving primary emphasis to the material welfare of the rural population, and effecting this through the intensification of land use, the prime role of the livestock subsector should be to provide elements (particularly milk) (emphasis added) in the rural diet in all areas, manure and draught for crop cultivation in areas where this is feasible and, in areas unsuitable for cropping to produce livestock for sale as a source of cash to provide food". He goes on to list the practical consequences of this which include:-

Redirection of agricultural research to finding technologies for livestock systems in the communal areas.

Alteration of market incentives.

Alternatives to manure and animal draught.

Re-alignment of extension work to the livestock subsector.
Attention to institutional structures.

Stock control by quota.

This recommendation would appear to be rational and soundly-based, and in the context of the preceding chapters, valid for KwaZulu as well. Apparently they were not universally acceptable in Zimbabwe and there is no information available as to whether they have been implemented and if so, the degree of success.

2.4.4 Botswana Tribal Grazing Land Policy (1975)

According to Jerve (1981: 3) this policy was initiated as a large scale attempt to solve the problems of low offtake from the national herd, an escalating problem of overgrazing, and a skewed income distribution among cattle farmers. Its objectives were:-

- "a) To make grazing control, better range management and increased productivity possible. The improved management system must start with fenced areas and land over which exclusive rights are recognised. Therefore under certain conditions, groups and individuals must be granted exclusive rights to land.
- b) To safeguard the interests of those who own only a few cattle or none at all" (Jerve, 1981: 3, quoting Botswana Government).

The policy made provision for land to be subdivided into communal land, mainly for small owners; commercial land for owners of 400 head or more, or syndicates of small owners with 400 head or more; and reserve land for future generations.

Crotty (1980: 138) predicted an explosive growth in numbers, and dispersal of cattle as a result of this, resulting mainly from the improved conditions in the communal areas from whence stock increases would come. He foresaw rapid polarisation among cattle owners and the emergence of a powerful land owning elite who would gain control of both commercial and ultimately communal land, leading to a landless proletariat.

Jerve (1981: 73) reports the start of this process but doubts whether many Botswana cattle owners would find the prospect of taking over and developing a ranch attractive. They appeared to view it as simply an opportunity to gain permission to sink

another borehole, water being the key to security and expansion of herds in the area. Large owners have already pre-empted the rights of others in communal areas by sinking private boreholes and the TGLP is seen as accelerating this procedure. Jerve (1981: 4) notes in his summary that the results of the TGLP will be that big cattle owners, already economically and politically strong, will gain extra privileges; small owners will be threatened with expulsion from cattle farming, with no alternative employment available; offtake will increase but the skewed nature of the income distribution will lead to social inequality. Particularly important, the over-grazing problem will not be solved but will be aggravated. It should be noted that all these developments arise primarily out of the alienation of publicly owned land into individual ownership.

2.4.5 Southey's recommendations for Transkei

In a report on land tenure submitted by Southey (1981) to the Planning Committee of Transkei, major emphasis was placed on the land/livestock issue. His main recommendations (Southey, 1981: 38) were to increase the tax per livestock unit to R10, and to limit stock numbers by issuing transferable stock certificates. He proposes the use of buy-back or lease-back of stock certificates to reduce numbers, and that a medallion be issued to those owners thus relinquishing their rights, in place of the animal forgone.

Southey strongly defends the right of the individual and community to determine the type of utility they will derive from their cattle and therefore expects that offtake may well remain below what outsiders might view as satisfactory. He argues that economic pressure may change the utility desired, with possible beneficial effects on offtake, but he has ignored the fact that the owner's utility, both tangible and intangible, is derived from the animal itself and not its monetary value, which could probably quite well be substituted for by a stock certificate and medallion.

2.4.6 Institutional reform of communal grazing in KwaZulu

This proposal by Crotty (1983) is a practical elaboration of the concept first outlined in his book (Crotty, 1980: 139). It is Crotty's contention that "the necessary and sufficient condition for the efficient use of grazing land is to maximise the (social net) revenue from it" (Crotty, 1983: 22). To achieve this he proposes a cattle tax levied by a local tax authority or operating company, the revenue of which would be diverted immediately to the bona fide residents of the discrete unit of land on which the cattle tax applies. It is an appealing and elegant solution, which if implemented could be expected to have the following benefits:-

1. Maximisation of net revenue from the grazing resource.
2. An equitable distribution of revenue among large and small herd owners and those with no cattle at all.
3. Cost-effective physical development in view of the larger scale of the grazing area involved.
4. The retention of public land in public ownership, which would prevent the development of a landless section of the population.
5. The shift of capital investment from the present distorted emphasis on cattle, to land improvements.

It would in addition offer a flexible arrangement, adjustable according to varying conditions, and would impose an opportunity cost on the population growth in communities.

A proposal that a pilot scheme to demonstrate the proposal in the Enkanyezi district of Eshowe was rejected out of hand by the local leadership (Crotty, 1983: 24). This probably was the outcome of two issues:-

1. A more equitable distribution of social net revenue inevitably implies a reduction in revenue flow to the rich and privileged, to provide for an increased flow to the poorer sector. Since the leaders are the rich and privileged in any Zulu community, any such proposal would meet with the same reception as in any economically stratified society - hostile.
2. In the form presented, the proposal makes the acceptance of what amounts to a fundamental reform in land tenure a pre-condition for benefits which will accrue in the future. The value of the benefits would of necessity be only hazily understood by the community, if at all, but the present cost of the proposed change clearly understood. The present loss would be exacerbated by comparison with future benefit in view of the very high discounting rate prevalent in rural areas.

Crotty (1980: 138) himself makes the statement "But the individualisation of land tenure is possibly the most profound and far reaching institutional change that a society can undertake". If this statement were to be made general by substituting "any change in" for "individualisation of", it would still be valid. In view of their likely uncertainty over the outcome of the change, the Zulu leadership may have been well-advised not to accept the proposal at this stage.

2.4.7 Workshop on pastoralism and African livestock development: Report by Johnson

The report of the Workshop, sponsored by United States - Agency for International Development (1980), and conducted by the Institute for Development Anthropology in Binghamton, New York, covered a broad range of issues including the poor quality of statistics and the conflict over what constitutes desertification and degradation of rangeland. Since the workshop covered the entire continent, no specific recommendations evolved. Two valuable observations were made however:

1. Interventions in the livestock sector should emphasise support of subsistence rather than commercial activities. It was argued that national needs were more likely to be met out of satisfying producer needs than by any other method.
2. Every programme or project in the livestock sector should include monitoring and evaluation as an integral element. This is true of course of any development project and it is an element more commonly ignored than included.

2.4.8 The Community Land Company

The concept of the Community Land Company (CLC) was first aired by Reynolds (1977) and subsequently elaborated in a major paper proposing a suitable design for rural development in southern Africa, (Reynolds, 1981: 26). It proposed that a socially and geographically cohesive community, probably defined by ward boundaries, form a land company. Each member of the community over the age of 16 would qualify for a single share in the company. The assets would be the common properties of grazing and arable land, forests and water sources, but members would still enjoy individual homestead and garden rights. The company

management (elected) would ensure proper land use and oversee periodic auctions of rights to use the various common assets. The principles of equality, democracy redistribution of wealth, and sanction to ensure proper land use feature strongly. A revenue base for community programmes would be created by the taxation of income on the various rights.

In regard to cattle, the possession of a share would obviously entitle the shareholders to a number of grazing rights whether he owned cattle or not. The non-owner could opt either to dispose of his rights at the annual auction or to buy cattle from shareholders with an excess of stock over grazing rights. Obviously a market in rights, amounting to a land market, would develop and, significantly, this would separate the interest in land from the interest in cattle, each which could be traded individually. It will be recalled that in KwaZulu the realisation of an interest in grazing (land) is only permissible through owning livestock. Unquestionably such a CLC would have profound beneficial effects. It would cause social and personal marginal costs of cattle owning to coincide (Reynolds, 1981: 31), and would provide flexibility permitting the number of grazing rights to be adjusted to annual variations in forage availability. It would inevitably lead to improved grazing management and the market value, of and taxes on, grazing rights would impel productivity and revenue upwards. The interests of the weak and less well-endowed members of the community would be well served.

It suffers however from two weaknesses:-

1. It appears that no provision is made for young people "coming of age" and qualifying for shares. If they are automatically granted shares then the asset base of the shareholding will continually be eroded or diluted, ultimately rendering the share worthless.

2. The changes required to the social and cultural systems of the community are monumental in scope. Fundamental redistribution of the power and wealth base will be inevitable, and again it appears that the programme required of the community will be for it to accept the proposal in the faith that the predicted benefits will follow. The concepts underlying the proposals will be totally unfamiliar and foreign to the individuals of the community and it would be surprising if they were not greeted with profound mistrust.

Cousins (1987: 24) reported that despite the manifest potential benefit it could deliver, and the fact that a pilot project in the Mweneze communal land could be used to guide its implementation, the scheme did not generate support at high levels of government and was finally shelved. It was promoted by only a few senior planners in government and was not even seriously discussed at village level.

2.4.9 Grazing schemes in Zimbabwe

There is a long history of attempts to establish grazing schemes in Zimbabwe. A specialist agriculturalist, C.T. Alvord was appointed in 1926 to, among other things, address the "present chaotic conditions in the reserves", partly to avoid the necessity for the acquisition of more land for native occupation (Chief Nature Commissioner 1931 quoted by Palmer, 1977: 201, in Cousens 1987: 10). Alvord concluded that the only recourse was to "centralise" the reserves, i.e. consolidate homesteads into villages, and demarcate arable and grazing areas. This established the nature of grazing schemes as part of a general "rehabilitation" programme, which by the mid-forties had profoundly affected the lives of a large proportion of the communal land communities, including incidentally, the enforced reduction of stock-holdings by over a million head. The programme continued under the Native Land Husbandry Act of 1951,

promulgated partly in response to resistance by communities to "centralisation". Although the act was suspended in 1964 its effects are still to be seen in the spatial pattern of development in the communal areas, and in grazing schemes (Cousens, 1987: 13).

Fifty operating grazing schemes and 56 planned schemes were surveyed by Cousens (1987). Only fourteen of the operating schemes had fencing, the balance being controlled by herding within "camps" demarcated by posts or earthen banks. Most were supported financially by a number of both foreign and local donors, including the government. Some of them (43 percent) date back to the pre-independence "colonial" period, and at least one persisted right through the pre-independence conflict. The commonest first proposer of the schemes was the Department of Agriculture (Agritex) at 42 percent, followed by the community (28 percent), with the balance a variety of local individuals and committees. The main benefits listed by respondents in a multiple response question were (Cousens, 1987: 47):

<u>Perceived benefit</u>	<u>Percent respondents</u>
Herding time reduced	62,1
Improved cattle performance	43,2
Improved veld conditions	31,6
Higher returns from cattle sale	24,2

Destocking and conflicts both with neighbouring communities and within their own communities were the commonest disadvantages listed. By far the commonest problem listed by respondents was lack of funds, not surprising in view of the state of development.

The schemes appear institutionally strong, with 89 percent having elected committees, of whom 72 percent have drawn up by-laws to manage the schemes. A particular point of interest is the

breadth of participation by the community, even including individuals not owning cattle. In all but one scheme, non-stock owners participate, and 82 percent expect contributions from all community members (Cousens, 1981: 58). No direct explanation for this is offered, but a possible one is to be found in the fact that all community members do benefit from stock, in the form of draft and other products, as a consequence of lineage relationships. The preponderance of unfenced schemes suggests that some particular advantages must be associated with them. One at least must be the low cost, which suggests that the marginal viability of investments in livestock development is well appreciated in Zimbabwe. In contrast to the fenced schemes, where saving in herding time is the prime motivation, with the unfenced schemes, respondents listed the improvements in cattle and veld condition as the most important benefits. In unfenced schemes, social conflicts with neighbours are reduced, and "technical" problems predominate, in contrast to the opposite relationships in fenced schemes. In general terms unfenced schemes increase the emphasis of local as opposed to external control and improve flexibility in adapting to changing circumstances (Cousens, 1987: 61).

In summary, Zimbabwean grazing schemes are highly heterogeneous but are characterised by functional community participation either through material contributions or institutional innovation. To this extent they appear to satisfy a need among cattle owners and their fellow non-cattle owning community members. The extent to which they satisfy planners objectives, mainly stock reduction and veld management, is dubious (Cousens, 1987: 40). Of all the schemes actually implemented, these grazing schemes above have addressed the broader community issues of livestock holding, as opposed to the interests of limited groups. These interest groups are to be found both within the administration and among that portion of the community owning cattle. The concentration on community as opposed to sectoral interests may be part of the reason why they have not only persisted but expanded, and with minimal undesirable by-products.

2.5 Conclusion

This chapter has enlarged on the problem which was the origin of the study. Since it was initiated by administrators and planners the problem has a normative bias, in common with most problem statements on the livestock situation in sub-Saharan Africa. The problem is characterised by a perception that there is on-going destruction of the grazing resource, which is an outcome of a value system which is peculiar to the cattle owner, combined with open-access common property. There is thus a loss of welfare, in company with the resource degradation.

As may be expected livestock proposals flowing from this paradigm tend to be prescriptive, based on grazing management, stock reduction and turnover increases. A selection of proposed and implemented schemes derived from these perceptions, show some degree of failure and, in some cases, complete failure. This record suggests that attempts to induce stock-owners to solve planners' problems is not a recipe for success. The hypothesis for this study, flowing from the findings of this chapter has four components. Firstly cattle are not an abstract form of "wealth" but perform a vital role in the household economy and the community; secondly the observed "tragedy of the commons" syndrome is a result not of simplified common-property theory, but a complex of utility based decisions which would be similar even for solely-owned property; thirdly that the degradation attributed to overstocking and the overstocking itself must be brought into question; and that solutions to the cattle problems are more likely to be successful if based upon satisfying the needs of cattle owning communities including non-cattle owning individuals.

CHAPTER 3

THE RESEARCH APPROACH

Farming systems research treats motivations and deals with goals.

Flora
1984

3.1 The Agricultural economy of KwaZulu

KwaZulu is a region of inherently high agricultural potential (Chapter 1). Yet Lenta (1978: 27) calculated that total gross value of output in 1973 (at 1973 prices) was some R23,5 million, reflecting an annual growth from 1957 of some 1,4 percent. (Table 3.1, taken from Lenta, 1978).

For perspective this can be compared to KDA's (1980: 68) estimate of potential gross agricultural production of R342,1 million. Lenta (1978: 30) provided estimates showing that real per capita income, for the rural population only, in 1973 was R10,53 per capita, having declined at the annual rate of 1,8 percent from 1957. In terms of annual earnings per farm worker, based on the average value of production from 1969-71, was R47 per annum. Regular labourers on neighbouring farms in Natal, during a comparative period, earned R222 per annum (Lenta, 1978: 31).

Lenta (1978: 32) calculated the degree to which production met requirements of four basic food-stuffs in KwaZulu. He used the "Daily Food Rations for Adults" estimates of the Department of Agricultural Services published in Watts (1967: 11), and for calculation purposes, converted the population of KwaZulu into "man-units". The comparison is provided in Table 3.2, taken from Lenta (1978: 33). An extra column has been added to show the potential output of these food-stuffs, estimated by KDA (1980: 68).

Table 3.1

Gross Value of Agricultural and Forestry Production at Constant (1973) Prices:
KwaZulu: 1957 to 1973 (R'000)

Year					Livestock and Pastoral Products				Total Crops and Animal Products	Livestock Changes	Forestry	Total Gross Value	Index of Gross Value 1957/59 = 100
	Field Crops (1)	Horticulture (2)	Industrial Crops (3)	Total	Cattle (4)	Sheep and Goats (5)	Pigs and Poultry (6)	Total					
1957	4 059	1 398	776	6 233	7 972	424	1 453	9 849	16 082	-	611	16 693	89
1958	4 018	1 121	1 087	6 226	10 600	688	1 463	12 751	18 977	+ 470	594	20 041	106
1959	3 513	1 276	1 147	5 936	9 967	563	1 430	11 960	17 896	+1 342	563	19 801	105
:													
1964	4 741	1 364	1 090	7 195	14 224	698	1 193	16 115	30 339	+3 042	485	33 866	180
1965	3 664	1 473	991	6 128	12 324	488	1 183	13 995	26 319	-6 375	488	20 432	108
1966	4 950	2 056	766	7 772	10 548	563	1 017	12 128	22 676	-7 227	487	15 936	85
:													
1971	5 877	3 080	1 932	10 889	10 535	605	1 139	12 279	23 168	+3 209	532	26 909	143
1972	5 861	3 583	2 896	12 340	7 238	598	939	8 775	21 115	- 902	545	20 758	110
1973	4 337	3 596	2 673	10 606	9 024	593	1 093	10 710	21 316	+1 529	587	23 432	124
Annual Growth Rate % 1957-59 1971-73	2.06	6.41	5.87	3.88	-0.39	0.43	-1.95	-0.53	1.36		-0.37	1.39	

(1) Includes - Maize, sorghum, legumes, groundnuts.

(2) - Tubers, vegetables, fruits.

(3) - Sugar Cane, cotton, tobacco, fibres.

(4) - Sales, private slaughtering, sale of hides, milk consumption.

(5) - Sales, private slaughtering, products marketed and consumed.

(6) Value of consumption.

(7) Includes - Cattle, sheep and goats.

(8) - Sales and firewood consumption.

Sources: Output: Agriculture, Annual Reports, 1957-73.

Prices: The sources of prices used in the evaluation of each item are given in G. Lenta, *op.cit.*,

Appendix B.

Table 3.2 A Comparison of Food Requirements with Food Production of Given Commodities. KwaZulu: 1957-59 and 1971-73.

Commodities	1957-59	1971-73	1980
	Man-Units: 1 041 700	Man-Units 1 739 800	Potential KDA(1980:68)
	Kg '000	Kg ' 000	Kg 1000
(1) Cereals: Requirements (183,6kg per man-unit per annum)	191 256	319 427	
Production*	72 144	94 889	341 678
Production/ Requirements (%)	37,7	29,7	
(2) Legumes: Requirements (30 kg per man-unit per annum)	31 251	52 194	
Production*	3 871	6 781	31 526
Production/ Requirements (%)	12,4	13,0	
(3) Tubers: Requirements (20,4 kg per man-unit per annum)	21 250	35 491	
Production*	12 163	24 406	170 317
Production/ Requirements (%)	57,2	68,6	
(4) Meat: Requirements (20,4 kg per man-unit per annum)	21 250	35 491	
Production*	12 784	11 730	20 248
Production/ Requirements (%)	60,1	33,1	

* Averages 1957-59 and 1971-73.

Sources: Requirements; Detailed diet requirements, conversion of population into man-units and scale of proportionate requirements (male-/female, adults/children) on which the estimates are based are given in G. Lenta, op.cit, Appendix B.28. Production: Ibid, Appendices B2 to B25.

Lenta (1978: 34) drew attention to the fact that over the time period concerned the ratios had basically worsened. What is equally significant is the fact that, based on KDA's (1980: 68) estimates, only in the case of meat production did actual exceed half of potential production (58 percent). The balance varied from 14 percent for tubers to 28 percent for cereals. In view of these disparities, Lenta (1978: 36) postulated either gross error in the estimates, which he later dismissed, or widespread malnutrition. The extent to which the rural population actually depends on remittances for survival has subsequently been established (Nattras and Nattras 1986). Tapson (1986) in a study commissioned to investigate among other things the nutritional status of a community at Ndombeni near Hluhluwe, could find no records of either kwashiorkor or marasmus at either Hlabisa hospital or any of its satellite clinics, for the previous 3 years, suggesting that these remittances are in fact sufficient to support a minimum nutritional level.

The data does, however, demonstrate the dependence on external sources for the most basic necessity of life, and this in the face of agricultural potential very close to large enough to supply them in full. The comparative advantage of household self-sufficiency in food is demonstrable in developing countries (Hawkins and Clarke, 1990), both in terms of household and national economies. With a welfare benefit in the growth of agricultural output so patent, it is appropriate to consider briefly the economic frameworks within which the root causes of the deficiencies could be found.

3.2 An economic approach to KwaZulu's beef industry

Cattle production is only a single sector of a fairly complex KwaZulu agricultural economy, which in regional terms might itself be described as miniscule. It is in addition, so enmeshed in the fabric of the greater southern African economy that it might well be considered derisory to think in terms of an

independently functioning economy. In the case of the cattle industry however there are features so peculiar to it, that it is in fact a type of island economy within the greater southern African livestock industry. It does in fact have well-established linkages in both directions with that industry, but internally has unique features, such as freedom from administrated market distortions which set it apart. It is appropriate, therefore, to at least consider a framework within which both the study and the conclusions that flow from it, could be couched.

Beukes (1989: 214) has characterised development as essentially activist and practically inclined, with the avowed intention to reconstruct societies. This being so, it appears that development theorists since the nineteenth century have been tribute to the simplicity that by observing the changes that occur as societies develop, they will be able to manipulate the forces causing the changes and therefore the course of society's change. Beukes (1989: 216) has reviewed the array of common development theories and grouped them into three broad streams of thinking on development which he describes as "the orthodox approach (stressing the virtues of modernisation), the political economy approach (stressing the locus of control of the development process), and the contra-modernisation approach (stressing the threatening and dehumanising side-effects of modernisation"

The basic goal of development in the orthodox approach is economic plenty, in conjunction with a democratic and dynamic society and associated with the liberal values of freedom in personal and political life. Economic growth is the engine of development, and given that there is enough of both, the benefits of development will "trickle" down to all levels of society. Since an agrarian life-style is associated with under-developed societies, it implies a thorough-going economic reconstruction, including among other things a shift in the centre of gravity of

development from the rural to the urban sphere, with a concurrent reduction in the urban population, notably farmers.

Cultural values require to be brought into line with the needs of industrialisation and technology, i.e. "modernisation". Perpetuation of traditional values constitutes one of the major obstacles to development, an endogenous problem requiring an exogenously prescribed remedy, typically capital transfer, technical assistance and training. Despite this, the orthodox approach recognises that development is not a mechanical outcome of a set of actions but requires a "spark or dynamic impulse in the minds of the people" to set it going (Beukes 1989: 218). Two forces drive the process forward: "the idea of growth and the idea of revolution". Growth is the fundamental stimulus moving human affairs to a more desirable condition; revolution increases the control that people have over their affairs, one of the basic tenets of modernisation.

The instruments of the orthodox approach are those of capitalism - private ownership of the means of production; individual profit the economic driving force; co-ordination and regulation of transactions by the market; and market-supporting actions by government. It is dependent on the rate of savings and the productivity of capital.

The principle criticisms of the approach arise from experience. Despite substantial rises in GNP in the 1950's and 1960's there have been failures in poorer countries including continuing high rates of unemployment, increased inequality and the stagnation of real income levels among the really poor. Subsequent modifications to the approach include the broadening of goals to include a direct attack on poverty via the provision of basic needs. In this respect, the gap between intention and reality has remained stubbornly wide, not the least because the intentions of the decision makers are not always congruent with those of the basic needs approach (Beukes, 1989: 220).

The political economy approach is remarkable less for its differences than its similarities to the orthodox approach. The goals, underlying paradigm, instruments and mechanisms are largely the same. The main, and very significant difference lies in the locus of control of the process (Beukes, 1989: 221). The orthodox approach permits the market to act to create and distribute benefits. A political economy has as its fundamental base the questions of who benefits and who decides. The prime value of the political economy approach is its structure as a critique of the orthodox approach, and the failure of the growth it generates to spread its benefits to the poor. The strength of the political economy approach lies in its acute analysis of failures of past development effort. It has little to offer in the form of prescriptions for the future (Beukes, 1989: 224, Nattras and Nattras, 1986).

The contra-modernisation approach has a more recent origin than the other two, first being expressed in the 1970's. (Beukes, 1989: 225). It arose from growing unease about the nature of development, and for a concern that to the concepts of underdevelopment and development, should be added a third, overdevelopment. It is extended in highly developed economies to include the idea of material over-consumption, coupled to non-material under-consumption. The sustainability of such a system is called into question. High levels of material consumption have been supported by increased labour productivity through technology; exploitation of internal labour through relative under-payment; exploitation of external labour through the importation of cheap goods and resources; and the exploitation of nature. All of these supporting structures have been put under stress over recent years, and it is a question whether any of them will give way in future. To persist with this combination implies an ever growing polarisation between decision-makers and labour, an outcome of increasing technological complexity, which is controlled by decision-makers.

So broadside an attack on much of Western society naturally provokes widespread criticism, not the least that contra-modernisation is an invention of the already (idle) rich. Nevertheless certain of the criticisms it raises remain to be answered. These include sporadic growth, the failure to solve unemployment and poverty and the alienation of labour and the unavoidable threat to labour arising from the need for technological competitiveness. No complete or single solution is available, rather an alternative value-system emphasising not employment per se, but working and living in the whole. Development should be less wasteful, more resource-efficient, smaller-scale and more self-reliant by nature. These concepts echo the Ghandi-ism: "The earth has enough for man's need, but not enough for his greed".

From the foregoing, to establish a paradigm within which to proceed in the case of the KwaZulu cattle is an interesting exercise. The degree to which past proposals to solve the "cattle problem" are embedded in the orthodox approach is plain. The perception of the need for growth; the endogenous values comprising constraint to be solved by exogenous prescription; the creation of individually controlled production rights, particularly land; and individual profit as the motivating generator. That so solidly orthodox a prescription should largely fail where it has been administered, and in the case of KwaZulu, be stoutly and successfully resisted is one of the roots of this study. Plainly the orthodox approach is not an effective paradigm for understanding the KwaZulu cattle case. The political economy approach suffers the additional disadvantage of the centralisation of decision making which on the evidence, KwaZulu cattle owners would not willingly tolerate. While the planners and administrators recommending orthodoxy appear quite comfortable in the cloak of the central planners of the political economy, the administration of KwaZulu does not have the powers of coercion used by the governments of centrally planned economies to force their decisions through. Nor, let it be said, is it likely to wish to have them.

It does appear that elements of the contra-modernisation philosophy could be found in KwaZulu cattle owning society - although admittedly neither rich nor idle. There appears to be a strong adherence to non-material values, even at the cost of increased productivity and profit. There is a wholeness in the obligation to share products that accompany the privilege of owning cattle. There is on the other hand, an apparent reluctance to adopt institutions imparting exclusivity in access to production rights, from which arises the problem of resource degradation, in contrast to preservation of ecosystems which is a key issue in the contra-modernisation approach. The key issue is that explanations of cattle owners' behaviour are not satisfactorily found in the orthodox or central planning philosophies. Contra/modernisation presents at least a paradigm within which an explanation could be looked for.

The analysis above suggested an approach to the problem based on gaining an understanding of cattle-owners' ambitions, rather than proceeding from planners' objectives to solutions or prescriptions grounded in pre-selected economic development approaches. Given a clear understanding of owners' objectives it might become clear what instruments would be required to satisfy planners' objectives, which are essentially orientated to national as opposed to individual welfare. This study proceeds, then, on the acceptance of (at least) two separate objective-sets which must either be, or be made to be, complementary for a successful outcome to be achieved. The lack of understanding of the cattle-owners' objective set makes this process impractical in present circumstances.

3.3. Objectives in pastoral development

As the departure point for both an analytical and research approach, a set of objectives which could be held to apply in the KwaZulu case are presented here. They are adapted largely from Sandford (1976: 3), who has articulated a clear and comprehensive

set of planners objectives, some of which he warns border on parody for the sake of making a point.

3.3.1 Planners objectives

Ecological objectives

a) Pure conservation

This objective could be satisfied by -

- i) the maintenance of present vegetative cover unchanged
- ii) the evolution of the vegetative cover under wildlife alone, or by wildlife together with a low density of human and domestic stock population.

The objective is not advanced as a serious proposal for the rangeland of KwaZulu. It is included simply to illustrate the logical conclusion of strict adherence to the "ecological" ethic.

b) Maximum sustainable yield of products useful to man

Plainly the yield will not be a constant but will vary about a long-term mean, depending upon season. Yield can be measured as plant biomass, animal biomass or in monetary terms. This objective, together with some recognition of economic objectives, is probably assumed as "given" in the traditional rangeland management approach.

Economic objectives

a) Maximising national income

This remains a valid objective, despite recognition that in its strictest essence it is an unsatisfactory development objective (Beukes, 1989: 219). Even though as Sandford (1976: 3) implies, increments in income may not necessarily be "good irrespective of to whomsoever they may accrue", the desirability of increasing the gross income from the KwaZulu herd can hardly be argued.

b) Maximising personal income

The most likely target for such maximisation would obviously be the cattle owners themselves. It could be argued however that, for example, the income of sugar cane growers could be maximised by the complete removal of cattle from cane growing areas.

c) Supplying beef products

This refers to the provisioning of the KwaZulu meat and meat products market with KwaZulu produced beef. To maximise for this objective could require, for example, a conversion to commercial production methods over the whole of KwaZulu's rangeland.

d) Utilising national resources fully

Given productive enough resources this can be a goal in itself, but in the context of KwaZulu it can be taken to mean securing optimum output from

the rangelands, including not only grazing but such utilities as tourism, wildlife, building material, woodfuel and other tree products.

e) Absorption of population

With natural population growth, and that caused by forced removals, the grasslands may well be viewed as a "sponge" capable of soaking up otherwise surplus population. To this extent, the accommodation of population increases is at least a candidate as a role for the cattle industry.

Socio-political aspects

a) Preservation of traditional Zulu culture

It could be argued that the ownership of cattle has such deep spiritual significance for the Zulu that the cattle herd has little other purpose, and action should be directed to meeting this cultural need.

b) General development

By this is meant a broadbased upliftment of the communities of cattle owners - in other words the improvement of the "quality of life".

Horowitz (undated: 6) lists as the foremost of "rulers" objectives the supply of beef to export markets, and simultaneously the reversal of environmental degradation while improving forage quality; improvement of producer income and quality of life; and the provision of a favourable rate of return for World Bank-funded projects. He classifies simultaneous success in all of these objectives as a neat trick which has been achieved rarely

if ever. His, and Sandfords' (1976) comments illuminate the essential internal inconsistency of objectives derived by planners or rulers, with little or no participation by cattle-owners. If any set of objectives are to be adopted, it can at least be supposed that owners' objectives would have a single-mindedness that make them more implementable.

3.3.2 Cattle-owners objectives

Far from providing a set of objectives for pastoralists, Sandford (1976: 5) in fact questions the logic of even considering them. It is submitted here that not only is it necessary to consider them, but it is essential to thoroughly understand them if livestock grassland policy is to be effective. The reasons for this are essentially pragmatic: "It is the farmer/herdsman and his family who make decisions on what to produce (choice of activities) how (choice in techniques) how much (intensity) and when and where to dispose of the eventual product. These decisions are made, based on objectives which include such aspects as self-sufficiency, risk aversion and money income. These decisions at the micro level are influenced by (dis)incentives generated at macro level, such as services rendered by rural institutions (agricultural research, extension and training, credit, cooperatives and marketing) and by other government and private sector interventions (for example food, employment and price policies) and by the legal framework. Cultural and political factors play a role as well and it is obvious that historical events, which have led to changes in land use can be an important factor in understanding present patterns of land use" (Luning, 1984: 112). It follows therefore that the output from the national herd of KwaZulu at the macro level is the outcome of a multitude of decisions made by individual owners of small herds at the micro level.

The most valuable insight into understanding the processes of small-holder decision making has been provided recently through

the application of household economics theory. Low (1986) used the theory to illustrate the decision making procedures of Swazi crop smallholders, and generalised it to include not only the land and cattle system of Swaziland, but to embrace the southern African sub-continent as well. What follows is derived from Low's interpretation (1986: 13-15). The principle change attributed to the modern theory of household economies is the expansion of the concept of a simple utility function to a two stage action. Firstly goods and time are used to produce an array of basic commodities or Z goods; secondly these Z goods are used in a conventional way by the consuming household to maximise a utility function which includes direct consumption of Z goods. Traditionally consumer behaviour in maximising utility is described by:

$$U = U (X_1, X_2 \dots X_u) \quad (1)$$

Subject to a resource constraint limiting the value of goods consumed (x_i) to the money income available. The modern household economic approach expresses the household's utility function as:

$$U = U (Z_1, Z_2 \dots Z_u)$$

The Z_i are produced using market goods and household time:

$$Z_i = F_i (X_i, T_i) \quad (2)$$

The utility function is subject to a production function constraint (equation 2), a constraint on total household time:

$$\sum_j H_j = \sum_j T_{jw} = \sum_j T_{ji} \quad (3)$$

and the conventional income constraint.

H_j is the total time available to the j th member of the household, which he uses in the labour market (T_{jw}) and in

producing Z goods (T_{ji}). By making E_j the market earning potential of the j th member of the household, the income constraint:

$$I = \sum_i P_i X_i = W + V \quad (4)$$

can be expanded to:

$$I = \sum_j E_j T_{jw} + V \quad (5)$$

$$I = \sum_j E_j (H_j - T_{ji}) = V \quad (6)$$

from this:

$$I + \sum_j E_j T_{ji} = \sum_j H_j E_j + V \quad (7)$$

Substituting for I , the full income constraint becomes:

$$\sum_i P_i X_i + \sum_j E_j T_{ji} = \sum_j E_j H_j = V = S \quad (8)$$

Equation 8 states simply that the value of market goods plus the value of time spent in producing Z goods must equal the value of total time available plus other non-labour income. By including both income-earning activities and non-income earning activities, i.e. the production of Z goods into the allocation process, the applicability of the theory is expanded and therefore more useful in explaining the many-faceted nature of the household economy.

The particular applicability of the theory in the case of small-holder cattle owners resides in two characteristics of the cattle owning system. It will be shown later that the fraction of marketed to marketed output is small: Z goods are the principle produce of the cattle system. Secondly, the high value of the Z goods if purchased in the market imputes an extraordinarily high value to labour. Low (1986: 36) shows that where:

$$P_z < P_x \cdot X_i = W_i \cdot T_i \quad (9)$$

and P_z is the purchase price of a unit of Z , P_x the price of input X , X_i the amount of x required, W_i is the wage of member i , and T_i the amount of time required to produce Z , then the unit of Z will be purchased. Equation 9 can be written:

$$\frac{P_z - P_x \cdot X_i}{T_i} < W_i \quad (10)$$

In this case the left hand term is the opportunity cost of purchasing Z . If it is less than W_i Z will be purchased and if more, W_i will be invested to produce it. Doing a crude substitution of real values into the left hand term gives an indication of the extraordinarily high opportunity cost. Taking a slaughtered beast as an example, P_z would probably be higher than R1000. $P_x \cdot X_i$ actually invested by the owner is either zero or approaching it, as it is Government policy to provide free dipping and statutory inoculations. The i th member providing T is likely to be a school boy, and T for a single animal would probably be not more than say 36 hours a year. This imputes to W_i a value of some R27,00 per hour or R1 080 for a 40 hour week.

It is self-evident that a small-holder household owning cattle does not operate in a purified system involving interaction between household and cattle alone. The output of the system depends on a plethora of influences, as outlined by Luning (1984: 112). In the case of cattle, to these must be added the obligations of cattle ownership, and the fact that cattle-owners are utilising a community resource which does not supply only grazing. Disentangling the influences or constraints and expressing and quantifying them individually is an essential preliminary or adjunct to understanding the household economy.

3.4 The Farm Systems Research (FSR) approach

It is this logical sequence which is the origin of the farming systems approach. Norman (1978: 813) has described western

thinking on agriculture in developing countries as passing through four phases: the extractive phase; the "knowing what was best" and technology transfer phase; using elements of technological success in high income countries as building blocks for technology in developing countries; and supplementing the "top-down" approach with a "bottom-up" approach, "which provides a foundation for the so-called farming systems approach" (Norman 1978: 813).

It is argued that while there may be conflict over the definition of a farming system (Norman 1983: 7), there is sufficient agreement on the structure and procedures involved. The essence of the approach is that the farmer is the centre of the research, and its intended beneficiary. His objectives become the objectives of the research. The systems within which are embedded the constraints inhibiting him from achieving his objectives, are analysed to identify the limiting impediments. Bembridge (1984: 3) describes "four interacting forces which, in combination determine the type of farming systems being practiced in any given agro-ecological area". These are:

1. The physical resources and environment which determine the type of agriculture which can be practiced.
2. The agri-milieu or development factors affecting agriculture - political stability, government policies, population increase, growth of the economy, physical and social infrastructure and the agricultural lobby.
3. The institutional or agro-political factors such as agricultural policies, prices, marketing, research, agricultural education and extension, inputs, credit marketing and land tenure.
4. The farmer and his family, who are the central figures in the production process.

According to Norman (1983: 7) the farming system existing is the result of a farm household using its managerial expertise to allocate its resources in land, labour and capital to maximise the attainment of its goals. It can do this through three processes - crop production, livestock production and off-farm enterprises in various combinations. Under Norman's (1978: 813, 1983: 3) approach, the systems are grouped into two major elements - the technical element which determines the set of agricultural options available, and the human element, which is the sufficient condition for one or more options to be selected. Past neglect, of the human element has been largely responsible for failure of past development efforts.

The human element has two subdivisions - exogenous factors and endogenous factors. The exogenous factors are those external to the farmer's personal system and specifically beyond his ability to modify. The main exogenous factors are:

Community structures, norms and beliefs.

External institutions and support systems.

Miscellaneous influences - location, population, density etc.

The endogenous factors are the four production factors, which the farmer controls, and his goals or ambitions.

In-field or "downstream" farm systems research has four components. (Norman, 1983: 10).

1. The descriptive or diagnostic phase in which the farming system is defined within its environment, and the farmers goals described.
2. The design phase in which, relying on existing knowledge, strategies are devised to deal with constraints revealed in the diagnostic phase.

3. The testing stage in which the selected strategies at two levels, on the research station and in on-farm (or in-herd) trials.
4. The extension phase in which information on the strategies is disseminated to the user group.

Rose and Tapson (1984: 176) recognise the first three phases above as belonging in the research field, with phase 4 falling into the extension field. They stress strongly the iterative nature of the method, and allow in their model for strongly developed, formal feedback links in the process of farmer evaluation of strategies. They stress also the dynamic nature of the process, emphasising that each successful introduction will generate a new level of demand from the farmer/household, and consequently a new cycle of research.

Being an evolving technique, farm systems research does suffer methodological problems (Norman, 1983: 12). Being holistic in nature, the system incorporates institutional problems, which are beyond the power of research to resolve. Often the political and administrative structures in developing countries are too fragile to introduce structural changes, which may not be universally popular. The concentration on the objectives of farm households rather than the needs of society may lead to strategies with short-term benefits to farmers but long-term costs to societies. Finally, because it is area-specific, systems research is expensive, and cost-reductions, particularly in the diagnostic phase, are necessary if it is to be widely applicable.

Farm systems research nonetheless does offer a promising route out of the pattern of past failures in agricultural upliftment in Africa. Probably its most valuable contribution so far in southern Africa has been the greater insight into rural systems it has provided, and the radical change in the approach to development which has become necessary as a consequence (Tapson 1986; Rose, Tapson and Williams 1986).

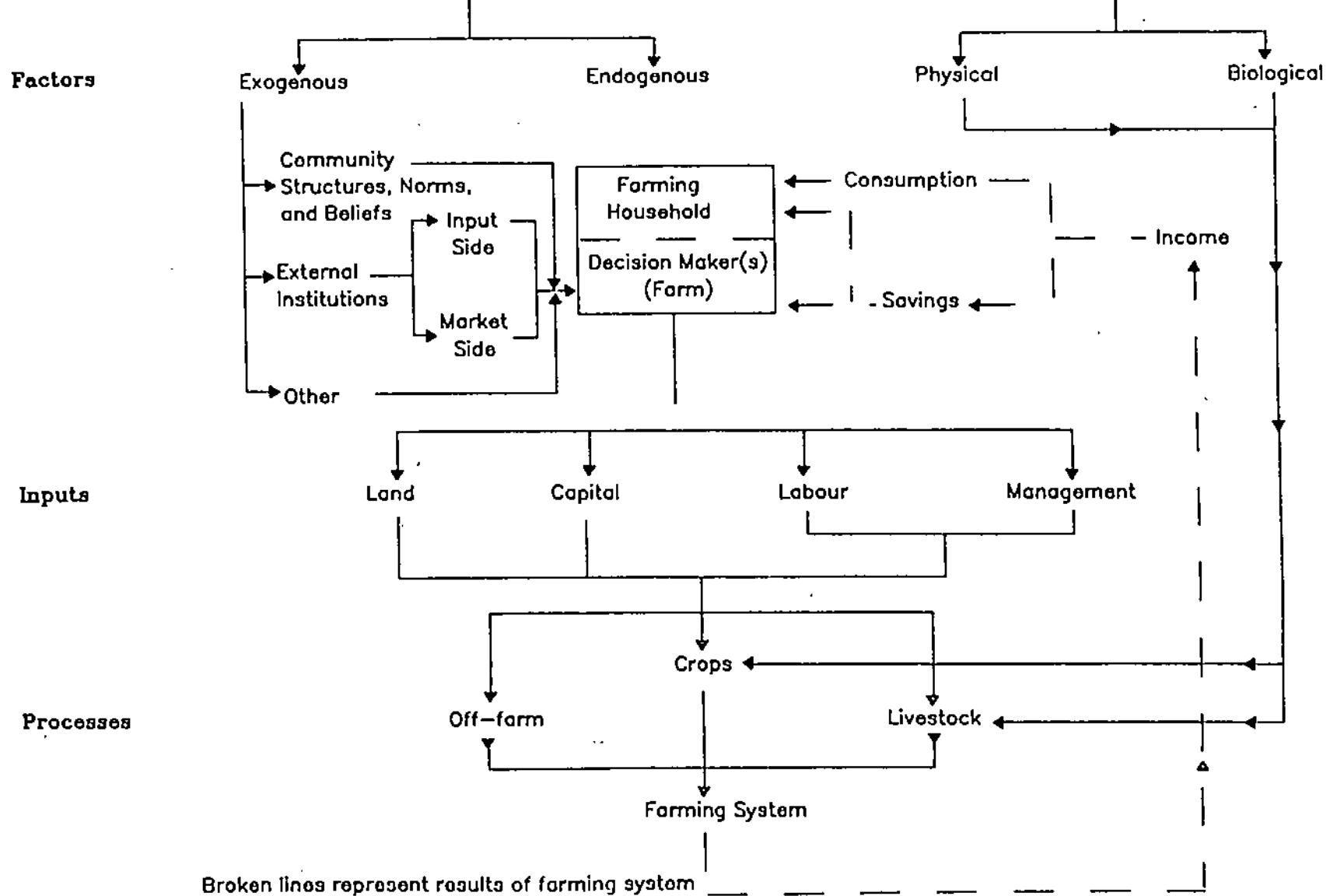


Figure 3.1: Schematic Representation of Some Farming System Determinants

Source: (After Norman: 1983)

In the case of this study, concentration will be on clarifying the determinants of the system (Figure 3.1), and the formulation of an hypothesis. The research which may become necessary is external to this work.

3.5 Farm Systems Research in Livestock

Until recently livestock has featured little in farm systems research. The reason is not clear, but it may be the lack of status of livestock in the development hierarchy, if the lack of mention in key publications is taken as evidence (World Bank 1981, Eicher and Staatz 1983, Eicher 1983). Livestock is, however, beginning to receive attention, with for example, the entire proceedings of Kansas State University 1983 Farming Systems Research Symposium being devoted to the theme "Animals in the Farming System" (Flora, 1984). Simpson and Evangelou (1984: 2), in the preview of a book edited by themselves and devoted to livestock development in sub-Saharan Africa point out that most of the chapters are based on a systems approach to livestock development.

Sidahmed and Koong (1984: 61), describe livestock production as "a very complex system which has many interrelated components, such as climate, soil plants and obviously, animals". While the traditional approach was to study each component separately, the emergence of systems theory in the last 20 to 30 years has made the use of a systems approach possible in the study of livestock production.

They define "system" as a "grouping of a set of components linked together for some common purpose or function". (Sidahmed and Koong, 1984: 61). It follows that the relationships can be described mathematically and a model constructed from the equations which will adequately describe the system. They list the advantages of the systems approach as being the increase in understanding the system through summarising and unifying the

data; the identification of knowledge gaps; the reduction of conceptual difficulties in analyses of systems too complex to understand intuitively; formulation and testing of alternative hypotheses; and in the planning and policy making process. In describing a case study of systems analysis applied to the Sudan, Sidahmed and Koong (1984, p64) emphasise the importance of describing and quantifying the components of the system, before model construction can be started. They confirm the observation made in the previous section that the diagnostic or descriptive phase provides greatly improved insight to the system. The study having been cast in the FSR framework, then the research programme was directed at securing information on the determinants of the cattle production system.

3.6 Research Programme

The study was initiated as a consequence of discussions with interested parties in the Department of Agriculture and Forestry of KwaZulu in 1981. The Department's material interest in the outcome of the investigation not only gave it substance, but very greatly facilitated the conduct of the field work. Its support and assistance in planning and execution of the surveys, and particularly its permission to use field officers of the Department of Veterinary Services as enumerators, were key factors in planning the research programme. The officers not only knew both area and cattle owners intimately but were interested in the programme and amenable to the training required to carry it out.

Familiarisation and planning took place in the balance of 1981 and field work proper got under way in 1982. Intermediate results from the initial, major survey resulted in two further surveys being conducted, and the final piece of fieldwork was completed early in 1985. Analysis and interpretation of the data was a continuous process from mid 1983 onwards.

3.7 Methodology

Analysis of the data likely to be required suggested that they would fall into two main categories:

1. The data describing the herd in national terms, the environmental conditions and the gross turnover figures for the herd. These could be obtained from primary sources such as departmental and consultant reports and the Annual Report of the Director of Veterinary Services (DVS).
2. The data describing the objectives and attitudes of the cattle owners themselves, together with the performance of their individual herds. For this purpose, a cross-sectional survey of cattle-owners was used.

3.7.1 Main Survey

The collection of the second category presented the greatest problems. A simple questionnaire was out of the question for logistical and literacy reasons (Selltitz et al, 1961: 238). The technique of an interview with responses recorded on a schedule seemed to be the only practical method to gather the type of information required. The limitations of the method due to its dependence on the respondent's memory (Murphy & Sprey, 1982: 27), the possibility of induced or unintentional bias (Sudman & Bradburn, 1982: 1 - 5) were recognised. These deficiencies cannot be eliminated entirely, but are largely countered by the advantages of flexibility (Selltitz et al, 1961: 238), spontaneity and the ability of the interviewer to probe and rephrase the question (Bembridge, 1984: 22 and Selltitz et al, 1961: 238). On balance it was determined that the personal interview with responses recorded on a schedule by an enumerator was the best available option for this task.

Because of the expressed limitations of the process on the one hand, and the personal and sensitive nature of some of the information sought on the other, the possibility of respondent bias still existed. To probe the reliability of the data, two further sources were tapped to provide a cross comparison to the interview data. A series of small semi-formal meetings were held, where a set of questions, again listed in a schedule, were discussed, and elaboration of the responses encouraged. These meetings were tape-recorded for later transcription and analysis. Finally, the same set of questions were addressed to a number of individuals, reputedly well-informed about Zulu attitudes towards cattle.

The three sources of information for this survey were therefore:

1. A series of interviews with schedules, constructed so as to make formal statistical analysis possible.
2. A series of semi-formal meetings with recorded responses for qualitative analysis.
3. A series of personal interviews with experts, also recorded for qualitative analysis.

There was a large measure of unanimity between the three sources on most of the issues, which considerably enhanced the level of confidence in the quality of the data.

Because of the very large number of cattle owners in KwaZulu (over 180 000) and their spatial dispersion into widely scattered and sometimes small geographical areas, it was decided, on the advice of the Department of Agriculture to limit the survey to two administrative areas: Mabedlana surrounding Nongoma in the north, and Ogwini, surrounding Eshowe in the central portion of KwaZulu. Even so both the area and number of cattle-owners remained formidable, and a sample survey was resorted to.

The large number of cattle owners (Ogwini 44 600, Mabedlana 25 689), and their spatial dispersion meant that pure random sampling would result in unacceptable costs in travel and time to reach all the elements of the sample. It was determined therefore to resort to a two-stage cluster sampling plan, using the diptank lists and stockowners' registers as the sampling frames. Because it was perceived that climatic differences could affect results, an element of quota sampling was introduced at the first stage, by distributing the selected diptanks according to the ratio in which they occurred in each bio-climatic zone (Selltitz et al, 1961: 516, 533, and Murphy & Sprey, 1982: 171 - 173)

The sampling was carried out as follows:

Stage 1

A sample of 10 percent of the total number of diptanks was selected. Within this sample, strata were defined according to bio-climatic zone and selections made randomly within strata. A random number table was used to generate the sample.

The result of this sampling stage was:

	Ogwini	Mabedlana	Total
Total number of diptanks	254	138	392
Sample selected	25	15	40
Sample size - percentage	9,8	10,9	10,2
Sample as percentage of total cattle	12,4	10,1	11,2
Sample as percentage of total owners	12,3	9,9	11,4

Stage 2

For each element of the sample of diptanks selected, a stock-owners list was drawn up and verified by ground checking with both senior and field personnel, and the owners numbered sequentially. With the enumerators and time available, it was

determined that a sample size of no more than 400 could be adequately handled and consequently a sample size of 0,5 percent was decided upon or 5,0 percent of the owners selected in Stage 1 of the sampling process. This sample was selected as a systematic random sample, by entering the stockowners register at a number determined by random number table, and selecting this and every twentieth subsequent owner on the list (Murphy & Sprey, 1981: 171 - 173).

The result of the second stage sampling was:

	Ogwini	Mabedlana	Total
Total stockowners	44 600	25 689	70 289
Sample selected	252	129	381
Sample as percentage of total	0,56	0,50	0,54
Total cattle	308 282	368 830	677 112
Cattle owned by sample (1)	2 227	2 029	4 256
Sample as percentage of total cattle	0,72	0,55	0,63

(1) According to stock-owners cards

It is of interest that the population of cattle from which the sample was drawn, 677 112 head, represents 49,9 percent of the total KwaZulu herd in 1981, the last year for which figures were available at the time the survey was conducted.

3.7.2 Secondary surveys

During the conduct of the survey, as a result both of examination of early returns and discussions with enumerators, two previously unknown issues surfaced. It was learnt that a conviction existed that stock numbers had been drastically reduced in the areas where sugar-cane was widely grown, and the enumerators held that not all the cattle registered on a dip card were the property of the holder of the card. For cattle numbers to be reduced in sugar growing areas was contrary to conventional wisdom. If the

sugar activities generated an increased cash-flow, it could be expected that it would be used to purchase more cattle, given the "cattle complex". Cattle numbers should therefore increase, not decrease in sugar growing areas. In the case of different owners of cattle registered on the same card, the implication was that the assumed "owner", the stock card holder, could have limited discretion to make production or disposal decisions regarding them. This arises out of Vilakazi's (1962: 114) observation that one of the lobola animals given to the bride's mother (the Ingquthu beast) is the exception to the rule that cattle are "house property". It belongs individually to the mother of the bride who has sole disposal rights over it. Most specifically her husband has no right over it. Both issues were deemed to be worthy of further investigation and consequently appropriate surveys were designed and carried out in 1983 and 1985.

In the case of the cane growers, the sampling plan was based upon two assumptions:

1. The definition of "cane grower" presents difficulties because some black growers abandon cane either after one year of production or without harvesting at all. In order to ensure that respondents could fairly be described as "cane growers" only those registered growers who had a record of delivering to the mills over the preceding two years were included in the population to be sampled.
2. Growers from different districts may well have different attitudes as a result of different treatment and histories. Accordingly, of the areas available the Felixton area was chosen to represent an area less developed as far as cane growing was concerned and reputedly had more cattle. The Amatikulu area reportedly had virtually no cattle and was a more developed cane growing area, while Delville represented

an area where there had been some block development of cane by a developing company with "contract" growing, and cattle numbers were dwindling.

Having regard for the time and staff available, only 75 interviews could be considered. As a result a 2,5 percent sample from each area was selected from a list of cane growers as defined above, by systematic random sampling. The samples were as follows:

Area	Cane Growers	Sample Size	Percent
Felixton	749	17	2,2
Delville	1 332	32	2,4
Amatikulu	825	25	3,0
Total	2 906	74	2,5

This survey, for obvious reasons, was termed "The Cane Survey" despite the fact its subject matter was cattle owners.

In regard to cattle ownership, the investigation started with a series of group discussions held over a period of a week, with a total of 114 owners. The outcome of this was confirmation that the animals registered on a dip card could indeed have different owners. In particular, as a result of marriage customs, it was possible that a proportion could belong to the women of the household. These animals were intended specifically for subsistence purposes, and sale was proscribed. At the time this information came to light the resources available for field work had been exhausted, and consequently only an exploratory survey to gain an indication could be considered. Two dips were randomly selected therefore from within the district from which the information had been obtained. Using the dip register as a sampling frame, a randomly selected, 10 percent sample was taken from each dip.

3.7.3 Conduct of surveys

3.7.3.1 Main Survey

In the interview schedule technique, it is obvious that the schedule itself is of paramount importance to the validity of the data gathered. Consequently several months were devoted to the design of the questionnaire and consultation with outside specialists on its structure. Those consulted included the Department of Extension and Rural Development, Fort Hare, Regional Directors of KwaZulu, and the Department of Agricultural Economics, Natal University. The questionnaire was amended as a result of each of these consultations and a pilot survey of fifty farmers was initiated in Nongoma to field-test the interview schedule. The enumerators carrying out the survey received a comprehensive training apart from a series of informal discussions in which they were involved prior to this, in the course of setting up the survey. Their understanding of the background to the survey and of the questionnaire itself was apparently complete.

At the end of the survey period only 34 of the fifty schedules were returned and despite follow-up visits, the balance could not be completed. Severe problems in completion of the questionnaire were reported by the pilot test team.

1. It had been intended that the interviews be carried out at the dip-tanks. Contrary to expectations, the majority of cattle are not brought to the dip by the owner but by children. This necessitated lengthy and time-consuming journeys on foot to find the homesteads, resulting in many interviews being conducted in the late afternoon. By this stage of the day, many of the stockowners were sufficiently disinterested to refuse to co-operate in the interview.

2. Some of the stockowners did not know the enumerators and suspected that the visit was to check on illegal activities (dagga or the "ghost herd"). They were not prepared to answer part or all of the questions as a result.
3. All enumerators declared the interview was too long, commonly taking 2,5 to 3 hours. Many farmers, having started enthusiastically, lost interest and refused to complete the session.
4. Several questions with slightly different nuances in the original, were identical questions in different form when translated into Zulu.

To overcome those problems it was recognised that several visits might be necessary before an interview could be conducted (or even started), and to shorten the individual interviews, and the questions were limited to those necessary to create a statistical data base. Attitudes, customs and felt-needs would be covered during the course of the planned semi-formal meetings and personal interviews conducted by the researchers, as described in section 3.7.1.

The final form of the schedule for the formal survey interviews was tested again by a full survey on six of the sample of diptanks selected as described in section 3.7.1. The interviews were conducted with despatch and the schedules accurately completed, and on the basis of this success the survey was extended to cover the whole survey area.

In the Ogwini region the survey was completed and the returns verified in the field by December 1982. Regrettably repeated administrative delays and problems in the Mabedlana region meant that returns were not ready for processing until October 1983. Of the Mabedlana returns, 11 had to be discarded either due to

anomalies found at the field check or at the preliminary stage of statistical analysis. The final valid returns were for Ogwini 252, and for Mabedlana 118.

3.7.3.2 The secondary surveys

The survey was greatly facilitated by the availability of experienced enumerators from the Ogwini region. Their competence and enthusiasm was proven and as a result the need for training and motivation was minimal. The exercise was carried out expeditiously, within the month of September 1983, and May and June 1985 for the cane and ownership surveys respectively.

3.7.4 Conduct of structured meetings and interviews

Two series of meetings were carried out using a proforma list of topics to be discussed based on the second part of the original questionnaire as an aide-memoire. These were with groups of farmers, in meetings usually chaired by a local dignitary, with interpretation being done by an official of the Department of Agriculture who was both competent in English and interested in the survey. While one of the meetings was completely dominated by a particular individual, the balance were characterised by rational and interested discussion. The commonest reaction was one of intense interest coupled to an apparent anxiety to portray attitudes towards cattle and their problems with accuracy. With the one exception, the manner of the participants suggested that some weight could be placed on the opinions discussed.

The final series of interviews were conducted on a one-to-one basis, most commonly in the interviewee's office. An assurance of anonymity (if required) was given, and permission obtained to record the interview on tape. As some of the comments could have been construed as criticism of the Government these precautions were deemed to be necessary. Most interviewees fully discussed the issues and again an atmosphere of interest and concern to contribute dominated the discussions.

3.8 Qualitative evaluation of data

Three groups of data need to be considered.

3.8.1 Primary data derived from official reports

The only data source of any substance available on a regular basis in KwaZulu is the annual reports of the Department of Agriculture and Forestry. These are extensively drawn on both by researchers (Colvin 1983, 1984, Lenta 1978) and in the compilation of major reports (KwaZulu Department of Agriculture, 1980, Thorrington-Smith, Rosenberg & McCrystal 1978).

There are serious deficiencies in the data relating to cattle presented in these reports, arising from two principle sources. Errors occur at the point of origin of the data due to the dependence of the recording officials on cattle-owners for information. There is no identifiable reason why the owners should report accurately, and on occasion it maybe in their interest to report inaccurately. For example, periodic official embargos are placed upon the import of cattle into KwaZulu. In this case an owner might well fail to report a death, and instead substitute an animal "smuggled" in thus maintaining his stock numbers constant. Apart from intentional inaccuracies, personal discussions with both owners and officials revealed that the convention in regard to recording of births and deaths varied considerably between farmers. Some registered calves officially at birth, and others only after the age of five or six months "because so many die before this". Animals dying of unknown causes, but being consumed, and others slaughtered prior to an impending death may be variously recorded as deaths or slaughtering.

The second source of error is in the processing of raw data into the form required for returns. This varies from simple (but large) arithmetic errors to confusion over boundaries and

therefore the districts to which stock should be attributed. It required a number of field trips over a period of six months to reconcile the number of diptanks in the field with the central register of dips, and serious errors had to be corrected.

It is not possible to estimate either the magnitude or direction of the composite error from these sources, but the possibility that it could be large must be acknowledged. As indicators of absolute values they must be treated with reserve. As indicators of population trends over time it seems they have value since fluctuations can be related to clearly identifiable casual events, mainly variations in rainfall.

3.8.2 Data derived from the questionnaire interviews

Even though there seems little alternative to the questionnaire as a means of gathering data, there are limitations on the quality of data obtained. Even assuming error due to procedure is reduced to acceptable levels by proper sampling, conduct of survey and analysis, there are weaknesses in the method itself. These can be identified either as originating from the researcher or enumerators, for example, problems with translation, interpretation and recording, or from the respondent in the form of reluctance to respond, indifference or even suspicion. Dahl and Hjort (1976: 132) maintain "that the act of counting domestic animals is often a cultural offence", although long exposure to counting at dips has habituated the Zulu owner to stock census.

It was these considerations which led to the adoption of three separate sources of information. In the event it seems that the statistical information has acceptable validity if only because it can be reconciled to some extent with the long term movements through the herd, and because no serious anomalies can be identified within the data. Those anomalies that did occur have been identified and eliminated from the analysis.

The report on adoption of management practices is completely congruent with personal observation in the field and information obtained in discussion with veterinary officers.

3.8.3 Meetings and informal interviews

Qualitative aspects were concentrated on in this exercise and the degree of unanimity between different informants was considerable. These ranged from traditional and unschooled cattle owners to officials and academics of high standing. Making allowance for some unexpected gaps in the knowledge of their culture exhibited (or admitted) by more educated Zulus, a consistent and clear understanding of the cultural and social values of cattle emerged.

3.9 Evaluation of methodology

The study was conceived as an initial, broad-based investigation aimed ultimately at establishing policy guidelines for the resolution of the stagnation afflicting the Zulu cattle sector. There was no previous empirical work which could be drawn upon to narrow the focus to specific problem areas. For this purpose the cross-sectional, "instantaneous" survey technique adopted was adequate and provided viable data. It does however suffer from weaknesses which reduce its effectiveness for identifying and providing information to solve specific problems.

The main weakness relates to the dominant effect of the timing of the survey on the quality of the responses given. The researcher is essentially dependent on the farmer for data, as the method does not permit any appreciable personal measurement or enumeration. Cattle-keeping being strongly dependent on climatic conditions there could be both long and short term conditions which introduce bias in the responses. In the short term they could be shaded by whether the survey is conducted in winter or summer, or at the start or end of the growing season. In the

long term, a succession of droughts or seasons of above average rainfall would affect not only the farmers responses, but the mortality and reproduction coefficients of his herd.

A further drawback is that the briefness of contact with the research subject does not permit development of understanding of the purpose of the study nor a sense of rapport with the researcher. In the environment of traditional agriculture both of these are essential inputs to the diagnosis of problems and the design of research programmes to resolve them.

The concentration upon cattle was essential to the design of the project as was pointed out in Chapter 1. Events have justified this decision, but again for research leading to detailed solutions to specific problems, in contrast to policy, cattle must be recognised as one of the set of subsystems comprising the farmers production system, all of which must be accounted for in the design of upliftment programmes. It is axiomatic that these systems are complex and interlocking and the subsystems are synergistic in both a positive and negative sense.

It is apparent that to obtain comprehensive information to describe existing practices and constraints in meaningful quantitative terms there is no alternative to long term studies at village level. A full year of recording to cover the cycle of seasons is likely to be the minimum practical requirement. A three year period of field work would permit the establishment of trends, and particularly in regard to livestock, would be the minimum required to establish values for performance measurements. All this notwithstanding the empirical data gathered did suffice to provide insights into the cattle system which had not been exposed before.

CHAPTER 4

BIOLOGICAL SUSTAINABILITY

Asking an extension officer to design the optimum grazing system is like asking an amateur engineer to design an economical bridge of undefined span to carry an unspecified but variable load; built from materials of unknown specifications; joined by unreliable techniques in an environment conducive to advanced structural deterioration of an ill-defined nature.

Biggins
1967

4.1 Introduction

Any animal production system comprises essentially three subsystems: the food resource exploited by the animals; the animals and their internal reproduction dynamics; and the interaction between the two which is controlled by the management regimes applied to each of the other subsystems. In the case of this study, concerning as it does an essentially unsophisticated production system, the food resource employed is unimproved veld grazing. The animal sub-system is the total cattle herd owned jointly by a large number of smallholder farmers, and the management sub-system is that set of practices which those owners apply to both the grazing and cattle resources. The system includes the added complication arising from individual ownership and therefore control of the cattle, linked to common ownership of the grazing resource, with all the limitations to individual choice that this implies.

Since the three subsystems are the foundation of productivity of the cattle industry, they will be individually examined to

determine the effect they may have on output. This chapter will be concerned with the grazing subsystem and the next with the cattle. Together they comprise the Technical element of the FSR approach used as a framework for the investigation. The management component falls under the Human Element and will be considered in that section dealing with the motivation and capacity of the farmer.

The grazing system has particular importance arising from the fact that degradation of the resource and associated soil erosion are cited as sufficient reason for intervention to change the nature of cattle ownership in KwaZulu, indeed in almost any of the less developed areas of the sub-continent. With the wealth of comment on the degree of overstocking in force in KwaZulu, policy and strategy proposals as may be expected, tend to take the necessity for destocking as given. Data presented in later chapters will show clearly the destructive effect this action would have on the welfare of cattle owners. It will be shown that the effects are such that destocking should not be embarked upon without thorough analysis to determine whether the welfare cost can be justified. The balance of this chapter will, therefore, consider first the value of the basic grazing resource, and then question the degree to which it has in fact been degraded as a result of grazing malpractices. This is also to question the foundation of the argument for destocking. The arguments presented are critical to both the sustainability of the cattle sector in KwaZulu and the issue of equity in the system.

4.2 The grazing resource

KwaZulu has already been described as an area of high agricultural potential, by the standards of the southern African subregion. The "Preliminary land-use plan for KwaZulu" published by the KwaZulu Department of Agriculture and Forestry (1980: 29-49), provides a detailed description of the potential of the ten

homogenous farming areas of which KwaZulu is comprised, which is then quantified in Tables 4 to 13. In short, of KwaZulu's total land area of 3.32 million hectares, some 2.24 million or 68 percent, is described as "natural grazing". Of this area, 28 percent falls into the high potential zone, 20 percent into the medium potential zone and 51 percent into the low potential zone. A further 411 600 ha (12 percent of KwaZulu) is described as "potentially arable", and in view of the tenure system, would also be available as grazing in the winter. As would be expected the bulk of this land falls into the high potential zone, giving a total of 1.50 million ha out of 3.32 million which would provide grazing of high or medium potential. While the "low potential" area of 1.154 million ha is rightly so described on account of its inherently low carrying capacity, it does have the advantage of providing high quality grazing and browse if managed correctly (KDA, 1980: 45, 47 and 48). This means that high levels of nutrition can be maintained throughout the year from the veld, without recourse to purchased or cultivated forage supplements.

Tainton (1981: Figure 2.1) shows that KwaZulu is dominated by Fire Climax Grasslands of potential forest and savanna areas, regularly interspersed with intrusions of Valley Bushveld. In the north, patches of Fire Climax Grasslands of potential savanna areas, and Eastern Mixed Bushveld occur. For management purposes, these classes of grassland are reduced to the groupings: sweet, sour and mixed veld. KwaZulu falls almost entirely into the sourveld category, with minor portions of sweet and mixed veld scattered throughout the territory (Tainton 1981: Figure 2.3). Sourveld is characterised as having rapid and regular growth as a consequence of relatively high rainfall, and therefore a higher carrying capacity than the sweetveld. The sward is described as dense and capable of withstanding moderate levels of overgrazing. Such treatment does lead to reduced productivity, due more to changes in species composition than reduction in cover (Tainton, 1981: 45).

In sum then, the grasslands of KwaZulu constitute a substantial grazing resource, capable of delivering some 23 percent of the region's net farm income (KDA, 1980: 69). It is, however, an article of faith that this valuable resource has been seriously degraded as a consequence of past overgrazing and mismanagement, and that the process continues today. As a result, it is argued production from the grassland is considerably lower than is potentially possible, and based on the continuing degradation is likely to decrease in future. Since the absolute limit of production from the animal system is determined by the primary productivity of the underlying grazing, an understanding of the dynamics of the grazing system is necessary to assess the implications of this for the whole cattle production system. The following section will therefore provide a brief outline of the theoretical basis for determining the productivity of grasslands, as precursor to testing the assertion that the productivity has in fact declined.

4.3 Grassland dynamics and the KwaZulu case.

Models of grassland productivity are predicated on the Pearl-Verhulst or logistic equation of theoretical biology. This a quadratic of the form $dx/dt = Ax(\bar{x}-x)$ where A is a constant, t is time, $\bar{x}$ is the equilibrium, unexploited population and x the population at any given time. A model widely used in South Africa (Tainton, 1985: 4) based on this relationship, is that developed by Jones and Sandland (1974: 335). Using experimental data, they showed that gain per animal is linearly related to stocking rate, thus:

$$Y_a = a - bx$$

where a and b are constants, Y_a is the gain per animal and x is the stocking rate (animals per hectare). Where this holds, the relation between stocking rate (x) and gain per hectare (Y_h) is a quadratic of the form

$$Y_h = ax - bx^2$$

where a and b are constants.

They show further, by differentiation, that maximum gain per hectare occurs when the stocking rate is half of that where $Y=0$, at n_{max} in Figure 4.1. Using data from a wide range of experiments they showed the generality of these relationships, and illustrated them using data from a tropical grass-legume pasture, grazed continuously by beef cattle. (Figure 4.1)

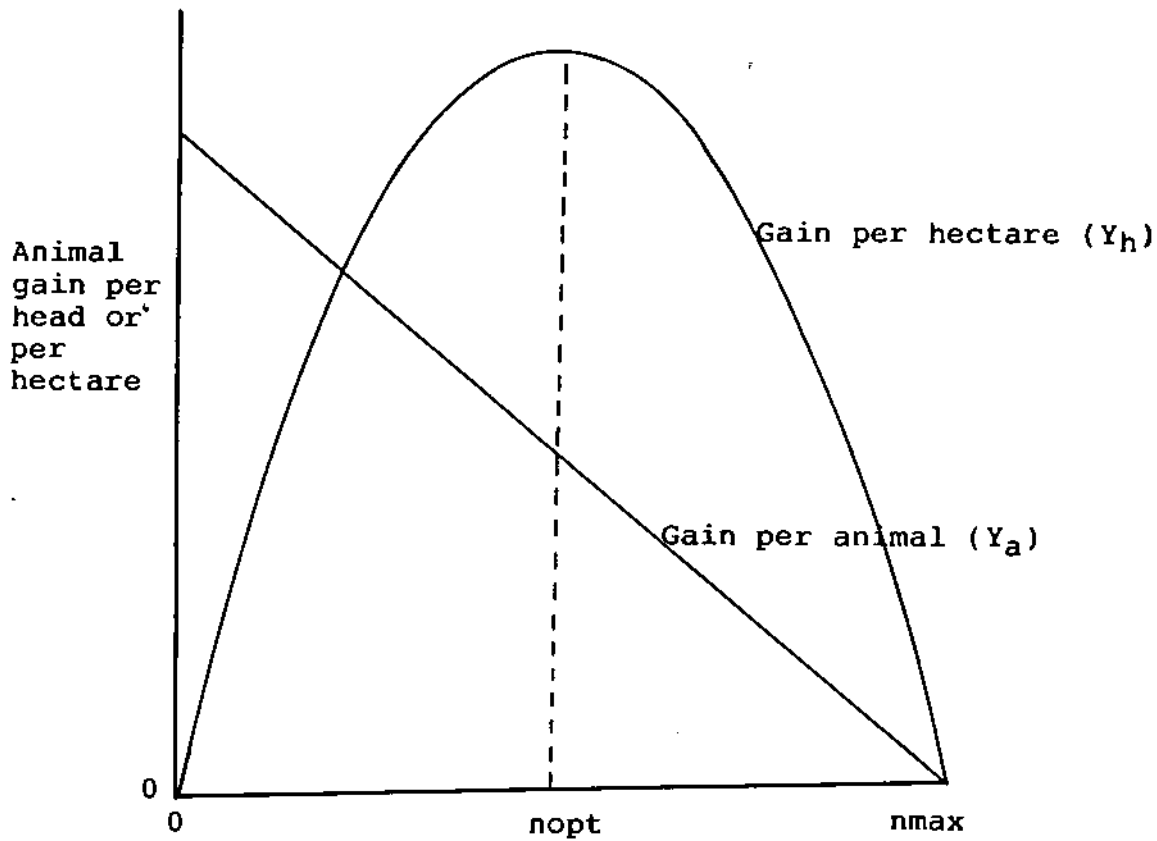


Figure 4.1 The relationship between gain per animal and gain per hectare in response to increasing stocking rate.

Source: After Jones & Sandland (1974: 337)

The foregoing provides the three relationships essential to critical understanding of the dynamics of overgrazing and resource degradation. These are:

1. Gain per animal will decline linearly as stocking rate increases, and can be negative if the limits set by the population dynamics of the grazing resource are exceeded.
2. Gain per hectare proceeds quadratically as stocking rate increases, with two equilibrium points at zero. The first of these is when stocking rate is zero, and the second occurs at that rate at which gain per animal has declined to zero, at "n max" in Figure 4.1.
3. Maximum gain per hectare occurs at the midpoint between these two values, "n opt" in Figure 4.1. This is the point of "maximum sustainable yield" (MSY), and it follows that mathematically, stocking rate can never exceed twice the theoretical MSY level. This is the basis upon which all comparisons of stocking rates are made.

4.4 Sustainability of the KwaZulu grazing resource.

The implications of the relationships above need to be brought to bear on the long history of statements of impending catastrophe in the grasslands of KwaZulu. The earliest traceable reference to the problem in KwaZulu is "Planning 27-12-38" quoted by Franklin (1948: 128): "The persistence of native cattle holding... is even more hampering to economic development, because religious cattle cumber and overstock the earth...". Brookes and Hurwitz (1957) refer to stock maintained at starvation point through the evils of overstocking and note that measures such as compulsory destocking and veld management

schemes have had little effect in improving the veld. The litany continues with Thorrrington-Smith et al (1978: 93) referring to the veld being brought to a state of near disaster as a consequence of overstocking; KDA (1980: 85) estimating overstocking to be of the order of 100 percent which is at least mathematically possible and the policy statements of the Minister of Agriculture (1977 to 1980) exhorting farmers to decrease livestock population and to conserve the natural resources of KwaZulu.

The image projected, and one firmly held by planners and policy makers is that the grazing resource of KwaZulu is heavily overstocked, by some 100 to 300 percent, and that severe degradation of this resource has occurred as a result. As a logical consequence, the degradation of the grassland has caused soil erosion on an unacceptable scale. These two conditions are held to be threatening the sustainability of cattle production on environmental grounds and are advanced as sufficient cause for stringent intervention by the authorities to halt the process, i.e. the "ecological" objectives of Sandford (1976: 3). With sustainability at the root of the argument for intervention, the validity of the received wisdom regarding it requires examination.

The arguments presented in this section will fall into two parts. Both are presented to support the contention that, assembled as a body of evidence, the information available is too weak and incomplete to justify any intervention including an action as drastic as destocking to the levels held by technical specialists to be "optimum" stocking rates. The first part of the argument is historical evidence which suggests that alarmist statements about the state of the grazing have been premature or possibly ill-informed. The second part examines some contemporary research findings, which show that at the least, the completeness of the understanding underlying the statements should be treated with caution.

4.4.1 Historical evidence.

The essence of the warnings made over the last half century are that the grazing resource is at an advanced stage of destruction and that as a consequence, soil erosion is proceeding at an unacceptably high rate. The primary cause of this has been the degree of overstocking the veld has suffered, and continues to suffer. As was shown above, the theory underlying the estimation of carrying capacity is rigorous, and suggests a degree of precision in the process. Estimates that the stocking rate is up to three times greater than the optimum based on carrying capacity are therefore, on the face of it, nonsensical. They can be explained only by errors in estimating either the carrying capacity, or stocking rate, or both. It could be argued that this is an over-precise and pedantic viewpoint, and that regardless of the mathematical niceties, the effect of the pressure on grazing caused by the stocking rate (whatever it is), is causing demonstrable degradation which will inevitably lead to an irreversible breakdown.

The references quoted above show that this view has been extant for some fifty years, and the very length of this history provides the opportunity to derive omnibus or holistic indicators of the validity of the statements. Had they been true over all or even part of this time, the decline in primary productivity as a consequence of the collapse over time of the basic resource would have resulted in a decline in stock numbers, accompanied by a decrease in offtake and an increase in mortality. The evidence suggests quite the reverse. The stock census maintained by the self-governing administration of KwaZulu since 1974 is probably no more accurate in absolute terms than any other developing country, but it has been recorded systematically and consistently. The time series also coincides with the period over which KwaZulu's land area has been relatively stable. Table 1.7 shows that stock inventory has increased from 1.27 million in 1974/75 to 1,515 million in 1987/88, a peak resulting no doubt

from a series of satisfactory growing seasons. Over this time period the inventory has fluctuated about a mean of 1.39 million with a coefficient of variation of 0,05. While sales, with a mean of 0,8 percent and mortality at 6,7 percent have fluctuated far more widely, neither show a trend over time which would indicate a deterioration in primary productivity. Mortality has in fact shown a declining trend (Figure 4.2).

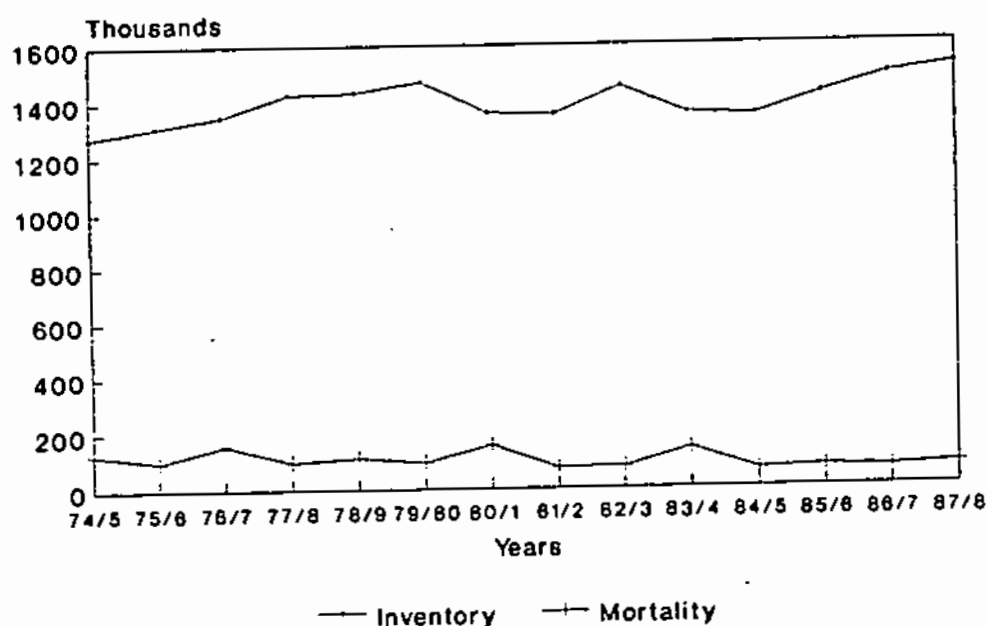


Figure 4.2 Herd count and mortality in the KwaZulu herd, 1974 to 1988

Source: Annual Reports of the Director of Veterinary Services

It must be reiterated that this fifteen year time series comes at the end of a fifty year spell, from the beginning of which the veld has been facing an ecological catastrophe. In the face of similar data in Zimbabwe, Sandford (1982: 57, quoted by Cousins, 1987: 72) enquired whether such prolonged defiance of the "Laws of Nature" could not be accounted for by under-estimation of the initial carrying capacity.

The validity of the assertion that deterioration has occurred due to overgrazing, or has occurred at all, is specifically challenged by Fowler (1981) and Sandford (1982 and 1983). Using regression functions to analyse death rate, extraction rate and calving percentage, and comparing these with rainfall, Fowler (1981: 7-10) concluded that the production statistics showed no significant trends in the period 1954 to 1964. However, between 1967 and 1977 all three showed significantly decreasing trends. This could not be attributed to rainfall variations between the two periods as there was no significant difference. He concluded that while the data presented supported current claims of overstocking, it was of more recent occurrence than is generally supposed and claims of overstocking made in "colonial times" were probably not valid.

Sandford (1982: 43-45) argues strongly that the normal definition of "degradation" suffers both from inexactitude and difficulties in measurement. He develops this argument further (Sandford, 1982: 13-19) putting the case against what he terms the "Mainstream View". He maintains that the causes of degradation and desertification are so many and variable that to attribute them solely to the effect of "overstocking" is not supportable. In this he is supported by Johnson (1980: 8) who cautions that influences like the invasion of agriculture into grazing land, and the concentration of stock about water points must also be considered. Further, the causes of gully erosion are "discipline-specific" and can be variously attributed, depending on whether the observer is an agricultural scientist, geologist,

palaeobotanist or archaeologist (Cooke and Reeves, 1976: 6, in Johnson, 1980: 9). It must be noted that in arriving at his conclusions Sandford does not use the very substantial body of research on grasslands which has been built up in southern Africa since 1960, the bulk of which is reported in the journal of the Grasslands Society of southern Africa.

Both Southey (1982: 67) and Sandford (1982: 57), quoted by Cousins (1987: 72) hold that in any event "optimal" carrying capacity is a value judgement. It would vary according to the objective function of the range manager, for example even for so simple a differentiation as between output per animal or output per hectare. This concept suggests an interesting comparison for KwaZulu. The survey data indicate that useful offtake from the sample herd, that is including sales and slaughter for home consumption, was 7.8 percent (Table 5.10). Extrapolating this offtake to the long-term mean inventory of 1.39 million implies an offtake of some 99 000 head. Accepting that the carrying capacity of KwaZulu is of the order of 465 000 LSU's (Section 1.3.2) and that the average LSU value for a herd of the type in KwaZulu is 0.75, the "optimal" herd size would be some 620 000 head. The offtake from a ranch herd run on an extensive basis with levels of management which could reasonably be assumed for KwaZulu has been estimated at 15,6 percent (Tapson, 1982: 5). Applying this offtake coefficient to the optimal herd size would give a total offtake of approximately 96 720 head. Including the increased benefit from milk, lobolo and draft in the larger herd, even allowing for the crudity of the estimating procedure, it seems at least possible that present stocking rates are capable of delivering a greater stream of benefits than the "optimal" rate.

In summary the historical evidence suggests that anxiety over the impending collapse of the ecosystem was exaggerated or at least premature (see Fowler, 1981). To date at least, the ecosystem in KwaZulu has stubbornly resisted complying with the prediction of

imminent collapse. Whether it will continue to do so or not, depends upon the inherent stability and resilience of the grassland system. This is a technical attribute, which can be assessed with some degree of reliability, even though as may be expected, conflicting views of both the meaning of the terms, and their application to KwaZulu can be found. Some of these viewpoints are considered in the next section.

4.4.2 Technical evidence.

Mentis (1985: 27) fires a philosophical broadside at the practice and principles of "conservation", as applied to rangeland resources. He uses a definition of conservation he attributes to the World Conservation Strategy (WCS, 1980, quoted by Mentis, 1985: 27), namely "the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". Few would quarrel with that. Mentis (1985: 27) describes it as being altruistic, expressing only one of many guidelines, being value-based, and finally being non-falsifiable in the sense that it is not amenable to tests which can "show incompatibility of observation with explanation, expectation or prediction"(Mentis, 1985: 27).

He argues, (Mentis, 1985: 28) with Hardin (1968: 1246) that altruism is genetically self-eliminating through Darwinian selection, and that since observations and measurements rest on value judgement, facts are theory-laden, and value-neutral knowledge is unobtainable. He accuses "rangeland thinking" of venerating the climax and the stable condition this implies. On the contrary, since a condition of disequilibrium can be more productive than the climax condition, the challenge of management is in fact to hold the system in an appropriate state of disequilibrium (Mentis, 1985: 29). He holds that the conservation concept is undermined through its dependence on empty words such as "optimal" which can only be defined within

the framework of a specific value system. He concludes that as currently defined, conservation is hardly operational and its success defies evaluation (Mentis, 1985: 30).

This simplified critique of conservation serves as an introduction to the concepts of stability, resilience, and optimality which are central to the issue of sustainability of the KwaZulu grazing resource. It also serves to question the applicability of grassland research findings to the practice of grassland management.

Walker (1980: 79) provides an analytical model which contends that in semi-arid savannas (undefined) the result of good veld-management aimed at high sustained production, is to reduce the resilience of the veld. He defines a stable system as one which does not change readily in response to stress, but if the stress is sufficient to cause a critical degree of change, may well not return to a condition of equilibrium. A resilient system on the other hand may well not be stable, but may be changed considerably and still return easily to its equilibrium state. His model showed that heavy grazing favoured all the features leading to a high level of resilience. Alternatively, under good management, species changes occur leading to a lower level of resilience. He remarks on the fact that the tribal grazing areas of southern Africa have been reported to be on the brink of collapse for 50 years, yet continue to persist, despite localised disasters due to periodic drought. On the other hand, neighbouring well-managed ranches with higher production and more stability suffer far more devastating effects when subject to the same drought (Walker, 1980: 83).

Walker's (1980: 79) theoretical analysis suggests that heavily grazed, "degraded" systems, typified by the KwaZulu case are inherently more resilient than climax systems, and therefore arguably more sustainable. McKenzie (1982: 21) in the case of Transkei, supports this finding empirically. He found that

despite stocking rates held to be 2,5 times higher than the acceptable carrying capacity (cf. Section 4.3 above) much of the grassland contains an abundance of climax species and has a high basal cover. "Such features tend to contradict the expected consequences of such heavy utilisation..."(McKenzie, 1982: 21). The quotation is supplied as an introduction to a theme that persists through the bulk of reports on research in grasslands - the stubborn refusal of the ecosystem to fulfill the predictions of those that research it. Other examples will be reported, and by themselves provide a notable reason for caution in proceeding with interventions. McKenzie (1982: 22) elaborates the stability concept to include resistant stability and recuperative stability which is close to Walker's (1980: 79) resilience concept. McKenzie (1982: 22) defines resilience as the ability of a system to absorb changes in state variables, and still persist intact through time. The particular effect of these concepts in Transkei, is that the desirable climax Themeda veld, being lower on the resilience scale than the less desirable Aristida, has been largely replaced by it. The Aristida on the other hand is showing both high resilience, and resistant and recuperative stability, and appears unlikely to be replaced by any other system, either higher or lower in the succession. In other words it is a degraded, but highly sustainable condition - supporting in addition, a stocking rate more than twice as heavy as its "accepted" carrying capacity (McKenzie, 1982: 21).

Trollope (1990, personal communication¹) has pointed out that Walker's (1980) and McKenzie's (1982) arguments remain untested hypotheses, and that personal observation of very well-managed climax veld following the 1982/83 drought indicated that it recovered considerably more rapidly than heavily grazed veld. Danckwerts and Stuart-Hill (1988: 218) however had different results from observations of veld during and after the drought.

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They made use of the classification of species used by grassland scientists to assess the condition of veld. For this purpose species are classified as Increaser I, which dominate in poor veld and which increase when it is understocked or selectively grazed; Increaser II species, which dominate in poor veld and increase with overgrazing; and Decreaser species, which dominate in good veld but decrease when it is mismanaged (Trollope et al, 1990: 52).

They found that Increaser I species suffered the least mortality during the drought, followed by Decreaser then Increaser II species, with the highest mortality. In contrast however, The ability of these grasses to recover after the drought followed the reverse order (Danckwerts and Stuart-Hill, 1988: 222). This seems to be consistent with the hypothesis of Walker (1980: 79) and McKenzie (1982: 21), that heavily stocked ("overgrazed") veld is inherently more resilient and able to recover and therefore persist, than moderately stocked (and better managed) veld.

The evidence presented to this point has been intended to show that firstly a concept as basic as conservation is value-loaded. This being so, concepts which flow out of it such as optimal utilisation rate, are equally value-loaded, and depend very largely on the objective function of the controller of the resource. Secondly, whatever the value system which governs the decisions on utilisation, it appears that the degraded, heavily stocked systems are inherently more resilient than veld closer to the climax condition. What is yet to be considered, is the applicability in practice, of the stocking rate model as a predictor of grassland behaviour, or as a management tool. Evidence will be presented to show that, despite its apparent mathematical precision, its performance even under tightly controlled experimental conditions is such to suggest that it should be approached with caution as a tool to guide policy in a situation where human populations will be profoundly affected by the application of that policy.

Over the past two decades a considerable body of knowledge has built up as a consequence of research into the maintenance and productivity of grasslands. It is proposed here to select pieces of this work to illustrate that the basic tools of the grasslands research process are less than adequate for making critical decisions involving the welfare of very large groups of people. Research into grasslands is aimed at determining optimum veld management practices, the efficacy of which is measured by the output of animal mass from grassland being tested. Since the concept "optimum" includes maintaining the condition of the veld on which the animals graze, measures of veld condition have had to be derived as well. The basic tools of research in grasslands science are firstly the stocking rate models of Jones and Sandland (1974) and derivatives of this original model. Secondly, various techniques of veld condition scoring are used to monitor changes in the quality of the grazing resource, and to determine the mean grazing capacity of the grazing site, based upon the supposition that the different species available have specific forage production potential (Tainton, 1981: 78).

Typically a research programme will include a number of treatments based upon variations in the stocking pressure and time of grazing. The effects are analysed and evaluated according to the Jones and Sandland (1974) stocking rate model, while the veld condition changes occurring for each treatment are measured using the veld condition scoring techniques.

The Jones/Sandland model based as it is upon the universal logistic growth curve has a defensible theoretical base, to the extent that it can be used to measure the performance of any biological population including the sward of a grassland. In practice, however, the performance of that grassland is largely expressed via the biomass of the animals utilizing it, which introduces a complicating remoteness from the theory. On the other hand, the veld condition scoring techniques which are used not only to monitor the condition of the veld but also to predict

their grazing capacity (Tainton, 1988: 78), suffer from imprecision and a modicum of value judgement. The basic procedure of the veld condition score is to determine the proportions of key species in the site under examination and to compare these with the proportions occurring in what is described as a "benchmark site". The grazing capacity is determined by estimating the forage producing potential of the combination of species in the test site, and then prorating them with the forage producing capacity of the benchmark site. Assuming that the grazing capacity of the benchmark site is known, a mean grazing capacity for the test site can be determined by simple proportion (Tainton, 1988: 78). The selection of the benchmark sites is described by Tainton (1981: 47) as follows: "The identification of benchmark sites is subjective. It involves the selection of sites which are productive and stable, and represent the type of veld which one suspects was widespread prior to large scale settlement and veld degeneration in South Africa".

The veld condition score techniques are subject to a number of criticisms. Firstly, it is a subjective procedure based upon the selection of a benchmark site, which is essentially a researcher's perception of a condition which might have existed, but which he patently has never seen. Secondly, while in the more stable humid grasslands benchmark sites might retain their characteristics over time it is not so in the areas of lower and more erratic rainfall. Because condition of benchmark sites will vary both within and between seasons, it requires a re-assessment of the site each time the test sites are analysed (Tainton, 1981: 55). Thirdly, the value of the climax grassland or stable state, which is the basis of the reference benchmark site, is completely subjective and highly dependent upon the objective function of the manager of the grassland. All these criticisms notwithstanding, the procedures adopted in the process of measuring veld condition are mathematically rigorous and have been fully tested by a number of researchers over a wide range of conditions. The procedure therefore cannot be faulted, although

it is conducted within a number of questionable assumptions, which are in the end, the basis of the judgements made from veld condition assessment scores.

Hardy and Hurt (1989: 51) evaluated six veld condition assessment techniques in the Highland Sourveld of Natal. The data was drawn from an existing stocking rate trial which had been in operation from 1977 to 1988. Several stocking rate treatments were applied, using accepted veld management practices including multi-camp systems and rotational grazing. The six veld condition scoring techniques evaluated cover the full range of those commonly in use and included specifically the techniques recommended by Tainton (1988: 78) for the grassveld areas. The treatments included stocking pressures varying from slightly lighter than the potential grazing capacity of the Highland Sourveld to pressures of the order of two and a half times this figure. The range of treatments therefore provided a basis from which the effective stocking rate on proportional species could be evaluated over a relatively short period of time. From the point of view of this discussion the results are interesting more for what they do not show than for what they do. The researchers conclude that none of the techniques tested were sufficiently sensitive to index veld condition, although the two methods recommended for the grassveld areas (known as the key species methods) were the most sensitive. However, according to these methods, all the stocking rate treatments showed a decrease in veld condition over time, despite the very wide range of pressures between treatments. The researchers go on to note that what was not considered is the correlation between loss of the key species and accelerated soil loss, or even whether they indicated a significant reduction in long term animal production. The conclusions are worth quoting: "Methods of indexing veld condition presently applied in the humid grasslands appear to be insensitive to grazing intensity and should not be used for monitoring veld condition. The use of these methods for estimating grazing capacity (where the method is based on

proportional species composition alone) is unlikely to lead to an improvement in veld condition and could considerably lead to further deterioration of veld. The key species method appears to have the greatest potential for indexing veld condition and future research should be aimed at identifying those species which react most sensitively to grazing management" (Hardy and Hurt, 1989: 57).

The implications of these findings need to be borne in mind in considering the results of two research reports by Turner and Tainton (1989a and 1989b). The first of these (Turner and Tainton, 1989a: 175) measured the relationships between herbage mass, veld condition, stocking rate and commencement of spring grazing on the one hand, and animal performance in relation to herbage mass, stocking rate and initial animal mass on the other hand. The trials were carried out in the Tall Grassveld area of Natal. The procedures were routine and of the type commonly accepted in grasslands research. Veld condition was estimated using both productivity methods and the key species methods, with the latter being modified for reasons not explained. The models developed in terms of herbage mass, veld condition and stocking rate were internally consistent and showed, not surprisingly, that at a particular stocking rate the residual herbage mass at the end of the season increased with veld condition, and on the other hand decreased with stocking rate, at significant levels in both cases. Patterns in animal production however were somewhat unexpected. In particular there were no significant linear relationships between average daily gain and stocking rate at any of the sites, and therefore no Jones and Sandland model (1974) could be constructed for animal performance. In all cases however, at the end of the season animals grazed at the more moderate stocking rates had shown the most gain. The authors suggest that animal performance only declines linearly once the available herbage decreases to such an extent that intake of herbage becomes the limiting factor to animal performance. This suggests further that the heavier stocking rate used in the

trials did not reduce the herbage available to this point. A more surprising result was the fact that generally poor animal performance was obtained on the sites with the best veld condition scores. The model developed was highly significant, and showed that average daily gain was negatively related both to stocking rate and herbage mass, but positively related to the initial mass of the animals going into the trial. It should be noted that, since herbage mass is positively related to the veld condition index, the implication is that animal performance is negatively related both to herbage mass and veld condition. It should be noted however that these results cover only a single summer and that longer term trials might vary the results substantially.

These results need to be contrasted with those presented by the same authors (Turner and Tainton, 1989b: 183) who tested animal performance in relation to herbage mass and stocking rate in the Natal Sour Sandveld. The methodologies and techniques were basically identical to those used in the trial reported on above. In this case, however, there was a significant linear relationship between average daily gain and stocking rate over a 195 day period which was predictable on the basis of the Jones and Sandland (1974) model. The grazing system however did not completely give up its independence, as animal performance declined more rapidly with stocking rate at the site which had in fact enjoyed the higher rainfall. These results are provided to do no more than illustrate the as-yet unexplained complexity of the interrelationships between rainfall, the grazing system and the animal system which exploits it.

The principle effect of rainfall is the complications it introduces by virtue of the variation it causes in yield of the grazing system from year to year, where the managers of the cattle using the grazing system would prefer to have a relatively stable and continuous flow of fodder. The degree of variability which is possible is illustrated by work done by Booysens (1981:

67) in the Tall Grassveld of Natal, near Pietermaritzburg. By comparison with the veld types associated with the lower and more erratic rainfall patterns this veld type is considered to be relatively stable.

Table 4.1 Influence of rainfall on yield of grassveld and response to nitrogen in the presence of phosphatic fertiliser (28 kg p/ha)

Season	Rainfall mm	Control yield (kg DM/ha)	Maximum response to nitrogen kg
1952/53	608	2188	2873
1953/54	756	5272	3456

Source: Booysens, 1981: 67

However, Table 4.1 shows that the difference in yield in the controlled plot from one season to the next, not only exceeded the total yield in the dry season but was approximately the same as the average response to the optimum nitrogen treatment. In the dry areas Danckwerts and King (1984: 26) shows that stocking rate expressed as grazing days per hectare can vary from 87 grazing days to approximately 50 from one year to the next. This variation was caused by a variation in rainfall from 560mm to 420mm.

Since productivity of the grassland is the basis of all estimates of carrying capacity and therefore recommended stocking rates, the implications of this type of variability are obvious. Livestock production under extensive systems is essentially a stable operation over time, and is not amenable to major fluctuations from year to year in stock numbers. This being so it begs the question as to how precisely the accepted techniques for assessing veld condition and therefore carrying capacity can be brought to account in a system as variable as a natural

grassland, without having an unacceptable effect on the animal system exploiting that grassland.

4.5 The erosion effect

Underlying the many references to degradation and the concern it causes, is the fear of accelerated erosion resulting in soil loss greater than the natural regeneration rate: soil loss is an inherently irreversible process. This is essentially Sandfords condition of a decline in the productivity of land and water resources which is irreversible except at a prohibitive cost of recovery (Sandford, 1982: 44). This fear is either implicitly or explicitly stated in the bulk of the comment on the degradation issue. This being so, there is a remarkable paucity of research evidence either supporting or contradicting the predictions of accelerated soil loss from degraded grazing land. The problem was recognized as early as 1955 by Penz (1955: 712) in his review of the state of erosion in South Africa. It is noteworthy however that he placed great emphasis on the effect of the encroachment of arable farming into grazing areas as a primary cause of denudation and soil erosion. Scott (1981: 277) stresses the importance of both canopy and basal cover in their role in the dissipation of the kinetic energy of falling raindrops, energy which would otherwise pound and pulverize the soil surface. He notes that cover is included as one of the factors in the SLEMSA (Anon: 1976) model used for predicting soil loss under various conditions. As may be expected, in this model soil loss is considered to be inversely proportionate to plant cover since plant cover is the prime determinant of the degree of interception of energy. The relationship is a generalised one, relating soil loss to percent of energy intercepted. Scott (1981: 277) makes the link between veld management practices which will in the short and the long term affect both canopy and basal cover and the degree of erosion which will result from these practices. He notes nonetheless, that "precise research data on soil loss from veld under South African conditions are, however, almost non-existent...".

One of the reasons for this is the cost in time and resources required to obtain data. Stocking (1985: 7) reviews the available approaches to obtaining soil loss and runoff data and concludes that the ideal method, field experiments using natural rainfall, would require a minimum of ten years worth of data to be valid. The cost of such programmes has lead to the widespread use of soil-loss estimating equations such as SLEMSA (Soil Loss Estimating Model for South Africa) and USLE (Universal Soil Loss Estimator). The latter was developed in the United States (Wischmeier and Smith, 1978) and has been standardised for use in many countries. While obviously of value in its role as an aid in planning and administration (Crosby et al, 1983: 8) it suffers from certain practical weaknesses, arising from the necessity to establish values for the parameters used in the estimation. One such is the T-value, or soil loss tolerance which must obviously be related to the rate of natural soil genesis. In the US this is estimated to be between 2,2 t/ha/annum and 11.2 t/ha/annum (Stocking, 1984: 51). For South Africa values between 3t/ha/annum and 9t/ha/annum have been suggested (McPhee & Smithen, 1984; cited by Scotney & McPhee, 1990: 6), for cultivated land. These estimates are determined largely subjectively, and all exceed accepted rates of soil formation. They appear to be used as a short-term solution to proceeding towards a more appropriate lower value (Scotney & McPhee, 1990: 6).

With these problematic issues and the very pressing problems of soil loss from cultivated land, it could be expected that empirical evidence on soil-loss from grassland is sparse. The problems are exacerbated by the fact that soil losses from the small plots used to calibrate the USLE cannot easily be related to measured soil loss from large catchments, and by the reliance on highly generalised judgement values of cover and management factors when using the USLE in grassland or forest areas (McPhee et al, undated). What evidence is available suggests that the rate of soil loss from grazing land may be well below levels which could cause concern.

In a survey of fire catchments feeding reservoirs in the Eastern Transvaal, Parsons, (1986: 1) found the following values:

<u>Catchment</u>	<u>Years</u>	<u>Sediment t/ha/annum</u>
Mpamo	17	2,96
Mgwempisi	2	5,00
Usutu	12	0,58
Komati (A)	19	0,18
Komati (B)	17	0,59

The high value for Ngwempisi was held to be anomalous because of the short period of accumulation. These losses compare well with the T-values for cultivated land quoted above, and Parsons (1986: 2) doubts that the higher sediment yields are a consequence of overgrazing.

Scotney and McPhee (1990: 8) provide summarised data from a number of classical studies employing natural runoff plots (vide Stocking, 1984) and point out the accelerated losses associated with conventional management practices. These results are presented in Table 4.2.

Table 4.2 Summary of soil losses reported in selected studies in the RSA (t/ha/annum)

Source	Soil losses under practices:		Natural Veld	Slope %
	Conventional	Conservation		
Scott (1951)	2,0 (burn and graze)	0,6 (graze only)	0,09	8,00
Sherry (1959)	113,7 (brushpiles burnt)	4,6 (not burnt)	-	25,00
Haylett (1960)	61,9 (continuous crop)	37,4 (rotations)	0,70	7,00
	21,1 (continuous crop)	14,3 (rotations)	0,70	3,75
Du Plessis & Mostert (1965)	8,2 (continuous crop)	5,9 (rotations)	0,20	5,00

Source: Scotney & McPhee (1990: 8).

A striking feature of these results is the contrast between the worst grassland data and the results from cultivated land. Snyman (1985: 116) in a study involving rainfall simulators found a highly significant relationship between basal cover and soil-loss, and established the following plant-succession/soil-loss relationship (Snyman, 1985: 89).

Successional stage	Mean Soil Loss (t/ha/annum)
Climax	1,8
Sub-climax	2,3
Pioneer	4,7

Danckwerts (1990: 15) in a trial testing the effect of particularly adverse burning and grazing practices adopted by farmers, record a loss of 0,223 t/ha from the most severe treatment. This was some two percent of the loss normally considered acceptable from cultivated land (10.0t/ha/annum) and far less than the rate of soil genesis. Danckwerts (1990: 15) questions whether in fact soil loss is a major issue on uncultivated land.

Venter et al, (1989: 89) have reported on a particularly applicable piece of work on the boundary of KwaZulu and the Mfolozi Game Reserve. His study proceeded from the management problem of the maintenance of species diversity in a game reserve, together with the problem of long term soil loss which under specific systems could exceed the rate of soil genesis. He used a "fenceline contrast study" comparing certain variables in KwaZulu and those in the Mfolozi Game Reserve. The KwaZulu area is described as having "a long history of abusive grazing practices by domestic livestock, in particular cattle" (Venter et al, 1989: 89). This is contrasted with the Mfolozi Game Reserve, where the stocking rate with large herbivores had been reduced to 60% of the recommended carrying capacity during the period 1982 - 1985. The basic assumption was that a fenceline study would indicate whether there was in fact a higher long term soil loss

rate in KwaZulu as compared to Mfolozi, and it should indicate whether there was in fact greater or lesser species diversity.

The study area fell within the Tropical Bush and Savanna veld types of Acocks (1975) (Venter et al 1989: 90). The measurement of short-term soil loss was by means of 48 Gerlach troughs (Morgan, 1979, cited by Venter et al, 1989: 90) which were randomly located in pairs at 24 sites in the study area, 12 on each side of the fence. The Gerlach troughs were sited to capture run-off and soil loss from small catchment areas which could subsequently be measured by standard procedures. Long term soil loss was measured by comparing the depth of the A horizon on either side of the fence. The assumption was that if the KwaZulu area had suffered accelerated soil loss over a long period, the A horizon depth would be significantly lower than that on the Mfolozi Game Reserve side. Since there was a clear demarcation between the A and B horizons the measurement was simplified. The relationship between the degree of soil erosion and production potential was measured by means of harvesting the herbage from protected exclosure plots on either side of the fence. The comparison between grass species richness and diversity was measured by assembling grass species frequency data using quadrats randomly placed within each plot, and deriving an index of similarity to compare conditions on either side of the fence. The study was conducted over two rainy seasons.

The results indicated that over the two year test period short term soil loss was consistently higher from the KwaZulu sites than from the Mfolozi Game Reserve sites, although no significant difference could be established. The long term erosion levels measured by means of the variation in depth of A horizon was again consistently higher on the KwaZulu side, but again no significant difference could be accounted for. There was no significant difference in terms of herbage accumulated in KwaZulu when compared to Mfolozi in the exclosure plots. As could be expected, under grazing there was a significant difference

between the two. Plainly this was due to the variation in grazing pressure applied to the two areas. While there were significant differences in species richness at the various positions on the slope, there was no significant difference between species variability between the pairs of plots measured in KwaZulu and Mfolozi Game Reserve. The authors in their discussion conclude that for all the variables measured the position of the plot on the slope made a greater contribution to variability than whether the plot was situated in KwaZulu or Mfolozi. In summary "the perceived management problem in following a non-interventionist policy therefore appears to be unfounded: both conceptually, when considered in the light of Natal Parks Board objectives for game reserves under their control and practically, when the herbage accumulation results are considered" (Venter et al, 1989: 95). They do make the cautionary note that the assumptions were that the grazing pressures between the two areas had varied considerably over the years. Since the underlying assumption leading to the research was that in fact the KwaZulu area had been subject to a long history of abusive grazing by domestic livestock, this is a somewhat unexpected cautionary statement at the end of the paper. What can be concluded from this work is that whatever the history of grazing conditions on either side of the fence, using the parameters of a number of important indicators of degradation, the conditions in KwaZulu are no worse than those that pertain in a well protected and presumably well managed conservation area. This information is significant for the conclusions that will be reached later on in this study.

4.6 Conclusion

The information presented in this chapter has not been intended to challenge or directly criticise the quality of the research carried out either on grassland dynamics or on erosion. In addition it does not purport to be a comprehensive review of such research. It has been provided to show that even under

controlled research conditions, the assumed relationships which underlie the present understanding of the dynamics of grasslands, are not sufficiently consistent to be used as the basis for policy prescriptions in the case of a grassland resource such as that employed by Zulu cattle owners. The effect of applying the research in South Africa might mean no more than a variation in gross margin for a farmer who, since he is proceeding with the recommendation, could presumably afford the risk of an error. In the case where the recommendation amounts to social experimentation on a grand scale, resulting in fundamental changes to the economic and social fabric of an entire ethnic group, it is submitted that the information is not strong enough to justify so drastic an action. This is particularly so, as long as the economic outcome of significant stock reduction in KwaZulu has not been estimated or predicted.

CHAPTER 5
HERD PRODUCTIVITY

Unfortunately the native traditionally
prefers quantity to quality.

Brookes & Hurwitz
1957

5.1 Introduction

At any given level of management and nutrition the productivity of the animal system is obviously highly dependent on the genetic potential of the animal used. In the case of KwaZulu, there has been considerable adulteration of the original Nguni stock, in common with most developing areas of Southern Africa, in the supposed interests of improving its productive potential (Trail & Gregory, 1986, quoted by Scholtz, 1988: 2, Hundleby et al, 1986:5). This deliberate adulteration with exotic breeds has been exacerbated by direct purchases by Zulu farmers of exotic stock from South African farmers over many years, but despite these introductions, the base stock of cattle in KwaZulu remained the indigenous Nguni.

Table 5.1 Breed type of sample herds (1982/83, N=370)

<u>Breed type</u>	<u>Number</u>	<u>Percent</u>
Indigenous Nguni	277	74,9
Exotic	2	0,5
Mixed	86	23,2
No response	<u>5</u>	<u>1,4</u>
	370	100,0

Source: Survey data

More recently, recognition of the genetic value of the breed (Oliver, undated quoted by Hundleby et al, 1986: 1) has led to efforts to improve it by internal selection rather than by crossbreeding. As a consequence, pure Nguni herds have been established, for the purpose of improving the breed, both in KwaZulu and Ciskei (Hundleby et al, 1986: 11). In addition, research work has been directed at determining the productivity of the Nguni (or the Sanga, a generic term which includes all the variants of the type, including the Nguni) compared to the developed breeds.

With inherent animal productivity the prime determinant of output at given managerial and nutritional levels, this chapter will look firstly at the internal productivity potential of the Nguni breed, and secondly at the actual output of the national herd, derived from the national census, and the sample herd, derived from survey data.

5.2 Production potential of the Nguni

Two representative papers are used here, one (Schoeman, 1989) which examines performance under what might be termed the Nguni's natural, extensive conditions, and the second (Scholtz, 1988) its performance under the controlled conditions of the National Beef Cattle Performance and Progeny Testing Scheme of South Africa. Reproduction rate is one of the prime determinants of productivity in a beef herd, and it was accepted for many years that the reproductive rate of indigenous livestock was low (Schoeman, 1989: 55). Using data from Omatjenne Research Station in Namibia, however, Schoeman (1989: 56) showed that in fact the Sanga breed had a significantly higher calving percentage than four developed breeds over a ten year period (Table 5.2).

One contributing factor to low reproductive rates is the failure of first calving heifers to reconceive in the following year, primarily as a consequence of physiological stress. Data from Omatjenne showed that over a six year period, 93 percent of first

calving Sanga cows reconceived, compared with values of 70 to 79 percent for the four other breeds (Table 5.3).

Table 5.2 Calving percentages of five cattle breeds (1977 - 1986). Annual Progress Reports, Omatjenne Research Station

Breed	Year										Unweighted mean
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	
Afrikaner	70,0	66,7	79,3	81,3	65,6	80,0	87,5	63,3	64,5	87,5	74,6 ^b
Hereford	79,3	66,7	80,0	73,3	*	89,7	65,6	78,1	75,0	93,8	77,9 ^b
Sanga	83,3	96,7	97,5	95,1	88,4	89,8	88,9	81,6	87,5	87,5	89,6 ^a
Santa Gertrudis	86,7	73,3	86,7	56,7	71,9	83,5	93,8	82,8	82,1	78,6	79,6 ^b
Simmentaler	87,9	65,5	71,0	77,4	73,3	90,3	*	*	70,0	85,2	77,6 ^b
Unweighted Mean	81,4	73,8	82,9	76,8	74,8	88,7	83,9	76,5	75,8	86,5	80,1

a,b $p < 0,01$.

*Excluded due to subfertile sire.

Source: Schoeman (1989: 56)

Table 5.3 Calving percentages of first calf heifers and calving percentages of heifers (Barnard & Venter, 1983, Annual Progress Reports, Omatjenne Research Station)

Breed	Calving percentages first calf heifers (1978-1986)	Recalving percentages of heifers (1977-1982)
Afrikaner	87,1	78,0
Hereford	82,1	0,4
Sanga	91,4	92,9
Santa Gertrudis	83,1	76,7
Simmentaler	76,9	76,6
Unweighted mean	84,1	78,9

Source: Schoeman (1979: 56)

Schoeman (1989: 56) concludes that the fertility of the Nguni breeds is in fact exceptionally higher than any other of the breeds recorded.

Results of trials conducted at Bartlow Combine Breeding Station, KwaZulu showed that in feedlots, although lighter than the other breeds, Nguni heifers had a better feed conversion ratio than either Bonsmara or Drakensberger heifers, although not significantly so. Onset of puberty is early, and calving as early as 25 months, veld-reared heifers achieved a 76 percent calving rate at first calving, with a 90 percent reconception rate (Lepen, 1980, quoted by Schoeman, 1989: 57). All of the above contribute to high fecundity levels, aided by exceptional calf-bearing and rearing characteristics (Schoeman, 1989: 57, Table 6).

The data above were obtained under what could be called field conditions at Omatjène and Bartlow breeding stations, where the Sanga could be said to hold an advantage as a consequence of adaptation. Scholtz (1988) on the other hand, reports on results achieved in the National Beef Cattle Performance and Progeny Testing Scheme between 1976 and 1985 where conditions are standardised and presumably do not favour any breed. He comments on the acquired tolerance of the Nguni as a consequence of 24 centuries of exposure to diseases such as trypanosomiasis, opthalmia, heartwater and other tick-borne diseases. (Scholtz, 1988: 3, citing Mason and Maule, 1960). He provides data showing that while the Nguni is consistently lighter than other breeds, it exceeds all other breeds, both indigenous and exotic types in calving performance, and, as may be expected, in calving interval (Table 5.4).

These data show that in contrast to the accepted view of the Nguni it, and its fellow Sanga variants, are extremely fertile, according to Scholtz (1988: 4) "the most fertile beef breed in South Africa (and probably in the world)". This, together with

its excellent mothering traits, means that its reproductive efficiency, measured as the ratio of weaned calves to cows mated is exceptionally high. This is attributed to natural selection which occurred as a consequence of the management system under which the progenitors of the breed have been run for centuries. (Scholtz, 1988: 4; Schoeman, 1989: 60; Hundleby et al, 1986: 6; quoting Oliver - undated).

Table 5.4 Cow mass and reproductive performance of different breeds in South Africa from 1976 to 1985 as summarised from data of the National Beef Cattle Performance and Progeny Testing Scheme

Type	Breed	Cow Mass (weaning) (kg)	Age at first calving (months)	Calving interval (1st-2nd) (days)	Calving interval (cows) (days)	Calculated calving percent
Indious	Afrikaner	459	41	512	469	72
	Brahman	477	37	462	441	79
	Nguni	396	36	442	412	87
Indious types	Bonemara	466	34	463	434	81
	Drakensberger	482	40	514	469	72
	Santa Gertrudis	483	35	501	458	75
British	Angus	455	34	427	425	84
	Hareford	479	35	428	423	84
	South Devon	522	36	455	441	79
	Sussex	555	34	430	430	82
	Charolais	632	38	446	456	75
European	Pinzgauer	474	34	432	426	83
	Simmentaler	507	34	459	449	77
Mean number of observations/breed		11 119	6 831	3 820	21 294	21 294

Source: Scholtz (1988: 5)

The very high reproductive efficiency is off-set to a degree by the low body mass of the Sanga breeds, which is part of their adaptive efficiency (Schoeman, 1989: 60). Despite either matching or exceeding the four other breeds in percentage increase in mass from birth to 24 months, the 24 month body mass of the Sanga was only 327 kg compared to a range of 368 kg (Afrikaner) to 432 kg (Simmentaler) for the others.

Table 5.5 Calculated productivity at weaning of different breeds expressed in different ratios of calf and cow performance.

Type	Breed	Calf/cow mass ratio at weaning %	Kg calf weaned/ cow exposed	Kg calf weaned/ 100 kg of cow exposed	Kg calf weaned/ cow mass 0,75 exposed
Indicus	Afrikaner	37,7 (11)	125 (13)	27,2 (12)	1,26 (13)
	Brahman	41,3 (8)	156 (8)	32,7 (5)	1,53 (5)
	Nguni	41,4 (7)	143 (12)	36,1 (1)	1,61 (2)
Indicus types	Bonsmara	42,3 (4)	160 (6)	34,3 (3)	1,60 (3)
	Drakensberger	41,5 (6)	144 (11)	29,9 (10)	1,39 (11)
	Santa Gertrudis	43,3 (2)	157 (7)	32,5 (6)	1,52 (6)
	Angus	42,2 (5)	161 (5)	35,4 (2)	1,63 (1)
British	Hereford	38,2 (10)	154 (9)	32,2 (7)	1,50 (6)
	South Devon	39,5 (9)	163 (4)	31,2 (9)	1,49 (7)
	Sussex	36,2 (12)	165 (3)	29,7 (11)	1,44 (10)
European	Charolais	36,1 (13)	171 (1)	27,1 (13)	1,36 (12)
	Pinzgauer	43,0 (3)	150 (10)	31,6 (8)	1,48 (8)
	Simmentaler	43,6 (1)	170 (2)	33,5 (4)	1,59 (4)

() - Ranking of breed

Source: Scholtz (1988: 8)

Scholtz (1988: 7) showed similar results in the National Beef Cattle Performance and Progeny Testing Scheme, where the final mass of the Nguni, after a 140 day feedlot test was 375 kg, compared to a range of 407 kg (Afrikaner) to 554 kg (Simmentaler) for the other 12 breeds tested. The feed conversion ratio for the Nguni was 7.07, better than the other indigenous breeds, and ranking with the developed British and European breeds.

For realistic comparison of total field performance between breeds, obviously some baseline, or relative technique must be used. Scholtz (1988: 8) uses four ratios describing performance per cow and per mass of cow (Table 5.5).

The last two ratios are preferred on account of the fact that productivity is related to cow mass, which is the main determinant of maintenance cost of the herd. The Nguni ranks first and second in these indexes. Schoeman (1989: 60), in Table 5.6 extends these comparisons to include a "herd efficiency index", in which again, by a considerable margin, the Nguni exceeds the other four breeds tested at Omatjenne.

The particular importance of these latter performance ratios is that they provide a proxy for economic efficiency, in the sense of input/output ratios. It is apparent from the data that the Nguni/Sanga is superior to all other breeds against which it was compared, including both ancient, highly developed breeds, and modern synthetic hybrids. This is true not only in the Ngunis natural, harsh conditions but under the more favourable conditions of the national testing scheme. The inherent productivity of the breed presents no constraints to output. In fact given this extraordinary genetically determined potential, the actual performance of the KwaZulu cattle herd can in technical terms, only be attributed to management failure, including specifically nutrition. The balance of this chapter will give dimensions to the actual performance, drawing from both primary data and survey results.

Table 5.6 Cow and herd efficiency indices of five cattle breeds (Omatjenne Research Station)

Breed	Calving rate %	Mortality rate %	Weaning rate %	Weaning mass kg	Adult cow mass kg	Weight of calf weaned/ 100kg cow/ year	Cow efficiency index ^a	Herd efficiency index ^b
Afrikaner	74,6	8,1	66,5	197	487	26,9	1,90	1,26
Hereford	77,9	15,0	62,9	202	491	25,9	1,94	1,22
Sanga	89,6	5,4	84,2	180	390	38,9	2,05	1,73
Santa Gertrudis	79,6	5,9	73,7	234	511	33,7	2,18	1,61
Simmentaler	77,6	13,4	64,2	250	553	29,0	2,19	1,41

^a 205-Day adjusted calf mass/adult cow mass 0,75

^b Cow efficiency index X Weaning rate (%)

100

Source: Schoeman (1989: 60)

5.3 Herd performance statistics

National herd inventory, mortality, sales, import and export statistics have been maintained in KwaZulu since 1975. Statistics for formal and informal slaughtering were added in 1978, and calving performance in 1982. From 1976 onwards the sales data were disaggregated to district level, making it possible to isolate the published statistics for the survey area, and to compare them with those for KwaZulu as a whole. In this section the national statistics will be considered first, followed by those for the survey area.

5.3.1 National statistics - KwaZulu

Livestock statistics from underdeveloped countries are notoriously suspect (Johnson 1980, Bembridge 1979, 1980). The limitation of data from this source in KwaZulu has been indicated in Chapter 3, but nonetheless they are worthy of study on two

grounds. Firstly, assuming that errors and distortions are of the same order for each year under review, trends can be established. Secondly, from the point of view of both those orientated towards ecology and those towards production, the statistics present an unfavourable picture. They are likely, however, to be more favourable than reality. Firstly if the reputed "ghost" herd does exist it means the total inventory is in fact understated. Secondly, there is reputed to be a large amount of illegal importation of cattle into the country. If this is true and the cattle are, as suspected, brought onto the dipcards surreptitiously as replacements for deaths then the mortality rate is higher, and birth rate lower than reported. It is as well to be aware that the published statistics are probably optimistic.

The pertinent information available is summarised in Table 5.7. There are several points of interest from this table. The first is that inventory has grown over the period. While the 1988 figure of 1516 million is 19,0 percent higher than the 1975 figure, regression is significant, suggesting that the present high values are one of the cyclical peaks characteristic of the data (See Figure 5.1).

The fluctuations in total herd numbers can be related to season to season variation in rainfall and concomitantly to the variations in mortality. Thus the drier seasons of 1979/80 and 1983/84 were associated with higher than usual mortality levels and reduced inventories. The recovery in herd numbers from 1985 onwards is associated with relatively low mortality levels. Mortality, lagged by one year, is positively related to herd inventory significant at the five percent level, with $R^2=0,68$. This suggests that the herd is in fact at the limit of the carrying capacity of the veld and that fluctuations in herd numbers are largely affected by natural causes, Lyne & Nieuwoudt (1990) show that herd count, lagged by one year, is significantly related to rainfall.

Table 5.7 National herd statistics, 1975 to 1988

Year ending 31/03	Inventory '000 head	Mortality		Slaughtered				Net Import/ (Export)	Sales	
		(1)		Formal		Informal			Number	%
		Number	%	Number	%	Number	%			
1975	1 273	127 766	10,0					(1 295)	12 994	1,0
1976	1 312	N/A						2 196	9 749	0,8
1977	1 349	156 377	11,9					5 036	9 606	0,7
1978	1 425	98 271	7,3	2 335	0,2	57 800	4,3	11 589	8 615	0,6
1979	1 431	111 923	7,8	5 135	0,4	70 850	5,0	21 721	8 060	0,6
1980	1 468	97 462	6,8	5 621	0,4	62 650	4,4	15 341	16 945	1,2
1981	1 357	154 836	10,5	5 591	0,4	71 750	4,9	4 525	9 634	0,7
1982	1 351	72 502	5,3	10 364	0,8	64 650	4,8	(13 067)	11 729	0,9
1983	1 447	67 151	4,9	3 652	0,3	69 690	5,2	4 874	9 048	0,7
1984	1 352	140 518	9,7	3 763	0,3	75 780	5,2	(2 399)	13 364	0,9
1985	1 344	63 932	4,7	3 782	0,3	57 750	4,3	12 682	5 862	0,4
1986	1 417	70 546	5,3	4 610	0,3	59 849	4,5	14 004	8 745	0,7
1987	1 483	67 248	4,7	3 687	0,3	58 300	4,1	8 225	8 201	0,6
1988	1 516	77 134	5,2	4 257	0,3	64 644	4,4	2 855	14 594	1,0
MEAN	1 394	100 438	6,7	4 780	0,3	64 883	4,7	Net	10 510	0,8
S.D.	68 004	32 011		1 987		6 026		Gain	2 901	
C.V.	0,05	0,32		0,41		0,09		86 287	0,28	

Source: Annual Reports, Director of Veterinary Services, KDA

Mortality is high with a mean value of 6,7 percent, and three times exceeding 10,0 percent. It also consistently exceeded the sum of informal and formal slaughterings (sales may not be additive to slaughterings as many sales are made to butchers for direct slaughter). The overall trend in mortality is negative, although not significantly so.

The dominance of informal slaughtering over other forms of offtake is apparent. Informal slaughtering (referred to as "bush-slaughtering" in KwaZulu) is typically carried out for home

consumption, either with or without a concomitant ritual function, and occasionally for sale. Formal slaughterings are those registered at abattoirs for sale through the formal system. A striking feature of the informal slaughterings is the relative lack of variability from year to year (C.V. 0,09 compared to 0,28 to 0,41 for the other coefficients). This suggests that while sales or formal slaughterings could be ad hoc and vary in accordance with variations within the cattle system, informal slaughtering is done in response to a demand or stimulus exogenous to the cattle system. For example, while ARDA (1982: 22,23) found no correlation between sale rates and herd size, in the South Gwanda district in Zimbabwe, they found strong correlation (significant at 1 percent level) between absolute numbers sold and family size. Since in this area farmers are heavily dependent on cattle sales for cash needs, ARDA suggested that sales are a function of the cash needs of the family - a variable exogenous to the cattle system. A similar influence may be at work on the informal slaughterings and since the survey data show that the bulk of slaughtering is for ritual purposes, this may well be the death rate of the herd owners. The derisory scale of annual sales is apparent. Over the fourteen years when data were available, the mean was 0,8 percent and only once was 1,0 percent exceeded.

In any herd of cattle, the stock flow through the herd can be traced using an annual stock trading account. Thus, the KwaZulu herd can be considered as a closed unit with movements of stock to and from the outside, monitored and recorded through the permits issued by the Department of Agriculture. Given such a closed system, deductions from or additions to the herd are accounted for by:

Deductions:	Mortality
	Exports
	Slaughtering
Additions:	Births
	Imports

Sales and purchases are not brought into account as they occur within the closed system and are ultimately recorded as slaughterings, exports, imports or mortality. Records of all the above have been kept consistently since 1981/82, and the data can be used to construct annual stock accounts. Their incompleteness can be shown through an unexplainable variance between opening and closing stocks each year, as can be seen in Table 5.8.

Table 5.8 Herd trading account (1982 to 1988)

Inventory Change	1982	1983	1984	1985	1986	1987	1988
Opening Balance	(1) 1357,0	1351,0	1447,0	1352,0	1344,0	1417,0	1483,0
Deduct							
Mortality	72,5	67,2	140,5	63,9	70,5	67,2	77,1
Slaughter	75,0	73,3	79,5	61,5	64,5	62,0	68,9
Exports	13,0	-	2,4	-	-	-	-
Add							
Imports	-	4,9	-	12,7	14,0	8,2	2,9
Births	160,1	199,1	154,2	168,1	191,7	196,2	192,6
Closing Balance	(1) 1351,0	1447,0	1352,0	1344,0	1417,0	1483,0	1516,0
Calculated Balance	(2) 1356,6	1414,5	1378,8	1407,4	1414,7	1492,2	1532,5
Residual	5,6	(32,5)	26,8	63,4	(2,3)	9,2	16,5
Cows	486,4	575,1	519,1	562,6	614,3	615,1	581,0
Births % cows	32,9	34,6	29,7	29,9	31,2	31,9	33,2
Births % herd	(3) 11,8	14,7	10,6	12,4	14,3	13,8	13,0
Total offtake % herd	11,8	10,4	15,4	9,3	10,0	9,1	9,8

Source: Annual Reports, Director of Veterinary Services, KDA.

Notes: 1 The opening balance for each year, (t) on 1st April is the inventory for the previous year (t-1), which is calculated as at 31st March. The closing balance is the recorded inventory for that year (t).

2 The calculated balance is that derived after recorded deductions and additions are allowed for.

3 Herd turnovers are calculated as percent of opening balance.

There are several significant features in this table. The first is that the closing balance calculated by deductions from and additions to the opening balance, varies considerably from the recorded closing balance, or census figure. Thus, in 1985, although additions to the herd exceeded deductions by 554 00 head, the herd was recorded as decreasing from 1,352 million in 1984, to 1,344 million in 1985. Accumulating these variances over the seven years for which full data are available suggests that the present herd size might be 1,603 million rather than the recorded 1,516 million. The second is that from 1982 to 1984, total offtake was almost exactly the same as the increases due to births, whereas subsequent to this birth rate consistently exceeded offtake rate. This accounts for almost all the steady increase in inventory over the last three years while the data for 1985 is simply an anomaly. Finally, the mean of the birthrate for the seven years for which data is available, calculated as total births divided by total cows, is a low 31,9 percent. The range about this mean is very narrow. This low birth rate is surprising in view of the high recorded fecundity of the Nguni breed under conditions allowing it to express its potential.

5.3.2 Survey area performance statistics

With the exception of the sales data, the statistics from the survey area were remarkably consistent with those for KwaZulu as a whole, with the gradient of inventory growth identical to the national herd although again, not significant. In years of drought, mortality losses are slightly higher in the Mabedlana district, presumably as a consequence of the fact that it includes the bulk of the drier areas of the territory. For the years for which data are available, no trend can be established for calving rates.

The major variation occurs with sales. Table 5.9 shows that while the mean inventory for the survey area is 49,9 percent of that of KwaZulu, sales for the survey area accounted for 62,3 percent of the total sales. This is consistent with the phenomenon that the bulk of cattle sales occur in the most northerly part of KwaZulu. The five districts of Mabedlana (including the two which it was not possible to include in the survey) have accounted for between 80 and 99 percent of total sales in KwaZulu since 1976. The sales turnover for the survey area is 0,94 percent compared to 0,8 percent for the whole of KwaZulu.

Table 5.9 Comparison of herd inventory and sales figures between survey area and KwaZulu

Year	Inventory '000 (1)			Sales (1)			Percent Sales (2)	
	KwaZulu	Survey	Percent	KwaZulu	Survey	Percent	KwaZulu	Survey
1975	1 273	662,1	52,0	12 994	N/A ⁽³⁾	N/A	1,0	N/A
1976	1 312	650,8	49,6	9 749	5 916	60,7	0,8	0,9
1977	1 349	704,6	52,2	9 606	6 128	63,8	0,7	0,9
1978	1 425	748,2	52,3	8 615	5 391	62,6	0,9	0,8
1979	1 431	733,5	51,3	8 060	5 084	63,1	0,6	0,7
1980	1 468	764,2	52,1	16 945	12 448	73,5	1,2	1,7
1981	1 357	662,5	48,8	9 634	5 386	55,9	0,7	0,7
1982	1 351	656,6	48,6	11 729	7 239	61,7	0,9	1,1
1983	1 447	722,6	49,9	9 048	6 370	70,4	0,7	1,0
1984	1 352	632,0	46,7	13 364	9 349	70,0	0,9	1,3
1985	1 344	652,5	46,0	5 862	3 132	53,4	0,4	0,5
1986	1 417	633,2	44,7	8 745	3 854	44,1	0,7	0,6
1987	1 483	744,2	50,2	8 201	4 718	57,5	0,6	0,7
1988	1 516	768,9	50,7	14 594	10 145	69,5	1,0	1,4
Mean	1 394	695,4	49,9	10 510	6 551	62,3	0,8	0,94

Source: Annual Reports, Director Veterinary Services, KwaZulu.

- Notes: 1. Calculated as the ratio of the survey area to the whole of KwaZulu.
2. Calculated as the ratio of sales to inventory for the relevant area.
3. Because of aggregation of the data in 1975, it was not possible to obtain a separate figure for the survey area.

5.3.3 Summary

The data presented in this section represent the movements through the entire herd of KwaZulu. It is the summarised outcome of the production decisions made by the universe of cattle-owners in KwaZulu, expressed through a limited number of coefficients which the administration is interested in. To some extent the movements through the herd can be related to causal variables, but the absolute values of for example, sales, is so low that the relationships are not only tenuous, but not particularly informative in addition. Further the aggregate figures mask inter-district variation. For example, between 1985 and 1988, when the national inventory was built up from 1,344 million to 1,516 million (13 percent) five districts had decreases in inventory from 1 to 13 percent, seven increased by between zero and ten percent, eight were between 10 and 20 percent and four were over 20 percent, with the highest at 55 percent. Six of the twenty six districts, accounted for 75 percent of the growth in herd size.

Finally it is the basis of this study that interventions aimed at the individual cattle owner are more likely to achieve the objectives of policy-makers than broadly worded statements of the desires of Government. The national figures might reflect the outcome of the decisions of the cattle-owners but what is required is insight into the decision making itself. It is

particularly relevant, for example, that KwaZulu cattle owners opt for a set of management practices which result in a reproduction rate approximately one third of that which the genetic potential of their cattle suggest is possible. Inter-herd movements, which are a significant result of individual decision making are not reflected in the national statistics. In the next section cross-sectional survey data are used to compare the dynamics of the sample herd, including inter-herd movements, with the published statistics.

5.4 Sample herd performance statistics

During the survey interview, respondents were requested to supply a count of cattle owned on the day of the interview. In addition they were requested to recall the transactions which had occurred over the previous twelve months, assisted by the dip card where appropriate. In view of the rarity of these transactions and the detailed knowledge the owners have of their relatively small herds, the degree of error due to faulty recall could reasonably be assumed to be low. Given this data, and using the herd count on the day of the interview as a "closing balance", it was possible, for each herd, to construct a trading account and an "opening balance" as at a year earlier. The figures presented in this section are the sum of the herd counts and transactions for all herds in the sample. They are intended to provide indications of trends, not necessarily absolute values.

The transactions used were as follows:

Deductions:	Mortality
	Sales
	Lobolo paid
	Slaughter
Additions:	Births
	Purchases
	Lobolo received

Theft as a transaction was ignored because, curiously, while a large number of owners recorded deductions as a result of theft, none recorded additions to their herds. It is, presumably, a zero-sum game in any case. The effect of these transactions is shown in Table 5.10.

Table 5.10 Sample herd trading account 1982-83 (N = 370)

Transaction		Number	Percent
Opening balance			3868
Deductions:	Mortality	323	8,4
	Sales	149	3,9
	Lobolo paid	161	4,2
	Slaughter	152	3,9
Additions:	Births	804	20,8
	Purchases	126	3,3
	Lobolo received	226	5,8
Closing balance			4239

Source: Survey data

Herd growth amounted to 9,6 percent compared to 7,1 percent for the national herd over the same time span. The main variations are in mortality and birth, both of which are higher than the figures for the national herd although birthrate is still very low. The national statistics did in fact record an abnormally high birth rate for this period, although not as high as the sample herd. The balance is likely to be accounted for by differences in interpretation and sampling error.

It is notable that the "useful" offtake, sales, lobola and slaughter, accounts for a turnover of 11,0 percent, more than ten times the usually accepted figure for offtake, sales only. It is of interest that the sales figure, nearly five times the "official" figure, supports the observations made by both respondents and enumerators that the formal sales channel is not the preferred means of disposing of cattle (see chapter 6).

Further both lobolo and slaughter exceed sales. In terms of additions to the herd, purchases, at 85 percent of the value of sales, and lobolo contribute significantly to the build up in herd size. Without these two inputs the net increase would have been 0,5 percent instead of 9,6 percent. If cows over three years old are taken as representing the breeding herd, 35,2 percent of the sample herd consisted of breeding cows. On this basis the calving rate is some 59,1 percent, very much closer to the genetic potential than is suggested by the national statistics.

5.5 Structure of sample herd

Because none of the respondents maintained written records, recording a reliable detailed age breakdown was problematic. It was determined therefore to record only two age groups; over three years and under three years old. This was held to be the boundary of maturity and although crude, would provide an indication of animals of breeding, working or selling age. Table 5.11 provides a break-down of sex by age groups on this basis, together with a standard model for an extensively managed beef herd, for comparison.

Table 5.11 Herd structure of sample herd, compared to model

Class		Sample (1)		Model (2)	
		Number	Per owner	Percent	Percent
Bulls	< 3 years	619	1,7	14,6	1,5
Bulls	> 3 years	246	0,7	5,8	1,5
Cows	< 3 years	483	1,3	11,4	5,6
Cows	> 3 years	1 492	4,0	35,2	37,3
Heifers	< 3 years	678	1,8	16,0	27,5
Oxen	< 3 years	106	0,3	2,5	28,2
Oxen	> 3 years	623	1,7	14,7	0

Source: (1) Survey data

(2 Enterprise model 40263, Division of Production Economics, Cedara.

Points of interest are the large number of immature bulls, which reflect the Zulu cattle owners reluctance to castrate. This will be discussed further under management practices adopted. The sample herd has some four times as many mature bulls, as a consequence of the small size of individual herds, and the need for each owner to have his own bull or bulls. Including the cows under three years old, the breeding herd in KwaZulu is proportionately 25 percent larger than the model herd. This could be attributed to a need for a greater number of cows as a consequence either of their low reproductive performance, or the demand for milk. The most crucial difference between the two structures is in the ratio of growing stock to mature stock. In the case of the model, some 60 percent of the herd is growing stock, compared to 33 percent of the KwaZulu herd. This is an indication of both productivity and age structure. The KwaZulu herd is, comparatively, older and less productive than the model.

5.6 Conclusion

The image presented by the sample data is one of considerable transaction activities within and between individual herds. This is in contrast to the indications from the national statistics, particularly as interpreted by administrators. The administrators' views are coloured by the drive to reduce herd count, and since increased sales is perceived as a means of achieving this, there is an undue concentration on sales as the only important statistic. From the sample data however, it is apparent that the herd owners have a range of important offtakes of which sales is only one, and not the most important one. It could be argued that, in any case, 85 percent of the sales are supported by purchases.

With a sample size of 370, it is apparent that in the case of those transactions requiring decisions (i.e. excluding deaths and

births) in no single transaction did every farmer become involved. With the exception of lobolo-received, in no case did as many as half the owners transact. Not only does this simply indicate the low level of activity in transactions, but suggests that there is a set of underlying conditions which influence the occurrence of transactions, and these require investigation. One of the influences assumed to affect transactions, individual herd size, is examined in the next chapter.

CHAPTER 6

HERD DYNAMICS

We can no longer afford to work on subjective views and generalisations regarding farming systems, cultural, personal and socio-psychological factors of the peasant farmers.

Bembridge

1979

6.1 Introduction

It is widely held that the small size of individual herds among traditional owners inhibits commercial output. The reasoning is firstly that a minimum number is required to be assembled into a functional herd structure, to optimise breeding and management; secondly a certain sub-minimum is required before cattle can be released for sale. There is, however, no general agreement on what the irreducible minimum herd size must be to achieve functional efficiency. Bembridge (1979: 168) illustrated the hierarchical role of cattle in satisfying needs in peasant farming. The most fundamental need was for primary survival and subsistence, followed by the social supportive role. A total of 6 to 8 large stock units (LSUs) were required to satisfy these two functions, implying that the market economy could only be entered if the owner had 9 or more LSUs. Using a crude conversion of 0,8 LSU per head over all classes of an average herd, this would imply some 11 head of cattle of all classes.

Behnke (1982) considers 25 head to be the threshold before commercial production can be considered, more than twice Bembridge's (1979: 163) estimate. Livingstone (1985: 4) estimates that the minimum for subsistence in the Sahel is 30 "livestock units", per family, but for assurance against drought, as many as 75 units may be required. He believes that the need

to keep stock numbers in excess of basic requirement to survive drought, is the prime cause of overstocking in the Sahel and not the competitive exploitation model advance by Scott Gordon (1954).

Behnke (1982) quoted by Colvin (1983: 12) derived "Management Thresholds" for Botswana, which are indicated in Table 6.1.

Table 6.1 Herd management thresholds for Botswana

Herd Size	Subsistence	Commercial
6-10	Plough team will include either cows or immatures.	Owner reluctant to sell any animals.
20-25	Critical threshold: owner able to plough without need to borrow or use own breeding stock.	Herd approaching productive size.
30-40	Herd of average composition able to field four mature oxen for ploughing. Owner has potential to reach self-sufficiency in food production.	Owners able to sell one or two beasts a year regularly.
Over 40	Increasing costs and responsibilities associated with wealth.	

Source: Colvin (1982: 12)

The KwaZulu Department of Agriculture (1980: 86) holds that "One of the biggest bottlenecks to the adoption of improved grazing and management systems is the fact that individual herd sizes are small, which does not allow for a suitable herd composition". No threshold size is given, nor optimal herd structure, but by implication it appears that 10 head is considered to be the minimum requirement.

Fenyés and Groenewald (1983: 3) investigated the perceptions of farmers in Lebowa, on the number of cattle required to "make a living as a farmer". A herd of 10 head was considered to be

insufficient by 92 percent of the respondents, and 55 percent held that more than 30 head were required. The range of responses was from 5 head to 1400 head, and it must be assumed that some of the respondents were referring to making a living from cattle only.

Tapson and Rose (1984: 42) considered the minimum requirements for a herd in a mixed farming subsistence system in KwaZulu. Their estimate was based on maintaining 2 cows in milk and 4 trek oxen as the primary products, with sales, slaughtering and lobolo as incidental or by-products. Using the productivity indices applying in KwaZulu, they arrived at the following herd composition.

Bulls	1
Cows	7
Calves	2
Heifers	2
Steers	2
Trek oxen	4
Total	18

The recruitment to and output from this model herd were very similar to those for the national herd of KwaZulu, derived from published statistics.

The findings of Groenewald and du Toit (1985: 20) in Bophuthatswana, presented in Table 6.2 suggest strongly that the decision to sell is influenced by herd size.

The authors remark that "relatively few owners of small herds (20 or fewer cattle) sold cattle", implying some sort of threshold at 20 head. In an earlier paper, the same authors suggested that "a herd of fewer than 10 beef cattle cannot become a commercial herd" (Groenewald and du Toit, 1982: 229).

Table 6.2 Marketing behaviour of owners of herds of differing sizes in Bophuthatswana (1976)

<u>Herd size</u>	<u>Percent of owners selling</u>
1- 10	33,4
11- 20	52,9
21- 30	82,4
31- 40	79,2
41- 50	84,8
51-100	85,1
101-150	100,0
> 150	92,6

Source: Groenewald and du Toit (1985: 20)

To sum up, while considerable importance is attached to a threshold herd size in the literature on peasant cattle owners, there is no consensus on what this threshold is, and apart from Tapson and Rose (1984: 42) no attempts have been made to derive a figure based on objective requirements. In relatively pure livestock subsistence economies (Sahel, Botswana) it seems from empirical evidence that the threshold lies somewhere in the region of 30 head. In mixed farming subsistence systems, (KwaZulu, Lebowa, Bophuthatswana) the figure is probably below 20 and possibly as low as 10.

Attempting to determine a threshold level, either empirically or from basic principles is probably an activity of dubious value in any case. It suffers from inherent flaws arising from the variability of conditions, not only between regions, but also within regions and from the necessarily arbitrary determination of the proportionate contribution of cattle to the household economy. Most particularly at least in the southern African context herd size appears to be of concern only in respect of its effect on marketed offlake. As has already been shown in the previous chapter, sales is not the major contributor to the

subsistence household economy, so at least to the owner, the linkage between herd size and sales opportunity may not be particularly critical. From the macro level or state point of view, a more important issue is that a causal link between herd size and market offtake has been assumed and the conclusion reached that unless herd size can be increased, take-off will remain low. The validity of adopting sales off-take as proxy for productivity will be considered later. The analysis presented in this chapter shows that herd size cannot be assumed to be a determinant of percentage sales offtake, or, indeed of any other offtake.

6.2 Distribution of herd size

The frequency distribution of herd sizes in the survey area is indicated in Table 6.2. If the threshold herd size for a mixed farming subsistence system is taken as 20 head, only 52 owners or 14 percent have herds exceeding the threshold.

The data was examined by cross-tabulation, in an attempt to isolate factors which might influence herd size. Because of differences in transactions between regions, discernible from the national statistics, and because Ogwini was considered to have a stronger cropping bias, the two regions were considered separately.

In Ogwini there were no discernible factors influencing the distribution of herd size. While the majority of herds of over 20 head were concentrated in the districts of Nkandla and Enseleni it was not statistically significant. Bioclimatic zone had no effect on distribution at all. As may be expected, the great majority of herds belonged to men (91,7 percent), and all the herds over 20 head in size belonged to men. In terms of occupational status there was a predominance of larger herds in the "resident" category, compared to the "commuter" categories but the difference was not significant. While the older age

groups tended to own more of the herds of over 20 head, the difference again was not significant. Cattle owners were however strongly biased towards the older age groups, 195 or 77 percent being over 50 years old, and 134 or 53 percent older than 60.

Table 6.3 Frequency distribution of herd size in the survey area (1982/83 N = 370)

<u>Herd Size</u>	<u>Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
1- 5	137	37,0	37,0
6-10	103	27,8	64,8
11-15	56	15,1	79,9
16-20	22	5,9	85,8
20-25	14	3,8	89,6
26-30	12	3,2	92,8
31-40	12	3,2	96,0
41-50	5	1,4	97,4
Over 50	<u>9</u>	<u>2,4</u>	<u>99,8</u>
Total	370	99,8	

Source: Survey data

The pattern in Mabedlana was very similar, with bioclimatic zone and district having no influence on the distribution of herd size. Again, the majority of all herds, 88 percent, was owned by men, as were all but two of the 32 herds over 20 head. In Mabedlana occupational status and herd size were associated, with 27 out of the 32 herds over 20 head being owned by residents, significant at the one percent level. As with Ogwini, while there was no discernible trend in herd size related to age, 88 of the 118 herd owners, or 75 percent were over 50 years old, with 50 percent over 60 years.

The association of larger herds and residential status may superficially suggest that the ownership of a larger herd reduces the need for migrancy. The age of the owners suggests this conclusion should be treated with caution. Tapson (1986: 15) has shown that in a sample drawn without regard for cattle ownership, the mean age of employed men was 45,5 years and of unemployed men 62,2 years ($P < 0,05$). The phenomenon of early "retirement" from regular employment is well recognised in Transkei as well.² It is conceivable that the migrancy period is in fact used to build up stock numbers, and that by age 45, mature sons can take over the role of wage labour for cash requirements in the household economy.

In summary, apart from the tendency for cattle owners to be concentrated in the older age group, there is little discernible trend in the distribution of herd size by district, bioclimatic zone, or age of owner. In Mabelana there is a tendency for larger herds to be owned by non-migrants, but the data does not permit firm conclusions to be drawn from this in this relationship.

6.3 The effects of herd size

The point of departure of this investigation was the phenomenon of the low rate of offtake from the herd, offtake being defined as sales. Attempts to identify the determinants of the sales offtake, by analysis of trends through individual cases immediately encountered the problem of a paucity of data points and the low values of the parameters. Table 6.4 provides the frequency of sales at different levels.

²Dr Olaf Martiny, Chamber of Mines, indicated to the author that the modal age of workers on last contract on the mines was 45 years.

Table 6.4 Number of sales from sample herd (1982/83 N = 370)

<u>Number of sales</u>	<u>Number of owners</u>	<u>Percent owners</u>
0	291	78,6
1	50	13,5
2	16	4,3
3	7	1,9
4	3	0,8
5	1	0,3
>5	<u>2</u>	<u>0,5</u>
	370	99,9

Source: Survey data

Only 21,4 percent of owners sold cattle at all. Of those selling, 83 percent sold 2 head or less. The shape of the distribution of sales makes obvious the difficulties in determining relationships between sales and causative variables. The skewness of the distribution and small number of observations made linear regression unusable. The numbers sold were so low, that reducing the data to a binary variable ("sales" and "no sales"), and testing for effects on this basis seemed an option. Stepwise discriminant analysis was used, using five explanatory variables:

age of owner - as a proxy for conservatism
herd total
lobolo receipts
purchases
management proxy

The last was rather arbitrarily estimated by applying values to the responses to the questions on management in the survey. The "possible" score was 16, and individual scores varied from 0 upwards.

Age of owner, purchases, herd total and lobolo receipts (all with negative coefficients) and management were significant. The residual variance was high (exceeding 90 percent) and the function had poor powers of discrimination, particularly in regard to the group which sold. The variability of the data from the sample was considerable. With the exception of the age and management variable the CV for all other variables exceeded 100 percent and some were as high as 400 percent.

While little of value could be deduced from the discriminant analysis the negative coefficient for herd total suggested a reverse of the common assumption - that sales should increase with herd size. The choice of statistical procedure to test this was limited by the fact that the data failed to meet one condition necessary to make parametric tests acceptable - that the population from which the sample is drawn must be normally distributed (Siegel, 1956: 19). The skewness of the primary population distributions negates this condition. The conditions for non-parametric statistical testing are less rigorous, and under conditions where the sample size is large enough, non-parametric tests can retain the same power to reject the null hypothesis as a parametric test.

It was determined, therefore, to subdivide the sample into four groups, based on herd size, and to determine the probability of an individual animal being sold from each group. The null hypothesis was that the probability of an individual animal being sold is the same for all groups, regardless of herd size. The test used was Chi-squared test for independent samples. Given that the null hypothesis is rejected, the source of the contribution to the Chi-squared value must be determined to establish the source of the variability as an explanation of the relationships being tested.

In assessing the effect of herd size on any transaction, the relevant herd size to be used is that which existed before the

transaction, not that which exists as a consequence of the transaction. Using the individual records of transactions, an "opening" balance was determined for each herd. The sample was then subdivided into four approximately equal groups based upon opening herd size. The need to adhere to discrete herd boundaries meant that the four groups could not be exactly the same in size, but since probability was being tested for, this does not affect the Chi-squared test.

The descriptive data for the four groups is provided in Table 6.5

Table 6.5 Group data for sample herds (1982/83 N = 370)

	Group size	Herds	Cattle	Mean herd size	Percent herds	Percent cattle
1.	0- 3	100	206	2,1	27,0	5,3
2.	4- 7	95	523	5,5	25,7	13,5
3.	8-13	95	967	10,2	25,7	25,0
4.	14-96	80	2172	27,2	21,6	<u>56,2</u>
Total		370	3268		100,0	100,0

Source: Survey data

The spread of mean herd sizes across the groups is large enough that herd size effects should be apparent, if they exist. Herd size effects can be expressed in two ways. Commonly they are expressed as effect on turnover - thus the larger the herd the higher the expected turnover percentage. This could affect transactions both into and out of the herd. The second effect herd size could have is on the propensity of the herd owner to transact. Thus an owner with a large number of cattle may be more ready to dispose of an animal than one with a small herd, regardless of the number of cattle involved in the transaction. Both these effects will be tested below.

The herd data used are provided in Table 6.6, in which the data have been assembled into the form of a stock account for each group, in the manner of Table 5.10.

Table 6.6 Stock movements through four groups of herds from the sample (1982/83 N = 370 herds;)

Transaction	Group 1		Group 2		Group 3		Group 4	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Opening Balance	206	100,0	523	100,0	967	100,0	2172	100,0
Deduct								
Mortality	23	11,2	37	7,1	80	8,3	183	8,4
Sales	13	6,3	25	4,8	35	3,6	76	3,5
Slaughter	21	10,2	38	7,3	52	5,4	41	1,9
Lobolo out	0	0,0	29	5,5	49	5,1	83	3,8
Total	57	27,7	129	24,7	216	22,4	383	17,6
Add								
Births	93	45,1	122	23,3	165	17,1	424	19,5
Purchases	39	18,9	17	3,3	21	2,2	49	2,3
Lobolo in	62	30,1	30	5,7	39	4,0	95	4,4
Total	194	94,1	169	32,3	225	23,3	568	26,2
Closing Balance	333	166,5	563	107,6	976	100,9	2357	108,5

Source: Survey data

Note: All percentages are relative to opening balance.

The data in Table 6.6 do not support the contention that turnovers will increase as herd count increases, for transactions either into or out of herds. This is illustrated graphically in Figure 6.1. While absolute values do in fact increase, relative

values show a decreasing trend as herd sizes increase. The second significant indication from this table is the high level of activity in Group 1, relative to the other three groups. Thirdly only in the case of the two lobolo transactions in Group 4, have transaction totals exceeded one head per owner. The generally higher values in Group 4 suggest that this may be a variation in propensity to transact, dependent upon herd count. The effect of herd size on turnover is considered next, followed by its effect on propensity to transact.

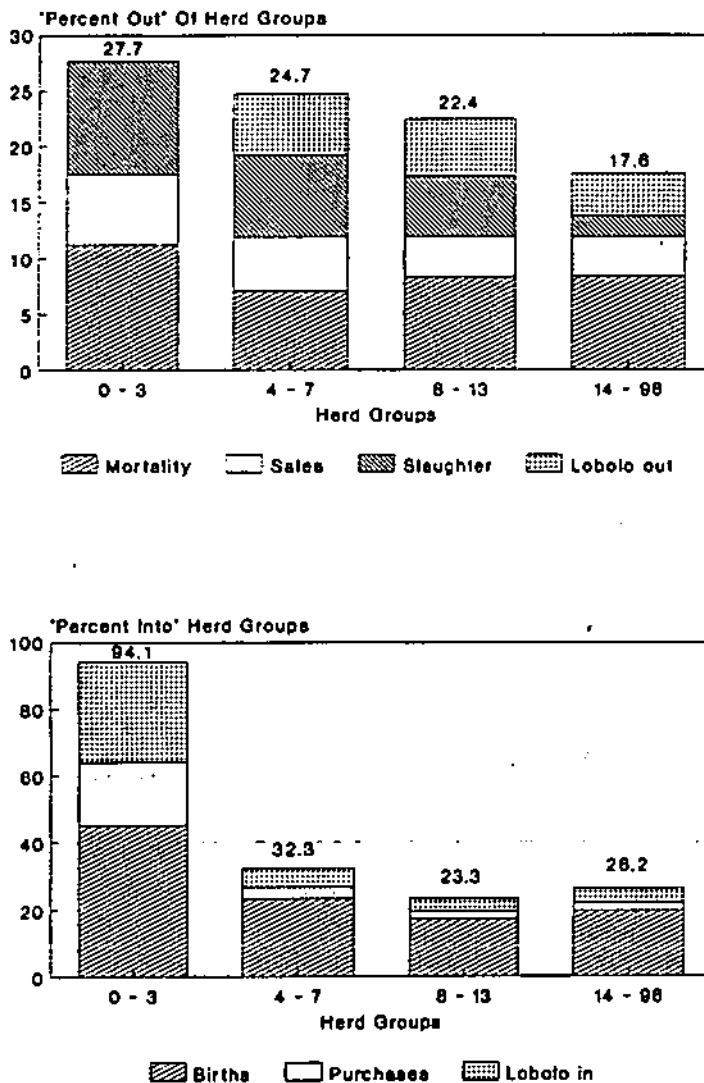


Figure 6.1 Movements through herd groups

6.3.1 The effect of herd size on turnover

Considering first the four transaction types under "deductions", the proposition is that the number of transactions will increase as herd size increases. Examination of the data in Table 6.6 shows this to be manifestly true. However, to have meaning, the absolute values have to be expressed relative to some other value. In this case group total provides a ratio which represents the percentage turnover - a commonly understood variable. For the Chi-squared test, the proposition is expressed as an hypothesis: the probability of an animal being involved in a transaction will increase with increasing herd size. The null hypothesis is that the probability is the same for all groups. The two conditions being tested are, in the case of sales for example, "sold" and "not sold". These together with the four classes or groups, give a 2 X 4 contingency table, for which, with 3 D.F., the Chi-squared values must exceed 7,82 for significance at the 5,0 percent level and 11,34 at the 1,0 percent level. In no case did the expected value approach the minimum rule-of-thumb value of 5,0 for the Chi-squared test.

Table 6.7 Results of Chi-squared tests on deductions from the four herd groups

<u>Transaction</u>	<u>Chi-squared</u>	<u>Significance</u>
Mortality	3,1	NS
Sales	6,9	P < 0,10
Slaughter	66,2	P < 0,01
Lobolo out	14,1	P < 0,01
Total	25,1	P < 0,01

The support of the null hypothesis in the case of the mortality data is not surprising - mortality can reasonably be assumed to be a random event affecting all classes equally. The relatively high value of Chi-squared in the case of sales is interesting.

It approaches significance at the 5,0 percent level, and is in fact significant at the 10 percent level. Examination of the source of the Chi-squared value indicates that it is almost entirely due to the high observed value of sales in Group 1 and 2. Thus in relative terms, the data indicate that sales decrease with increasing herd size. This can be interpreted as the demand for cash, which could be even across groups, rather than production decisions dictating sales events. Colvin (1984: 37) supports this with evidence from the Mona sale-yard, for which an unbroken sequence of records is available for 16 years. Having ascertained from sellers that the main reason for sale was for cash to make essential purchases, particularly of food, Colvin discounted the nominal price received for the cattle by the CPI index for grain products, as a proxy for food. On this basis, the real price of cattle had increased by only 2,2 percent over the period. Within this period however, there were three cycles when prices increased to a plateau for two to three years, then declined. There was no indication of increases in prices being accompanied by rising sales. Colvin (1984: 37) concludes that this inelasticity is a consequence of sellers inability to respond to rising prices: they are "forced" sellers and price-takers as a consequence of their need for cash. Plainly in the circumstances, greater proportional use is made of the smaller herds for this purpose.

In summary, the trend for disposals is negatively related to herd size for sales and slaughtering. The results from lobolo are anomalous as turnover is strongly related to herd size, except for Group 1, which paid no lobolo at all. Total offtake, expressed as a percentage, is strongly negatively related to herd size. This information is not particularly significant except that any tendency to increase the average size of herd would result in a reduction in relative and therefore ultimately, absolute offtake. This would be contrary to the expressed objectives of planners and policy makers. Given the net increase for each group it could be trivially argued that had the entire

sample fallen into Group 1, it would have increased by some 66 percent over the year. On the other hand, had it all fallen into Group 4, it would have increased by only 8 percent.

Given that there is a "threshold" herd size in a subsistence economy, it could be expected that owners of smaller herds would act to build up their herd counts, while owners of larger herds may be less concerned to do so. On the other hand the wealth represented by larger herds might well present an opportunity to expand, not available to the smaller owner regardless of his desire. To test this proposition, the herd-increasing variables were tested, again using the Chi-squared test. In this case it was not possible to use the contingency table. The hypothesis - that the number of cattle involved is proportional to herd size - suggests a causal relationship, which is used to set up expected values as hypothesised counts, based upon the ratio of cattle in each group to the total. Comparing those expected values with the observed, gave the Chi-square values in Table 6.8

Table 6.8 Results of Chi-squared tests on additions to the four herd groups

<u>Transaction</u>	<u>Chi-squared</u>	<u>Significance</u>
Births	69,4	P < 0,01
Purchases	166,7	P < 0,01
Lobolo in	222,4	P < 0,01
Total	313,2	P < 0,01

In each case the very high values of Chi-squared are due to 85 to 95 percent contribution from Group 1, where "observed" consistently exceeded "expected" values. Minor contributions were made by Groups 3 and 4 in which observed values were consistently lower than expected. In no case then was the null hypothesis supported, and intakes into the herd are strongly negatively related to herd size.

As with the case of deaths, calving could reasonably be expected to be a random event and therefore strictly proportional to herd size. The very high calving rate in Group 1 is therefore anomalous. It can probably be adequately explained by the fact that the herds in Group 1 are "immature", and in the process of being built up. In fact nine of them only came into being during the year preceding the survey having zero opening balances. This, together with the very high purchase and lobolo figure suggests that herd owners in Group 1, in building up their herds, procured mostly breeding cows, which would be a rational decision. This is supported by the survey data which shows that 71,3 percent of cattle bought, and 65,8 percent of those received as lobolo, were female stock. In contrast, only 32,2 percent of cattle sold were female stock, although the proportion of females given in lobolo is very similar to that received. This being so, the high birthrate would be a function of the high proportion of breeding cows in the smaller herds.

Several significant conclusions can be drawn from this data. The first is that, contrary to the image of a herd in stasis projected by the official statistics, there is in fact a great deal of activity, both into and out of the herds. In all cases, total offtake from the herd exceeds that of a conventional ranch herd managed at a level consistent with conditions in KwaZulu (Tapson, 1982: 5). Secondly sales is a minor component of offtake, in fact it is either exceeded or closely matched by purchases. It is one of a set of consumption activities, which includes slaughter, lobolo and, it will be argued in the next chapter, mortality. The remarkable increase in herd count in Group 1 (66,5 percent) is evidence of both serious investment, and hard bargaining in lobolo agreements to build up herd numbers. In absolute terms, the net increase in Group 1 was only exceeded by that of Group 4, the largest herds. The pattern of offtake suggests strongly that the underlying motivation for cattle keeping is consumption, not production.

Obviously consumption and acquisition decisions will be affected by the number of cattle the decision maker owns. It could be argued that the propensity to transact would be proportionate to the number of cattle owned. A proxy for this would be the proportion of owners within a group making transaction decisions, which is dealt with in the next section.

6.3.2 The effect of herd size on propensity to transact

The proposition here is that an individual's propensity to transact will depend on the number of cattle he owns - the higher the number of cattle the higher the propensity to consume. The measure used here is the probability of an individual in a particular group making decision to consume. Using the same groups as before, there are two conditions ("decision" and "no decision") and four classes, giving a 2 X 4 contingency table which can be tested with the Chi-squared test. The null hypothesis is that the propensity to make a decision will be the same for all groups. The numbers of decision-makers, including for interest the numbers of cattle involved per person transacting, are presented in Table 6.9.

Table 6.9 Number of decision-makers per transaction by group, and cattle transacted per decision-maker

Group Transaction	Group 1		Group 2		Group 3		Group 4	
	Decision	Cattle	Decision	Cattle	Decision	Cattle	Decision	Cattle
Mortality	15	1,53	29	1,28	46	1,74	53	3,45
Sales	5	2,60	21	1,19	25	1,40	28	2,71
Slaughter	21	1,00	35	1,09	45	1,16	38	1,08
Lobolo cut	0	0	12	2,42	12	4,08	17	4,88
Total (1)	34	1,97	67	1,92	77	2,80	68	5,63
Births	69	1,35	69	1,77	75	2,20	72	5,89
Purchases	18	2,17	11	1,54	15	1,40	25	1,96
Lobolo in	14	4,43	11	2,73	8	4,88	15	6,33
Total (1)	79	2,46	75	2,25	80	2,81	74	7,68

Source: Survey data

Note: 1 Since owners may have been involved in more than one transaction, totals are not the sum of other transactions.

Evidence from the previous section shows that births may well be subject to a specific decision making process so the reason for their inclusion is self-evident. The reasoning behind mortality being the outcome of a decision is not as tenuous as it may seem - owners patently decide on mortality if the options of sale or consumption are rejected. This argument will be developed more fully in Chapter 7.

The Chi-squared values for decision makers are presented in Table 6.10.

Table 6.10 Chi-square values for decision makers

Transaction	Decision makers	
	Chi Square	Significance
Mortality	55,8	P < 0,01
Sales	26,2	P < 0,01
Slaughter	19,0	P < 0,01
Lobolo out	20,9	P < 0,01
Total	69,4	P < 0,01
Births	12,5	P < 0,01
Purchases	17,0	P < 0,01
Lobolo in	4,4	NS
Total	7,5	P < 0,10

The pattern for all the tests was for the major contributions to Chi-squared values to come from Group 1 and Group 4, indicating greater deviation from expected values, according to the null hypothesis, in these groups. The values from Groups 2 and 3 were

insignificant. Little can be read into the deviations in the transactions into the herd, except that Groups 1 and 4 both exhibit more buying decisions than might have been expected. Comparisons of these two groups in the case of transactions out of the herd, however, reveal a significant difference. For every form of consumption in Group 1, the observed values of decisions made were lower than expected, and for every one in Group 4, observed values were higher than expected. These are illustrated below:

	Group 1		Group 4	
	Observed	Expected	Observed	Expected
Mortality	15	38,1	53	30,9
Sales	5	21,4	28	17,1
Slaughter	21	37,6	38	30,1
Lobolo out	0	11,1	17	8,9

This observation is consistent with the argument that owners of small herds limit consumption, it can be presumed, to build up their herds more rapidly. Conversely the owners of large herds have greater latitude to consume, and do so.

6.5 Conclusion

Herd size is held to be a critical factor in determining the efficiency of production of herds. On the one hand a subsistence owner requires a certain minimum number of cattle to satisfy social needs before he can indulge in commercial production. On the other hand a certain number of cattle are required to develop a productive herd composition. The small herd sizes in KwaZulu are consequently held to be an important reason for the low recorded sales figures.

Classifying the sample by herd size into four groups and using Chi-squared test, showed that although absolute values of sales

increased with herd size, relative or percentage sales declined as herd count increased. The relationship was significant at the 10 percent level. Sales however was only one of an array of usage which included mortality, slaughter and lobolo exchanges, all of which exceed sales in absolute value. All showed a declining trend as herd count increased, and only mortality was not significant at the 1,0 percent level. The data suggest strongly that the herds are held for consumption, not for production for sales. This conclusion was reinforced by an analysis of the effect of herd size on propensity to transact. The owners of the smallest herds consistently showed a propensity to make fewer consumption decisions than expected, while those in the largest herd group showed the opposite tendency. The importance of lobolo, not only to the extent that it represents the largest transaction, but also the effect of undischarged lobolo debt which will be dealt with in Chapter 7, is a critically important component of the cattle system. The effect of both these factors is to reduce the availability of animals for transaction.

Analysis of acquisitions to the herds was even more conclusive. It demonstrates a strongly developed tendency among owners of the smallest group of herds to build up stock numbers by all the means available to them, including withholding from consumption. Acquisitions to the herd other than through natural increase is a significant factor, which in contrast, is negligible in commercially run herds.

The general conclusion to be drawn is that cattle herds in KwaZulu are kept primarily for consumption purposes not for production. Even when cash sales occur, the evidence is that they are to generate cash to support immediate consumption. This conclusion is drawn from the statistical data available from the sample survey. In the next chapter more qualitative evidence will be discussed, which supports this conclusion.

CHAPTER 7
CATTLE AS 2 GOODS

We have use for the cow. That is why it has become religiously incumbent upon us to protect it.

Gandhi
1954

7.1 Introduction

There can be few taboos which have become so ingrained in general understanding as to give rise to an English idiom. The prohibition on slaughter of India's sacred cows is one. Yet Harris (1965: 217), explodes it as one of the "popular myths of social anarchy", and reverses the direction of its causality. It is not because they are sacred that they are not slaughtered: to slaughter them would destroy the precarious Indian subsistence economy, therefore they are sacred. Despite their low levels of productivity, they provide four products which are indispensable in so cash-poor an economy - milk, manure, draft and fuel in the form of dung. The cows produce in addition replacement oxen for draft, and incidentally large amounts of beef for the non-Hindu members of the population. Despite the fact they are so numerous that they "wander all over the place, cluttering up the markets, railroad stations and roadsides" there are in fact shortages of all the products they supply. Finally Harris (1965: 225) sees the relationship between cattle and humans as complementary, not competitive, both being part of an efficient ecosystem. Most particularly, cows and humans occupy separate nutritional niches, and the cows supply their contribution to Indian welfare without competing for human food.

Much of the attitude of mind which gave rise to the myth of the sacred cow, "substituting untested assumption for verifiable hypothesis, rhetoric for analysis" (Horowitz, 1979: 26), seems to

be detectable in the approach to the KwaZulu issue backed up by what little analytical work has been done (Colvin, 1984; Uys, Hearne and Colvin, 1985; Lyne and Nieuwoudt, 1989). The Zulu cattle owner is depicted as a victim of economic forces generated by his common property, existing in an institutional vacuum and enduring the results of a very low offtake, despite the fact that it could be substantially increased. In contrast it could be argued that cattle comprise a valuable array of high-value goods in the household economy, and that this function explains most of the behaviour of the Zulu cattle owner. In this chapter it will be shown that in fact, like the Indian, the Zulu has need of his cattle, and in fact consumes them in a manner very closely analagous to the way his urban counterpart consumes his wealth. It will also be shown that where appropriate, he will substitute cash for cattle, suggesting that he is not ineluctably bound to the cattle complex. The factors dealt with relate to the spread of utility derived from owning cattle and not from selling them.

7.2 Milk

Herskowitz (1926: 516 to 523) in one of the earliest comprehensive works on cattle among African tribes (including the Zulu) makes frequent reference to the use of milk by the numerous tribes he discusses. To illustrate its fundamental importance, among the Suk of east Africa, the verb "to drink" is different for milk, to any other liquid. The calabash which contains milk has a name different to that for all other liquids (Herskowitz, 1926: 260). The Bunyoro, accustomed to a milk diet, would prefer to die than to degrade themselves by eating vegetable food. Krige (1936: 55) recorded that "The mainstay of the Zulu diet is amasi or curds of milk, and most of their dishes are a mixture of the amasi with different vegetables". That this is still relevant is confirmed by Njoko (1990: 3) who refers to amasi as "the staple food of a Zulu household". Reader (1966: 38) provides four descriptions of cows, based on milking ability, used by the Zulu Makhanya tribe. Bonsma et al (1951: 11)

included milk at first place in the list of values attributed to cattle by Zulus, but played it down as a reason for keeping cattle. Without exception in these references milk is mentioned only in passing and the main reason for keeping cattle is invariably cultural factors. At no stage during the drawing up or testing of the questionnaire was the issue of milk raised by the KwaZulu field staff involved, and as a consequence, no provision was made for questions on milk in the main survey. It was unexpected therefore, when at every discussion session held with cattle owners, the importance of milk supply for the family was invariably the first issue raised. Great emphasis was placed on milk supply, despite the fact that probing on the volume of milk obtained revealed it was seldom more than one to three litres per day. The importance attached to milk by the cattle owners was brought into discussion with individual Zulu informants, who confirmed it without exception, up to and including the Chief Minister - his comment was that it had taken the academics a very long time to discover so obvious a fact.

Gandar and Bromberger (1984: 12) provide empirical data of milk production in the Mahlabatini district, obtained during a survey on subsistence production and household budgets. Of the sample of 65 households, 45 produced milk with a mean annual production of 795 litres (550 litres for the whole sample) or 2,2 litres per day. The value of milk exceeded all vegetable and field crops, together with eggs. They conclude that milk is a vital resource particularly in drought years. This order of supply is supported by Bembridge (1984: 366) who in a survey in Transkei recorded a yield of 1.72 litres per cow per day. He notes that this was not out of line with other observations both in Transkei and other countries.

The emergence of milk as an important factor early in the course of the main survey in Ogwini and Mabedlana, made it possible to test attitudes towards it in the later cane survey. This survey was conducted to determine whether there had been a reduction in

the number of cattle kept in the cane growing areas. If a respondent recorded that he had retained cattle he was asked why he kept them since cattle keeping in cane areas presents considerable problems. Of the sample of 74, 36 had retained cattle. The questionnaire allowed for four responses, which are summarised in Table 7.1.

Table 7.1 Respondents' reasons for keeping cattle in cane-growing areas (1983, N = 36)

Reasons (1)	1st	2nd	3rd	4th	Total
To supply milk	20	6	3	1	30
For cash sales	2	4	-	2	8
For feasts and ceremonies	4	1	3	-	8
For cultivation	1	3	3	-	7
For lolo	1	5	3	2	11
To supply meat	-	6	-	-	6
For manure	-	-	1	-	1
They represent wealth	1	-	-	-	1
Unclassifiable	7	3	4	2	16

Source: Survey data

Notes (1) The question was open-ended. The classifications were arrived at after assessing the responses.

(2) The unclassified responses included five of "for no good reason"; "A homestead is not a homestead if it doesn't have cattle about it"; and three relating to compensation for injured fathers whose daughters might be molested by the respondents' sons.

As Gandar and Bromberger (1984: 11) experienced, estimation of milk yields presented difficulty and the data was discarded. However, 50 of the sample bought milk regularly, of whom 34

bought between one and six litres, and 16 from seven to over nine litres per week. No direct indication could be obtained on how many cows are required to supply sufficient milk, or how much "sufficient" is. A cross-tabulation performed on number of cows against respondents claiming "sufficient" or "insufficient" milk, seemed to indicate a value between 2 and 4 cows, as the borderline between "sufficient" and "unsufficient".

The importance of milk, even in the small amounts obtained, is well illustrated by the Zulu owners treatment of calves. Mortality between birth and weaning is widely reported to be very high, as high as 30 percent by some reports. The principle reason is malnutrition or malnutrition-related diseases, arising from the denial of milk to the calf, in favour of the family. The Director of Veterinary Services (1985: 10; 1987: 12; 1988: 18) regularly comments on malnutrition in calves as a consequence of competition from the households for the milk. Despite the potentially valuable asset it represents, the calf is sacrificed to obtain milk. In India, where male calves are preferred for traction "If a female calf is born, the scrub and chaff are converted into milk, while the calf is starved to death" (Harris, 1965: 225). while there has been no attempt by the Department of Agriculture to address the issue of increasing milk supplies, a farmer and veterinary surgeon on the border of KwaZulu has successfully assisted Zulu cattle owners to establish small (up to one hectare) high-yielding pastures to improve nutrition specifically for milk cows. Substantial investments are made in fertiliser, fencing and high-yielding planting material, and Nguni cows kept on these pastures, can, in addition to rearing a calf, produce up to five litres of milk per day for the household for extended periods over the summer. (Ardington, 1983: personal communication³).

³Dr P. Ardington, Mandini Road, Mandini, 4490

If a single most important reason for keeping cattle is to be identified, the literature, what empirical data is available, and exhaustive discussions with both groups and individuals all point conclusively to milk. The KwaZulu beef herd, it turns out, is a dairy herd, according to its owners. It could be expected therefore that interventions in the cattle system based on increasing milk production might be more acceptable than those based on beef output. The likely appeal of this approach could be judged by the comment of a senior Zulu animal health official, who explained the importance attributed to milk, despite the very small amounts obtained, with the statement: "They still have ringing in their minds, the memories of the milk they used to get". This is not to deny that there is an array of other reasons, but in selecting a medium upon which to base state interventions, the opportunity to increase milk production offers itself as premier hook upon which a livestock improvement project could be hung.

7.3 Lobolo

The importance of cattle for lobolo as part of the marriage arrangements is long established. McLean (1883: 27, cited by Herskowitz, 1926: 271) recorded that among the Zulu, "it was only through the possession of these (cattle) that they were able to marry and establish themselves". Critics of Herskowitz's (1926) concept of a "cattle complex" have tended to concentrate on the mystical and romantic attitudes he describes, and ignore the numerous references to fundamental need such as this - it is difficult to imagine a more pressing imperative to obtain and hold cattle than this.

Contrary to the assertions of many of the urbanised informants consulted, the practice of exchanging cattle as lobolo is still widely adhered to in the rural areas of KwaZulu. Table 5.10 shows that in fact lobolo exchanges exceed all other usages of cattle. This implies that lobolo predominates over other forms

of disposal when disposal decisions are made. Lobolo exchanges are governed by Section 64 of Act 6 of the code of Zulu Law, 1981, which states "lobolo shall consist of fair average cattle or their equivalent in other stock, money or property and for the purpose of any dispute the value of each head of lobolo cattle shall be regarded as one hundred rand". Vilakazi (1962: 115) dates this back to the publication of the Natal code of native law in the 19th century, a value of five pounds sterling having been fixed by officials of the Native Affairs Department. The wide disparity between the "legislated" and real value of lobolo cattle can be expected to create an insistence on the payment of cattle rather than cash. Custom dictates that the bride-price for a "commoner" is 11 head, while a "princess" commands 21 head.

Table 7.2 Types of cattle involved in lobolo exchanges (1982/89)

Class	Received		Given	
	No	Percent	No	Percent
Under 3 years old				
Bulls	42	18,6	41	25,5
Cows	0	0	0	0
Oxen	3	1,3	7	4,3
Heifers	47	20,8	36	22,4
Over 3 years old				
Bulls	10	4,4	10	6,2
Cows	67	29,6	50	31,1
Oxen	24	10,6	3	1,9
Heifers	33	14,6	14	8,7
	226	99,9	161	100,1

Source: Survey data

It is widely reported that the "lobolo animal", typically a half-grown heifer, enjoys a premium price at KwaZulu sale-pens. Colvin (1984: 44) reports a specific market demand for lobolo

cattle, typically met by buying in the necessary beasts which to some extent is supported by the survey data. Table 7.2 provides details of the type of animals exchanged. Some 60 to 65 percent of cattle exchanged are female stock, of which one third are young heifers. The fact that one of the lobolo cattle is required for slaughter for the wedding feast probably accounts for the number of young bulls and oxen.

With lobolo set at 11 head, i.e. more than the total herd of over half the cattle owners (Table 6.4), plainly few families can afford the entire lobolo. This issue was identified early in preparation for the study, and provision made in the questionnaire schedule for recording outstanding debits and credits. The statistics are provided in Table 7.3.

Table 7.3 Lobolo debits and credits in KwaZulu (1982/83)

	Number	Percent of total herd
Lobolo out		
Payments	161	4,2
Debits	435	11,2
Lobolo in		
Receipts	226	5,8
Credits	491	12,7

Source: Survey data

The significance of the large undischarged lobolo debts lies in the security of the debt commitment. The issue was discussed at length with both farmer groups and informants and it is clear that the lobolo debt is binding and persists until fully discharged. It is a debt upon the groom's family not an individual, therefore in theory and in fact in practice, it can remain in perpetuity. There is a clear inter-personal obligation arising from the debt. When pressed to define this, the common

response from farmer groups was that, in a tribal meeting for example, a man would "look at his father-in-law" before committing himself on any issue under discussion. There is a more specific effect, which is that a lobolo debt may have a prior claim on any surplus available for disposal, and may therefore affect the decision to dispose of an animal. With very few lobolo commitments fully paid up, the network of reciprocal and linear debts must be both extensive and involuted. Thus two family clusters may have reciprocal debts which partly cancel each other out. On the other hand, A may owe cattle to B, who in turn owes to C, and he to A. Since all of these carry obligations to consult with or at least consider a creditor's requirements before disposing of an animal, the resultant mesh of obligations and counter obligations must seriously affect the freedom an individual has to make disposal decisions.

The lobolo system is essentially closed, although Colvin (1984: 44) does report that it is one of the reasons for cattle being bought from South African farmers or speculators, thus bringing cattle into Kwazulu from outside. Lobolo exchanges do not, of course, have any direct impact on national statistics, and therefore have no role in efforts to increase offtake from the herd, or productivity in general. The survey data, confirmed by interaction with both owners and informants, suggest that lobolo has a powerful indirect effect on offtake, however. From the data it appears that lobolo is at the top in the hierarchy of demand a Zulu owner faces for his cattle. It appears he has an obligation to lobola before he can sell or slaughter. This being so, it will materially affect the number of animals which can be sold or slaughtered, i.e. offtake measurable in terms of national statistics. This being so, the obvious option which presents itself to increase sales is that the institution of lobolo cattle should be done away with or diminished. While there is little to suggest that this could happen in very traditional cattle owning societies, evidence is presented in Table 7.4 to suggest that in fact cash is being substituted for cattle in lobolo in more

consumer oriented communities. The cane survey was conducted in Ogwini, and the respondents selected were all cane growers. The intention was to determine whether cattle had been reduced in numbers in an intensive cane growing area, and if so to establish what substitutes were used. For those farmers responding, 100 out of 120 responses cited cash either directly as lobolo, or to buy in cattle specifically for the purpose.

Table 7.4: Source of lobolo in Ogwini (1983, N = 74)

Source	Choice			Total
	1st	2nd	3rd	
Buy in cattle	46	4	0	50
Use cash	10	40	0	50
Use own cattle	17	0	3	20
No response	1	30	71	102
	74	74	74	222

Source: Survey data

7.4 Slaughter

Slaughtering at the homestead constitutes by far the greatest usage reducing national herd inventory, over 13 years almost ten times the sales figure. In addition to this, it has the unusual attribute of varying very little from year to year, unlike sales and mortality (Table 5.7). Of the 152 animals slaughtered, "for custom or celebration" was given as the reason in 118 cases (77 percent), with 16 cases of "for home consumption" (10 percent). Since animals slaughtered for ceremonial reasons are slaughtered to be eaten, the difference to an outsider is difficult to perceive. The principle customary reasons for slaughter are wedding feasts and the ceremony associated with the end of mourning "bringing home the spirit" of departed family members. The ceremony usually occurs approximately a year after the death, and is an illustration of the spiritual role of cattle (Krige,

1936: 169). The Zulus are ancestor worshippers, and cattle the means of communication with the ancestors (Berglund 1976). Despite the relationship between ceremony and slaughter Zulu officials hold that ceremonies are planned to occur at regular intervals in a community thus ensuring regular supplies of fresh meat. Schneider (1957: 283) maintains that the subsistence role of cattle cannot be separated from the cultural role among the east African Pakot tribe, and has also observed that the many ceremonials are regulated so that meat does not pile up. Further people who ritually consume meat may not consume milk, thus sparing it for consumption by others, or for consumption on the following day (Schneider, 1957: 289).

It seems likely that the decision to slaughter an animal is regulated by the need to satisfy a ceremonial demand, but the data suggest that insufficient cattle are available from the herd to supply that demand. In the main survey, of the 152 head slaughtered, 21 or 14 percent were bought in specifically for the purpose. It is significant however, that among cane growers, of the 70 responses to a query as to the source of cattle for ceremonial purposes, 52 or 74,3 percent reported buying in cattle specifically for the purpose. On the other hand at least some individuals had a commercially usable surplus, as four head were slaughtered exclusively for sale as fresh meat.

It is a technological irony that the greatest consumptive use of the herd, home slaughter, appears to be completely unrelated to any herd parameter except possibly individual herd count. It seems to be linked to a variable as exogenous as the death of the herd owner or his relatives. Increasing offtake through slaughter, it appears, could best be achieved by an increase in mortality rate of the herd owners. Since, on the other hand, at the present death rate, supply is already inadequate to meet demand, slaughter offtake could only be achieved by increasing herd inventory. Neither action is being seriously promoted - they serve only to illustrate the internal inconsistency in concentrating on a single variable in a system as intricate as a cattle complex.

7.5 Mortality

Mortality as a consumption variable is not as unlikely a concept as it may appear at first sight. If the Zulu cattle owner is a sentient being, aware of the fact that unless sold, slaughtered or exchanged for lobolo an animal will in due course die, then the act of retaining it until it does is a deliberate decision, not a random event. The case of calves being sacrificed in favour of milk for the family has already been made. The retention of older, even aged animals can equally rationally be explained.

Chavunduka (1976: 399), as a veterinarian, believes that African cattle owners wish to increase their herds as a consequence of experience of losses through epizootic diseases. "If a man loses half of his 100 cattle he is still better off than if he had lost half of his two cow herd". Insurance against loss by increasing numbers is now widely recognised and reported. It was very specifically mentioned by discussants in the cattle owners' meetings, details of the losses suffered by individual farmers being provided as corroborative evidence. In the Mabedlana region many smaller herds had been completely wiped out and the devastating economic consequences were quite evident from the comments.

Livingstone (1985: 3) describes insurance against risk as one of the two fundamental motives for expanding livestock numbers, the other being investment. He attributes to Lipton (1968) the application of a "survival algorithm" to explain "non-maximising" behaviour, and argues that it applies with greater force in the case of pastoralists. For pastoral families largely dependent on cattle for subsistence in the drought-prone Sahel, Livingstone (1985: 4) postulates a pre-drought level of four times subsistence requirements, as a minimum level of insurance for post-drought survival. Thus based on their expected values of loss, herds of up to five times the basic requirement for

subsistence would need to be maintained in "good" seasons. "Drought" has been defined as a condition where the standing dry matter in the veld is less than 100 kg/ha, (Fouche et al, 1985: 5), and its occurrence was shown to be linearly related to stocking rate. Under these conditions, the need to carry excessive numbers of cattle makes the pastoralists expected values self-fulfilling prophecies.

7.6 Animal draught

The value of cattle as draught animals is one of the commonly recognised subsidiary utilities, and has been extensively researched in Zimbabwe (Danckwerts, 1974; ARDA, 1982; Sandford 1982; Scoones and Wilson, 1988). All of these found high values attributable to draught, up to 40 percent of total value of inputs to crop production (Scoones and Wilson, 1988: 12). It was therefore anomalous to find so little importance attached to draught by respondents both in the survey interviews and discussion groups. In the latter, it was invariably first introduced through a question from the researcher, with the commonest response being "Yes, of course, we use cattle for ploughing too". This could be an outcome of the perception that draught is a value so self-evident it requires no mention, or it could be that cattle are not widely used for draught. The survey data support the latter proposition (Table 7.5).

From the data, some 68 percent of owners had less than the two trek-oxen necessary to make a team. Only light tasks could be undertaken with a team of two - under most conditions, four oxen are required for ploughing, and only 15 percent of respondents could muster a team of four or more oxen. With only 32 percent of owners being able to mount a team of even two oxen, and with 40 percent of households owning no cattle at all (Lyne and Nieuwoudt, 1990: 93), the scope for meaningful contribution from cattle to draught requirements is very limited.

Table 7.5 Frequency of distribution of trek-oxen among respondents (1982/83 N = 370)

Trek-oxen	Owners	Percent
0-1	253	68,2
2-3	60	16,2
4-5	24	6,5
6-7	17	4,6
8-9	9	2,4
>9	<u>7</u>	<u>1,9</u>
	370	100,0

Source: Survey data

7.7 Ukusiza - the loaning of cattle

None of the analysis underlying proposals for solving cattle and grazing issues include as a variable the fact that ownership of cattle carries responsibilities proportional to the benefits and status derived from numbers of cattle. More specifically the Z goods derived from owning a large number of cattle do not accrue only to the owner. He is expected to distribute these benefits, for example through the institution of ukusiza (literally "to help") among households with either fewer or no cattle. Njoko (1990: 3) describes the custom as being aimed at eradicating inequality and poverty, and in the process, imputing to the cattle owner "dignity and presence" through his action. The survey did not provide data on the degree to which the custom is still adhered to. It was however consistently advanced both as a reason for owning large herds and as a counter-argument to suggestions that grazing rights should be saleable or otherwise convertible. It was argued that people not owning cattle already benefit through ukusiza and the fact that meat from slaughtered beasts is available to the whole community. A typical transcription from the tape recording of a meeting in Chief

Biyela's district reads: "Traditionally it is not our custom to lease the grazing. This comes in because when I am the owner of cattle and I happen to have more milk, I do not charge my neighbour to get milk from my home. And when I have slaughtered a beast, I do not restrict anybody to come and have a good feast". There is also a clear indication of reciprocal obligations in the case where cattle are borrowed for ploughing: "when somebody owns no cattle they usually hire the draft animals, or when this particular somebody owns no cattle he goes and pays through labour, that means he goes and works and takes those animals".

The practice is reported over most of sub-Saharan Africa. Scoones and Wilson (1988: 23) report it among the Shona (called "ronzera"), and ARDA (1982: 11) in a survey in the South Gwanda district in fact differentiated between "household" cattle, cattle held on loan arrangements ("amasisa") and cattle loaned out ("amasisela"). They found it was not widespread, with only 16 percent of owners and 13 percent of non-owners having "amasisa" cattle in their possession. Scoones and Wilson (1988: 23) however warn that "ownership is sensitive", and inaccuracies arise as a consequence of respondents being unwilling to reveal the truth. Among the Pakot in east Africa, the custom is known as "tilia" and involves mutual exchange, for example a cow for a steer. Schneider (1957: 28) reports that it has its counterparts throughout east Africa, and is both for material reasons as well as obtaining "rights in persons" i.e. mutual obligations. The Pakot also enjoy communal feasts with slaughter, and the exchange of milk and other products between neighbours (Schneider, 1957: 285).

The Z goods which cattle deliver therefore accrue not only to the owner, but to a great extent to all the households making up the community of which he is a member. The prestige, dignity or presence this action confers on the large cattle owner is itself a Z good. The critical importance of this systematic

distribution of Z goods is that under existing institutions the opportunity cost of producing Z goods is low, both to the cattle owner, and to the non cattle owner who gains access by an exchange of "rights in persons". Institutional amendments which seek to reduce cattle numbers by what Vink (1986: 133) refers to as the "familiar avenues of internalising externalities", will inevitably disturb what is an equilibrium established by custom. It is most unlikely that a cattle owner, faced with taxes, levies or grazing fees to increase the cost of keeping cattle and therefore the opportunity costs of these Z goods, would still be prepared to distribute his surplus free to the more indigent households of this community. The calculation of the consequent losses and gains in welfare would be an exercise in finesse.

7.8 Cattle are wealth

One of the ingrained mind-sets of commentators of the "cattle problem" is the perception that cattle are some kind of representational wealth, in default of "real" wealth. Real wealth is savings, consumer durables, debentures, shares and property - denied these things by circumstance, the African kulak must resort to collecting a four legged, peripatetic, environment-consuming cowrie shell in lieu. The comments to this effect cover a continuum from the non-analytical "unfortunately cattle represent wealth to an African" (Franklin, 1948; Brookes and Hurwitz, 1957; Bonsma et al, 1950; Hamburger, 1978); through the argument that they could be substituted by symbolism in the form of medallions or stock certificates (Goldschmidt, 1975; Southey, 1981) to carefully considered arguments of a store-of-wealth "concept" (Doran et al, 1979).

Evidence has been provided in the preceding chapters showing that cattle are real wealth, producing an array of market output and Z goods in the subsistence system, and that "a man without cattle is indeed poor" (Kuper, 1961: 150). Given that their function in the market is demonstrably insignificant, and that, through the

reproductive capacity of the female portion of the herd they represent a substantial interest bearing instrument of investment, there is justification in describing them as the non-human wealth of consumption theory. Wealth is a society's or individual's cumulative surplus of income over consumption. In the case of cattle in the subsistence sector the herd inventory is the cumulative surplus of income in cattle to the household, over consumption by the household in both market and Z good activities. As shown in Chapter 5, income is derived from:

Birth
Purchases
Lobolo receipts

Consumption is accounted for by

Mortality
Sales
Slaughter
Lobolo payments

If cattle do fairly represent non-human wealth in the subsistence household, and the transactions listed above represent income and consumption expressed as the principle measure of wealth, cattle, then the income and consumption data could be expected to behave in accordance with consumption theory. To test this, certain (fairly heroic) assumptions are made:

- 1: The subsistence households are essentially consuming rather than producing households, at least in so far as cattle are concerned. The ratio of market to Z goods from Chapter 5 supports this.
2. In these households cattle are non-human wealth, representing an array of classes of this wealth, from consumer durables, through near-liquid savings, to "fixed" investments.

3. The Z goods represent the flow of services from the "consumer" goods component, and cash sales represent consumption supported by liquidation of savings. Those cattle not required for these purposes, among those households who have them, could be held to be fixed interest bearing investment.
4. Income is defined as additions to the herd through birth (interest) purchases, and exchange for Z goods ("rights in persons"). Theoretically, income is defined as the amount a household could consume without depleting its wealth (Friedman, 1957: 10). Income as defined here is consistent with that definition.

Cast in these terms the data available represent measured income and measured consumption (Friedman, 1957: 20-25) over a single year's time span. Friedman's (1957: 26) permanent income hypothesis is couched in three equations, which at household level are expressed as follows:

$$c_p = k(i, w, u) y_p \quad (1)$$

$$y = y_p + y_t \quad (2)$$

$$c = c_p + c_t \quad (3)$$

Where:

c_p and y_p are permanent consumption and income respectively

k is a fraction dependent on interest rate i , the ratio of non-human wealth to income w , and an omnibus variable u , indicating household tastes and preferences.

c_t and y_t are transitory consumption and income respectively, components of measured income which are random events.

c and y are measured income and consumption.

As it stands the hypothesis is empty since Equations 2 and 3 are definitional only, adding in two unknowns, the transitory components, so that it cannot be contradicted by empirical data. Friedman (1957: 26) chooses to specify these unknowns, to make this contradiction possible, by assuming that the transitory components of income and consumption are not correlated to each other, nor to their corresponding permanent components; thus:

$$r y_t y_p = r c_t c_p = r y_t c_t = 0$$

Using this set of equations, Friedman (1957: 26-37) shows that, for households whose measured income is greater than the mean measured income for the group, the transitory component is always positive; for those on the mean the transitory component of income is zero; and for those whose income is below the mean it is always negative. Since c_p is a fraction of y_p (Equation 1), and since $y = y_p + y_t$, for households above the group mean income, consumption will always be less than measured income, i.e. a fraction of y_p , not y . Equally, for households below the mean, where y_t is negative, consumption will always exceed permanent income. Given that the transitory components of income are not zero for all groups, the measured consumption line will always be flatter than permanent consumption, with a positive intercept. These relationships are illustrated in Figure 7.1

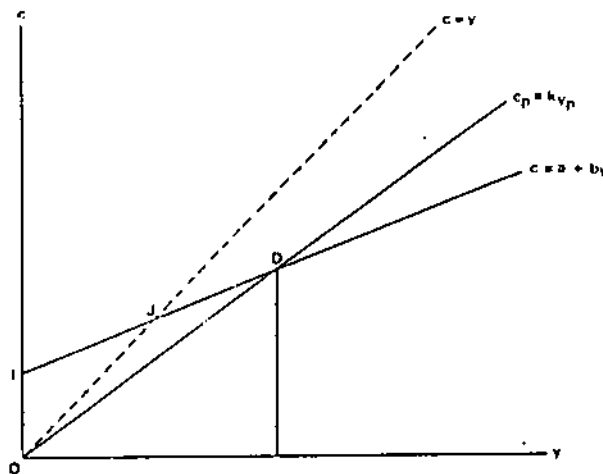


Figure 7.1: Hypothetical relationship between measured consumption and measured income (mean transitory components equal zero).

From the survey it was possible to assemble data for measured income and consumption as defined above, into classes according to income level up to 13 head. Over 13 head, only single observations of widely divergent values were available which were rejected as outliers. For the income levels used, the relevant data are presented in Table 7.6.

Table 7.6 Measured income and consumption data for income classes in KwaZulu (1982/83, N = 360)

Income class	Number of households	Mean income	Mean consumption
0-1	158	0,61	1,34
2-3	121	2,37	1,97
4-5	43	4,26	2,16
6-7	12	6,75	3,25
8-9	11	8,36	3,36
10-11	9	10,22	5,00
12-13	6	12,33	3,67
Totals	360	905	686

Source: Survey data

For the year under consideration the data suggest that the average propensity to consume was 0,76, and the regression of consumption on income was:

$$c = 1,30 + 0,26 y$$

R^2 was 0,79, T for the slope 4,347, significant at the 1 percent level. Thus, the average propensity to consume is 0,76, the marginal propensity 0,26, and the income elasticity of consumption 0,34. It is accepted that the data are fragile related to the rigour of consumption theory procedures, but it is submitted that the analysis casts a new and useful light on the

function of cattle in the subsistence household in KwaZulu. At the least it is consistent with the preceding findings on consumption and its role in household economics.

It also provides an alternative explanation for Lyne and Nieuwoudt's (1990) finding that herd count in KwaZulu decreased with increasing interest rates. Lyne and Nieuwoudt (1990) attribute this to the effect of increasing the cost of running cattle, they being unable to identify any other meaningful cost to the owner. If cattle represented a store of wealth in the form of savings, then inventory would decrease as resources were shifted to a more favourable interest bearing investment. Alternatively if the bulk of the cattle represent consumer goods, increasing the interest rate would indeed have the effect of reducing holdings - one intended result of tightening monetary policy wherever it is applied.

These findings imply a paradigm shift for future research aimed at improving the cattle system's output. Firstly the function of cattle as non-human wealth is demonstrated. It follows that interventions to increase off-take amount to an induced disinvestment from a continuum of assets yielding very high financial and subsistence returns, and for which satisfactory substitutes may be difficult to find. Secondly the previous concentration of analysis on off-take (consumption) needs to be expanded to include income. Even though the income elasticity of consumption is low at 0,34, consumption (output) remains strongly related to income, at least at income levels below 14 head.

7.9 Conclusion

This chapter has made the proposition that the principle role of cattle in a subsistence household in KwaZulu is the provision of Z goods. The value of these Z goods is high, or alternatively, the cost of purchasing them imputes a high opportunity cost to the labour used in producing them. The nature of the Z goods

ranges from material items such as milk or meat, intermediate inputs such as draught, to investment and security functions as a hedge against uncertainty. The substitutability of cash directly or cash used to buy cattle for specific purposes supports their definitions as 2 goods. Given these characteristics, the range of functions the cattle perform equate to those provided by non-human wealth in the western consumer household.

Using income and consumption data from the sample, it was shown that the marginal propensity to consume was less than the average, and that measured consumption was significantly related to measured income, although income elasticity of consumption was low at 0,34. Since consumption is a fraction of permanent income, determined by interest rate, the ratio of non-human wealth to income, and a variable related to the utility function of the household, interventions to increase consumption (offtake) are more likely to be effective if based upon these three variables, and on increasing income. The welfare implications of any such intervention requires thorough investigation: actions aimed at increasing offtake would ipso facto increase inventory which is already held to be too high, and actions to reduce inventory would reduce consumption. The most important implication is that interventions based on single-factor actions, for example increasing the cost of owning cattle by internalising externalities is likely to have unpredictable welfare results if they are tolerated by the communities at all (i.e. both cattle owners and non-cattle owners). Gradual, secular improvements, arising from constant multifaceted interaction between community and state agents, are more likely to be achieved than quantum increases in consumption based on single-factor, one-time interventions.

CHAPTER 8

EXTERNAL INSTITUTIONS

The roads between ability to act as a community and willingness to act as a community, are filled with roadblocks, wrong turns, steep hills and dead ends.

Hoiberg
1955

8.1 Introduction

What has been considered up to this point has been the factors most proximate to the household: the grazing and animal systems, and the motivation of the owner in keeping cattle. They comprise the technical element, and some of the factors of the human element, endogenous to the farm system. The most important outstanding endogenous element, knowledge and management skills, is dealt with here, in company with the important exogenous factors affecting the farm system. This is justified on the grounds that the level of knowledge and skill possessed by individual farmers could be held to be an outcome of the efficacy of the extension service serving them. In a barely literate society there are few other channels for transferring technology.

The importance of the exogenous factors arises from two characteristics. The first is that they are essentially beyond the control or influence of the farmer. Thus, he can combine the resources of the technical element, employing his management skills, to maximise an outcome according to his own objective function. He has to do this, however, within the limitations of certain state variables or environmental constraints, which are essentially the actions or inactions of the various levels of Government which putatively serve him. The second characteristic is that the exogenous factors include the channels through which

signals generated by policy are sent. They also include, as will be seen, some of the blockages in these channels. The signals and blockages are the essential components of the "rules of the game" or institutions within which the household must select its position on the production or utility frontier. It is changes in the institutions which alter the shape of the frontier, and therefore the options available to the household. Their effect on production or consumption decisions is therefore pervasive.

The exogenous factors to be considered in this chapter are the extension service, marketing arrangements, land tenure and local government in the form of chiefs and tribal authorities.

8.2 Extension service

A comprehensive evaluation of the extension service of KwaZulu was carried out by Bembridge, Steyn and Williams (1983). In their summary they comment: "With one notable exception, the extension service has operated in a haphazard manner, with neither priorities specified nor plans drawn up and implemented, with the result that its objectives have not been achieved. The investigation has shown considerable deficiencies in technical support and administrative control at all levels".

The majority of extension staff does not have a clear idea of any policy for agricultural development, even though an annual policy statement is given in Parliament by the Minister of Agriculture and Forestry each year. The shortage of professional and technically trained personnel in the extension service, as well as at the Cwaka College, is the single most inimical factor to efficiency and development in the service.

The general morale and status of extension workers leaves much to be desired. This is attributed, among other things, to inadequate office and housing accommodation, low salaries, lack of support and materials, and lack of selection procedures, all

of which are problems undermining the efficiency of the extension service. Extension workers have an over-optimistic perception of their own efficiency and of general farming standards, and view extension problems as a function of the characteristics of rural people.

Evidence of knowledge levels and extension activities showed that extension officers had received inadequate technical and extension information and guidance from head office and regional offices. Communication channels did not function effectively, because of a lack of clearly defined goals and policy, of contact with research and subject-matter specialists, and of organisation. Shortcomings in the quality of staff were found at regional and district supervisory level, and at field level, though with varying degrees of intensity. It was found that training at Cwaka Agricultural College is not adequately equipping agricultural officers to perform their duties effectively and efficiently. The study showed that too little time has been devoted to extension activities. A relatively low percentage of farmers was contacted by extension workers. Lack of training in management skills and deficiencies in the training methods of senior staff were found to be a serious constraint to the efficient operation of the extension service.

Quantitative communication inputs from the extension service are clearly not as effective as they might have been if a more balanced use of communication channels were to be employed, particularly if greater use were to be made of mass media and group methods. There was practically no contact with research stations, and specialists were not fulfilling their role of training and developing field staff. An integrated approach to agricultural and rural development was generally lacking. Little more than lip-service has been paid to applying the principles of extension in planning work programmes, and advisory work has been ad hoc and piece-meal.

Because extension requirements are numerous and diverse, there is a need for systematic liaison and co-operation between all the various agencies involved. This investigation showed that such liaison, although reasonable at head office, is generally unsatisfactory, and at regional and district level, it is in many cases, completely lacking.

In regard to extension workers knowledge of animal husbandry and animal health, they found that while animal health officers had a satisfactory knowledge of the symptoms and general treatment of livestock diseases, the extension officers had little practical knowledge of livestock breeding, feeding, management and disease control practices (Bembridge et al, 1983: 94). They felt that "extension officers are generally not equipped to give satisfactory advice on livestock husbandry". Extension officers lacked knowledge of extension principles and methodology and had only a poor knowledge of the characteristics of the communities they serve, something with which they should be thoroughly acquainted. A final problem is the neglect of animal husbandry extension by agricultural extension officers because of a perceived overlap with the functions of animal health officers.

Their recommendations amount to a fundamental re-organisation of both the policy and approach to agriculture and the department. They include the formation of a Central Agricultural Planning and Development Authority responsible to Cabinet (Bembridge et al, 1983: 144), and a host of changes affecting both the technical aspects and agri-milieu. None of the principle recommendations have been adopted and only marginal changes affected in the more minor, technical issues.

The most crucial effect of the extension service in regards to cattle is in the degree to which it has failed to provide the farmer with the management tools essential for handling the interaction between animal and grazing systems. The detailed responses to survey questions on management skills are provided in Appendix II.

From these it will be seen that of the total of 370 respondents, 5,2 percent reported adhering to a fixed calving season, the great majority of these occurring in the Mabedlana district (17 out of 19 responses). Only 5,6 percent bought bulls either from White farmers, the KwaZulu government or other Zulu farmers, with 91,4 percent using bulls from their own herds. It is of interest that only 1,0 percent, or 4 farmers, made use of the bull breeding farm at Bartlow Combine. Of the whole sample, 7,1 percent reported feeding their cattle. Awareness of diseases seemed to be fair, with only 46,2 percent being unable to name a disease. The four predominant diseases named were blackquarter, redwater, heartwater, and diarrhoea. In terms of treatment however, only 6,5 percent reported treating their animals for redwater, the commonest reported. In Ogwini only 8,7 percent of owners sought advice on illness or injury, while in Mabedlana 52,5 percent did, an interestingly high figure. To complete the picture on health 86,8 percent of cattle-owners stocked no remedies at all. The commonest remedy kept was an antibiotic ("terramycin"), held by 13,2 percent of farmers.

The awareness of parasite problems seems to be good. In Ogwini 96,8 percent of owners favoured compulsory dipping, and whereas in Mabedlana on 39,8 percent responded favourably, and 58,5 percent refused to answer the question, which suggests an administrative problem unrelated to the presence or absence of ticks. Treatment of internal parasites was commoner than other treatments, with 27,3 percent dosing against them. It is of interest that such basic practices as dosing, inoculation, treatment and castration are not necessarily, or even commonly performed by the owner. In the case of medicinal treatments approximately 22 percent of owners relied upon their neighbours, and for castrating, 35,4 used neighbours. There are two factors likely to be responsible for this. The absence of many owners on migrant labour would make reliance on a neighbour seem reasonable, and from the structured interviews it was learnt that castration was perceived as a hazardous operation with a high

probability of death. A neighbour with a proven degree of skill, gained possibly in employment, in South Africa would obviously be favoured for the operation.

The operations which are taken as standard in commercial herds are by no means so for the KwaZulu owner. In the case of castration, only 5 percent favour an age younger than seven months, and a further 15 percent the age 7 to 12 months. The most popular age group was 13 to 24 months (33,8 percent) while 22,7 percent preferred over 24 months, and 23,8 percent believed bull calves should not be castrated at all. The issue of castration provided the most interesting contrast between the attitudes of Zulu cattle owners and white commercial farmers. In both the questionnaire interviews and the structured meetings the commonest response to questions on castration was one of bemused puzzlement. They could not grasp the significance of the question or attach any importance to the age at which an animal is castrated. The residual impression was that a bull was simply an un-castrated ox, which could be converted when necessary or convenient. In the case of dehorning, only 6 respondents of whom 5 were in Mbedlana practised it.

It is noteworthy that the practices which would provide an improved supply of both market and 2 goods to a subsistence household, are in all respects similar to those which would optimise technical efficiencies for a commercial producer. It is plain that the KwaZulu owner has a low level of perception of these practices and an even lower level of adoption. The degree to which this is an outcome of the tenure system is arguable. For some, inoculation for example, the tenure system is not relevant: for others it imposes difficulties arising from the need to co-operate, but does not render them impossible to implement.

8.3 Marketing

The importance of formal marketing channels as a means of increasing sales is a constantly recurring theme (for example Franklin, 1948; Brookes and Hurwitz, 1957; Hamburger and Waugh, 1968; Hamburger, 1978; Lenta, 1978; Bembridge, 1979; KDA, 1980; Uys et al, 1985; Colvin, 1984; Hundleby et al, 1986; Njoko, 1990). It is argued that the lack of organised marketing is a major deterrent to increase sales offtake from the herd, and by some authors, that increasing offtake would act to reduce inventory.

Colvin (1984) provided a comprehensive review of cattle marketing in KwaZulu including proposals for structural and institutional reform of the system (Colvin, 1984: 55). Implicit in the bulk of literature on the subject, and explicit in the case of Colvin (1984: 77), who finds it difficult to perceive a role for the private sector, is the expectation that the public sector, either directly or through corporate bodies, should actually participate in the marketing activity. The logic behind this is presumably a perceived market failure, but it is a questionable conclusion. The origin of cattle sales in the 1930's was a consequence of approaches by white farmers around Hlabisa to the administration, to establish a stock sale at Mona in the Nongoma district, which flourishes today. Stock marketing remained in the hands of a series of private sector companies, until 1980. At this stage a company known as Kwazulu Stock Owners Ltd. was formed, in which the public sector, through the KwaZulu Finance Corporation, is a shareholder (Colvin, 1984: 21; Njoko, 1990: 3). Apart from attempted control of movements into or out of KwaZulu through permits issued by the Department of Veterinary Services, the marketing system has remained remarkably free of administered interference. The public sector function has been confined to support of private sector activities.

Colvin's (1984: 55) recommendations maintain the stance of limited statutory interference, but propose a major expansion into areas where the private sector has not found it viable to operate. The inevitable consequence of this will be a substantial increase in both direct and hidden subsidy. Thus, a specialised Department of Livestock Marketing is proposed, deploying full-time marketing and liaison officials to promote cattle sales where formal offtake is low (Colvin, 1984: 56-67). Saleyards should be upgraded at the expense of the public sector; mobile buying units should be established within KwaZulu Stock Owners Ltd.; holding grounds obtained to cope with low-grade cattle not acceptable to the market, despite an "abortive attempt by the BIC" to operate a similar system in the 1970s (Colvin; 1984: 55).

The intention behind such proposals is well-meant and obvious and the costs in subsidy could be predicted with some accuracy. The benefits accruing, however, are less predictable. In Table 8.1, it is shown that 72,0 percent of sellers prefer not to use the formal system.

Table 8.1 Sales channel selected by owners (1982/83).

<u>Channel</u>	<u>Number</u>	<u>Percent</u>
Official auction sales	21	28,0
Cattle sales in South Africa	1	1,3
Sold to Zulu farmers	47	62,7
Sold to Zulu butcheries	3	4,0
Sold to White farmers	2	2,7
Sold to speculators	<u>1</u>	<u>1,3</u>
	75	100,0

Source: Survey data

In view of the discussion of the previous chapter it is dubious whether the efficacy or otherwise of the formal marketing channel is a factor in the size of the recorded offtake. Given the relatively minor function of sales in the household system it is even more questionable whether major resources should be diverted to enhancing its efficacy. It is plain that the private sector dominates the cattle market in KwaZulu - it would seem rational to allow it to continue to do so in the expectation that it will respond to opportunities in the form of an increased flow of cattle to the market.

8.4 Land tenure

These are probably two general statements that can be made about land tenure issues in sub-Saharan Africa. The first is that generalisation on the matter is ill-advised: the second that the issue is not simple. Thus, there is an almost reflex assumption that land tenure is communal in KwaZulu, and that all the observed failures in agricultural productivity must invariably follow. In contrast Cross et al (1982: 1) have as their objective "to substantiate the following propositions:

1. Indigenous or traditional tenure is not 'communal';
2. Indigenous tenure as it stands does not appear to be a persistent and serious obstacle to development;
3. KwaZulu's tenure system is not static, it is rapidly adapting itself to the modern economy and, it is developing an indigenous answer to "freehold" rights;
4. It is unwise at this point to impose any planned artificial tenure system on the rural districts; and
5. A survey and registration system can be developed to meet the requirements of an evolving tenure system and contribute directly to regional development".

It is a pre-requisite to interpretation of the effects of land tenure, to understand what "land tenure" means, at least in Kwazulu. Cross et al (1982: 3) describe land tenure as deriving from rights held by a land-holding cluster - a group of families who, by right of first arrival, claim the right to allocate and control land within its family cluster. Population growth, particularly in areas close to urban areas, can cause a rapid change from this system towards a "modern open-tenure", with many of the characteristics of the freehold. This change is accompanied by a shift from "over-rights" which basically empower the cluster to inhibit transfer or specific use, to sovereignty, where individuals have gained the power to transfer without consultation.

Classically the Zulu concept is that land is never anyone's unique property. There are layers of "over-rights" equivalent to Hughes (1982: 62) "right of avail". They refer specifically to right of access to environmental resources (waterpoints, reedbeds clay deposits, bush yielding firewood etc.), even when they occur on individual land holdings. It specifically does not include any community right to share the use of an individuals land, for example by grazing, without the owners consent, but does include access to public pastures. A number of individual rights and constraints are recognised under the tenure system as it exists at present (Cross et al, 1982: 6). These are:

1. Right of permanent allocation

This can be obtained in two ways. Firstly, on marrying a man acquires land by right from his father, at which point he becomes a full member of the tribe. This transaction is notified to the chief and induna. Secondly a land-holder has the right to allocate land to an outsider or relative approved by him. Alternatively a stranger may ask the chief for land, who may have to ask a large land-holder to accept him, if he himself has no surplus land.

2. Rights of temporary transfer

Traditionally unused land is held by families for future expansion, but the Legislative Assembly has decreed that land unused for two years for residential or cultivation purposes, may be expropriated and re-allocated by the chief. Land may also be lent for one or more years or leased to others in the community. It may also be lent to a relative, who while cultivating it, has full rights over the land.

3. Rights and restrictions on the use of land.

Three levels of uses are recognised:

- Residential land subject to individual rights once allocated. It is a curiosity that while land may not be owned or transferred, the structures on it are privately owned and can be sold. In practice both house and land are sold as a unit, or on occasion the house alone is sold.
- Arable land with standing crops is entirely private. Once the crop is harvested, the residue is available to the public subject to the land holders precedence and consultation.
- Grazing rights fall into two groups: those on formally designated public pastures and those on privately held land made available for public use. Over time the latter can through custom become public grazing. On the other hand "smaller grassy tracts" which are part of an allocated land-holding are held to be exclusive to the land holding family. Only on the formally declared public pastures do the open-access rules apply

which give them the "communal grazing" character. Even these are converted to fields owned by individuals over time.

Far from the classical simplified common-property open-access case therefore, the land in KwaZulu is held under a web of overlapping rules, sufficient to negate the "tragedy of the commons thesis". The most crucial feature of this is that the vacuum of institutions often assumed to exist, is not so at all. The failure of agricultural development, which it has been argued is a consequence of lack of institutions, could as well be a consequence of resistance from well-developed and robust institutions, unconvinced of the merits of change.

The degree to which the tenure system per se is an impediment to advancement is questionable, and highly dependent on the value judgements implicit in the definition of development. Is it an impediment to realising the full agricultural potential of KwaZulu? Almost certainly yes, as under present factor prices and the productivity of labour, increasing productivity implies a level of capitalisation in tillage which is inhibited by the small size of lands. In addition the cost of transactions in acquiring a big enough parcel of land to invite entrepreneurial involvement would be very high. On the other hand, it was precisely under these tenure conditions in Zimbabwe (Hughes, 1972), that massive increases in cotton production by peasants occurred before independence, and maize in the years following. In KwaZulu the expansion of sugar cane growing is a case in point.

Is the tenure system an impediment to realising the diverse economic and social benefits from land that its rural occupiers expect (Cross et al, 1982; Tapson, 1985; Tapson, 1988; Cross, 1988 a and b, de Wet, 1988)? The answer to this is demonstrably no - the very complexity and flexibility of the system is an excellent guarantee that it does and will continue to deliver these benefits.

Can increases in output be achieved within the existing tenure system, thus increasing the benefit it delivers? Taking the case of the sugar-cane, again the answer has to be yes, although Gilbert (1988: 233) is sceptical about the real increase in benefit to the community. Sukumani, the organisation promoting sugar production in the Ndwedwe district, has successfully expanded its support activities to include the production of vegetables and other small-scale cropping, chicken-production and consumption activities such as water and electricity supplies and schooling (ARDRI, 1990). Bromberger (1988: 212) argues emphatically that land tenure reform is neither a necessary nor sufficient condition for agricultural development.

The issue is, however, whether the cattle system, which is based on that portion of land deemed "commons" can be improved without changes in tenure, regulation through quota or taxation (Nieuwoudt, 1985: 22) i.e. the familiar routes of internalising externalities (Vink, 1986: 105). All of these are likely to have large and unpredictable negative welfare consequences. Given the modern interpretation that the system is best represented by the prisoner's dilemma model (Runge, 1981; Vink, 1986: 78) a solution does appear achievable. The essence of this model is that, lacking assurance of the actions of the other prisoner, each prisoner's individual strategy must dominate, leading to a Pareto-suboptimal solution. In the commons situation, assurance is provided by a set of rules governing access, or institutional arrangements. In the absence of such rules, the prisoner's dilemma will operate, but in the case of KwaZulu it is highly questionable on the evidence, whether such a complete absence of rules exists. What the evidence does suggest very strongly is that the cattle issue cannot be attacked in isolation, from the other land/productivity issues. It exists within a plethora of interlocking rights and obligations for both individuals and community, which delivers an array of 2 goods, from the material to the abstract, in the form of, for example, the security derived from existing within an ancient and functional social

framework. Most particularly, the successful route to increasing welfare is likely to be via the community, through its common interest, and not via the individual who owns cattle.

8.5 Local government

This term is used here as a collective noun including chiefs, tribal authorities and headmen. Any proposed institutional changes whether aimed at production or social change, will inevitably be subject to scrutiny by this group, who retain a powerful influence in the rural areas of KwaZulu. The preceding section suggests a formal set of institutions which do not of themselves suggest an inevitable resistance to change. This section presents evidence suggesting why, despite this, change proves so difficult to achieve in KwaZulu's rural areas.

"The chiefs, in general, comprise an intensely conservative force whose interests are based on the maintenance of a traditional agrarian based life-style. As a result they oppose violently any attempts to introduce policies which they perceive as making significant inroads upon their traditional personal authority. By very tightly maintaining order these chiefs form a critical basis of support, so their feelings carry great sway. However,... the chiefs experience the age old dilemma of traditional leaders of seeking development, without jeopardising their own authority" (Cowles, 1986: 17). Cowles (1986) emphasises both the importance of the power of the chiefs and the way in which this takes effect. The territory is essentially controlled by rural elites, whose traditional and inherited powers have been considerably enhanced by the support of the South African Government, provided "to obtain and consolidate their hegemony over the rural populace ...". An important feature of the power of the chiefs is that it derives from their delegated authority to maintain law and order through the security acts. While, however, the chiefs as a body have considerable influence, skilled use of state resources means that

concerted action by the chiefs against the administration is unlikely, unless they perceive that their authority as a group is being threatened.

It is plain that the chiefs have very considerable power both to affect national policy, and over the daily lives of their subjects, derived both from their inherited positions and their co-option into the national political system. For the purpose of this study the source of their power is probably less important than how they use it. With some outstanding exceptions, the general picture is one of lack of concern for the welfare of the community and the corrupt use of power for personal enrichment and aggrandisement. Glass (1986) reports that the process of co-option of the chiefs started in the 1920's, when the traditional relation between chief and people was subverted "to one of the imposition of the white state's taxes and regulations". The main source of the chiefs ability to control and manipulate his people is through his control of resources. Research in KwaZulu has documented widespread abuse of the right to issue both arable land rights and housing sites. The abuses range from (relatively) extortionate demands for fees in both cash and kind for the granting of rights, to the threat of expropriation to maintain acquiescence and support from his subjects.

While it is widely held that land-rights granted under this system are relatively inviolate, dispossessions do occur. Glass (1986) reports that indunas are known to expropriate good land for their own use, and to replace it with land of inferior quality. In another extraordinary case, an induna banned all cash-cropping in his area with the exception of that on his own land. The effects of this kind of arbitrary use of power hardly need expansion: suffice it to say that an induna was murdered in one ward and the local inhabitants believed that the police would not succeed in solving the case, because the induna "had no friends".

Apart from land-rights, the chiefs, through the tribal authority, also control the issue of trading licences in the rural areas. The result is a form of "bureaucratic capitalism, in which economic well-being is guaranteed by political participation". Inevitably it is not capitalist or market forces that determine the relative prosperity of the entrepreneurial class, but allegiance to the tribal authority. As a consequence while this class may well be able to develop itself and consolidate its power-base, it will inevitably follow the interests of the tribal authority and not those of the community.

The chiefs have jurisdiction to handle legal matters of a minor and more traditional nature - inheritance disputes, compensation and other issues arising out of custom. In many cases the conduct of these cases is held to be unfair and arbitrary. "The perception of justice reveals it to be a system of favouritism and nepotism. Cases of bribery were reported ranging from money, to liquor, to sexual demands. Indeed, in one rural area the local residents refer to the vehicle of the local officials as a 'mobile brothel'. No wonder that ... "Research suggests that chiefs, izinduna and councillors have caused people to regard their institutions with scorn, low esteem and hatred" (Glass 1986).

Glass (1986) concludes that the rural-traditional power structure, in the face of pressing scarcity of natural resources, has opted not to develop and expand the output of the resources for the benefit of its subjects, but to expropriate to itself those limited benefits they can deliver in the absence of development. The source of their power to do this requires examination. Glass (1986), Cowles (1986) and Natrass & Natrass (1990) all stress the dependence of the homeland governments on the support of the rural elite, that is to say the chiefs, headmen and tribal authority. All report that this support has been achieved by artificial inflation of their traditional powers by successive South African governments, starting with the

Colonial government in the mid-19th century. The purpose of this has consistently been to secure and maintain the hegemony of the central government over the tribal societies of the homelands.

These reports vividly illuminate Vink's (1986: 181) "tragedy of the chiefs" theme. Given increasing populations, ever-scarcer resources and an undiminished need for the security offered by access to traditional land-rights, the ordinary villager will be reluctant to disturb a status quo, made so precarious by the intransigence of the local ruling elite. The stasis observed in development activity appears, then, to be due less to the legitimate "primordial" institutions, than to gross deviation from them and aberrant behaviour on the part of those whose presumed concern would be the welfare of their subjects.

8.6 Conclusion

This chapter was concerned with some of the exogenous factors with which the cattle owning household must contend in determining its utility function. Of the four factors considered, only marketing limitations present little impediment in the context of the household economy. Each of the remaining three is a sufficient condition for a failure to exploit fully the potential of the cattle/grazing system. Equally, if improvement is sought through ameliorating in any one of them, it is a necessary condition that the other two be ameliorated as well.

The dominant constraint appears to be local government. While it is not suggested that the pathology described above occurs universally, where it does, the potential for meaningful change in any of the other factors is limited. It also re-affirms the sterility of single-factor approaches, based on classical theoretical analysis of one component of an intricately complex mosaic. This is not to say that progress is completely out of reach, but that a tactical, multi-faceted approach needs to be adopted. This is the subject of the next chapter.

CHAPTER 9

WHAT TRAGEDY? WHOSE COMMONS?

A crisis, properly defined, is a state of affairs in which a decisive change for better or worse is imminent.

Pearse
1979

9.1 Introduction

One of the pervasive themes in comment on cattle in developing societies is the assumption that action of some sort is imperative. From the ecological point of view it is held that environmental catastrophe is looming if not upon us: from the economic point of view, depending on its inclination, the production system is inefficient, or inequitable, or unsustainable, or all of these. The common point of agreement is that the system must change, sooner rather than later, and drastically rather than slightly, if some of the proposals are a criterion. The theme of this chapter is to examine the validity of the conventional wisdom, and in the light of this, to provide an outline of policy proposals derived from the findings of the foregoing chapters.

The structure of the following sections will be cast as a series of questions. Is change imperative, and why? What scope and type of change is necessary or desirable? What type and scope of change is possible? If acceptable answers can be found for these questions, the policy guidelines will be almost self-evident and will be provided in the closing sections.

9.2 The imperative for change.

Leukes (1989: 214) has described development thinking as having a activist and practical bent, intended to reconstruct societies, particularly in regard to their material welfare. While

therefore change might not necessarily be development, development cannot be achieved without change: development could be defined as change from one condition, less favourable by a given definition, to another condition, more favourable by the same definition. Accepting this framework, and avoiding for the moment the issue of defining "favourable", development, in the broadest sense, becomes something to be sought after. Since the process of achieving this desirable condition has been defined as change, a favourable shift in the condition of a society means that change is an unavoidable necessity. This reassuring platform having been achieved, it remains to determine what the less favourable, or undesirable characteristics of the KwaZulu cattle system are, that make change not only desirable, but feasible.

The genesis of proposals for change will vary according to the position and standpoint of the proposer. At the most fundamental level, however, proposals to change systems must have their origin in three questions. Is the system sustainable? Is it equitable? Is it efficient? Negative answers to one or more of these questions will indicate not only that change is desirable, but that, more importantly, potential for change for the better actually exists.

9.2.1 Sustainability

Applying the questions to the KwaZulu cattle and grazing system, threats to sustainability could arise from environmental deterioration, and economic and political instability. The threat to stability arising from ecological damage has been part of the rationale for reform of the cattle system in KwaZulu from the late 1930's (Franklin, 1948: 128) to the present (Colvin, 1983: 17). The findings of Chapter 4 suggest that while grassland degradation, as defined ecologically, may have occurred, the present condition of the veld is probably more resilient to damage than it would be in the highly productive

climax condition. Even the comparative productivity can be questioned, as it can be shown that the present regime in fact produces a greater output per hectare than would be the case if an appropriate low-level commercial ranching regime were applied. The major threat, that of soil erosion, soil loss being an irreversible process, is likely to have been overstated. Available evidence suggests that the level of soil loss from grassland systems, even those degraded to the level applicable in KwaZulu, is not high enough to be of legitimate concern. Except in grossly damaged areas, is unlikely to exceed the rate of soil genesis. Certainly it is many magnitudes lower than the losses experienced from arable land managed under what are held to be acceptable cropping regimes. If soil loss is an issue in KwaZulu, or in any other region for that matter, it would seem logical to proceed from the area of greatest contribution - cultivated land and other point sources of erosion.

Biological sustainability implies some sort of stability in output, and the data support this. The time series data available show that national herd inventory has been relatively stable for some 14 years in keeping with the supposition that it is in a state of static equilibrium with its supporting environment. While other production coefficients have fluctuated widely, the herd has been able to sustain a remarkably stable flow of animals for home slaughter, the most important of the herd offtakes. Mortality has shown a declining trend, although it is not statistically significant. In summary, there is no significant trend from the environmental perspective which suggests an impending quantum deterioration in condition. There is therefore, no supportable demand for change on environmental grounds.

The principle threat to economic sustainability arises from market collapse. In the case of KwaZulu, it has been shown in Chapter 6 that market offtake is only a very minor portion of the use made of the cattle herd. This being so, even a total market

collapse would have little welfare impact on cattle owners. Even if it were not so, the variables controlling the market are exogenous to the KwaZulu cattle system, and thus beyond the power of interventions in the KwaZulu system to effect. The output of KwaZulu is insignificant compared to the output of the greater southern African region, and can only respond to influences in that market, not affect them. Thus, market demand, price and supply are determined exogenously to the KwaZulu system and largely administratively at that. Thus instability in this exogenous market could affect KwaZulu, but it is unlikely to be to any significant extent, in view of the limited role the market plays in KwaZulu.

The land and cattle issue is inextricably involved with the politics of KwaZulu. To that extent, the political sustainability of the system is as much in question as that of any other political system in the region in current circumstances. In the particular case of the grazing system the issue of equity plays a political role, and will be dealt with in the next section. Again while the system could well be defined as being under threat, the threat is of exogenous origin, and does not arise from inherent system deficiencies or defects. Rather, the opportunity presented by the system creates threats by its very attractiveness to outside agencies. Thus the pathologies described in Chapter 8, and which are typical of many of the rural local governments, suggest that there is a persistent threat of the misuse of power to gain inequitable access to agricultural resources, including grazing land. To the extent that such a threat would be more likely to be realised during the period of instability following a substantial change in rights of access, for example the imposition of any of the solutions put forward by Lyne and Nieuwoudt (1990: 91), the inertia of the existing primordial and legitimate system may present some sort of security. While therefore, the political sustainability of the existing arrangement may not be secure, the origin of likely distortions is exogenous. Internal changes to

the system may in fact make it more vulnerable to such exogenously determined influences.

In summary then, it is a reasonable conclusion that, given a degree of equilibrium in the variables exogenous to the system, the system is sustainable. This is not to say it is locked into a condition of stasis- on the contrary, Cross et al (1982) have documented a degree of dynamism in the tenure system which is one of the bases of the system. Cattle-owners themselves are demonstrating a willingness to respond to shifts in the utility of cattle by substituting money for functions traditionally performed by cattle, as was shown in Chapter 7. Rather it can be argued that there are no apparent internal stresses in the cattle/grazing system which are likely to cause changes adverse enough to warrant intervention on the grounds of preserving sustainability.

9.2.2 Equity

Interpretation of the equity issue is very subject to the definition. It cannot be interpreted as equality of access to production rights, to take an example applicable in the present case. Equal access to rights does not imply equal opportunity to enjoy those rights. Access to rights is derived from a political base: to make use of the rights implies an entitlement, which has an economic derivation. For the purpose of this argument equity will be defined as arising from equality of opportunity to utilise the grazing resource. Perfect equality is hardly achievable, so equity is understood as fair or equitable access to opportunity, or entitlement (Okun 1975: 76, cited in Vink, 1986: 195).

In regard first to the right of access to grazing, while generalising for every community in KwaZulu is probably inadvisable, two features appear to prescribe who may have access to grazing and in what form. The source of this information is

the participants in the structured discussions, and the informants interviewed. The first is that access to a particular grazing area is limited to that tribal group which is recognised as having an exclusive right over it. Thus access to the common grazing in a tribal area is limited to those "members in good standing" of that tribe. Membership is obviously most commonly gained by birth, but can be obtained by agreement with the community at large following marriage, for example. The acceptance of a foreign individual is a relatively formal procedure, and is usually ratified through the headman or chief, the process being accompanied by a suitable fee. The second feature is that utilisation of the grazing can only be through livestock. Thus it was suggested to the groups that a poor member of the tribe, having an unarguable right to the grazing, could possibly fence off an area approximating to his right, and preserve the grazing for sale to cattle owners at times of seasonal scarcity. The usual reaction was one of derision and on one occasion it was suggested that this was tantamount to suicide.

In contrast to Lebowa, where Vink (1986: 182) has suggested that the tribal leadership tends to pre-empt the grazing for its own use, in KwaZulu there was no suggestion from any level of communicant that access to grazing was in any way exclusive. Nor was there any perception that the number of cattle owned should be prescribed. Some respondents argued that the interests of the established members of the tribe would be better served if newcomers were limited to a specific number, but no case could be found where this had been done. The foregoing does not imply that under certain circumstances, exclusive access to range cannot be obtained. Thus, Njoko (1990: 6) lists five community and individually owned Nguni stud breeding schemes which would require the exclusion of non-stud stock from the area used for the stud stock. One scheme belongs to the King, suggesting a level of exclusivity difficult to challenge. The others are individuals or spontaneously formed groups. In summary then,

with the exceptions noted, the right of access to grazing is equal for all members of the tribe having control of that grazing. Use of the resource, however is limited to the grazing of livestock.

Equity involves entitlement to the resource, and it is plain from the data of Chapter 6 that entitlement is highly skewed. In Chapter 7 it was shown that cattle represent the non-human wealth of consumption theory, or the accumulation of unconsumed income. This establishes the relationship between income, savings and cattle ownership, and just as the range and quality of consumer durables and investments owned by an individual in a consumer society reflects his income, so does the number of cattle owned by a Zulu. In both cases, the source of the income used for the investment is largely external to the assets in which it was invested. If therefore, equity in the ownership of cattle is an objective to be pursued it will be achieved by increasing the entitlement of the poorer sectors of the community: this in turn will be achieved by increasing their general level of wealth. With the skewness of herd size among those who do own cattle, and the fact that some 40 percent of rural people in KwaZulu own no cattle at all (Lyne and Nieuwoudt, 1990: 93), the potential to achieve this by changes to the cattle and grazing system is limited. With herd count at the limit imposed by the primary productivity of the grazing resource, greater equity can only be achieved by redistribution within some order of number of cattle close to the existing number, or if the environmental argument is to be followed, approximately half of this. Even the most extreme of interventions available, an externally enforced quota, would rapidly be subverted in a society where entitlement through wealth is skewed, and the institution of "siza" is an established norm.

This latter issue introduces a complicating factor in the equity argument. Community norms dictate that the primary products of cattle-keeping, milk and meat from home slaughter, are

distributed to the community free of cost other than obligation, or "rights in persons". The only output for which the owner may claim exclusivity is the proceeds of sales, and it has been shown that sales constitute a relatively minor portion of total output. A crude but enlightening comparison can be gained by imputing a value of R800 (based on a dressed mass of 200 kg, and a price of R4.00 per kg) to animals slaughtered or sold, and a value of R1.00 per litre to the milk consumed by the household. From Table 5.7, mean sales amount to 10 510 or R8.4 million per annum. The mean number slaughtered informally was 64 883, equivalent to R51.9 million per annum. Milk production has not been measured, but a working estimate can be made for purposes of comparison. From Table 5.8 it can be calculated that the mean number of cows calving in the years for which data are available was 180 310. Assuming that each cow provided the household with two litres per day for four months of the year, the value of milk output would be some R43.3 million. The total value of products consumed in the community therefore amounts to some R95.2 million, compared to the R8.4 million attributable to sales. The consumption of these goods by the community implies that the grazing is communally owned; the cattle are individually owned; and the bulk of the product from the cattle communally consumed.

To sum up, equity is not constrained by right of access, which is equal for all members of a tribe in respect of the grazing they control. There is a skewness in entitlement, and therefore ownership, in proportion roughly to the skewness of distribution of wealth. Equity in consumption of the output of the system is however, far less skewed than the distribution of ownership might suggest, since the bulk of products is consumed communally. Since the source of the inequity is exogenous to the cattle system, it is arguable whether interventions directly in the system would serve to improve entitlement, and therefore equity.

9.2.3 Efficiency

The efficiency of the system can be argued two ways. In terms of input/output ratios, it is efficient compared to conventional production systems. Thus the single significant identifiable input cost is that of veterinary services, which is born by the fiscus. While the cost in KwaZulu is not known, data from Transkei, under very similar conditions, would suggest that the total cost of veterinary services would amount to some R14.0 million per annum (source: unpublished annual estimates for the Department of Agriculture, Transkei, 1990/91). From Appendix 2 it is apparent that almost no other input costs are incurred, and the cost of labour, if not in fact zero in terms of opportunity cost, is close to it. Taking into account the estimates of value of output made above, the system is arguably relatively efficient. On the other hand in terms of production parameters, there is considerable room for increases in efficiency at little incremental cost. Uys et al (1985: 223) have shown that simply by adjusting disposal decisions, annual revenue could be increased by some three times present output, without any technological innovations. It goes without arguing that the introduction of rudimentary veld management systems, internal parasite control, supplementary feeding and controlled breeding practices would substantially improve productivity primarily through improved reproductive efficiency. This applies whether the form of output preferred is 2 goods for household consumption or for production for sale.

To conclude, there is an imperative for change in the cattle/grazing system of KwaZulu, but the justification for it on grounds of sustainability or equity is weak. On the other hand the productivity of the system could be meaningfully enhanced through increases in efficiency, and this is so whether the output is for consumption or the market. This is not to imply that drastic disturbance of the status quo is immediately necessary, but that through induced technological innovation, a

shift from a less to a more desirable condition is possible, "desirable" being measured by the value systems of the cattle owners.

9.3 The nature of change

Accepting from the foregoing that change to the system, in the form of increased productivity, is not only desirable but possible, the nature of the change required to achieve the improvement is essentially institutional. Productivity increases are achieved primarily through the adoption of improved technology or management techniques, and for these to be effective in the KwaZulu case requires the establishment of a set of institutional rules which at present does not exist. The function or purpose of these institutions and the means of establishing them require examination.

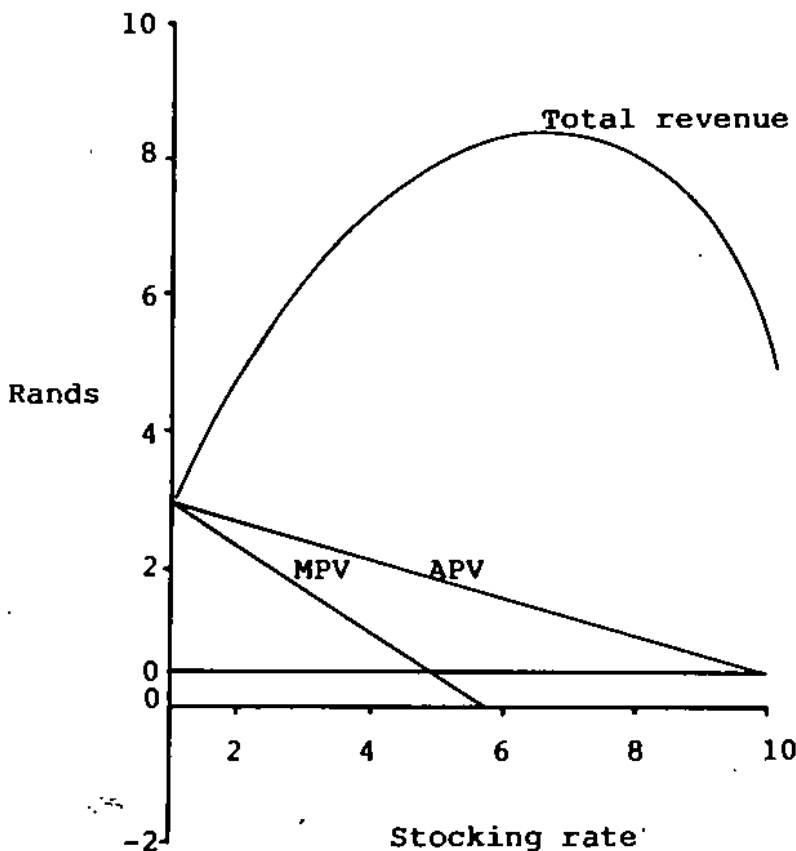


Figure 9.1 Total revenue and marginal and average value curves - general case. After Lyne & Nieuwoudt (1990: 89)

Typically, the assumption is made or implied that the institutions will of necessity be exogenously derived, if not enforced, and that the general intention is to reduce stock numbers, convert external to internal costs, and increase the output of the herd, measured as saleable surplus (Lyne and Nieuwoudt, 1990). The basis of the common set of interventions is Gordon's neo-classical analysis of the fisheries case. The usefulness of this approach in providing applicable solutions to problem sets in complex and involuted social and economic systems can be shown to be limited, however.

Lyne and Nieuwoudt (1990: 89) provide a figure demonstrating the common property problem according to Gordon's (1954) interpretation. The figure is reproduced in a more abstract form is shown at Figure 9.1, and its origin in the Jones and Sandland (1978) stocking rate model is plain. The assumption underlying both these models is that total revenue is a function of a specific marketable output, meat or milk for example. Chapter 7 showed that in fact in KwaZulu the bulk of output is in the form of 2 goods, both tangible and intangible, and the sections above give an indication of the order of value of the tangible component of these 2 goods. The essence of the 2 goods is that they are derived from the ownership or retention of cattle, not from trade in the products of cattle. This plainly imputes to the cattle a value derived from ownership, and on the evidence this value is likely to be higher than that derived from marketable products of cattle. A specifically important characteristic of this value is that it is directly proportional to the number of cattle owned. It is not subject to the linear decline in output associated with increase in stocking rate, which is the basis of the Jones/Sandland model. In the KwaZulu case, therefore it is argued that the "total revenue" curve of Figure 9.1 should reflect a blend of marketable output and a fixed value per head derived from ownership. This will radically alter the relationships between the total, average and marginal value product curves as is demonstrated in Figure 9.2.

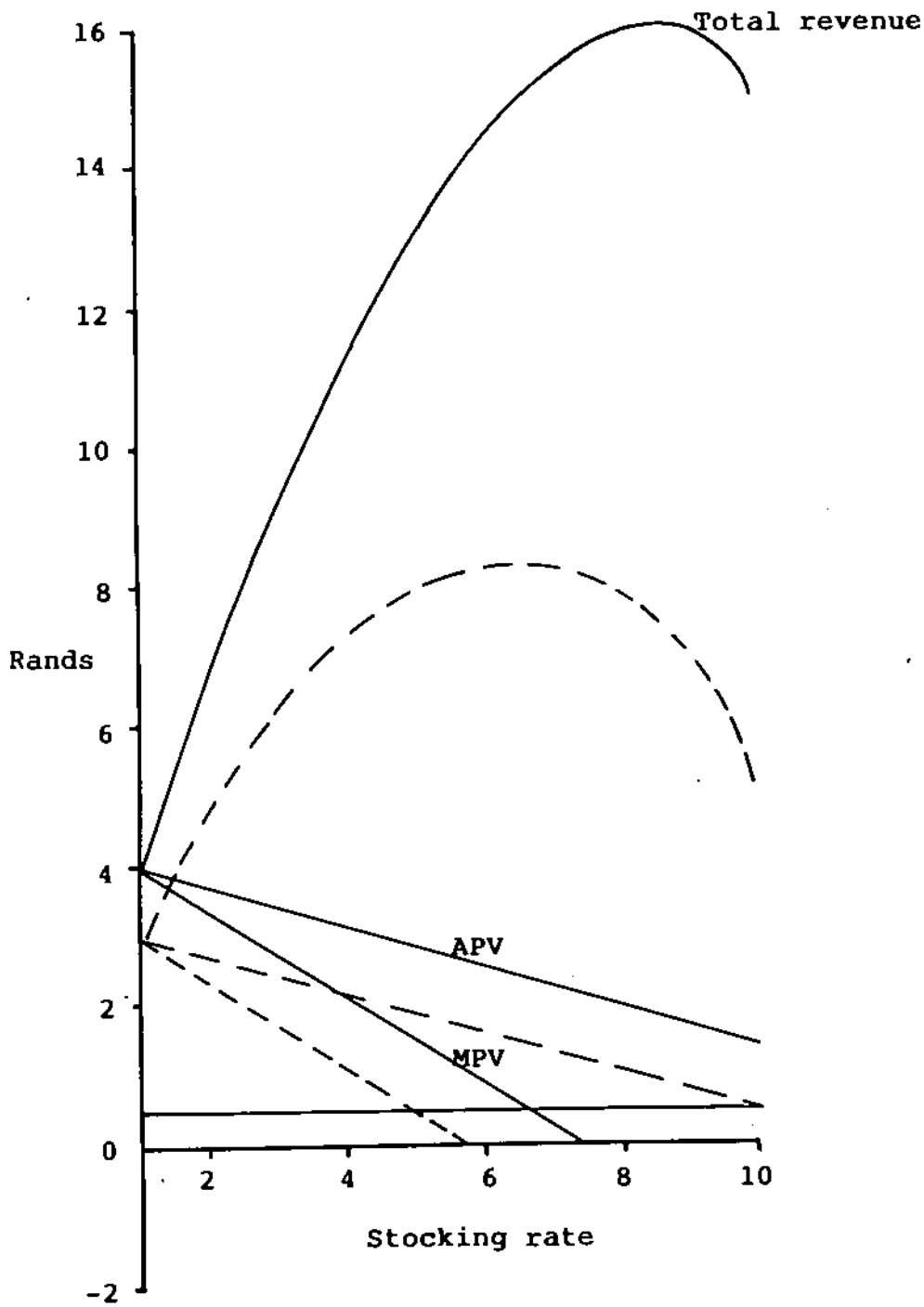


Figure 9.2 Total revenue, marginal and average product value curves - the KwaZulu case.

In this figure the "ownership" value per head is assumed for demonstration purpose to be R1.00 per head, using the scale of the original. The slopes of the VAP and VMP curves remain the same, but are shifted upwards. The zone of rational production shifts to the right, with the VMP curve intersecting the average cost curve at approximately seven head, instead of five. This becomes the point where rents are maximised, and the total rents are much higher. In biological terms, the point of maximum sustained yield and therefore maximum total revenue occurred at seven head. Including the ownership value shifts the point of maximum total revenue to nine head, considerably in excess of the MSY stocking rate. It is submitted that this model reflects the reality in KwaZulu more accurately than the conventional model, and substantiates the contention of Clark (1973) and Scott (1955) that communal ownership of a resource is not a necessary condition for that resource to be used at a level exceeding its biologically determined MSY. The model described for KwaZulu would apply whether the resource was under communal or sole ownership. Conversion of the commons to individual ownership, suggested as a solution by Lyne and Nieuwoudt (1990), might increase investment in veld improvements, but the increased capacity would be likely to be absorbed in increased stock numbers, rather than increased production of marketable surplus.

The second assumption implicit in the conventional approach is that increasing marketed offtake, which is the measure of effectiveness adopted, amounts to an expansion of the production frontier. On the contrary, any increase in market goods is at the expense of Z goods, and represents a substitution effect. This changes the shape rather than the position of the production frontier, and is an outcome of institutional change. Expansion of the production frontier remains an outcome of the adoption of improved technology, regardless of the use to which the increased production is put.

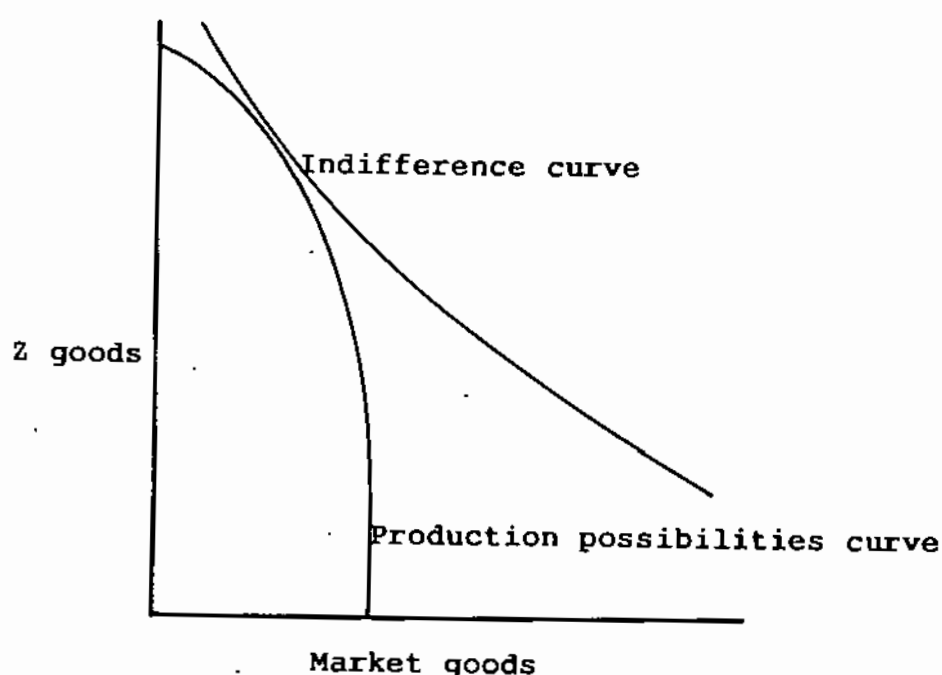


Figure 9.3 Production possibility curve for market and Z goods.

Figure 9.3 illustrates a production possibility curve, with two products, market goods and Z goods. It should be noted that the production of these goods is mutually exclusive- an increase in market goods can only be achieved with a decrease in Z goods. The institutional structure governing the production system favours the production of Z goods, and the indifference curve illustrates the relative value of Z goods to market goods, suggested by the data. In Figure 9.4 a second production possibility curve has been added, illustrating the condition where the institutional arrangements favour the production of market goods over Z goods. The production frontier has not shifted outwards, but simply changed shape. An institutionally-induced shift from Z goods to market goods does not expand the frontier, but changes its shape to that of a compound curve, curve ABC in Figure 9.4. As long as the indifference curve retains approximately the same slope and shape, the optimum combination remains in the region of point D. No increase in productivity is assumed; it is in any case irrelevant to the

proposition. Since the same technological adaptations are required for both Z and market goods, the frontier will simply shift outwards in proportion, regardless of the institutional framework assumed, and the indifference curve will intersect in the same general area.

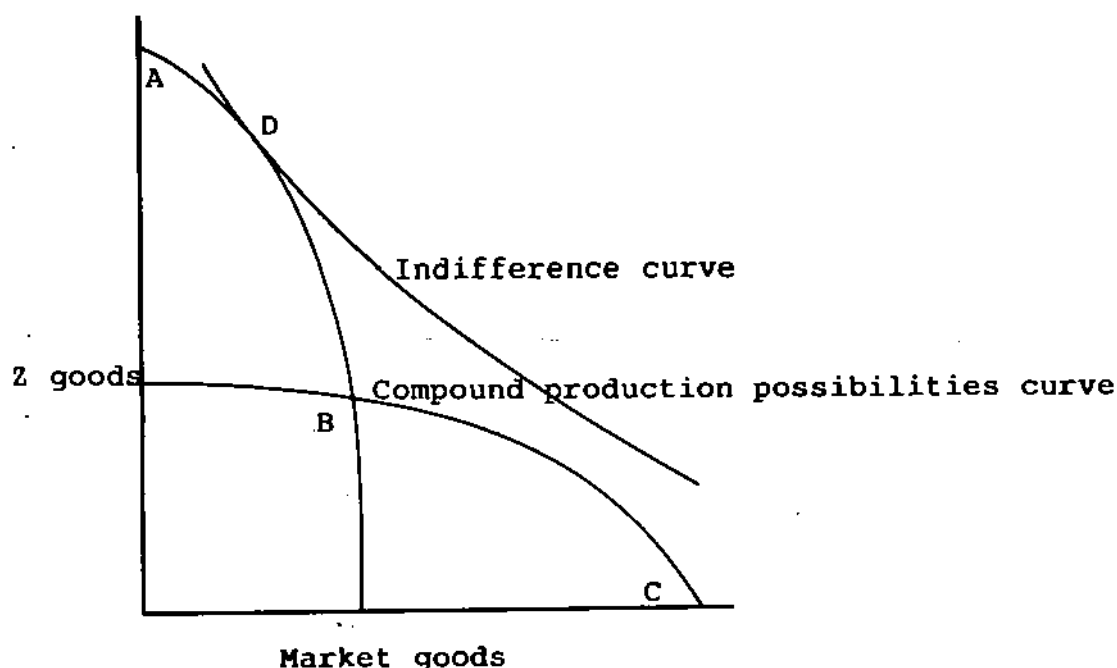


Figure 9.4 Production possibility curve for market and Z goods, influenced by institutional change.

It has been shown in Chapter 7 that the potential loss of welfare associated with the internalisation of costs, whatever the device adopted, is reason for caution in advocating radical institutional change. This section has suggested that the perceived overstocking is rational given acceptance of the role of cattle as Z goods and will occur whether the grazing is communally or solely owned. In addition, the effect of institutional changes driving the system towards marketed offtake at the cost of Z good production, does not expand the production frontier, but simply distorts its shape. Unless the slope of the indifference curve shifts towards a preference for market goods, utility will not be increased simply by institutional change. On

the other hand increased productivity derived from the adoption of improved technology will increase utility, regardless of the shape of the production possibility curve or the indifference curve. Changes that are likely to be successful, then, will be based on the adoption of technologies that will increase in absolute terms the productivity of the individual herds in KwaZulu. Institutional changes are not a necessary (or sufficient) condition for increasing utility, but they may facilitate improved technology adoption, leading to increased utility.

9.4 The potential for change

All the evidence available suggests that the potential for change in the KwaZulu cattle system is limited. Thus Crotty (1983: 24) proposed a carefully argued case for a pilot project in the Biyela district of KwaZulu, to the leadership of the area, the outcome of which would have been the maximisation of revenue from the grazing resource by the imposition of a tax. Maximisation of revenue is "the necessary and sufficient condition for the efficient use of land" (Crotty, 1983: 22), which was the solution to the overstocking problem. Potential loss of welfare was to be countered by distributing the tax revenues directly to individual tribal members, and Crotty showed that the increase in output could have been considerable. The reaction from the tribal leadership was "categorically negative", and the pilot scheme was never implemented. Warned by Crotty's experience, a similar proposal was put to a group of influential farmers at Mpukunyoni during the course of the field work. On this occasion the audience was primed by reporting the fact that, according to the evidence of the survey, the Zulu farmer had a need for more cattle for milk production, lobolo and slaughter. Further, that all these things, given the knowledge available, could be achieved from the same number of cattle as were presently owned by the tribe. When the achievement of this aim was stated to be conditional on limiting the stock numbers in future to those

currently held, the meeting erupted into protest, quite violent relative to the mildness of the proposition. The speaker was accused of being an emissary of "Ulundi", a reference to the capital of KwaZulu where the government is based, and requested to go back there and inform the government that if this was its latest proposal on land reform, it was not acceptable. The violence of this rejection was in contrast to the reaction to a report by the following speaker. A custom grazing scheme had been established on Trust Land under which cattle owners could graze their cattle for a monthly fee, under the controlled conditions of a normally run ranch. There was hardly need to explain the benefits, and an invitation to participate met with an enthusiastic response.

This latter incident belies the suggestion that Zulu cattle owners reject proposals intended to improve output as a result of ignorance of the benefits. On the other hand their almost pathologically extreme rejection of perceived threats to their primordial tenure and rights systems can probably be explained by their experience of the betterment programme. In Cross's (1986) words: "The often intense revulsion against past planning efforts stems to a great extent from their unintended officiousness, in that they reduce people's capacity to support themselves, while simultaneously subordinating them in many humiliating ways. In this light betterment schemes assume the role of a shadow anti-system, encapsulating everything people fear in the land system in one bitter pill, and adding broken promises on top". Given this prevailing attitude, reform of the land system as a precursor to the adoption of improved technology is in the nature of a lost cause.

Ruttan and Hayami (1984: 204) hold that institutions must be stable for an extended period of time if they are to provide their role of maintaining expectations between interacting people. On the other hand, they must change if development is to occur, and anticipation of gain from overcoming disequilibria in

factor endowments, product demand and technical change is a potent incentive to change. Institutional innovation as a consequence of technological change and its associated benefits, therefore, presents an opportunity. The essential prerequisite is that technical improvements be affected within the existing institutional constraints, and there is evidence, admittedly sparse, that this can be achieved. Apart from the five breeding schemes recorded by Njoko (1990) in KwaZulu, there are examples of spontaneous institutional innovation in Transkei where the institutional background is very similar. In Pondoland a community has established grazing camps, monitored and controlled by the community, the use of which is reserved exclusively for cows in milk (Mbana, 1989: personal communication⁴). The institutional control mechanisms are not clear but the ability to control access, and the very specific nature of the usage applied, represent a true institutional innovation. At Orange Grove, south of Umtata, a tribal group requested assistance in the renovation of a long-abandoned grazing scheme, and once fit for use, devised a relatively elaborate set of rules of access, ensuring that grazing was available for improving the condition of cattle for sale. The animals were permanently identified to facilitate the control of trespass, and the assistance of the State Veterinarian obtained to initiate a disease and internal parasite control programme.

Of particular importance is the fact that all these instances of change, particularly in KwaZulu, were initiated in a complete vacuum of extension pressure from government. They are actions which have arisen independently as a consequence of anticipation of benefits from the innovation. Further, it is a matter of certainty that while efforts have been made by government to improve livestock (Njoko, 1990), they have never been directed at the most potentially effective motive to generate institutional

⁴Mr L.M. Mbana, Director General of Agriculture, Private Bag X5002, Umtata

innovation- the high value attributed to Z goods in the Zulu community. It is submitted that programmes aimed at improving the output of Z goods, particularly milk, will in due course induce institutional innovation in response to a demand to exploit fully the opportunities presented by the technology. The form of the innovation is not predictable: what is predictable is that it will be peculiarly suited to the purpose as a consequence of accumulated experience (Ruttan and Hayami, 1984: 215).

9.5 A policy approach for the future

The proposals contained in this section do not amount to a detailed action plan, but rather a set of principles and guidelines which could guide the production of action plans. The reason for this is the impracticality of devising a blanket plan for a widely diverse set of communities of cattle owners, whose objectives and command of resources will be equally diverse. The findings and analysis in this work suggest however that given a clear understanding of cattle-keepers objectives, a set of principles can be described, from which strategies could be designed to improve the utility derived from cattle. This section, therefore, will proceed from a definition of the role of the cattle sector to the objectives of cattle owners, then a set of principles, and finally a list of possible strategies for the improvement of the cattle sector.

9.5.1 The role of the cattle sector

While planners and officials might prefer otherwise, reality dictates that a successful policy for the development of the cattle sector would best be derived from the fundamental motivations for keeping cattle. Interventions aimed directly at owners' values are as likely to satisfy officials' values indirectly, as are efforts to persuade owners to compromise their own values to satisfy those of officials. Thus Reh (1982: 118) found that in Senegal, farmers have two separate herd, one to

provide draught and one for "other" purposes. The practices applied to the draught herd to ensure a reliable and effective supply of animal draught also, incidentally, resulted in higher production efficiencies compared to the "other" herd, the outcome of which was a significantly higher yield of saleable beef, an objective of the state. The primary role of the cattle sector then, is defined as supplying the demands of the communities in which cattle owners reside.

9.5.2 Development goal of the cattle sector

Goals are understood as over-arching qualitative statements of intent or desire, as opposed to the quantitative objectives of strategies or action plans. Since the satisfaction of community demands is primarily achieved through consumption of the products of cattle-keeping and the ownership of cattle, goals can be expressed in terms of physical productivity. An appropriate goal for the KwaZulu cattle sector could be defined as a sustainable increase in the output of the cattle products demanded by the communities of cattle-keeping people, both tangible and possibly intangible. This goal is unqualified- the limiting qualifications are included in the principles listed below.

9.5.3 Principles of development

To be sustainable in the most fundamental sense, and efficient, which implies "possible", development strategies will need to be developed within the following set of principles:

Development should proceed according to acceptable economic principles, within a specific economic paradigm.

It should be equitable, which subsumes "efficient".

It should be initiated by increases in output, resulting from technological improvements, as a precursor or inducement to innovation in institutions.

It should be broadbased in the sense of including both owners and non-owners of cattle.

Interventions to improve cattle production should not be advanced in isolation, but rather as components of a multiple-factor community upliftment programme.

Both technological and institutional innovations should be introduced as relatively insignificant incremental steps, rather than attempted quantum jumps in change.

Initial steps should be aimed at attainable target changes in the condition in which change is most desired by the concerned community.

External inducements to change should be based upon a combination of radically improved intensity and quality of extension, and financial arrangements having regard for the emerging nature of the cattle-owners.

The intention of these principles are firstly to improve the likelihood of success, and secondly to ensure that improvements are achieved within an acceptable economic framework.

9.5.4 Strategies

In the circumstances of KwaZulu, the range and scope of strategies available for developing the cattle sector is limited. Further, whatever potentially successful strategies are available are severely constrained by the state's lack of bona fides among cattle owners, in respect of cattle development policy. Cattle owners' perceptions are moulded by three levels of contact with

the state. Firstly the minister's annual policy statement, which consistently advocates the reduction of stock numbers, is inimical to cattle owners' objectives in keeping cattle. Secondly the past experience of betterment and the associated social and economic trauma has created deep-seated mistrust of government action. Thirdly, at field level, while an outsider might assume that Animal Health Officers are concerned with the broader production issues, to rural Zulus their sole official function is to count cattle. Evidence for this is provided by the fact that during the severe droughts of the early 1980s, the water supply to several dip-tanks dried up. Despite the very poor condition of the cattle the owners were required to trek them to the empty dip-tank every week, for counting. The government attitude to cattle is seen as hostile, and proposals regarding cattle or land issues are, as a consequence, treated with a mixture of skepticism and mistrust.

The pre-eminent strategy required therefore is to establish the state's bona fides with cattle owners, on issues of development of the cattle sector. The principle action required is to align state policy, strategies and action plans with owners' objectives for their cattle. This will require that the state understands the expectations that owners have of cattle-keeping, and given that its objectives are clear enough, generate signals to achieve its own objectives through farmers satisfying theirs.

The second operational strategy proposed is that the mechanisms used to upgrade the cattle sector should be based on increasing productivity of 2 goods, pre-eminent among which is milk. The justification for this strategy lies in the findings and analysis of Chapters 5 to 7.

The principle cause of low performance in the herd is not genetic potential, but the level of nutrition. The herd is frequently under nutritional stress as a consequence of both the stocking rate and the compounding effect of internal parasites. The

major, low-cost improvements in herd performance are likely to arise from actions intended to improve the level of nutrition enjoyed by the herd. The third strategy, therefore, is aimed at raising nutritional levels. Opportunities exist in internal parasite control, grazing management, individual and community improved pastures, and supplementary feeding of vulnerable classes, for example young stock and cows in milk.

It was argued above that cattle-keeping is as much a community as an individual activity - certainly actions taken to improve grazing, for example, will affect and therefore involve the whole community. The proposition above was that institutional innovation would arise as a response to opportunity provided by increased or increasing output. It is essential therefore that the potential for both technical and institutional innovations be present in a community to justify the investment of scarce human and financial resources. The fourth strategy therefore is to identify responsive target communities as recipients of state interventions in the form of development programmes.

Sound economic principles in a production activity such as cattle keeping include, inter alia, the association of risk and benefit, and in particular, cost recovery on what may be defined as merit goods, for example, production infrastructure. Increasing the cost of cattle keeping, however, has its own counter cost in welfare. The final strategy is that cost recovery principles be developed which both community and cattle owners find appropriate to their peculiar condition of keeping cattle.

While four of these strategies can be considered development accelerators, (Mosher, 1971) the first, establishing the bona fides of the state, is a development essential. Without it the effect of actions derived from the other four, or any other strategy for that matter, is likely to be limited.

9.6 Conclusion

This study has served to put dimensions to the nature and scope of the complexities of the cattle production and consumption system of KwaZulu. The interlocking components of this system include the grassland, the cattle which graze on it, and the set of operational decisions which govern both. It involves the role of cattle as the non-human wealth of Zulu rural society and the consumption of income and accumulation of wealth. It has shown that milk, household slaughtering and lobolo are the primary means of use of the products, with formal sales representing a relatively minor factor. The substance and status imputed to owners of large herds by their cattle is precisely analagous to the accumulation of monetary wealth in consumer societies.

The value of neo-classical analysis in such a complex system lies in the increase in understanding it provides. Its value in providing policy guidelines is limited, particularly when narrowly applied to isolated components of the system. The potential for increase in physical output is more limited than is generally supposed and the problem of calculating welfare losses and gains is acute, particularly taking account of the very real but intangible security benefits derived from centuries of association with the primordial land tenure arrangements. Potential for change for the better does exist, but the array of policies and strategies available to realise that potential is not convincing. None-the-less, an approach based on technology-derived increases in productivity as an inducement for institutional innovation is proposed.

The over-all findings of the study are that there is no impending crisis creating an urgent imperative for change. There appears to be no threat to sustainability arising from biological, economic or political sources internal to the system. Finally the limited potential for incremental benefit suggests that those Zulu communities which include cattle owners will not be well served by powerful, externally-induced changes to their system.

APPENDIX I

Cattle inventories in selected sub-Saharan countries
(1980) KwaZulu and South Africa (1981)

Country	Number of Cattle	('000)
Low income - other - total		81 757
Benin	771	
Burundi	846	
Central African Republic	1 236	
Guinea	1 760	
Ethiopia	2 600	
Guinea-Bissau	200	
Lesotho	590	
Madagascar	10 000	
Malawi	823	
Mocambique	1 400	
Rwanda	640	
Sierra Leone	343	
Sudan	18 354	
Tanzania	12 578	
Togo	230	
Uganda	4 080	
Zaire	1 186	
Middle income, oil importers - total		29 189
Botswana	2 911	
Cameroon	3 200	
Ghana	950	
Ivory Coast	700	
Kenya	11 000	
Liberia	39	
Mauritius	56	
Senegal	2 238	
Swaziland	665	
Zambia	2 151	
Zimbabwe	5 729	
Southern African region - total		12 200
South Africa (1)	8 400	
KwaZulu (2)	1 350	
National States (excl. KwaZulu)(1)	2 450	

Source: Simpson & Evangelou Appendix 5, p367 except
for:

1. Abstract of Agricultural Statistics 1984
2. Annual Report of Director of Veterinary Services
KwaZulu 1981/82

APPENDIX II

Cattle Management practices in Ogwini and Mabedlana

Table 1 Respondents with fixed calving season (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
With	2	0,8	17	14,4	19	5,2
Without	159	63,1	48	40,7	207	55,9
Don't know	91	36,1	53	44,9	144	38,9
	252	100,0	118	100,0	370	100,0

Table 2 Source of replacement bulls (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Keep own	238	94,4	100	84,7	338	91,4
Buy from white farmers	5	2,0	0	-	5	1,4
Buy from Government	2	0,8	2	1,7	4	1,0
Buy from other Zulus	6	2,4	6	5,1	12	3,2
Buy at stock sales	1	0,4	0	-	1	0,3
No response	-	-	10	8,5	10	2,7
	252	100,0	118	100,0	370	100,0

Table 3 Respondents feeding cattle (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Feed	17	6,8	9	7,6	26	7,1
Don't feed	234	93,2	108	91,5	342	92,9
No response	-	-	1	0,9	2	-
	252	100,0	118	100,0	370	100,0

Table 4 Common diseases named and treated for by respondents (N = 370)

Named	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
No disease named	133	48,9	38	32,2	171	46,2
Blackquarter	98	36,0	80	67,8	178	48,1
Redwater	139	51,1	76	64,4	215	58,1
Heartwater	14	5,1	15	12,7	29	7,8
Diarrhoea	15	16,5	21	17,8	66	17,8
Treated for						
No disease treated for.	261	96,0	99	83,9	360	97,3
Blackquarter	2	0,7	19	16,1	21	5,6
Redwater	11	4,0	13	11,0	24	6,5
Heartwater	4	1,5	7	5,9	11	2,9
Diarrhoea	1	0,4	13	11,0	14	3,9

Table 5 Number of respondents seeking advice from veterinarian or AHO on sick or injured animals (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Seek advice	22	8,7	62	52,5	84	22,7
Do not seek advice	228	90,5	55	46,6	283	76,5
No response	2	0,8	1	0,8	3	0,8
	252	100,0	118	100,0	370	100,0

Table 6 What stock remedies are kept by respondents (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Vermifuge	14	5,6	5	4,2	19	5,1
Patent medicine	10	4,0	4	3,4	14	3,8
Antibiotic	20	7,9	29	24,6	49	13,2
Redwater remedy	13	5,2	6	5,1	19	5,1
Traditional/ herbal	9	3,5	3	2,5	12	3,2
None	232	92,1	89	75,4	321	86,8

(Note: Because more than one remedy is often kept, totals will not balance)

Table 7 Respondents favouring compulsory dipping (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Favour	244	96,8	47	37,8	291	78,6
Do not favour	3	1,2	2	1,7	5	1,4
No response	5	2,0	69	58,5	74	20,0
	252	100,0	118	100,0	370	100,0

Table 8 Respondents dosing against internal parasites (N=370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Dose	49	19,4	52	44,1	101	27,3
Don't dose	201	79,8	62	52,5	263	71,1
No response	2	0,8	4	3,4	6	1,6
	252	100,0	118	100,0	370	100,0

Table 9 Agents dosing, inoculating, and treating respondents cattle for illness (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
No treatment	150	59,5	13	11,0	163	44,1
Owner	40	15,9	44	37,3	84	22,7
Stock inspector	6	2,4	23	19,5	29	7,8
Neighbour	56	22,2	27	22,9	83	22,4
Others	-	-	11	9,3	11	3,0
	252	100,0	118	100,0	370	100,0

Table 10 Respondents perception of best age to castrate bull calves (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Never	69	27,4	19	16,1	88	23,8
1- 6 months	12	4,8	7	5,9	19	5,1
7-12 months	36	14,3	18	15,3	54	14,6
13-24 months	67	26,6	58	49,2	125	33,8
Older than 24 months	68	27,0	16	13,6	84	22,7
	252	100,0	118	100,0	370	100,0

Table 11 Agents castrating bull calves (N = 370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Don't castrate	66	26,2	19	16,1	85	23,0
Owner	27	10,7	21	17,8	48	13,0
Stock inspector	14	5,6	8	6,8	22	5,9
Neighbour	76	30,2	55	46,6	131	35,4
White farmer	1	0,4	1	0,8	2	0,5
Other	68	27,0	14	11,9	82	22,2
	252	100,0	118	100,0	370	100,0

Table 12 Respondents dehorning cattle (N=370)

	Ogwini (n=252)		Mabedlana (n=118)		Total (N=370)	
	No	Percent	No	Percent	No	Percent
Dehorn	1	0,4	5	4,2	6	1,6
Don't dehorn	250	99,2	111	94,1	361	97,6
No response	1	0,4	2	1,7	3	0,8
	252	100,0	118	100,0	370	100,0

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