Livestock Development and Drought in the Northern State of Nigeria

P. N. de LEEUW
*Department of Animal Science,
Institute for Agricultural Research
Ahmadu Bello University, Zaria*

INTRODUCTION

BELOW average rainfall and abnormal patterns of rainfall distribution are normal attributes of arid and semi-arid climates. Regions within these climatic belts are characterised by low population densities, usually can not support settled agriculture and are mainly used for grazing by pastoral nomads. In the past, these pastoral systems were adapted to seasonal scarcity of fodder and water and possessed a socio-economic framework oriented to survival and security for man and stock. It appears that a dynamic equilibrium existed based on a fairly long-term stability of fodder resources with balances maintained by periodic stock reduction caused by drought and disease. More recently, this environmental balance has been disturbed because the human and animal population increased to a level exceeding the carrying capacity of the land, following the introduction of modern disease control.

The catastrophic proportions of the drought are therefore largely man-induced and an inevitable corollary to applying modern science and technology in a marginal environment.

Though in Nigeria the disastrous effects of the drought on livestock and their owners are less spectacular than in the Sahel zone, they are onerous enough to critically evaluate present development policies

and strategies and see if changes in emphasis and direction are needed. As the developmental framework has been largely based on concepts and projections that did not allow for the impact of drought, it is reasonable to suppose that a new set of priorities needs consideration. On the other hand, many of the problems and constraints to progress of the industry have altered little or have increased proportionally with the seriousness of the drought.

This paper presents a comparative and sometimes critical review of several development strategies and project proposals contained in recent reports that were commissioned by the Nigeria Federal Government (MANR, 1972) and the Chad Basin Commission (Carter and McLeroy 1968; Henry and Licht, 1971; Woodhead *et al.*, 1971).

Fodder resources

If there were no constraints to optimal and efficient use, the fodder resources within the six northern states, appear to be adequate to feed the present herd, since about 9 ha is available per head (Table 1). The two major obstacles to use are the overall shortage and uneven distribution of dry season water supplies and the risk of tsetse fly in all but the northernmost part of the country, which has resulted in a 3-4 times higher stocking

TABLE 1. Distribution of cattle population and approximate number of hectares of non-farmed land per head and per season

Area	Total (1) land '000 ha	Non-farmed (2) land '000 ha	(%)	Cattle wet season	('000) wet season	ha/head wet season	wet season
<i>Tsetse-free</i>							
Katsina-Kano	6763	4795	(71%)	1476	1254	3.2	3.8
Sokoto	9457	6859	(92%)	1159	1069	7.5	8.1
Borno (3)	11433	10507	(92%)	2246	2092	4.7	5.0
Plateau	2920	2268	(78%)	355	492	6.4	4.6
Sub-total	30573	26229	(86%)	5236	4907	5.0	5.3
<i>Tsetse-infested</i>							
Central area (4)	18776	17462	(93%)	1045	1493	16.7	11.7
"middle belt" (5)	23699	22392	(94%)	828	1107	27.0	20.2
Sub-total	42475	39834	(94%)	1873	2600	21.3	15.3
Grand Total	73048	66063	(90%)	7109	7507	9.3	8.8

(1) Adapted from Ferguson (1967).

(2) Fed. Office of Statistics, agric. sample survey (Mc Leroy Salihu, 1971).

(3) Including Dikwa Emirate.

(4) Zaria, Bauchi and Niger provinces.

(5) Adamawa, Sardauna (without Dikwa), Benue, Kabba & Ilorin.

density in the fly-free zone as compared to the fly-fested zone and also account for increase in the dry season population towards the south.

Since the data represent provincial averages estimated a decade or more ago, they obscure within-province differences and do not allow for increases, particularly in the proportion of farmed land. This is evident from a summary of more recent land use/vegetation surveys in selected area (Table 2), which show that farming

has increased considerably as compared to 1957-58, thus aggravating further the unequal cattle distribution between north and south.

It is therefore of paramount importance that the eradication of tsetse fly be combined with a rapid provision of water supplies both in the tsetse-free zone and in areas that are recently cleared or to be cleared. These projects should receive first priority in plans for livestock development.

TABLE 2. Percentage land use/vegetation classes in selected areas

Area	Kano (1) Emirate	Central (2) Katsina	Rima (3) Sokoto	N.E. Nigeria (4) tsetse-free	Tsetse infested
Cultivated land	49.0	55.0	15.6	13.1	11.1
Fallows	—	—	—	19.3	12.5
Cultivated land + Savanna	—	—	47.6	—	—
Savanna	37.0	43.0	32.8	20.1	66.8
Rivers & fadama	8.0	2.0	4.0	12.0	6.2
Others	6.0	—	—	2.2	3.4
'000 ha estimated	2773	118	5611	5730	8100

(1) Dix (1967), (2) de Leeuw (1968), (3) FAO (1969), (7) de Leeuw (1974).

Tsetse eradication

Out of a total of 250,000 km² of infested territory in the Sudan, sub-Sudan and northern Guinea zones, up to 1972, some 85,000 km² have been cleared. Another 37,000 km² are probably tsetse free, leaving 127,500 km² yet to be reclaimed. It is estimated that eradication in this remaining area will take about 15 years and will cost N17.5 million to execute. This cost of N136 per km² (or N1.36 per ha) in terms of labour, materials and supervision is calculated on the basis of the size of the area opened up for grazing and other land use and not that of the area actually sprayed (Woodhead *et al.*, 1971).

Recently, spraying campaigns have been concentrated in NE Nigeria, where over 50,000 km² have been freed from fly. It has been calculated that this area can carry about 20 animal units per km² on a year-round basis, allowing for grazing land lost to farming, flooding and inaccessibility, hence some one million units could be supported (de Leeuw, 1974). If a similar grazing capacity is accepted for fly areas further west the 15-year eradication programme would open up land for another 2.5 million units.

Development of water supplies for stock

In Nigeria and adjoining countries, actual and proposed investments for stock water development comprise a substantial part of total project budgets. In general, four types of structures are used, the selection of which largely depends on the volume of water required and is often determined by the geomorphological characteristics of the area¹.

Apart from the construction cost per unit, overall project costs are mainly determined by the number of points per km². Though in many projects the distan-

ces to be walked by herds for watering, actual project analyses show that spacing varies considerably. An even greater variation is found when investment cost per ha and per animal unit are compared. Table 2 shows that the drilling of boreholes in areas with a low grazing potential such as NE Bornu and the northern part of Sokoto is ten times more expensive than excavating small reservoirs in grazing lands that are potentially more productive.

The waterpoints are arranged along a grid 10-15 km apart.

A most ambitious programme of water development is planned for the four countries within the Chad basin so as to open up nearly 1.5 million ha of underutilised grazing land. This project involves the construction of over 1100 water points at an estimated cost of 3.2 million Naira (Henry and Licht, 1971). In the near future similar plans are required to provide water to the areas freed from tsetse in Nigeria. During the next 15 years as many as 1400 small dams and reservoirs need construction to provide water to some 200,000 km² of grazing land. If it is assumed that each unit cost N5,000 and are being established on a 10 by 10 km grid covering about 70% of the total area (the remainder being provided by river, streams and existing water facilities) a total expenditure of some 7 million Naira would be needed.

In this context it needs stressing that such projects involve a large-scale and planned approach and should be carried out simultaneously with other measures (health and grazing control, produce marketing etc.). When introduced as an isolated innovation, water development inevitably leads to severe over-grazing as happened when the NE Borno borehole scheme suddenly introduced year-round

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Table 3. Cost estimates and other variables of some past and proposed stock water development projects

Type of structure	Boreholes		Wells	Reservoirs/dams	
Estimated cost/unit (N)	6,000	12,000	3,200	2,200	3,000
No. of units	17	3	66	35	250
'000 ha/unit	6.2	13.0	12.0	6.4	25.0
Estimated carrying capacity (ha/hd)	10.0	8.0	9.0	4.5	4.0
Cost/ha	0.96	1.20	0.27	0.34	0.12
Cost/animal unit	9.60	9.60	2.40	1.53	0.48
Area	NE Borno	Sokoto	SE Niger	Sokoto	NE Nigeria
Ecological zone	Sahel	Sudan	Sahel	Sudan	S. Sudan
Year installed/proposed	1967 (1)	1971 (2)	1971 (3)	1967 (1)	1971 (3)

(1) Kemmis et al (1967), (2) FMANR (1972), (3) Henry & Light (1971).

water to rangeland that hitherto were used only during the 3-months wet season. The age-old pattern of herd movements being adapted to the prevailing environmental conditions, became disrupted and was replaced by a system of continuous stocking far in excess of the year-round carrying of the grazing resources (de Leeuw, 1974 ^a).

Sown pastures

The need to increase forage production through replacing natural range land with intensively managed sown pastures has been emphasised in many reports on livestock development. When analysing the detailed investments for individual projects it is noted that pasture improvement often receives only modest financial support. This reluctance to commit large

sums to sown pastures appears to be related to the high cost of establishment (bush clearing, seedbed preparation), high additional expenditure for seed, fertilisers, fencing and water supplies and also the need to provide continuous managerial expertise to maintain such pastures at a high level of production. It seems fruitful in this context to review the sown pasture inputs in some of the planned livestock projects.

Aerial seeding of Stylosanthes humilis in rangeland. The Fulani group-ranches, holding grounds and breeding/fattening ranches to be financed by World Bank loans are believed to become viable if a portion of the grazing land is sown to the annual legume *Stylosanthes humilis* (Townsville stylo)². It is claimed that

1 (a) Artesian and sub-artesian boreholes tapping aquifers at depth varying from 75-375 m in NE Borno, 250 m in Sokoto and near Mokwa. Cost of construction depends on depth and bore-diameter and ranges from N6,000-10,000 in NE Borno (Grove, 1973), N6,000-12,000 in Sokoto (Kemmis et al., 1967) and N15,000 in Mokwa (FMANR, 1972).

(b) Cemented wells, which tap groundwater and shallow aquifers up to 30 m depth and have a limited flow (1.5-2.0 l/sec), can be constructed for N1,000-3,200; Renard et al (1972) estimated construction at N60 per m depth. Wells with windmills are believed to cost between N1,800 and N3,000 (Kemmis et al., 1967).

(c) Reservoirs have been dug using bulldozers in flat terrain with impermeable and self-sealing, subsoils at the cost of N350 per 1000m³. Depending on size between N1,600 and N3,000 are required.

(d) Small dams can be constructed in granite and basalt areas where suitable streams can be found. Such dams cost some N7,000 (FMANR, 1972).

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al sowing of this legume early in the season in the open tree and shrub anna within the 600-1000 mm rainfall will be equally successful here as in similar areas in Australia. As no clearing or cultivation is required, the operational costs are limited to seeding, seed and fertiliser amounting to N15 per ha. In support of this project, research has been going on since 1970, the results of which can be summarised as follows (Anon, 1972-3 (de Leeuw, 1974^b):

- a) After thorough seedbed preparation, the legume established well and produced 2-3 ton DM/ha at the end of the second growing season.
- b) Without cultivation, results have been very variable and appear to be governed by soil type, competing ability of the herbaceous cover and the rainfall distribution immediately before and after sowing.
- c) Even if first-season establishment was satisfactory and a good yield of forage and seeds was obtained, subsequent self-seeding was sometimes impaired because the seed supply is destroyed by grazing, (livestock and rabbits), termites and early fires.
- d) The present variety needs a growing season of at least 120 days and therefore did not survive in the drought-affected areas. Varieties better adapted to a short growing season need to be obtained.
- e) Once established, grazing management should be directed to reducing

competition from other plants. Such management is difficult to achieve in projects where stock control is left to the local herd-owners.

*Reseeding of fallow land*³. The re-seeding of fallows with *Andropogon gayanus* has been recommended as part of ambitious programme to introduce plough-cultivation into the farming economy within the Chad Basin countries. The only input is seed to be issued to farmers for sowing in cereal stubble so that a fallow containing a mixture of annual and perennial grasses becomes established. Though *A. gayanus* is a common constituent in Guinea zone fallows on sandy soils, it is not generally found in fallows further north. It seems doubtful if seed, broadcast in stubble will germinate in the next growing season. Instead, *A. gayanus* could be sown together with a companion crop during the last cropping season⁴.

Admittedly, intensive forage production from fallows would greatly assist livestock production within the arable farming economy. Though technically feasible, this innovation presupposes that private ownership and use of fallows becomes accepted in a society where communal dry season grazing in unfenced upland has been the traditional custom.

Sown Stylo and grass pastures in higher rainfall areas. Though the excellent performance of stylo as a perennial pasture legume has been demonstrated in large-scale grazing trials in Shika (Anon

3 The programme anticipates that annually about 10,000 ha of "go-back" land will be reseeded. Two seed multiplication centres totalling 6000 ha will be created involving an initial expenditure of N116,000 for fencing, cultivation and seed purchases. Recurrent cost will be high in particular for fertiliser. As a annual yield of some 300 ton of seed (10,000 ha @ 30 kg seed per ha) is needed seed yield/ha at the centres should be at least 50 kg/ha. To obtain such yield, 100-200 kg N/ha have to be applied (Haggard, 1966).

4 Haggard (1969) demonstrated that reasonably dense stands (2.4×10^5 plants/ha) developed in the first year of fallow when seed was sown together with maize, millet and soyabeans, the best results being obtained with early-maturing crops such as millet. Presently the same technique is tried out with *Stylosanthes* spp.

1972-3), its use for sown pasture in commercial livestock operations is recommended only at a small scale. For instance, it is proposed to plant 120 ha to stylo on the 2300 ha NLMA ranch at Manchok, at a total cost of ₦13,000 (Table 4). It can be argued however, that a larger area of stylo pasture would add to the overall holding capacity of the ranch and its financial viability. If stylo is regarded as a supplementary forage and a system of day-grazing on savanna and

night paddocking on stylo combined with limited feeding of supplement in the wet season be adopted, the ranch could carry some 1500 head and achieve satisfactory growth rates throughout the year. It is true that the original proposal also aims at a herd size of 1500 head (1.6 ha/head); but to obtain an average daily growth rate of say 0.75 kg/head, a high level of concentrate feeding is essential, for past stock performance on savanna grazing with limited supplementation has been disappointing (MEP, 1964).

TABLE 4. Cost estimates of the establishment of sown pastures (₦1 ha)

Location/Operations	Mokwa (1)	S.G.Z. (2)	Manchok (3)	Afaka (6)	Shika (5)
Stone/bush clearing	66.0	50.0	90.0	17.0	—
Ploughing		12.5	10.0	7.8	7.0
Disc-harrowing		7.0	7.5	5.4	4.7
Harrowing (2 x)		—	—	—	9.5
Seedbed preparation	30.0	19.5	17.5	13.2	21.2
Other operations					
Sowing (seed + fertilizer)	—	—	3.7	—	3.1
Cost of fertilizers	—	—	7.5	—	6.0
Seed	—	—	6.3	—	6.3

1. MacLennan (1967) clearing and cultivation using heavy equipment at NLMA ranch, Mokwa.
2. Woodhead *et al* (1971), clearing and cultivation of Southern Guinea zone savanna for maize growing. At the Upper-Ogun ranch clearing was estimated at ₦20/ha and pasture establishment at ₦100/ha.
3. FMANR, (1972), World Bank estimates for stylo establishment at Manchok including stone clearing. At Borno ranch cost were projected at ₦72/ha. Pasture establishment on cropland at Mokwa was estimated at ₦35/ha.
4. Allan (1972). Cost derived from trials in Afaka Forest reserve with heavy equipment and experienced operators. Costs based on optimum use of equipment.
5. Couper and de Leeuw, (1971). Cost of stylo establishment at Agricultural Research Station, Shika at 1969 price levels.

A similar dilemma in resource development appears evident in the projections made for NIMA ranch in Mokwa. The alternatives are either to allow for a limited increase in sown pasture to some 350 ha to provide for the hay and silage requirements of a yearly through put of 2400 head or to develop 1600 ha of sown pasture from shrubland at a total cost of ₦160,000 and double the stock carrying capacity (table 4). The first system relies

heavily on savanna grazing in the wet season, while in the second, sufficient sown pasture is available for wet season use leading to better growth. A further advantage of carrying more stock derives from a large reduction in overhead cost per unit stock. Woodhead *et al* (1971) calculated that the net profit margin per head would increase from ₦1.90 to ₦4.70 if stock rose from 2600 to 5200 head. The feasibility of such intensive

management is based on the high productivity of green panic pastures which produce 10 ton/ha/annum of high quality forage and are at least five times more productive than unimproved shrub savanna (1974).

An equally strong divergence between the "World Bank" (FMANR, 1972) and the "CDC" (1971) approach emerges when one compares the on-ranch investments for pasture development on the 9600 ha Upper-Ogun ranch. The first proposal anticipates a doubling of the sown pasture area to 2100 ha involving no bush clearing and an investment of ₦60,000 over 3 years. The "CDC" proposes to develop an additional 6600 ha over 11 years which includes large-scale bush clearing and a huge investment of ₦880,000. The comparable herd projections are 6,700 (after 6 years) and 12,000 head (after 20 years), respectively.

These comparisons bring out that the expert notions on the role of sown pastures in intensive breeding and fattening operations differ and depend largely on the desired balance between investment input, total herd size and the level of recurrent expenditure for overhead and supplementary feed.

Forage production for irrigated pastures

The projected expansion of irrigation throughout the northern states has generated an interest to incorporate a livestock component into irrigation schemes. The need to integrate livestock is based on several considerations.

a) Irrigated farming usually brings about a reduction in dry season grazing

and, when done on a large scale, upsets traditional animal husbandry practices, often involving displacement of stock and overgrazing of areas surrounding the schemes. This situation may become more serious when the extra wealth created by irrigated cash cropping is converted into livestock, thus increasing the livestock population on a reduced acreage of land.

b) The growing of forage crops, particularly legumes, is recommended, firstly to break continuous cropping of heat and rice and secondly to provide a potential supply of dry season fodder for farmer-owned stock.

Grave doubts are expressed as to the profitability of irrigated forage production though it is unfortunate that there are no existing schemes in which forage crops have been incorporated into the wheat-rice rotation to prove the opposite, (W. Payne, personal communication). More optimistic projections are given by FAO/UNDP experts in respect of growing elephant grass for fattening young stock (Henry and Licht, 1971). They propose to set up three experimental small-scale feedlots (30-50 head per lot) to test financial feasibility. If the preliminary results are favourable, large-scale operations will be started. It is envisaged to plant elephant grass on 25% of all projected irrigation schemes in the Chad Basin area⁶. In the completed phase of development it is estimated that as many as 240,000 head could be fattened yearly during the 8-9 months dry season. The successful execution of such an ambitious project is subject to many uncertainties and assumptions.

6 The feedlot operations will be located in three main areas: the "Polder" region on the eastern shore of Lake Chad, the Bosso area north of the Yobe river delta totalling together 130,000 ha of potential and suitable for irrigation and in Nigeria another 16,000 ha of land in the "Ngala" irrigation scheme which, on full completion may eventually cover some 100,000 ha.

The supply of feedlot cattle. The basic rationale of the scheme is to put 100-130 kg of weight on 240,000 head of young male stock before they are exported, mostly to Nigeria. Though the total theoretical off-take of the supplier countries exceeds 200,000 head, the actual official export are much smaller totalling some 80,000 head per annum, falling far short of the target⁶. It is equally difficult to find the 40,000 head for the operation in Ngala. Even if the total off-take of all herds resident within a 100 km radius from Ngala were fattened 26,000 head would be available annually⁷. A reduced through put of some 100,000 head for all three operations combined would be more realistic while in view of the drought, this reduced target will not be reached for some time to come.

The suitability of elephant grass. To recover the high cost of planting (N67/ha) the crop should be kept on for at least 4 years. It may be questioned if a farmer is prepared to devote 2500ha. of his land to elephant grass for such an extended period.

The cost of feeding. The feeding costs are based on an annual production of 200 tons of fresh forage per year, 5120 tons of which will be suitable as forage.

These yield estimations appear realistic when compared to those reported for Agricultural Research Station, Shika⁸. The cut and carry forage is expected to cover the energy requirements of steers growing about 0.4 to 0.5 kg per day, while protein needs are supposed to come from concentrates (cottonseed) and/or leguminous forage grown under irrigation or in the wet season. Total production costs per ha are estimated at N200 per ha green forage or about N1.7 per ton⁹. This is below the cost of mechanised growing and harvesting of elephant grass for silage, largely because the harvesting is not accounted for, since it is done by the farmer¹⁰. For an expected growth rate of 0.5 kg per day, the forage feeding cost would come to 17 kobo per kg liveweight gain; including some miscellaneous expenses the total cost per head add up to N20. However, it seems optimistic to expect a 0.5 kg daily growth on forage alone without supplementation. If it is assumed that at least 1.5 kg of cottonseed need to be fed to accomplish this growth the total feed cost would amount to N36 per head or 28 kobo per kg gain. It may therefore be concluded that the proposed enterprise will not pay unless there is extremely

6 The cattle imports originating from the Niger, Chad and Cameroun republics declined from 148,000 in 1966 to 78,000 in 1970. Total exports from Borno province averaged over 1968-70, totalled 248,000 head about 85,000 from imports and the remaining 163,000 from the province itself (Renard et al., 1972).

7 Cattle densities in a semi-circle with a 100 km radius from Ngala averaged 17 head per km² amounting to a total herd of 260,000 head. Assuming a off-take of 10 percent, a surplus of 26,000 would be available for fattening.

8 In Shika rain-grown elephant grass fertilised with 100 kg N produced between 450-650 kg green forage per day when cut every 7-9 weeks, while with irrigation a crop planted in early February and fertilised with 375 kg compound (21:14:14) produced 105-135 ton of forage per ha in 115 days or 900-1200 kg growth/ha/hay (de Leeuw, 1972).

9 The annual cost/ha include: planting N13.3, irrigation N99.9, fertiliser N13.3, annual depreciation of feedlot facilities N66.6, depreciation of hand tools N6.7 or a total of N199.8/ha/annum (conversion: one Naira = 300 CFA).

10 Couper (1972) estimated the cost of land preparation and planting at N32/ha and N2.7/ton, provided the annual yield reached 50 ton/ha. Cost of growing alone amounts to N1.0/ton.

favourable ratio between purchase and selling price. Some measures to boost profitability should include reduction of feedlot overhead, increase of forage production through higher levels of fertiliser, substitution of expensive forage with low cost wheat and rice straw.

Mixed Farming

Among the programmes proposed by the Lake Chad Basin Commission, work bull programme is probably the most ambitious. It envisages the purchase of 700,000 bulls and 350,000 sets of implements over a period of 5 years involving the total cost of N63 million. When realised, this would mean a 20-fold increase of the number of plough-farmers in the NE State, which number 30,000 at present. This large-scale introduction of work-oxen is believed to accomplish three functions: First, reduction of cattle on ranges competing with breeding and young stock for grass; second, higher crop yield resulting from better land tillage and third, the bulls or steers eventually reach the market at much heavier weights than the average, thus resulting in more meat for slaughter (Henry and Licht, 1971, p33)

Apart from generating production increases in food crops, the introduction of oxen will also have a large impact on groundnut farming, the rate of increase being estimated at 5% per annum¹¹. To achieve this goal, the work bull programme will be accompanied by an intensive groundnut production campaign to promote increased groundnut farming in conjunction with the use of better

varieties, seed dressing, spraying against leave-spot disease and efficient distribution of fertiliser to stimulate optimum application rates.

In addition to a N8.5 million increase in income from groundnuts over a 5-year period, sales of old bulls for slaughter commencing 5 years after the programme's start, will provide another N17 million per annum. This estimate is based on an average slaughter figure of 170,000 bulls per annum valued at N100 per head.

Since in time some N19 million will be added annually to the NE State economy the authors state that "This project is one of the soundest and best from the standpoint of expected monetary returns on investment of any project in the Basin. And there is no reason short of calamity, that would prevent farmers from paying off their farm credit loans in 4 to 6 years from the time they actually receive their loan.

It is the sheer magnitude of the programme rather than its technical feasibility that invites comment. Firstly, it appears impossible to acquire an annual total of 175,000 young bulls, if one realises that the total cattle trade in the NE State involves about 0.5 million head including imports from surrounding countries, stock for local slaughter and export. A drastic reduction in the supply situation through purchasing trade bulls for drought purposes, would no doubt lead to soaring cattle prices in response to such increased demand and would thereby jeopardise the financial soundness of the programme. However, in theory there should be over

11 According to the plan 2% increase will come from a larger acreage, 1% from improved seed, 1% from the use of fertiliser and 1% from better land preparation and tillage because of animal traction. These projections are somewhat different from those given by Harkness *et al* (1971). This report stated that in the NE State during 1971 about 400,000 ha was planted with groundnuts by 480,000 farmer units producing 342,000 tons. Production is expected to rise by 25% in 5 years, 10% from increased acreage and 18% from improved production methods. In the same period the number of farmers growing groundnuts will rise with 11%, while the average groundnut farm will decline from 0.80 to 0.77 ha. Valued at N90/ton, this rise in production will generate an annual incremental income of some N1.7 million.

300,000 bulls aged between 3 and 5 years if it is true that this category represents 12% of the total herd as Woodhead et al. (1971) predict. It may need a persuasive campaign and a strong policy of price incentives to convince the local herd owners to sell even a fraction of their potential slaughter stock, the more so since they are fully aware that for some years to come there will be a seller's market for cattle as a result of the drought.

Let it be supposed that drought bulls can be bought on the proposed scale, there still remains the problem of training farmers and bull-teams together with the launching and execution of a campaign to increase groundnut production. The training of extension staff alone to cope with such an innovative programme, would take years to accomplish. It appears therefore that a scaling down in scope is essential for any success to be achieved.

Discussion and conclusions

In reviewing some of the plans and projects aimed at increasing the productivity of the Nigeria livestock industry, three basic development strategies can be detected. First, investment policies directed towards the improvement of the infrastructure and the primary resources on which the rural livestock sector depends. These include investments in tsetse eradication, water development, reservation of grazing areas and disease control. These projects deserve the highest priority as they contribute immediately and directly to the main objective of all development plans, namely, to increase the size and the productivity of the national herd, which remains the key determinant to all other developments in the industry. Second, there are projects aimed at innovating and modernising traditional systems of production through injecting limited funds into local enterprises whilst enduring the full partici-

pation of the herdowners. A fitting example of this approach is the transformation of semi-nomadic herdowners into resident group-ranches with full title to grazing resources in demarcated and legally constituted grazing reserves. The project includes 800 families '77,000 ha of land and a total projected herd of 24,000 cattle, involving an "on-ranch" investments of over N800,000, most of which is being spent on rangeland improvement. Similarly, the creation of holding groups for the growing-on and fattening of trade cattle in transit will benefit a substantial number of local traders. It involves N330,000 in funds, a total area of 40,000 ha. holding, 12,500 animal units at any one time. The Lake Chad Basin proposals discussed above, also involve full local participation, but in addition attempt to integrate livestock more directly in the farming economy through the development of farmer-operated feedlots on irrigation schemes, provision of seed for re-seeding fallows and the issue of animal traction and implements on credit to promote "mixed farming". All these projects have in common that they aim at increased productivity at the local level through providing input financing which is small in relation to the number of people it will benefit. In contrast there is the third strategy, which is primarily concerned with new systems of beef production requiring large capital inputs, and limited but highly technical personnel. This approach is justified by the concept that under the traditional system of management, the national herd will remain static and is unlikely to exceed the present off-take levels. To remedy this, the first step is to establish semi-intensive breeding ranches, on which due to greater calving percentage, reduced mortality and faster growth, off-take can be doubled. Over a

twenty year period 156 ranches will be established, each comprising 24,000 ha, a herd of 5000 head, generating 1200 young stock and cull cows annually. Loans to the tune of N42,000 will be given to local entrepreneurs who will be assisted in these ventures by a government-sponsored advisory service at a fee. To further promote vertical integration of the industry, all feeder stock will be channelled into fattening ranches with an average throughput of 5000 head annually. It is estimated that over the project period N13.3million are required.

Less local participation is envisaged in some projects outlined by the World Bank (FAMNR, 1972). In total, 6 breeding and fattening units are proposed, which require N610,000 for on-ranch investments and another N900,000 to buy breeding and feeder stock. Together these ranches comprise 100,000 ha of land, 21,300 animals units and an annual production of 8,100 head of stock. It is seen that underlying the development strategies proposed by agencies advising in identifying bankable projects, is the opinion that most traditional herdowners are unreceptive to change and will not respond to incentives or inputs that generate increased production. It is unfortunate that this opinion is difficult to refute through reference to the effects of past programmes, since these have been aminety-rather than production-oriented. Even the distribution of subsidised supplementary feed was on too small and fragmentary a scale to provide measurable data on its impact. In spite of this absence of a tested basis for guidelines, a production-oriented policy focusing on the needs and problems of the traditional stock-owners needs immediate attention in order to counteract the terrible effect of the drought. This catastrophe has created an entirely new and largely unforeseen set of conditions, the

most serious of which is the high mortality in the national herd. Though the mortality rate and the protracted effects of prolonged malnutrition escape accurate assessment a scarcity of stock, whether for breeding, fattening or slaughter will overshadow all other constraints to development.

This infers that all projects which rely on stock extractions from the traditional herd have become unrealistic and require re-evaluation in the light of the present situation. In conclusion therefore, it seems inevitable that strategies and planning should be directed to assist all stock-owning groups in the rural economy to recuperate their losses and rebuild the herds. Without attempting to outline an all-embracing plan of action it seems appropriate to focus on its more important components.

To reduce the pressure of the drought-affected rangelands so that further degradation can be arrested and their forage potential will be restored the opening-up of new grazing land should be accelerated. This can be accomplished through channelling increased funds and manpower into the tsetse eradication campaigns simultaneously with a rigorously planned programme of water supply projects. However, these actions alone will fail to have the desired effect, unless they are combined with a package of incentives aimed at persuading pastoralists to move away from their customary grazing areas. Therefore, in the districts where unused grazing land exists, cattle tax should be abolished, veterinary clinics and depots for the subsidised sale of concentrates, salt and mineral established.

Establishing "group-ranches" should become an integral part of the resettling programme; it is quite likely that herd-owners after having broken away from their old environment, will readily accept innovations into their way of live. Fur-

thermore, it seems necessary to remove the restrictive regulations on arable cultivation in grazing reserves, with the aim to encourage rapid adaptation to their new environment. A change in this policy will pave the way for a stable and permanent mode of settling and will bind the settlers to the land to which they have been given title and legal ownership.

Such programmes would hopefully induce the nomadic and semi-nomadic cattle owners to move permanently, thereby reducing the fodder shortages for herdowners who are less mobile. Because of their more permanent ties with the local farming society, the settled groups are much less inclined to leave and settle elsewhere, hence, the improvement of their situation is less subject to short-term solutions. As they own at least 40% of the total cattle herd, their importance to the livestock industry should not be underestimated.

In addition to their wealth and status as stock owners, they usually have large farms and families, own workbulls and ploughs and are often keen and capable to accept innovations and introduce modern farming practices. Because of their stock, they have easier access to bank credit than those farmers who own little land and stock. As mixed livestock and cropping operations are probably the agricultural production system that is most efficient in terms of output per unit land and labour, provided population density is low (below 100 people/km²), it seems worthwhile to direct more financial and advisory assistance to this group.

It can be concluded that the thorough re-structuring of the livestock industry has a greater chance of success than ever before now. The drought has caused a much higher than average mortality in stock, has enforced de-stocking of the drier rangeland and large-scale movements to the south,

accompanied no doubt by changes in social organisation, traditional customs and attitudes. In view of this emergency situation, a re-evaluation followed by a re-orientation of development policies and strategies is urgently needed. These new strategies should include: (1) continued de-stocking of the drought-affected rangeland and (2) orderly and planned movement to and settlement on newly opened lands and (3) production-oriented assistance to all stockowners in order to rebuild the national herd.

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