We cannot accuse wild animals for our losses. If livestock stray they end up in someone’s house, slaughtered and eaten. It’s not jackals, but people.
Fumbe Headman.

‘No drunkeness!’

Comment under the heading ‘What worked well’ - part of an evaluation of a meeting between MAWRD staff and Shikoro farmers at the local ADC.

EXECUTIVE SUMMARY

Part I of this report reviews the literature in English on Kavango agriculture, with special emphasis on livestock husbandry and problems of grazing management. This review will be published separately in the 1998 issue of *Agricola*, a journal devoted to agricultural research in Namibia.

Part II of this report discusses the results of field research on livestock management in Kavango. One week of field work was carried out in and around Fumbe, an inland NOLIDEPI pilot village. A second week of field work was conducted in a series of contiguous riverine villages about 100 kilometres east of Rundu. These villages were chosen for study because of the availability of background information collected by RDSP and KFSR/E in this area.

Results and recommendations arising from both Parts I and II of this report are presented in this executive summary.

**Part I: literature review**

*Main conclusions*

Existing survey evidence provides a consistent picture of the statistically ‘typical’ Kavango household. Irrespective of their rural residence, most of these households are not primarily supported by farming. In the main, economically productive Kavango residents are wage earners, wage seekers, informally employed, or retired pensioners. Some details:

- About half the men aged 15-19 are absent from their villages looking for work or working (Yaron *et al* 1992: 17).
• For the household with average income, employment (either formal, informal or work from home) is by far the most important source of income - constituting more than two-thirds of the total (Yaron et al 1992: 27). When asked to rank the importance of different income sources, a sample of rural Kavango residents cited pensions as their most important income source, followed by formal sector employment, non-formal work, beer brewing and remittances. Only one respondent in ten cited either crop or livestock production as his or her major source of household income (Matanyaire 1997: 5,8).

• According to some sources, agricultural income (in both cash and in kind) contributes as little as 16% (Yaron et al 1992: 27) to 18% (Keyler 1994) to total household income, although recent work suggests that these estimates may be too low (FMS 1997b).

• Crops produced by the household constitute on average about a third of household caloric intake (Yaron et al 1992: 28) but crop sales are an insignificant proportion of total household income - about 1% (FMS 1997b and Yaron et al 1992: 28).

In sum, many Kavango villages are not self-sufficient farming communities so much as cash-dependent rural dormitories. This limits what a livestock development and range management project like NOLIDEP can achieve. The intensification of Kavango agriculture and improved resource management may be both technically feasible and justified in terms of current low output levels. But having inherited a relatively extensive farming system, many Kavango households cannot now afford to invest in low-yielding sub-subsistence agriculture, which cannot compete for labour or capital against more remunerative forms of commercial employment.

The opportunities afforded by accumulating livestock wealth may provide an exception to the otherwise gloomy agricultural development outlook. Both absolute levels of agricultural income and the percentage contribution of agriculture to household income improves with increasing cattle wealth. One survey suggests that households with 11 or more cattle obtain about two thirds of their income from agriculture, in contrast to cattle-less households in which about two thirds of income comes from non-farm sources. Households with 11+ cattle also have treble the estimated mean income of households without cattle - N$3723 versus N$1336 per year (FMS 1997a,b).

**Recommendations**

These results support several conclusions with policy implications for NOLIDEP’s programme in Kavango:

• Kavango residents reap considerable material benefits from cattle wealth. If it is environmentally sustainable, both individual and regional herd growth are economically beneficial and should be encouraged.

• The case for ecologically sustainable herd expansion is based on the current population distribution in the Kavango Region: 95% of the Region’s total
population lives along the Kavango River terrace on about 5% of the Region's land area. While less dramatic, livestock population densities follow the same pattern (Tolmay 1996a).

- These are not favourable conditions for the adoption of programmes of range management. Farmers' motivation for more intensively managing either natural or cultivated forage will be minimal when there exists an open frontier, as in Kavango. Taking animals to feed (by migrating seasonally or by relocating the household) will almost certainly be more profitable for the farmer than protecting natural vegetation or cultivating forage crops.

- The exception may be poorer riverine farmers in densely settled areas who permanently keep animals - such as milk cows or plow oxen - near their homes and cannot afford to move their homestead or their herd. Improved range management is unlikely, however, to appeal to owners of small numbers of animals who probably lack both sufficient income and motivation to invest in agriculture.

Part II: field study

Main conclusions:

1. Many Kavango rural residents have a detailed knowledge of the forest products and fish resources upon which poorer households, in particular, are dependent. Local knowledge of grazing resources is less extensive and often not used in practice because seasonal stock movements are constrained by the availability of water and the location of cropped areas. Irrespective of the quality and quantity of available forage, livestock must find water and avoid damaging fields with standing crops.

2. Stock cannot exploit areas without water, but areas with water tend to be heavily cropped. These considerations set up a simple seasonal oscillation: stock graze the periphery of settled areas under the supervision of a herder in the wet season when crops are growing, and are left free to roam around harvested fields in the vicinity of settlements in the dry season after the harvest is collected.

3. Land pressure is severe along the river, where water is cheap and plentiful, heavier soils are suitable for cultivation, fishing is an option, and social services are available. But many of the fields in these communities are exhausted or weed infested, and uncultivated grazing land is in short supply. Households interested in or dependent upon agriculture often resettle inland. Resettlement is led by the owners of larger cattle herds. A small nucleus of pioneering households may open up an area without water or with limited water supplies, but the real influx of settlers occurs after a water point has been developed. Inland communities form around water points, reach a maximum size of about 300 people, and then spawn subsidiary satellite communities.

4. Cattle are by far the most important livestock species in Kavango. The value of cattle ownership is realised in the recurrent harvesting of live-animal products - traction power from oxen and offspring and milk from cows - with the carcasses of old, sick or dead animals providing a residual benefit. These are not cattle husbandry systems designed to optimise the volume or quality of meat offtake. Not one cattle owner interviewed for this study claimed to sell young male animals for slaughter without first using them for plowing.
5. Goats are kept for meat production and sale, but they are less numerous than cattle and constitute a small proportion of total ruminant biomass. Few households own goats that do not already own cattle, and goat flocks rarely exceed 30 head. Goat fertility is high, but so is morbidity and mortality, especially in years of high rainfall.

**Recommendations:**

1. Any programme of range management in Kavango must address the immediate concerns of herd and flock owners. Availability of forage is not a pressing problem in many Kavango villages. Maintaining the physical separation of wet season grazing areas from cultivated fields is a recognised need. Some inland communities discourage settlement and cultivation around designated pans which are reserved for use by stock during the cropping season. Because the heavier soils found around pans may also be suitable for cultivation, these restrictions are often difficult to maintain as communities grow in size, land pressure builds, and all areas suitable for cropping are put to the plow. NOLIDEP should help to preserve the distinction between arable and pasture in areas where there are uninhabited pans around settlements.

2. This can be done by endorsing local efforts to designate and enforce separate zones for cultivation and grazing, and by helping communities to deepen pans. Pan excavation - as NOLIDEP has already demonstrated in Kavango - can be labour-based because the object of this work is to provide temporary water in the wet season, rather than to preserve large volumes of water for the dry season. The effects of improved grazing management are, however, likely to be modest. Reinforcing the distinction between arable and grazing land will encourage the seasonal rotation of grazing areas, but it will neither control stock numbers nor promote the immediate adoption of the kinds of rotational grazing systems found on commercial ranches. Farmers do not at present preserve forage or limit stock numbers; rather they seek to limit stock damage on arable fields, reduce the costs of herding, and increase their livestock holdings.

3. With the exception of the labour-based excavation of pans, in Kavango it will be difficult to implement NOLIDEP’s policy of community contribution to water point development, for several reasons:

- Mechanised water points in Kavango are expensive, individual herds are small, inland communities rarely contain more than about 300 people, and herd owners sell few animals. A significant cash contribution towards constructing a diesel-equipped borehole would be difficult for most inland communities to afford.

- Fully-settled communities form after a water point has been created, not before. Present policies encourage the large herd owners who initiate settlement to recruit additional, poorer settlers in order to qualify for government assistance. While the evidence is circumstantial, cash contributions to water development would probably limit access by poorer herd owners to installations built on a cost-sharing basis. This is presently the case at privately owned boreholes where non-owners must pay for water.
• Kavango residents are accustomed to receive public services free of charge, and would be reluctant to participate in an isolated programme that challenged the principle of free entitlements.

The economics of dependency is deeply embedded in Kavango society. Until government, donors and the NGOs operating in the region are prepared to challenge this dependency, NOLIDEP should avoid involvement in capital-intensive water development. NOLIDEP’s current policy of requiring Kavango communities to contribute to the costs of rehabilitating water points is appropriate and affordable for local communities and should be maintained.

4. Large flocks of goats are rare, and farmers are unanimous in citing disease problems as the cause. Contrary to the pattern elsewhere in Africa, poorer households do not commonly accumulate small ruminants and then ‘trade up’ to cattle, and programmes targeted at small stock are of no special interest to poorer families. At current high rates of mortality, giving poor households a few goats under the SSSCF is unlikely to make any permanent contribution to their welfare. A more lasting contribution could come from DART-NOLIDEP research on developing a low-cost regime to control parasite infestation in small stock. Disease control would help to create more goats, and deserves support. The SSSCF will temporarily create more goat owners but no more goats, and should be abandoned until DART and NOLIDEP can also offer an appropriate disease control package.

5. Kavango herd owners sell cattle when they are old, sick, dead or dying. Economic analysis suggests that this is a rational cattle marketing strategy for Kavango producers given the relative value of live-animal products versus sale for slaughter. High rates of sale - especially among small herd owners - diminish the capacity for crop production and should not be encouraged by MAWRD. Kavango needs more rather than fewer cattle, and the needs of small-holders would be served by official recognition of this reality.

6. In Kavango, NOLIDEP’s current package of interventions is based on borehole rehabilitation for inland villages. Clearly, this approach would need to be modified if NOLIDEP was to work in riverine areas. There would appear to be little enthusiasm for range management or cultivated forage production in riverine areas. On the other hand, it is reasonable to assume that parasite problems are as great or greater in riverine areas than they are inland, given the higher concentration of animals and their dependence on floodplain grazing along the river. If current trials in inland communities are successful, DART-NOLIDEP work on parasite control should be extended from inland to riverine villages as soon as possible. Given the loose social organisation of riverine villages, it may be best for NOLIDEP to work with individual farmers rather than whole villages, or through schools, churches and volunteer groups. Shops are also common in riverine villages. It is critical that these shops have access to a wholesale supply of appropriate drugs, stock these drugs, and are trained to give appropriate advice to farmers who buy them. In conjunction with DVS, NOLIDEP should provide support for such a programme as soon as an effective and affordable regime of parasite control has been identified.

7. NOLIDEP’s adaptive research programme in Kavango should be scrutinised in light of producers’ needs. Forage is not a severe constraint in many communities. Large herd owners suffer the most when forage is insufficient, but these households are in the forefront of resettlement in areas with abundant forage. The poorer households that are left behind usually do not grow enough food to feed themselves, and will be
disinclined to devote scarce family resources to growing food for livestock, especially since they tend to own few animals. Fencing is a problem for farmers, and live fencing may be of interest in areas where timber and brush is scarce. Research on forages for fallow fields may also be an option. However, invasion by *Cyanodon dactylon*, a preferred forage species, is one the principal reasons farmers abandon fields. When benefits are weighed against costs, natural sequences of plant succession on abandoned fields may prove to be a more attractive option than ley farming. Compared with water development that opens up virgin land, grazing exclosures and range rehabilitation are of little interest to farmers.
PART I
LITERATURE REVIEW

THE CONTRIBUTION OF LIVESTOCK TO KAVANGO LIVELIHOODS

Northern Regions Livestock Development Project (NOLIDEPE) and
Kavango Farming Systems Research and Extension Project (KFSR/E)\(^1\)

This review asks two questions: Why are so many people in Kavango poor? What might government or donors do to relieve this poverty through the promotion of extensive livestock production? The objective of this analysis is to identify areas for future research and development intervention to support improved livestock and range management and to strengthen the integration of crop and livestock farming. This review is part of a programme of field study on these issues by NOLIDEPE and KFSR/E.

Poverty in Kavango

There are many poor people in Kavango. Regional per capita income is low, an estimated N$ 1,763 per person in 1993/94, and more of this income is spent on food than in any other region in Namibia (UNDP 1996: 9; CSO 1996: 161-163). In terms of the UNDP’s Human Development Index, an amalgam of critical welfare indicators, only Ohangwena Region is more disadvantaged than Kavango (UNDP 1996: 10). Poor infrastructure is part of the explanation; with the exception of North Central Division, Kavango has fewer kilometres of improved road per capita than any other part of the country (Fowler 1996).

Infrastructure aside, however, the causes of poverty in Kavango are not immediately apparent. The level of employment is the highest of any region (CSO 1996: 69), and by Namibian standards, the Region receives good rainfall, contains patches of decent soil for cultivation, and has access to abundant surface water from the Kavango River. Human population densities are low, land pressure is not severe and arable land is generally available (CSO 1996: 129). Moreover, Regional forage production routinely exceeds the feed requirements of the Regional herd, and in comparison with other regions, Kavango residents have the best access to grazing and fishing resources in the country (CSO 1996: 129).\(^2\) Development of the interior of the Region has been delayed by a lack of surface water, but this problem is not insuperable. Adequate yields of good quality groundwater are widely available in the Region, often at depths accessible to hand dug wells or shallow boreholes equipped with hand pumps (Namibian Groundwater Development Consultants 1991). Prior to the introduction of boreholes, hand-dug wells excavated by farmers opened up inland areas in Eastern

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\(^1\) NOLIDEPE and KFSR/E staff who contributed to this analysis include RH Behnke, R Bovell, A Henguva, H Matsaert, and T Tolmay.

\(^2\) Regional carrying capacity has been estimated at about 500,000 large stock units (Yaron et al 1992: 7). In 1995 Kavango Region supported about 100,000 cattle and 40,000 goats (DVS 1996).
Oshikoto, and have permitted immigrants from Oshikoto to use parts of the Kavango interior (Behnke 1997; Kerven 1997).

From an agricultural perspective, the problem with the Kavango environment is not that it is unproductive but that it is erratically productive, in large measure because of irregular rainfall. Because of this variability, small-scale crop farming in Kavango is a hazardous undertaking. Based on an analysis of grain production over a 23-year period, Keyler estimated that four out of ten years in Kavango were likely to produce poor harvests due to low or badly distributed rainfall (1994: 115, Tables 4.1.312 and 13a).

Table 1: Rainfall (in millimetres) and the number of rain days per month (in parenthesis) for selected Kavango stations, 1963/64

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Source: EIS 1993: 7

Kavango residents have responded to these risks by diversifying. Since the turn of the century, the inhabitants of Kavango have engaged in production systems dependent upon multiple resources - the gathering of forest products, fishing, livestock husbandry and crop agriculture (Matsaert 1996). Crop agriculture was not necessarily the primary component in this mix of activities; cattle farming was important in the west of the Region, while fishing and arable farming were important further east. Migratory, contract labour - involving up to 60% of all young people by the 1960s and supplemented by soldiering (or the servicing of soldiers) in the 1970s and 1980s - added a cash component to these already diverse livelihood systems. Thus, instead of the production of grain surpluses to tide people over in lean years, household food security in Kavango depended on a diversity of alternative food sources (Von Garnier 1986).

The Kavango population grew ten-fold from 1930 to 1997 (from 14,000 to 137,000 people), which almost certainly placed pressure on forest and river resources (EIS 1993). It is unclear how local farming systems responded to these pressures. With the exception of the introduction of the plow, farming practices may have stagnated; there is little evidence of the adoption of more intensive farming methods or, at least in some parts of the Region, of the need for such methods. With respect to soil fertility management, for example, Keyler found that:

In Kavango households have still the option to abandon unfertile land and clear new land....With exception of households from Kavango West only about 5 to 7 percent of all Kavango households use manure and/or chemical fertilizer on
their fields. However...48 percent of all Kavango households cleared new land during the last five years (1994: 47).

Labour withdrawal may have further encouraged extensive farming practices. The young workers who might have supplied labour to intensify the farming system were drawn into migrant labour, and the resulting inflows of cash probably more than compensated for declines in per capita output from agricultural and natural resources, as the total population increased and the worker:dependent ratio declined. In short, neither the need nor the opportunity to innovate may have existed.

The legacy of the past is reflected in the organisation of Kavango agriculture today, as depicted in Rural Development in the Kavango Region of Namibia (Yaron et al 1992). According to this source:

- About half the men aged 15-19 are absent from their villages looking for work or working (page 17)
- ‘For the household with average income, employment (either formal, informal or work from home) is by far the most important source of income - constituting more than two-thirds of the total’ (page 28)
- Agricultural income (in both cash and in kind) contributes 16% to total family income (page 27).
- While crops produced and directly consumed by the household constitute on average about a third of household caloric intake (page 58), cash income from crop sales is insignificant - about 1% of total household income (page 28).

Subsequent work has tended to confirm the overall conclusions of Yaron et al, although the precise statistics may vary:

- When asked to rank the importance of different income sources, a sample of rural Kavango residents cited pensions as their most important income source; 87% of households receiving a pension considered it their major source of income (Matanyaire 1997: 5).
- After pensions, wages from formal sector employment were the next most important income source across all households, followed by non-formal work, beer brewing, and remittances. Only one respondent in ten cited either crop or livestock production as his or her major source of household income (Matanyaire 1997: 5, 8).
- Keyler (1994) estimated that 18% of total household income was derived from agriculture.
- About a third of all household income (in cash and in kind) comes from home produced and consumed crops, but crop sales are an insignificant proportion of total household income - less than 1% (FMS 1997b).

The evidence adds up to a well defined picture of the statistically ‘typical’ Kavango household. Irrespective of their rural residence, most these households are not primarily supported by farming. In the main, economically productive Kavango residents are wage earners, wage seekers, informally employed, or retired pensioners. And, of course, they do a little farming on the side, not because they expect to make a
profit but because they are poor - an estimated 40% being unable to meet their basic food requirements (Yaron et al 1992: 35).

Since they eat most of what they grow, Kavango farmers are not in any conventional sense making much money from farming. But they are reducing their cash expenditures on food. The advantages of this system are revealed by a comparison of retail food prices versus the prices farmers receive when they sell their produce. In areas like Kavango where rural retailers may have little competition and where transport costs are high, there is likely to be a wide differential between the cost of purchasing a calorie of food at a retail outlet versus the price paid to the farmer for the same calorie of food as a raw agricultural commodity (Yaron et al 1992: 39). Phrased somewhat differently, a farmer will be paid much more (based on replacement costs) for the last kg of her produce that she consumes than for the first kg that she sells. Figures in Keyler suggest, for example, that in 1992-3 the cost of buying a kg of maize meal was slightly less than double to more than three times the price paid to farmers for a kg of raw millet (1994: 89, 148, 149). Sell after harvest and buy during droughts - as the poor frequently do - and this differential widens (Yaron et al 1992: 100; Keyler 1994: 136-143). In short, the shadow price/opportunity cost incentives for subsistence production are much stronger than commercial price incentives for surplus production for sale.  

These price considerations become important when perceived returns to farming are marginal relative to the benefits of non-agricultural employment. This is the case in Kavango, even for less remunerative, non-formal types of work:

The use of household labour in non-formal work has potential negative effects on the household’s crop production...However, according to the value judgement of the households, investing their labour in non-formal work should be yielding more household income than investing that labour in crop production (Matanyaire 1997: 9).

The poor, almost by definition, are likely to own small informal cuca shops in which traditional beer is sold and drunk....Economic returns to this informal sector activity are so high relative to millet production that resources are directed away from producing the subsistence crop (Yaron et al 1992: 61)

Restrictions on trade (eg. the Veterinary Cordon Fence), poor roads (animals may be trekked up to 360 km to market, Tolmay 1996a: 12), low-yielding farming practices (120 kg of millet harvested per hectare, Kavango FMS 1997a: 42), and the ever-present risk of drought all depress the value of an hour spent farming. The problem is compounded by a high legally enforced minimum wage, the attractions of public-sector employment, and a commercial, service and retail economy sustained by mineral

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3 The valuation of subsistence production in terms of replacement costs was developed by M. Chibnik (1978), in C. Kerven’s work on farming in Botswana (1979, 1982), and by A. Low, writing on smallholder agriculture in Swaziland (1986).

4 Yaron et al used farm gate prices to value home consumption (1992: 24), which probably underestimates the real importance of agriculture in Kavango. Problems of valuing subsistence production are especially important in Kavango because households in this region spend on average more of their income on food than in any other region of Namibia (CSO 1996: 172).
revenues - which inflate cash wages relative to subsistence agricultural incomes. When the differential between agricultural versus non-agricultural wages becomes large enough, peasants will divert rural savings into the search for urban jobs, and leave agriculture not for alternative wage employment but for the mere chance to compete for such employment (Todaro 1969). The result will be unemployment combined with a labour shortage in peasant agriculture - a fairly accurate description of the present situation in Kavango.

We have arrived at a partial answer to our first question: Why are so many people in Kavango poor? They are poor because:

- Although it is not deficient in natural resources, Kavango is a hazardous environment in which to practice rainfed crop agriculture;

- Traditionally, Kavango residents managed risk through diversification, an adaptive strategy that could easily accommodate wage labour when population growth undermined the value of fishing and forest resources;

- There are, however, disadvantages to diversification, which demands resources - particularly domestic labour - that might otherwise be used for agricultural intensification and the accumulation of grain surpluses;

- Having inherited a relatively extensive farming system, many households cannot now afford to invest in low-yielding sub-subsistence agriculture, which cannot compete for labour or capital against more remunerative forms of commercial employment.

Why, then, do so many households continue to farm? They do so because job seekers outnumber job opportunities, unemployment is high, cash is scarce and family farming reduces cash expenditures on food. In this situation, subsistence farming remains attractive because, somewhat paradoxically, it pays itself a commercial wage - the money saved by avoiding food purchases at retail prices. Small-scale commercial agriculture, on the other hand, is penalised by relatively low producer prices, high transport costs, and competition from commercially produced and milled maize, which limits the windfall profits that surplus producers would otherwise realise from millet sales at inflated prices in drought years. Thus, in addition to any practical or technical impediments confronting them, emerging commercial farmers face a price disincentive when they shift from production for home consumption to surplus production for sale. The current state of Kavango agriculture suggests that very few households are willing or able to make this shift:

Most of the households (54%) indicated that they farmed for subsistence. Forty-six percent were farming to feed the family and make money. None of the households reported that they were farming exclusively to make money (Matanyaire 1997: 4).
Cash, crops and cattle: how livestock make people richer

The previous section described a self-sustaining cycle of poverty - a low-input, low-output farming system that was only competitive at a subsistence level of production, and often did not achieve even that. We now turn to our second question: What might government or donors do to break this poverty cycle through the promotion of improved livestock production? To answer this question we must first understand the special functions of livestock within the household economies of Kavango.

There are various explanations as to why African small-holders value livestock and attempt to maximise herd sizes. In Kavango the evidence on this issue is contradictory, but becoming clearer with each new study. Standard explanations of low offtake rates and high stocking densities are offered in the following quotations:

The current cattle off-take rate in the Kavango region is estimated by the DVS to be approximately 3.5 per cent. This is far below the commercial off-take rate of 10 per cent which would imply the slaughter of some 9000 cattle in 1992. The explanation for this is partly cultural - cattle owner generally have the objective of maximising her size rather than income from the herd. Nonetheless, there have been significant impediments to livestock marketing in Kavango (Yaron et al 1992: 91).

The huge stores of livestock wealth being accumulated are resulting in heavy over exploitation of communal grazing... which has been attributed to 'the tragedy of the commons'... Most of the large herd owners should be strategizing to exploit the free communal grazing to the full while they have the chance...As individuals these 'cattle barons' are totally exploiting the open access grazing to the detriment of the poor (Matanyaire 1997: 14).

Larger herd owners tend to have access to... cash sources [other than livestock sales to purchase food]. Their herds are mainly unproductive and are used for capital accumulation (Matsaert 1996: 28).

Embedded in these quotations are a number of questionable but widely accepted assumptions: that livestock sales are the major form of herd offtake, that capital accumulation through herd growth is unproductive if it does not lead to higher volumes of sale, that large herd owners prosper at the expense of poorer ones, and that herd accumulation is a culturally sanctioned but economically misguided endeavour. There now exists evidence that challenges many of these assumptions.

The values of livestock and crop production are usually calculated separately in estimations of household incomes. This procedure is revealing for some purposes, but misleading for others. In Kavango there is strong evidence that much herd 'output' is not realised directly as income from livestock products. Instead, cattle are an input into arable farming, and the benefits of cattle keeping are realised in the form of grain.

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5 There are many potential ameliorative measures that have little to do with livestock - such as the introduction of high-value commercial crops, price supports for staple crops, farm input subsidies, or efforts to reduce marketing costs. This paper examines only livestock-related possibilities.
In Kavango animal draught power is the link between crop and livestock production. 93% of households in the Region plow with oxen, about 71% using their own animals and 21% borrowing or hiring plowing services. Farmers state that insufficient animal draught power is - aside from the vagaries of the weather - their most important agricultural constraint (Matanyaire 1995: 2, 3), a conclusion broadly endorsed by economic analysis. According to the Kavango FMS, both a household’s net profit and its returns to labour in arable agriculture are directly correlated with herd size, which is illustrated by the following calculations based on the 1995-6 agricultural season:

- Households with no cattle realise a total level of crop production worth N$432, and receive a shadow wage from arable farming of N$3.5 per day if they are able to borrow draught power, or a net loss of N$ -1 per day if they must hire plowing services;
- Households with five head of cattle achieve a crop income of N$871, and a net daily wage of N$4.6 or N$ -0.8, depending on whether they borrow or hire plowing services;
- Finally, households with a mean herd size of 23 head obtain an income from crops of N$1314, and a daily wage of N$5.4 or N$4.9 (FMSa,b 1997).

Despite widespread impoverishment, successful arable production is a relatively capital intensive undertaking, and most of this capital is tied up in stock. One recent study estimated that 94% of households in the Region owned some kind of livestock (chickens, pigs, equines and goats, as well as cattle) worth on average N$ 23,000, while 54% of households held bank savings with an average value of N$1,224, a ratio of livestock capital to bank savings of approximately 33 to 1. This ‘distorted’ (SSD 1995: 55) pattern of investment was not, however, predicated on a low estimation by farmers of the value of cash savings. Bank savings were deemed by farmers to be both high yielding and safe, as against livestock which were thought to yield only medium returns at a medium level of risk (SSD 1996: 56, 57). Livestock were preferred not solely as a means of savings, but because they combined a steady income (in kind if not in cash) with an opportunity for some savings:

Those who prefer livestock referred to its multiple uses: ‘livestock gives meat, milk, manure and skin’; ‘livestock can be used for farming purposes’; ‘livestock can be sold if we need money for an emergency’. Other advantages of livestock scored much lower than these three, but included: ‘livestock multiplies each year’; ‘livestock is convenient because it is nearby’; ‘cattle are used for ceremonial purposes’; ‘convenient to slaughter during starvation’ (SSD 1996: 57).

In sum, farmers accumulate livestock in order to increase their incomes in absolute terms and to increase the efficiency of their cropping activities, as evidenced by the higher daily wage rates paid to farmers of larger herds. Farmers may be culturally inclined to keep cattle, but their cultural inclinations pay real dividends - in cash, grain and livestock products. This should come as no surprise - capital accumulation usually does pay off in a capitalist economy.
Livestock marketing

We are now in a position to better understand the limited role of stock sales in Kavango production strategies. The evidence, unfortunately, is equivocal. Matanyaire’s interpretation of sales patterns is based on farmers’ perceptions of the importance of cattle as a saleable commodity:

Six percent of the households with 1-21 head of cattle reported livestock sales as a major income source....It is interesting to observe that none of the 29 households owning more than 21 head of cattle mentioned them as a major income source....This confirms that households with smaller herds are more likely to sell than those with large herds. Furthermore, it also clearly shows that cattle are a highly valued production resource that is sparingly used as a consumption commodity (1997 10, 11).

Cattle are sold in emergencies, however:

Livestock is viewed as a ‘capital bank’ only to be utilised in times of emergency....The use of cattle for food security seemed however to be restricted to households whose heads were not employed. Households whose heads were in wage employment had more readily disposable income (wages) to use for emergencies without resorting to the cattle herd (1997: 14).

These results are supported by Yaron et al, who divided households into three wealth categories - food insecure (very poor), generally poor, and income sufficient. Livestock sales provided about 11% of income for all households, but were proportionally more important for the poorest ‘food insecure’ households, providing 21% of total household income, versus 13% and 10% of household income for generally poor and income sufficient households, respectively: ‘The limited ownership of livestock amongst the poor coexists with a greater reliance by them on income from livestock sales....’ (Yaron et al 1992: 89).

These results were not confirmed by a recent SSD study which suggested that livestock sales - the source of about half of all household agricultural income - were equally important for both wealthy and middle-income families (SSD 1996: 33, 34). The recently concluded Kavango Farm Management Survey also provided evidence on this point. According to the FMS, the cash value and percentage of total household production derived from livestock, crops or non-farm sources is presented in Table 2, for three different herd size classes.

**Table 2: Cash and Percentage Contributions to Household Incomes, by Source and Herd Size**

<table>
<thead>
<tr>
<th>Income source</th>
<th>0 Cattle</th>
<th>1-10 Cattle</th>
<th>11+ Cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock</td>
<td>N$43</td>
<td>N$481</td>
<td>N$1169</td>
</tr>
<tr>
<td>Crops</td>
<td>N$432</td>
<td>N$871</td>
<td>N$1314</td>
</tr>
<tr>
<td>Non-farm</td>
<td>N$960</td>
<td>N$1164</td>
<td>N$1239</td>
</tr>
<tr>
<td>Total</td>
<td>N$1336</td>
<td>N$2517</td>
<td>N$3723</td>
</tr>
</tbody>
</table>

Source: Kavango Farm Management Survey, 1997a, b.
In Table 2, both the absolute and percentage contribution to household income from livestock increases as herd size increases. Crop income, on the other hand, retains its relative importance as an income source - at about a third of total household income irrespective of herd size - though the absolute levels of income from cropping increase significantly with increasing herd size. Finally, although levels of non-farm income improve slightly with increased livestock wealth, the importance of this source of income declines steadily as herds get larger.

To summarise, Matanyaire and Yaron et al provide evidence that most livestock sales take place under stress, the last resort of poorer producers with no option but to de-capitalise. The SSD and Kavango FMS results document, on the other hand, significant levels of voluntary sales by larger herd operators. These results are not necessarily inconsistent, given variations in rainfall conditions from year to year and possible recent improvements in marketing conditions in the Region, as a result of Meatco activities (see Tolmay 1996a: 8, 12 and Table 3).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1453</td>
<td>2153</td>
<td>2841</td>
<td>4663</td>
<td>(5120)</td>
</tr>
<tr>
<td>Avg. wt.(kg)</td>
<td>382.03</td>
<td>375.75</td>
<td>376.16</td>
<td>352.49</td>
<td>(2812)</td>
</tr>
</tbody>
</table>

Given the contradictions noted above and the general lack of information on the subject, the benefits from improved livestock marketing warrant further investigation. Of particular interest in Kavango are the positive effects of higher livestock prices on capital accumulation and herd growth.

It is usually assumed that improved marketing conditions will help to prevent, or at least slow down, increases in livestock numbers. This is probably too simple an interpretation. For small herd owners, higher livestock sale prices will reduce the number of distress sales that are needed to meet a given financial target, thereby permitting herd growth - all else equal. For large herd owners, higher output prices will inflate the capital value of their stock holdings and, thereby, improve the incentives for further investment - in additional stock, water development, the purchase of commercial inputs, etc. On the evidence presented here, these trends will make both large and small herd owners in Kavango more prosperous by increasing both cash incomes and on-the-hoof savings.

Livestock health

The preceding analysis suggests that capital accumulation in the form of herd growth is beneficial - because it increases crop production and (in all probability) improves incomes from livestock product sales and use. Growth in stock numbers seems to be
occurring in Kavango. While annual figures fluctuate in response to rainfall and pasture conditions, there is evidence for a modest expansion in Kavango cattle populations - by about 25% from 1985-1996 (see Figure 2 based on DVS estimates).

**Figure 2:**

![Kavango Livestock Population (1985-1996)](image)

Some impediments to the more rapid expansion of the Regional cattle herd are suggested in Table 4:

**Table 4: Inventory Changes in Cattle Herds in NOLIDEF Pilot Communities over two years**

<table>
<thead>
<tr>
<th></th>
<th>Cattle population</th>
<th>Number sold</th>
<th>Number slaughtered</th>
<th>Number died/lost</th>
<th>Total exits</th>
<th>Annual attrition rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fumbe</td>
<td>323</td>
<td>24</td>
<td>28</td>
<td>29</td>
<td>81</td>
<td>13%</td>
</tr>
<tr>
<td>Kapughedi</td>
<td>411</td>
<td>36</td>
<td>11</td>
<td>44</td>
<td>91</td>
<td>11%</td>
</tr>
<tr>
<td>Nkutu</td>
<td>278</td>
<td>24</td>
<td>3</td>
<td>99</td>
<td>126</td>
<td>23%</td>
</tr>
<tr>
<td>Silkunga</td>
<td>546</td>
<td>77</td>
<td>15</td>
<td>120</td>
<td>212</td>
<td>19%</td>
</tr>
<tr>
<td>Muthin.</td>
<td>128</td>
<td>6</td>
<td>18</td>
<td>60</td>
<td>84</td>
<td>33%</td>
</tr>
<tr>
<td>Totals</td>
<td>1686</td>
<td>167</td>
<td>75</td>
<td>352</td>
<td>594</td>
<td></td>
</tr>
<tr>
<td>Mean rates</td>
<td>9.9%</td>
<td>4.4%</td>
<td>20.9%</td>
<td>35.2%</td>
<td>17.6%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Calculations based on field surveys conducted by T. Tolmay in 1995.

The attrition rates quoted in Table 4 provide a picture of what happens to herds in a couple poor years - death, sales and slaughter combine to eliminate one in every three animals. The capacity of herds to rebound from a period of decline depends upon the number of breeding females in the herd, their fertility, and the probability that their offspring will survive. Unfortunately, reliable information on mortality and reproduction rates are unavailable for Kavango, and information on herd structures is contradictory. Data collected by the Kavango FMS suggest that herds do not contain enough breeding females to grow quickly in good years or recover easily from large
losses in poor years. The cow component in the FMS sample of herds ranged from a low of 20% (in herds of from 1-5 head) to a high of 32% (for herds of 11-20 head), and across the different sample sites, from 37% (at Myl 20) to 18% (at Ndonya). Assuming even very favourable reproductive rates, these are not herds that can sustain the levels of losses documented in Table 4.

Herd structures with low reproductive capacities are characteristic of production systems in which animal draught power is an important herd output. In these systems, it is in the interests of small herd owners to emphasise short-term grain production by maximising oxen numbers. If this is done by castrating all breeding males or trading /bartering reproductive females for young adult males, then the future growth capacity of these herds is imperilled. Such herds are sustainable only if owners are in a position to purchase rather than breed replacement oxen. But the Kavango FMS data revealed no specialised cattle breeding operations in Kavango.

This pessimistic picture is contradicted by herd structure data that differs from the Kavango FMS results in important ways (Table 5).

Table 5: Cattle herd structures

<table>
<thead>
<tr>
<th></th>
<th>Bulls</th>
<th>Cows</th>
<th>Oxen</th>
<th>Calves</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOLIDEP 1996</td>
<td>2%</td>
<td>56%</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>DVS 1992</td>
<td>6%</td>
<td>57%</td>
<td>20%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Note: DVS data cited in EMI 1993: 33.

The herds surveyed by NOLIDP and DVS can sustain losses of about 20% per year (the calf component in the herd), and still maintain a constant herd size (Table 5). Moreover, the NOLIDP data suggests the existence of breeding herds that could supply oxen for smaller herds that were biologically not self-sustaining. In the NOLIDP sample, small and medium-sized herds (beneath 20 head) contained on average 47% adult females; herds of 21+ head contained, on the other hand, 62% cows.

In sum, the growth capacity of Kavango herds is subject to dispute. But the attrition rates from these herds are high, at least in poor years, and would place severe pressure even on herds with a robust breeding component. These results suggest that improved livestock health could have a dramatic impact on the viability of herding operations in Kavango. Vaccination campaigns against scheduled diseases are the responsibility of the DVS and individual herd owners do not pay for these services. Livestock owners are responsible, however, for the treatment of non-scheduled diseases and/or feed supplementation, and are unlikely to adopt improved practices that they cannot afford. NOLIDP is currently experimenting with low-cost improvements in animal health and nutrition that farmers may eventually be able to purchase on a commercial basis (Tolmay 1996b). The material summarised here supports these investigations.
Range management

In Kavango the availability of feed and the management of range resources are among the most problematic aspects of livestock development. Herd growth may be economically beneficial (as argued above), but this does not mean that more animals can be fed or that they can be fed without damaging the environment. An environmentally responsible programme of agricultural development cannot ignore these issues, which are examined in this final section of the review.

The case for ecologically sustainable herd expansion is based on the current population distribution in the Region: 95% to the Region’s total population lives along the Kavango river terrace on about 5% of the Region’s land area (Yaron et al 1992: 5,6). While less dramatic, livestock densities follow the same pattern. Tolmay points to the livestock populations in three stock inspection areas - numbered 9, 11, and 19 - arranged roughly on a transect from the river’s edge to the interior of the Region. Moving from the river to the interior, the 1994 cattle populations of these areas declined from 7670 head, to 4797 and finally 2941 head - despite dramatic increases in the size of inspection areas as one moves inland. A pair of adjacent inspection areas 7 (inland) and 8 (riverine) provides another illustration of this pattern. Although roughly comparable in size, the riverine area contains more than double the cattle of the inland area (Tolmay 1996a: 10, 11).

While some of these differences in stocking density may be attributable to local variations in forage quality and quantity, they also reflect the settlement history of the Region. When inland communities grow to about 30-40 households, households begin to drift away to form new settlements (Tolmay 1996a: 15), a process led by

... large scale farmers (who have access to transport to bring water inland from the river). Once a number of these farmers have cleared land and built homesteads, the authorities are more likely to agree to construct a borehole to serve the new settlement. Once this borehole has been sunk, households without livestock are able to move into the area (Matsaert 1996: 5).

These are not favourable conditions for the adoption of programmes of range management. Farmers’ motivation for more intensively managing either natural or cultivated forage will be minimal when there exists an open frontier, as in Kavango. The exception may be riverine farmers in densely settled areas who permanently keep animals - such as milk cows or plow oxen - near their homes and cannot afford to move their homestead or their herd. Otherwise, taking the animals to feed (by migrating seasonally or by relocating the household) will almost certainly be more profitable for the farmer than protecting natural vegetation or cultivating forage corps.

The advantages of relocation are suggested by both the larger herd sizes and the greater equity of cattle distribution in inland versus riverine villages (Table 6):
Table 6: The distribution of cattle holdings in riverine and inland villages

<table>
<thead>
<tr>
<th>Herd size class</th>
<th>% households in inland villages</th>
<th>% households in riverine villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 cattle</td>
<td>36</td>
<td>62</td>
</tr>
<tr>
<td>1-10 cattle</td>
<td>28</td>
<td>17</td>
</tr>
<tr>
<td>11+ cattle</td>
<td>36</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Recalculated from Kavango FMS data.

The processes that create the different patterns of stock ownership in riverine and inland villages are not known. Are inland villages richer because they attract large stock owners from outside or because they also provide a favourable environment for the expansion of small herds? And how do inland herds grow - primarily through internal reproduction or by recruiting surplus stock from (and thereby relieving grazing pressure in) riverine areas?

Until we have answers to these questions, it is difficult to judge the effect of Kavango’s open frontier on Regional household income levels, the equity of income distribution and the evolution of farming practices. We offer, nonetheless, the following interpretation:

Resource degradation is almost certainly a problem in parts of Kavango.

Away from the driver, water supplies are very limited. Consequently, many areas of the river bank have been denuded of vegetation and are likely to face further erosion. The area around inland water points is also typically degraded. Shortage of water is not, however, the only cause of overgrazing - lack of rotational forms of livestock management on communal land has led to overgrazing even where there is a good supply of water (Yaron et al 1992: 10; see also EIS 1993: 25, 28).

But the existence of a problem does not mean that it can be solved, or that it would be sensible or economic to attempt to do so. If plentiful grazing resources are readily available elsewhere, it will be difficult to convince farmers to conserve or rehabilitate areas that they can afford to abandon. To be sustainable, resource conservation must pay tangible dividends to the farmers who engage in it. Conditions in Kavango may be such that range management has, as yet, little to offer many livestock owners in terms of increased profit or output from their stock. The exception may be riverine stock owners who cannot relocate their household or herd, on a seasonal or permanent basis. It is this group of farmers that are likely to be most receptive to new techniques which increase cultivated forage production or conserve natural supplies.

Water development in the Region’s interior is likely to have broader appear. In the short term it will probably decrease stocking pressure and improve herd performance around existing water points. But these effects are likely to be transitory. In the long term it will increase livestock numbers as farmers push into new and currently under-stocked areas, and their herds grow in response to
favourable conditions. After a few decades of this kind of expansion, forage availability is likely to become a constraint that livestock can no longer walk away from. Herd owners will then be forced to intensify their operations through the adoption of range management practices that now appear to them to be unaffordable and unnecessary.
PART II
FIELD STUDIES

A COMPARISON OF GRAZING MANAGEMENT IN RIVERINE AND
INLAND KAVANGO COMMUNITIES

Methods, objectives and study sites

The purpose of this study is to provide practical guidance for NOLIDEP’s programme
of sustainable range management in Kavango Region. A previous literature review
(Part I of this report) identified three potentially important questions regarding range
management:

- To what extent are Kavango farmers willing to adopt improved range
  management practices or cultivate forage crops?

- How does resettlement and the colonisation of the Kavango interior effect
  resource management decisions at the village level?

- Why do Kavango farmers sell so few cattle and should they be encouraged to
  sell more animals?

Based on two weeks of field research undertaken in mid-November 1997, the field
study reported here provides some preliminary answers to these questions.6

About one week of field work was undertaken in the vicinity of the inland NOLIDEP
pilot community of Fumbe, which is situated about 50 kilometres east of Rundu and
several kilometers south of the main east-west highway along the Fumbe Omuramba.
The village is fairly representative of older, well-established inland Kavango
communities. As will be described later in this report, declining soil fertility and land
pressure are now forcing some Fumbe residents, themselves once immigrants from
riverine communities, to resettle further inland.

According to a NOLIDEP survey conducted in 1995, Fumbe contains 31 households
and a total human population of about 300 people. The village population is made up
of roughly equal numbers of adult males and females, with about a third of the
population consisting of children. About 84% of Fumbe households owned livestock
(including poultry), 55% owned cattle, but about half of all households owned no oxen
at the time of the survey.

NOLIDEP work in Fumbe since early 1996 is described fully in NOLIDEP’s Kavango
Region annual and quarterly reports, but includes the rehabilitation of the village

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6Field work in Kavango was carried out in co-operation with the DfID-funded KFSR/E project;
KFSR/E staff freely supplied me with their field notes and preliminary reports, which I gratefully
acknowledge.
diesel borehole, the construction of community vegetable gardens adjacent to the borehole, the provision of improved bulls, research on parasite control and supplementary feeding, grazing exclusion trials, and discussions regarding the subsidised provision of goats to a number of poorer village households.

The vast majority of the residents of Kavango live in riverine villages. In order to evaluate the prospects for NOLIDEP in this area, a further week of field research was spent in a series of contiguous riverine communities about 100 kilometres east of Rundu. These communities lie within the jurisdiction of Senior Headman Sindimba Balthazar, resident in Shikoro viallage, and are located along a 25 kilometre stretch of the gravel road that runs parallel to the Kavango River. Individuals were interviewed from the villages of Hoha, Ructarar, Shikoro, Ndiyona, Kangweru, Gumma, Karutici, and Nyondo, and from a number of inland communities colonised by immigrants from these villages.

Two KFSR/RDSP Working Documents (Numbers 8 and 14) provide an overview of agricultural practices in Shikoro, one of the riverine villages included in this study. There are 70 households in Shikoro village and a total population of 631 people (Matsaert nd: 1). 70% of these households own livestock (including poultry), 39% own cattle, but only 31% have work oxen. Shikoro, in common with neighbouring villages, grew quickly in the mid-1970s following an influx of refugees from the war in Angola. By the mid-1980s many households were abandoning their old fields and clearing new land a few kilometres back from the river, a process which has continued with farms and compounds now extending from the river to the paved east-west road that runs 5-7 kilometres south of the river.

Shikoro’s population is young and, among adults, predominately female. 65% of the people in Shikoro are less than 21 years old; among adults, females outnumber males by a ratio of nearly two to one. Between 1993 and 1996 the majority of households in the village were not food self-sufficient and members of the community received drought relief supplies from government (KFSR WD 8: 1-2.). Households heavily involved in crop agriculture tend to own cattle; poor households frequently rely for their income on fishing or are hired locally as agricultural labours.

The agricultural calendar

The agricultural year in Kavango communities oscillates between two extremes - the rainy and the dry season. During the rains (Nov to April), crops are in the fields and cattle are both herded and milked; at this time the floodplains adjacent to the Kavango River are flooded and riverine stock are pushed inland for grazing. Animals from Fumbe also tend to graze inland from the village at this time, staying away from fields around the settlement.

During the dry seasons (May to Oct), cattle are not closely herded for there are no crops to damage, nor - because of the declining quality of feed - are cattle commonly milked. In these seasons stock accumulate along the river to graze on exposed floodplain vegetation and on both natural vegetation and crop residues on the terrace.
above the river. In Fumbe, herds are free to return to the omuramba and graze the residues in the harvested fields, though some animals may stray as far as the river.

Table 7 provides an overview of the seasonal rhythm of crop and livestock husbandry practices. It also provides an initial impression of the balance between pastoral and non-pastoral interests among Kavango villagers. Left to their own devices, Kavango informants spontaneously subdivide the year in terms of the dominant cropping activities - field clearing (kwenyé), plowing and planting (kurombo), weeding (lipemba), and harvesting (kufu) (column 3 in Table 7). This suggests that cropping activities dominate household decision-making with respect to agricultural labour allocation, and that pastoral interests are subordinate to arable concerns. This possibility is examined more fully in the following discussion. Livestock movements in riverine communities are described first, followed by a comparison with grazing patterns in Fumbe.

<table>
<thead>
<tr>
<th>Season</th>
<th>Approximate duration</th>
<th>Farming activities</th>
<th>Primary stock feed resource</th>
<th>Management practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>kwenyé</td>
<td>Aug-Oct</td>
<td>land clearing</td>
<td>floodplain vegetation</td>
<td>no herding</td>
</tr>
<tr>
<td>(dry)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kurombo</td>
<td>Nov-Feb</td>
<td>plowing and planting</td>
<td>upland vegetation</td>
<td>herding, milking cattle</td>
</tr>
<tr>
<td>(wet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lipemba</td>
<td>late Feb-April</td>
<td>weeding</td>
<td>upland vegetation</td>
<td>herding, milking cattle</td>
</tr>
<tr>
<td>(wet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kufu</td>
<td>May-July</td>
<td>harvesting and</td>
<td>harvest residues</td>
<td>no herding</td>
</tr>
<tr>
<td>(dry)</td>
<td></td>
<td>threshing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Herd management and grazing patterns in riverine settlements

**Kwenyé** is the latter part of the dry season - roughly from August to October - characterised by the burning of brush and overgrowth to clear fields in preparation for the coming agricultural year. Cattle are not continuously herded at this time because there are no standing crops in the fields for them to destroy. They are therefore left to choose their own grazing. Typically, they graze on the terrace above the river in the morning after being released from their kraals. About mid-day they descend to the river to drink, followed by an afternoon spent grazing on the floodplains bordering the river, often on green lawns of close-cropped grass exposed by the retreating flood waters. If the bulk of floodplain grazing in a particular area lies on the Angolan side of the main river channel, low water levels at this time allow the cattle to easily cross the international border. Because they are searching for riverine grazing, the cattle tend not to wander far inland after crossing into Angola. Herd owners generally try to collect their cattle at dusk, return them to the homestead, and kraal them overnight, although animals that have wandered may escape detection and a few animals are left free overnight either out of negligence or to permit night grazing.
Kwenye is commonly described as a difficult season in which pasture conditions are poor and goats (in particular) die due to lack of water at inland locations were grazing is good but water unavailable. Some herders identify November - the transition between dry and wet seasons - as the most difficult period. Some cows may calf in kwenye, but because of poor feed conditions, herd owners usually do not milk the cow and leave all milk for the calf.

**Kurombo** (November to February, depending on the timing and strength of the rains) is the season of plowing and planting. As soon as crops have emerged and are vulnerable to damage by animals (usually before Christmas) all animals must be continuously supervised to prevent trespass on the fields. To economise on herding costs, households with few animals tend to herd their cattle and goats together in a combined flock/herd.

In densely settled areas along the river, the freedom of movement and availability of grazing is restricted in this season by the prevalence of cropped areas. The Kavango River also begins to flood at this time and inundates large lowland areas that had previously provided good grazing in the dry season; the flood also makes it difficult to come and go from pastures on the Angolan side of the river. The livestock thereby lose - either to cropping or flooding - access much of the pasture adjacent the river - both on the floodplain itself and on the terrace above the floodplain.

Combined with the threat of crop damage and heavy fines, these restrictions encourage most large to medium-size herds to spend increasing periods of time 4-8 kilometres back from the river in the vicinity of the major east-west paved road linking Rundu and Caprivi Region. In some instances, the herd continues to be managed from the main homestead, walks further inland to the south of the paved road, but returns in the evening to the home kraal and drinks every-other-day from the river. In other cases, owners set up a second kraal, usually hiring young men and boys to look after the animals under the intermittent supervision of the main household and taking their water from an inland borehole. Finally, some households maintain two homes and move seasonally between them, sometimes considering the inland house as their main residence with the riverine house serving primarily as a dormitory for school children.

In this and the following season, cattle milk makes an important contribution to household food supplies; it is relatively plentiful at this time because of abundant forage.

In **lipemba** (late February through April) the main crops are beginning to ripen and early maturing varieties - green maize and squash - are available for consumption. Weeding continues but plowing is finished. As in kurombo, herds spend most of their time grazing inland and are continuously herded to prevent trespass on crop fields. Milk production remains high.

**Kufu** (May to July) is the harvest and threshing season. May-June is typically devoted to harvesting and June-July to threshing. As soon as the crops are off the fields (probably in July, August at the latest), grazing patterns shift.
The animals return to the heavily cultivated riverine areas to feed off crop residues (viringe). Because there are now no crops to damage, livestock are left unattended in the day, though some wealthy stock owners may herd their animals year-round as a precaution against theft. Farmers estimate that it takes about a month for the herds to eat the bulk of the field stover.

The herds are thought to provide a service for field owners - clearing and manuring fields - and there is no attempt to exclude neighbours' animals from one's own fields. Nor is there any attempt to preserve standing stover for later use in the dry season or cut, carry and store materials for later feeding when natural forage is less readily available. Most of the stover is consumed when it first becomes available in early kufu, with the herds shifting back to natural forage sources after it is finished. Typically, floods are receding from the Kavango floodplains by the end of kufu, and herds gradually increase their reliance on this pasture area as the dry season wears on. Most cattle owners stop milking their cows sometime in or just before kufu due to declining milk yields caused by deteriorating pasture conditions.

**Herd movement and management in Fumbe**

Despite differences in the geographical setting, the principles behind seasonal herd movements and grazing patterns are remarkably similar in both riverine and inland communities. In Fumbe in the wet season, stock are herded away from the omuramba which is heavily cultivated, and graze in an inland direction to avoid competing for forage with riverine stock that are pushed south from the river at this time. Left to themselves in the dry season after harvest, Fumbe cattle graze the harvested fields and forests around the settlement, but may also drift towards the river, attracted by fresh grass and the smell of water. Stock may water from temporary pans in the wet season. Because they are obtaining some of their water from green forage, they do not need to drink every day at this time of year. Daily stock watering at the borehole is routine in the dry season when the animals feed on dry grass and leaves.

Stock cannot exploit areas without water, but in Kavango areas with water tend to be heavily cropped. These considerations set up a simple seasonal oscillation: stock graze the periphery of settled areas under the supervision of herdsmen in the wet season when crops are growing, and are left free to roam around harvested fields, in the vicinity of settlements, and far afield in the dry season after the harvest is collected. A rudimentary system of pasture rest and rotation therefore already exists. But the factors that sustain existing patterns of stock movement could also discourage the adoption of more elaborate systems of grazing rest and rotation. This possibility is examined below.

**Herded, free ranging or fenced**

Many animals are not herded between July/August and Christmas. Herding labour is the major expense connected with keeping livestock, at a cash cost of about N$100-150 per month plus rations and possibly clothing for the Angolans commonly employed in riverine villages or for the Bushman who may be hired by inland livestock owners. Other livestock production costs are negligible. Water for stock is generally
free and neither feed supplements nor veterinary inputs are routinely used. Labour costs per animal are higher for smaller herd owners and lower for large herd owners who can spread this expense over more animals. Wealthier owners also have more capital invested in their herd and, generally, have more cash to spend on herd management. Small herd owners are therefore more inclined to cut costs, accept the risks of straying and theft, and let their animals roam freely in the dry season. Some full-time professional herders also maintain that free-ranging animals are better fed because they can graze during the night and choose their own pastures.

**Losses due to the theft of free-ranging animals are not uncommon and can be catastrophic (Kakakuru et al 1997: 10).** That small herd owners accept these risks suggests that they would not be inclined voluntarily to herd year-round to achieve the marginal increases in output that could result from improved systems of grazing management requiring continuous herding.

Fencing is an alternative to herding, but also would appear to be uneconomic. During the 1980s the previous government supplied some wealthier herd owners with fencing for large paddocks in the forests back from the river. Livestock owners report that these fences were useful in preventing straying and theft and in reducing the labour costs associated with herding, but only if fence construction was subsidised. Most of these fences have since collapsed because their owners did not maintain fire breaks and the fence poles have burned in forest fires. This suggests that even for large herd owners the labour costs of herding were less than the costs and associated benefits of controlling fires and maintaining fences, even when initial construction costs were subsidised.

**Non-pastoral influences on grazing patterns**

‘Improved’ grazing schemes assume that livestock management practices are designed to optimise livestock output and that owners will alter their husbandry practices to improve output. This is not necessarily the case in Kavango, where the livelihoods of most households are derived from a variety of non-pastoral sources - fishing, hunting, gathering of wild products, agriculture, working on other people’s farms, pensions, remittances, and labour migration outside the region. In these diversified livelihood systems, the benefits of stock husbandry practices are not assessed in isolation but in terms of how well they integrate with other activities.

In the management of grazing and forest resources, the needs of gathering and hunting may be more important considerations than pastoralism for local residents. This conclusion is supported by the way people are interested in plant resources and by the way they use fire to manage these resources.

In both inland and riverine areas, herd owners are able to name important forage species and identify different soil types associated with particular plant communities - the periodically flooded clay soils of the floodplains, the cultivable clay soils (*ndombe*) of the riverine terrace and omurambas, and the sandy soil (*mushoke*) that predominates in the interior. The following interchange (with a farmer in Fumbe) is typical:
Researcher: What are the most important grasses for livestock feed?

Farmer: There are two. Ngwena [*Cyanodon dactylon*] is short and you find it in omurumbas, not on sandy soil. *Erampi* [*Schmitidia kalaharensis*, an annual] is also found on *ndombe* soils, but the cattle don’t like it as much as the goats.

Researcher: What forage grasses are found on sandy soil?

Farmer: I can recognise the grasses that come from sandy areas when I see them, but I don’t know their names. Normally, in sandy areas the cattle seem to eat the leaves of bushes and trees rather than grass, especially the *murere* [*Diplorhynchus condylacarpon*] and *mbunze* [*Baphia massaïensis*] trees.

Researcher: Is there any particular time of year when cattle prefer the plants in *ndombe* or *musheke* areas?

Farmer: No.

Researcher: How about goats?

Farmer: All areas seem to be fine all the year, but goats are fond of trees with thorns found on *ndombe* soils, particularly *mukeketi* [*Ziziphus mucronata*] and *umyondo*.

In riverine communities herd owners can identify particular forage species and their locations. But herds spend much of their time unattended when grazing along the river, and - with the exception of trying to keep animals away from the crops - livestock rather than humans make many of the decisions about pasture areas. The daily herding cycle - mornings on the terrace above the river and afternoons spent grazing on the floodplains below - reflects the feeding preferences of free-ranging animals. According to livestock owners, this feeding pattern also minimises the damage to cattle caused by two pests - *karata ngombe* (unidentified) and *mashundju* (described as a small worm) - which are found in grass around shallow water. Both of these pests graze in the morning but retreat to thicker vegetation in the afternoon. By grazing the floodplains in the afternoon, stock are less prone to accidentally eat these animals. Reputedly, *karata ngombe* kills quickly while *mashundju* kills slowly.

While some Kavango herders are unusually knowledgeable about local forage resources, most farmers are competent to discuss these issues but have neither a specialist knowledge nor a keen interest in the subject. Modest local knowledge of natural forage resources is in marked contrast to the detailed knowledge villagers have of plants that are edible or otherwise directly useful to humans. In walks with farmers around Mashare village, KRSR researchers identified 34 useful plant species, but only one species was spontaneously identified as an animal feed (KFSR WD No. 6 1995: 32-35). Similarly, in a list of 27 important tree species identified by farmers around Shikororo village, only one species was spontaneously identified as cattle fodder KFSR WD No. 14 1996: 24).
There is a reasonable explanation for these different levels of knowledge and concern. As livestock owners point out, natural feed is reasonably abundant in most seasons, there is little variation in forage quality among different plant communities, and both cattle and goats spend many months making their own decisions about grazing locations and preferred forage species. Under these conditions, a detailed knowledge of natural forage resources is not that useful since many factors other than the quality of the vegetation play a dominant role in deciding where to pasture animals. Farming is particularly important in this respect.

In order to avoid crop damage, herds are taken to graze in the opposite direction of the concentration of field sites when crops are standing, and taken towards the fields after harvest. The physical distribution of arable activity - rather than the location of favoured grazing areas - determines herd movement. Community opinion - represented in heavy fines for stock damage to crops - supports arable over pastoral interests.\footnote{While poor fencing may mitigate the severity of the fine, up to N$30 per cow can be levied in cases of trespass on cultivated fields. Because of their ability to graze closely and kill rather than damage crops, goats which trespass in fields can be fined up to N$40 per head, 30-40\% of the sale value of a prime animal. According to the Shikoro Senior Headman, disputes over stock damage are a constant headache during the cropping season.} Under these conditions, an unusually detailed knowledge of forage plants is not needed and, if possessed, would not alter patterns of herd movement or result in significantly higher herd output.

Fire also plays a role in determining stock movements, but pastoral concerns do not appear to markedly influence the distribution of burning. About a third to a half of the forested areas immediately south of the main east-west paved road were burned in 1997, and fires were also common both on the terrace above the river, on the floodplain, and around Funbe. No one spoken to in this study claimed to set these fires, to know who set them, or to condone them. Some fires were apparently set by accident (usually late in the dry season, sometimes when clearing fields) while others were intentionally set for hunting purposes (usually early in the dry season).

The fires create immediate problems for livestock in that they destroy forage in a season when grazing is relatively scarce. Some herd owners report moving their stock in the dry season to the floodplains where uncontrolled fires are less prevalent. Other herders - especially those in sparsely inhabited interior forests - maintain that there is plentiful grazing despite fire. Fires also benefit stock owners. They encourage green grass re-growth before the rains and provide a low volume of quality forage at a time when good feed is scarce. Fires also control ticks, maintain a open forest floor and keep bushes and shrubs at a height that can be conveniently browsed by stock. Some herders observed that grass became less common in forested areas that were not burned for several years.

Despite these advantages/disadvantages, livestock-related reasons were never cited by informants as the probable motives for setting intentional fires. As one informant put it, 'Fire is good for cattle, but they eat grass. We don't.' Instead, the benefits of fire were primarily assessed in terms of gathering versus...
hunting. Fires were set (always by someone else) for hunting and were admitted to be advantageous in that context. On the other hand, fires were considered to be detrimental because they destroyed wild fruits, nuts, vegetables, medicines and building materials collected in the forest for human consumption and use. In sum, villagers know that burning is frowned upon, they continue to burn, and assess the costs and benefits of burning in non-pastoral terms. It is doubtful if current burning practices - beneficial or harmful - would change in order to institute a novel grazing management system.

Colonisation of inland areas

For many Kavango villagers, pastoralism is subservient to other interests. This is not because livestock husbandry is economically unimportant. Rather, Kavango’s part-time pastoralists have devised solutions to their livestock problems which do not unduly interfere with their other agricultural and off-farm activities. Migration from densely settled to sparsely settled areas is one of the ways livestock owners obtain abundant, low cost forage while minimising demands on household resources. By relieving land pressure, intra-regional migration may frustrate attempts to intensify grazing management practices in particular areas.

Land pressure is high along the Kavango River, where the bulk of the rural population is settled because water is cheap and plentiful, heavier soils are suitable for cultivation, fishing is an option, and - today - villages are close to social services and roads. But many of the fields in these riverine communities are exhausted or weed infested and the density of cultivated areas constrains stock movements during the cropping season. Households committed to agriculture often resettle inland.

This section describes two stages of the resettlement process. First we examine the movement by riverine farmers into adjacent inland areas; we then examine the movement of households out from Fumbe, an established inland village on a large omuramba, to the smaller pans scattered around the main settlement.

Riverine villages

By the mid-1980s many riverine villages were becoming crowded and most field sites on the terrace adjacent to the river were already claimed or in use. Many of these riverside fields had either lost their fertility or had been infested by the ngwena grass (Cyanodon dactylon) that invades fields on clay soil and is difficult to eradicate. Farmers in the Shikoro area began by opening new fields several kilometres inland from the river. Since these new fields were within walking distance of the riverine villages, most farmers maintained their old homesteads. This process has continued and today the land between the main east-west highway and the river is heavily cultivated. New settlements are now appearing on the south side of the highway.

The increasing density of riverine settlement and cultivation has created problems for livestock owners during the cropping season. Fines for stock trespass are heavy. Larger herd owners repeatedly cite ‘quarrels with the neighbours’ as the primary reason why they try to pasture their animals away from heavily cultivated areas when there are crops standing in the fields. In practice, this means that many large herds and flocks are now pastured south of the main east-west highway, at about 10k from the
river, in seasonal cattle camps maintained by young male relatives or hired herdies. The 10k that separates the camp and the river is a long way for cattle, and too far for goats, to walk for water. Most inland cattle posts therefore have additional water sources - such as seasonal pans or local boreholes (sometimes constructed for schools) - or herd owners transport their own water (especially for goats) by ox sled or truck.

If water supplies can be improved, these grazing areas may be gradually transformed into permanent settlements. Large herd owners lead this process. Typically, the search for pasture has acquainted them with potential settlement sites. Because they own plows, sledges and oxen, large herd owners have the capacity to haul water and plow large areas, and are motivated to look for new field sites. Finally, because they are well-to-do, large herd owners are likely to have the social-connections needed to convince government authorities to improve an area’s water supply.

Table A1 in Annex 1 lists some of the satellite hamlets created by residents of the riverine villages between Hoha and Nyondo. Two settlements - Kaurnara and Shitombo - illustrate different stages in the settlement process, and are described below.

**Shitombo**

The grazing area and proto-settlement of Shitombo illustrates the colonisation process at an early stage. Four families - two from Gumma and 2 from the neighbouring riverine village of Karutci - currently use Shitombo as a grazing area and have opened new fields in the area, which lies inland from their home villages. Each of these households owns between 50 and 70 cattle. One of these four households lives year-round in Shitombo and no longer maintains a house in his home village, having first used the area in 1990 and settled there in 1993. The other three households occupy the area in the wet season when water is locally available from pans and grazing conditions are difficult close to the river. In the dry season, however, the balance of advantage shifts back to riverine settlement, and the three temporary occupants move their herds back to the river. At this time grazing conditions along the river improve as crop residues become available and retreating flood waters expose the floodplain pastures, and cattle remaining in Shitombo must trek back to the river every other day to drink. The distance between the river and Shitombo is too far for goats to commute regularly, and the one permanent resident of Shitombo owns no goats.

A combination of arable and pastoral considerations brought the early settlers to Shitombo. The Shitombo area contains *ndombe* soils favourable for cultivation and all households have opened new fields. The one permanently resident household has also noted improvements in the productive and reproductive performance of his cattle. The cattle give birth more regularly than they did when they were kept along he river, calf about three to four months earlier (in August rather than December) because of they are in better condition, and produce enough milk to sustain offtake for humans even when rainfall is poor.

Initially those using Shitombo received permission to settle from the Humpa and ‘registered’ the area with district-level government authorities. The provision of a government-built borehole was requested through the local government councillor, but nothing has happened yet. In the future, those who want to settle in Shitombo will not go to the Humpa but will seek permission to settle from the first settlers at the site. In the estimation of Karutci residents, outsiders must seek approval and be assigned field sites by those living in Shitombo. No one from Karutci, they believe, could be refused permission to settle, and Karutci immigrants should be free to choose their own arable plots.

There are six pans scattered around Shitombo. The pans contain *ndombe* soil but are not cultivated because they are reserved for grazing. Most of the larger cattle owners in Karutci have not resettled because - unlike the one permanent resident of Shitombo - they have too few oxen to haul water from
the river. One farmer who tried to stay during the dry season could not get enough water for his goats and many died. All say that they are interested in resettling as soon as a borehole is constructed, citing deteriorating pasture conditions around Karutci, especially in Kurombo when the floodplain is inundated and it is difficult for the herds to find a way through the cultivated areas to the open bush.

A group of four Karutci cattle owners were asked if they were willing to contribute money towards the cost of borehole development at Shitombo. They were not interested as long as the borehole remained public property. The construction of boreholes, as with other public services, was in their estimation the responsibility of the government. They thought that this was a good policy, but the authorities were being unnecessarily slow in developing Shitombo.

**Kaurmara**

The recent history of Kaurmara illustrates the process of resettlement after a water point has been constructed. Kaurmara is inland from the riverine village of Karutci and long served as a cattle post and grazing area for herd owners in Karutci. One of these wealthy families was the first to settle in Kaurmara, lobbied government for a borehole at the site, and was initially refused on the grounds that not enough people lived in the area. This individual then set about recruiting additional settlers, mostly from Karutci, and a borehole was installed in 1992. About 20 families moved to Kaurmara after the borehole was constructed, while others have moved their stock but still maintain a house in Karutci. According to one estimate, about 75% of Kaurmara residents have cattle, a significantly higher proportion than own cattle in the riverine ‘parent’ village of Karutci.

**Settlement of the Fumbe area**

The inland village of Fumbe lies along a major omuramba and is a well-established village in its own right. People started moving into the area from riverine villages in the 1960s. At first the nearest water installation was in the camp operated by the agricultural college at Mashare, and Fumbe residents obtained their water from hand-dug wells (matope) in the omuramba. In 1966 the Fumbe borehole was drilled and equipped with a windmill, which fell down and was replaced by a handpump and then upgraded to a diesel pump after Independence, circa 1992.

Fumbe is now experiencing land pressure and is spawning its own peripheral settlements. Due to declining soil fertility, grass infestation on the omuramba soils (by *Cyanodon dactylon*), the unavailability of good field sites which are unclaimed, and problems of keeping large herds in heavily cultivated areas, long-time Fumbe residents are leaving the main settlement and moving further inland. At the same time, immigrants from riverine villages are still moving into the Fumbe area, but most are settling in hamlets around small pans or in the Fumbe omuramba at some distance from the main village (see Table A2 in Annex 1).

**Tossa**

The most important of these satellite settlements is at Tossa, a pan about 11 kilometres south of Fumbe which formerly served as a wet season cattle camp (muraka) for Fumbe herd owners. After Independence a Fumbe schoolteacher and large herd owner started plowing fields at Tossa on ndombe soils similar to those found in the Fumbe omuramba. At first he had to haul water to Tossa by ox sledge or car and continued to water his stock at Fumbe during the dry season when there was no water in the pan. In 1992 he convinced the authorities to install a diesel equipped borehole at Tossa and moved his household there in 1993 when he retired. After the borehole was installed, other families started moving in, and today Tossa is inhabited by 8 families, 7 from Fumbe and one from the riverine village of Mororo nearby Mashare. Three more families are settled around Tossa at Ngovo where there is no water but there is ndombe soil suitable for cultivation. These households obtain their water from Tossa.
For the majority of settlers, the primary reason to move to Tossa was the availability of land suitable for cultivation. The exception is the large herd owner who founded the settlement; he moved because his animals were too numerous to keep in a heavily settled and cultivated area like Funbe, and the neighbours were complaining. According to farmers who know both Tossa and Funbe, similar kinds of plants occur at both sites. But there are fewer animals around Tossa and stock are better fed, in better condition and more productive. Because the area is not intensively farmed, crop damage by livestock is not a problem. Some livestock owners continue to herd their animals in the wet season, but others simply drive their animals out of the settlement to graze in the opposite direction from the fields, and retrieve them in the afternoon. Only two households in the settlement have cattle, which makes it easy to coordinate herd movements.

Rujaja

Rujaja, a pan in the Funbe omuramba about 7 kilometres west of Funbe village, illustrates conditions in new settlements prior to water development. First settled in 1991, the hamlet consists of four closely related households from the riverside village of Ngoni. They left Ngoni to locate new fields, but recognise that the grazing conditions in Rujaja are also better than those along the river. Their only problem in Rujaja - and the principal impediment to further settlement - is unavailability of water. There is still free land and more people are interested in settling around Rujaja, but they are deterred by the water situation. Water must be obtained either from Mungunda, Mangundu or Funbe - a two or three hour journey in all cases. The families in the settlement have three pairs of oxen and rely upon agriculture and agricultural labour for all their income. Although they received guidance from the founder of Mangundu settlement (see Table A2 in Annex 2) in identifying a good location to settle, they asked nobody’s permission before moving. Additional settlers would come to them and seek permission before settling.

The prospects for ‘improved range management’ in Kavango

We are now in a position to answer two of the questions posed at the beginning of the field study:

- To what extent are Kavango farmers willing to adopt improved range management practices or cultivate forage crops?

- How does resettlement and the colonisation of the Kavango interior effect resource management decisions at the village level?

Material presented thusfar supports four conclusions:

- When they are not under the supervision of a herder, livestock make many of the critical decisions about pasture utilisation; year-round control of stock movements - either through continuous herding or fencing - are uneconomic.

- Non-pastoral considerations often dictate livestock movements. The distribution of arable fields is of paramount importance in the wet season when stock are under human supervision. Fire - an important factor controlling the availability of dry season forage - is not used primarily to manage livestock or grazing. Fires are condoned or opposed because they either assist hunting or impede the gathering of forest products.
• Although ‘space’ for grazing may be at a premium, especially in riverine villages, forage is sufficient in most areas. Most households resettle in order to obtain more or better fields, although livestock condition also improves after resettlement. If herders resettle for pastoral reasons, the stated reason is to avoid crop damage and quarrels with the neighbours, not to obtain better forage supplies.

• When forage is not abundant, herd owners have a relatively low-cost way to solve the problem - they move their homestead to a less-populated area.

Range management - which involves the more intensive exploitation of finite forage resources - probably has little to offer households with access to the abundant grazing in the Kavango interior. Herders also maintain insufficient control over their livestock to implement a rigorous rest and rotation regime, and many management decisions effecting livestock - the setting of fires, the siting of fields and the choice of residence - are made for non-pastoral reasons. Finally, many Kavango villagers do not view the availability of forage as a serious constraint and would be disinclined to expend their labour or cash resources to redress a problem that they do not consider critical.

Maintaining the physical separation of wet season grazing areas from cultivated fields is a recognised need. Some inland communities discourage settlement and cultivation around designated pans which are reserved for use by stock during the cropping season. Because the heavier soils found around pans may also be suitable for cultivation, these restrictions are often difficult to maintain as communities grow in size, land pressure builds, and all areas suitable for cropping are put to the plow. NOLIDEP should help to preserve the distinction between arable and pasture in areas where there are uninhabited pans around settlements. This can be done by endorsing local efforts to designate and enforce separate zones for cultivation and grazing, and by helping communities to deepen pans.

Pan excavation has been undertaken by NOLIDEP and the Fumbe community at Doushi pan, about 5 kilometres outside the village, and is considered to be a success by local residents. The pan has no fields around it and can serve as a centre for livestock grazing and a source of water in the wet season. Villagers support pan excavation because it reinforces the customary muraka or cattle post system of stock management in which animals were removed from village areas in the wet season to prevent damage to crops and relieve the pressure on grazing near settlements. Pan excavation is also affordable. Pans can be excavated by hand because the improvements are meant to conserve a small volume of water for temporary use in the wet season.

The effects of pan excavation on grazing management are likely to be modest. Reinforcing the distinction between arable and grazing land will encourage the seasonal rotation of grazing areas. But it will neither control stock numbers nor necessarily promote the more rigidly structured systems of rest and rotation that are found on commercial ranches. Adjustments in stocking density and problems of localised overgrazing are already handled in other ways - through the relocation of large stock owners to new settlements where grazing pressure is lower.
With the exception of the labour-based excavation of pans, in Kavango it will be difficult to use water development as a means of influencing livestock numbers. Along the river, water is abundant and stocking rates are already constrained by factors other than water availability. In the interior, water availability does limit stock numbers, but it may be difficult to use community contributions to water development as a means of encouraging responsible expansion of supplies, for several reasons:

- Mechanised water points in Kavango are expensive, individual herds are small, inland communities rarely contain more than about 300 people, and herd owners sell few animals. A significant cash contribution towards constructing a diesel-equipped borehole would be difficult for most inland communities to afford.

- Fully-settled communities form after a water point has been created, not before. Present policies encourage the large herd owners who initiate settlement to recruit additional, poorer settlers in order to qualify for government assistance. While the evidence is circumstantial, cash contributions to water development would probably limit access by poorer herd owners to installations built on a cost-sharing basis. This is presently the case at privately owned boreholes where non-owners must pay for water.8

- Kavango residents are accustomed to receive public services free of charge, and would be reluctant to participate in an isolated programme that challenged the principle of free entitlements.

The economics of dependency is deeply embedded in Kavango society. Until government, donors and the NGOs operating in the region are prepared to challenge this dependency, NOLIDEP should avoid involvement in capital-intensive water development. NOLIDEP’s current policy of requiring communities to contribute to the costs of rehabilitating water points is appropriate and affordable for local communities and should be maintained.

The economics of livestock ownership

We now turn to the final question investigated in this study: Why do Kavango farmers sell so few animals and should they be encouraged to sell more?

Cattle

Table 10 estimates the value of plow oxen for a small sample of riverine households in the 1996-7 agricultural season. In 1996-97 rental fees for a plow team in these

8 The borehole of Nanazi - located inland from Ndonya about 13k south of the main east-west highway - is a case in point. This private borehole was drilled in 1978 and is owned by a retired school teacher who moved his household there when he retired four years ago. The owner and a close relative use the borehole together. According to the owner, other farmers are free to use his borehole if they supply diesel, which he has to purchase privately. Few take up the offer. The farm employs enough labourers to sustain a small primary school.
communities ranged from N$20-40 per day. For these calculations, the cash value of plowing for oneself was estimated at $30/team/day; cash returns for the hiring out of oxen were based on the fees that team owners said they received for the rental use of their animals in 96-7.

Table 10: Estimated value of plow oxen in riverine agriculture

<table>
<thead>
<tr>
<th>households sampled</th>
<th>plow-days/team in 96-7 season</th>
<th>gross income per ox in 96-7 - N$</th>
<th>estimated gross income per ox - 5 yr working life - N$</th>
<th>estimated gross income per ox - 10 yr working life - N$</th>
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<tbody>
<tr>
<td>1</td>
<td>26 days</td>
<td>390</td>
<td>1950</td>
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<td>1650</td>
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<td>445</td>
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<td>na</td>
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<td>23</td>
<td>345</td>
<td>1725</td>
<td>3450</td>
</tr>
<tr>
<td>mean values</td>
<td>23 plow days/team</td>
<td>N$336/ox in 96-7</td>
<td>N$ 1746/ox</td>
<td>N$3200/ox</td>
</tr>
</tbody>
</table>

Farmers’ estimates of the slaughter value of plow oxen depended on the animal’s age and condition. One large herd owner claimed to use plow oxen until they were 9-10 years old, rest them for a year prior to sale, and receive about N$900-1000. Other farmers estimated that a working ox would fetch N$700-800 from Meatco, while a lazy or lightly worked animal could obtain N$900-1000. Replacement oxen three years of age and suitable for training were estimated to cost N$900. In other words, farmers that plow with an ox for five years can expect to realise an estimated gross income from plowing that is nearly double the sale value of the ox for slaughter, and receive from the sale of the old animal nearly enough money to purchase a young replacement. Oxen that work for ten years can be expected to earn from plowing more than treble their eventual sale value.

Aside from plowing costs (which incorporate the value of human labour and animal traction power), the cash costs of plowing are low. The costs of purchasing a plow are high - at about N$400 plus transport costs to Rundu since plows are not commonly available for sale locally. However, the working life of a plow is long - 20 to 30 years (with repairs) for the plow itself and 3-5 years for the blade - and the amortised costs of plow ownership are corresponding low.

The value of milk production for household consumption is significant and milk also has a local sale value. Large cups of milk sold in 1996-97 for about N$1.50 or could be exchanged for equivalent volumes of maize meal, the precise terms of trade depending on seasonal shifts in supply and demand. As a subsistence food source, milk is particularly valuable because it is available during the wet season, at a time
when crops are still maturing and last year’s harvest may have been depleted. In an intensive KFSR study of a small number of households, farmers with significant cattle herds estimated that milk provided about 15% of the food they consumed and 25-40% of household income came from livestock production, mainly from milk sales (Kakukuru et al 1997: 7,9).9

In sum, for both male and female cattle the value of stock ownership is realised in the recurrent harvesting of live-animal products - traction power for males, offspring and milk for females - with the animal carcass providing a residual benefit. These are not cattle production systems designed to optimise the volume or quality of commercial meat offtake. Livestock sales strategies reflect these economic calculations:

Animals are slaughtered or sold for many different reasons. Cattle were sold because they were ill, bad tempered (in one case) and to meet funeral costs. No animals were sold to Meatco....No healthy cattle were slaughtered for home consumption. Regular slaughter and sale of sick animals in the community appeared to provide enough meat for all households to consume beef regularly (Kakukuru et al 1997: 11).

Not one cattle herd owner interviewed in the course of the present study (including one claiming to own 175 head) said that he/she sold young male animals for slaughter without first using them for plowing.

Kavango herd owners sell cattle when they are old, sick, dead or dying. Economic analysis suggests that this is a rational cattle marketing strategy for Kavango producers given the relative value of live-animal products versus sale for slaughter. High rates of sale - especially among small herd owners - diminish the capacity for crop production and should not be encouraged by MAWRD. Kavango needs more rather than fewer cattle, and the needs of small-holders would be served by official recognition of this reality.

Goats

Goats, on the other hand, are kept primarily for meat production - either for sale or for home consumption - and milk is said to be drunk only occasionally and by children. Farmers commonly estimated that a mature goat suitable for slaughter was worth about N$100, although some quoted sale prices as high as N$120-150 for very large animals. At least one commercially-oriented flock owner interviewed in this study sold most of his animals during the Christmas season when prices were said to be highest. Most families, however, sold animals to cover large expenses. For example, one owner said that she routinely sold goats at the beginning of school terms in order to cover the costs of sending her children back to school.

9Despite the importance of dairy products, it is unlikely that the value of milk production by female animals equals the value of draught power provided by male animals. This conclusion is supported by the relative sale values farmers place on three-year-old oxen suitable for training versus three-year-old heifers. Young oxen were generally considered to be worth more than a comparably aged heifer, unless the heifer is also pregnant.
The scale of goat production is modest, and flocks of about 30 animals are considered large. Reproduction is reportedly good and multiple births are common; the impediment to further flock expansion is disease, with farmers reporting high rates of mortality in most years and catastrophic losses in wet years, especially among young animals (see also Kakukuru et al 1997: 14). As a result, farmers do not specialise in goat production or use goat herding as a way to accumulate capital or ‘trade up’ to cattle ownership. If only one herd species is owned, it is more common for families to own cattle but no goats. Programmes targeted at small stock are therefore of no special interest to poorer families.

At current high rates of mortality, giving poor households a few goats under NOLIDEP’s Small Stock Seed Capital Fund (the SSSCF) is unlikely to make any permanent contribution to their welfare. A more lasting contribution could come from DART-NOLIDEP research on developing a low-cost regime to control parasite infestation in small stock (see Steyn 1997). Disease control would help to create more goats, and deserves support. The SSSCF will temporarily create more goat owners but no more goats, and should be abandoned until DART and NOLIDEP can also offer an appropriate disease control package.

Work on veterinary issues also provides a means of extending NOLIDEP activities from inland to riverine communities. It is reasonable to assume that parasite problems are as great or greater in riverine areas than they are inland, given the higher concentration of animals and their dependence on floodplain grazing along the river. If current trials in inland communities are successful, DART-NOLIDEP work on parasite control should be extended from inland to riverine villages as soon as possible. Given the loose social organisation of riverine villages, it may be best for NOLIDEP to work with individual farmers rather than whole villages, or through schools, churches and volunteer groups. Shops are also common in riverine villages. It is critical that these shops have access to a wholesale supply of appropriate drugs, stock these drugs, and are trained to give appropriate advice to farmers who buy them. In conjunction with DVS, NOLIDEP should provide support for such a programme as soon as an effective and affordable regime of parasite control has been identified.

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10 According to a NOLIDEP survey, there were 12 goat owning households in Fumbe in 1995, and none of these households owned 30 or more goats. In all five NOLIDEP pilot communities combined, about 10% of all households that owned goats had 30 or more animals.
### ANNEX 1: Satellite communities

#### Table A1: Some settlements inland from Shikoro area

<table>
<thead>
<tr>
<th>Inland settlement</th>
<th>Parent villages</th>
<th>Water</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shitombo - oldest occupant first used area 3 years ago and settled there 2 years ago</td>
<td>Gumma (2 households), Karutci (2 households)</td>
<td>6 pans holding water 3 months; year-round resident gets water from river in dry season</td>
<td>about 4 k south of paved road; 4 families use area in the rains and one settled there</td>
</tr>
<tr>
<td>Single household settled along paved highway</td>
<td>?</td>
<td>School handpump</td>
<td>Settled here 3 years; moved because of quarrels with neighbours over stock damage to crops</td>
</tr>
<tr>
<td>Shipondo - south side of highway</td>
<td>Hoha</td>
<td>borehole and river - no pans</td>
<td>Informant has no fields in Shipondo but goes seasonally and plans to set up muruka next year</td>
</tr>
<tr>
<td>Kushambane</td>
<td>Hoha, Linus</td>
<td>1 pan holds water for 6 months; no improved water facilities</td>
<td>Five families use area; informant had fields there and wanted to resettle if water supplies were improved</td>
</tr>
<tr>
<td>Kaurmara</td>
<td>Karuc</td>
<td>handpump fitted in 1992</td>
<td>About 20 families settled, most after 1992. Area now ‘full’</td>
</tr>
<tr>
<td>Ndiyona school</td>
<td>mixed, all permanent settlers (4-6 families) are school workers; muraka of riverine stock owners south of highway but using school bore</td>
<td>borehole next to school</td>
<td>Now settled adjacent to highway but were here before it was constructed</td>
</tr>
<tr>
<td>Nanazi - about 13 k south of paved highway</td>
<td>Owner from Gumma; 2^nd^ household from Kadedere</td>
<td>Private diesel borehole drilled in 1978; numerous pans holding water for short period in rains</td>
<td></td>
</tr>
</tbody>
</table>
Table A2: Some satellite communities around Fumbe

<table>
<thead>
<tr>
<th>Settlement</th>
<th>Parent villages</th>
<th>Water</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rujaja - about 7k west of Fumbe in omuramba; settled in 1991 and now occupied by 4 households</td>
<td>Ngoni</td>
<td>seasonal pan for livestock use</td>
<td>Further settlement likely following water development</td>
</tr>
<tr>
<td>Tossa - about 11k south of Fumbe; settled by 8 households and 2 Fumbe households plow but do not live here; settled continuously from 1993</td>
<td>1 household from Mororo; rest from Fumbe</td>
<td>Natural pan, diesel borehole installed in 1992</td>
<td>Bulk of cattle owned by settlement founder, a retired teacher</td>
</tr>
<tr>
<td>Mangundu - first settled in 1992 and currently occupied by 4 households</td>
<td>Mororo, riverine village close to Mashare</td>
<td>handpump constructed in 1993</td>
<td>settlement dominated by wealthy individual with large fields, many cattle, car and employment; he is a major employer of agricultural labour</td>
</tr>
<tr>
<td>Kavingwa - settled by 4 households</td>
<td>Mororo</td>
<td>no water; obtain water from Mangundu handpump</td>
<td>did not visit this site</td>
</tr>
<tr>
<td>Itareni - not yet settled; 2 households plow here; no livestock because there is no water</td>
<td>Fumbe</td>
<td>no water</td>
<td>Both households plowing at Itareni also farm in Fumbe and water their stock in Fumbe; unclear if Itareni will become settlement</td>
</tr>
</tbody>
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